November 6, 2013

OPERATION, MAINTENANCE, AND MONITORING MANUAL

Sunnyside Yard — Operable Unit 3
39-29 Honeywell Street
Queens, New York

Prepared for:

NATIONAL RAILROAD PASSENGER CORPORATION
400 West 31st Street, 6th Floor
New York, New York 10001

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.
209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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1.0 INTRODUCTION

On behalf of the National Railroad Passenger Corporation (Amtrak) and the New Jersey Transit Corporation (NJTC), Remedial Engineering, P.C. (Remedial Engineering) and Roux Associates, Inc. (Roux Associates) collectively known as Roux Associates, have prepared this Operation, Maintenance and Monitoring (OM&M) manual for the Dual Phase Vacuum Extraction (DPVE) system to address the mobile separate-phase petroleum hydrocarbon (SPH) plume within Operable Unit 3 (OU-3) of the Sunnyside Yard (Yard) located at 39-29 Honeywell Street, Queens, New York (Figure 1). The Sunnyside Yard is listed as a Class II Site in the New York State Department of Environmental Conservation's (NYSDEC) Registry of Inactive Hazardous Waste Disposal Sites. As a result of the listing for the entire Yard, Amtrak, NJTC, and the NYSDEC entered into an Order on Consent (OOC) Index #W2-0081-87-06, effective October 1989.

This OM&M manual is a reference for operating and maintaining the DPVE system in conformance with its design, applicable regulations, and permit requirements. Detailed operation and maintenance manuals prepared by the equipment manufacturers for each major component of the System are also included within this manual. This OM&M manual also presents the OM&M activities, which will occur from the time of System start-up and throughout the operation of the system. Performance monitoring (i.e., product well gauging) will also be performed as part of the OM&M activities. Should these activities be changed, modifications to this OM&M manual shall be documented through the preparation of manual revisions or addenda. Amtrak assumes the overall responsibility for the operation and maintenance of the DPVE system. Equipment specific maintenance, or those activities which would not be considered routine, will be contracted out by Amtrak, as required.

2.0 OWNERS AND RESPONSIBILITIES

The designated owner of this OM&M manual described herein is Amtrak. Roux Associates, Inc. is the designated operator. Roux Associates will be responsible for the operation and maintenance of the DPVE treatment system and DPVE wells described within this OM&M manual. The key personnel involved in the operations and maintenance at OU-3, located in Queens, New York are as follows:

- Richard Mohlenhoff – Owner Representative
- Glenn Netuschil, P.E. – Lead Design Engineer
- Charles J. McGuckin, P.E. – Engineer of Record
- Rob Kovacs – Project Manager / Senior Hydrogeologist
- John LoMeli – Senior Field Technician

Emergency contact numbers are provided in Section 9.0.

3.0 SITE DESCRIPTION AND SYSTEM DESIGN BACKGROUND

The following sections provide the Site description and describe the DPVE system to be operated within OU-3 at the Site.

3.1 Site Description

The Yard is located in an urban area in northwestern Queens County (Figure 1). The East River is located approximately one mile to the west while Newtown Creek, which defines the border between Queens and Kings Counties, is located less than 0.5 mile south of the western portion of the Yard. The Yard consists of a railroad maintenance and storage facility that currently encompasses approximately 133 acres. The Yard functions as a maintenance facility for electric locomotives and railroad cars for Amtrak and a train layover storage yard for NJTC. The land use surrounding the Yard is a combination of commercial, light industrial, and residential areas. The Metropolitan Transportation Agency (MTA) currently owns a portion of the original Yard along the northern boundary and maintains rights of way through the Yard.

Based on historic investigations completed at the Yard, the Yard has been divided into six Operable Units (OU-1 through OU-6):

- OU-1: Soil above the water table within the footprint of the High Speed Trainset Facility Service and Inspection (HSTF S&I) Building. A ROD was issued for OU-1 in August 1997, and the remedial work was completed in April 1998.
- OU-2: Soil above the water table within the footprint of the HSTF S&I Building ancillary structures. A No Further Action ROD was issued for OU-2 in November 1997.
- OU-3: Soil and SPH above the water table within approximately eight acres in the north central portion of the Yard (includes property owned by the LIRR).
- OU-4: Soil above the water table (unsaturated zone) in the remainder of the Yard.
- OU-5: Sewer system (water and sediment) beneath the Yard.
- OU-6: Saturated soil and the groundwater beneath the Yard.

3.2 DPVE System Design Background

The use of a DPVE system was proposed as an alternative remedial technology in lieu of open excavation below the water table in OU-3 to address the mobile SPH plume in a letter work plan dated August 6, 2009 and approved by the NYSDEC on September 29, 2009. The letter work

plan outlined a DPVE pilot study to be completed to evaluate the effectiveness of this alternative technology. This DPVE pilot study was completed in July and August 2010 and the results were submitted to the NYSDEC in the DPVE Pilot Study and Conceptual Design Work Plan Report (Roux Associates, 2011). The Revised Remedial Design/Remedial Action Work Plan for OU-3, Sunnyside Yard, Queens, New York (RD/RA Work Plan) was submitted to the NYSDEC on July 26, 2011 for the use of DPVE for the removal of SPH from OU-3. An addendum to the RD/RA Work Plan was submitted to the NYSDEC on March 15, 2012. The NYSDEC approved the use a DPVE treatment system on July 5, 2012.

The DPVE treatment system has been installed in a fenced area of OU-3. The DPVE treatment system trailer, existing product storage tank, electrical transformer and concrete pad, and DPVE wells and aboveground piping are located within the fenced area. Outside of the fenced area to the north are two tracks, the North Runner track, and the new service track (located south of the North Runner). Additional DPVE wells, DPVE pre-cast concrete well vaults, and underground piping are located outside the fenced area of the two tracks. The DPVE treatment system location is shown on Drawing No. 1.

4.0 SYSTEM PROCESS DESCRIPTION

This section provides a description of the major components of the DPVE treatment system installed at OU-3. The description includes the primary function of individual components of the systems and their relation to the system as a whole.

4.1 DPVE Wells

The DPVE system consists of 41 DPVE wells (additional wells may be added as necessary during operation of the system) that will be operated in two areas of OU-3 (Area A and Area B). Area A consists of 19 DPVE wells (DPVE-1A to DPVE-19A) that are located generally in the northern area of OU-3 surrounding the two tracks. Area B consists of 22 DPVE wells (DPVE-17B to DPVE-37B and MW-93) that are located generally in the southern area of OU-3 and within a fenced in area. Within each Area, the DPVE wells have been broken down into zones with each zone consisting of three to five DPVE wells. The DPVE wells and zones are summarized below:

DPVE Well Schedule

Zone	DPVE Wells
A1	DP-1A TO DP-4A, AND DP-10A
A2	DP-5A TO DP-9A
A3	DP-11A TO DP-14A, AND DP-19A
A4	DP-15A TO DP-18A
A5	CONTINGENCY
A6	CONTINGENCY
A7	CONTINGENCY
B1	DP-17B TO DP-21B
B2	DP-22B TO DP-24B, AND DP-27B
B3	DP-25B, DP-28B TO DP-30B, AND MW-93
B4	DP-26B, DP-31B TO DP-34B
B5	DP-35B TO DP-37B
B6	CONTINGENCY
B7	CONTINGENCY

The DPVE wells are constructed of 4-inch diameter Schedule 40 polyvinyl chloride (PVC) with 1-inch diameter Schedule 80 PVC drop tubes and are screened from 2 to 10 feet below land surface (bls). The drop tube extends to approximately 6 inches off the bottom of the DPVE well. A union connection is provided on the drop tube at the top of the DPVE well to allow for the adjustment of the drop tube depth. A vacuum gauge (0 to 30 inches of mercury [in. of Hg]) is provided at the DPVE well head. The DPVE wells have been designed for flow rates ranging from 20 to 40 cubic feet per minute (cfm) at 18 to 20 in. of Hg. The DPVE well and piping layout are shown on Drawing No. 1. The well construction details for each DPVE well are shown on Drawing No. 2.

4.2 Piping Network

The piping network constructed within OU-3 allows for the conveyance of product, groundwater, and vapor for treatment. The DPVE wells within each zone are manifolded together to a common header using 4-inch diameter aboveground and buried Schedule 80 PVC piping. The zones will be manually gauged and operated, as needed, to optimize SPH recovery.

4.2.1 Aboveground Conveyance Piping and Network

Generally, the DPVE wells for Area B are linked together using aboveground piping. The 4-inch common header aboveground Schedule 80 PVC piping is installed on pipe supports 18 to 24 inches above the ground and spaced approximately 8 feet apart. The pipe supports consist of Kindorf struts anchored with concrete. A U-clamp is used to attach the pipe at the supports. Two-inch diameter Schedule 80 PVC pipe connects each DPVE well to the common header.

4.2.2 Underground Conveyance Piping and Network

Generally, buried piping is used to connect the DPVE wells in Area A located outside of the fenced area. Two buried 4-inch diameter Schedule 80 PVC pipes are connected to two underground pre-cast concrete DPVE vaults at the locations shown on Drawing No. 1. The DPVE pre-cast concrete vaults are 3 feet by 4 feet and 2 feet deep and were manufactured by Atlantic Pre-Cast. Each DPVE vault has a single-door hatch manufactured by Bilco and rated for H-20 loading. The 4-inch diameter header pipe enters each DPVE vault where it is

manifolded into individual 2-inch diameter Schedule 80 PVC pipes. The 2-inch individual lines are equipped with 2-inch ball valves to control the flow to the DPVE wells. The pre-cast concrete DPVE vaults are used to control zones A1 and A2.

4.3 DPVE Treatment System

The product, groundwater and vapor extracted during product recovery operations from the DPVE wells is conveyed to the DPVE treatment system trailer located in the fenced area in OU-3. The treatment trailer includes a control room and a process room. The DPVE treatment system includes the following major treatment components/processes:

1. Treatment system control;
2. Liquid ring pumps (LRPs);
3. Oil/water separation;
4. Recovered groundwater treatment;
5. Product recovery; and
6. Off-gas treatment.

The process and instrumentation diagram (P&ID) is provided in Appendix A. The P&ID shows the DPVE treatment system instrumentation and controls and how the treatment system components are integrated together for operational control. Each of these treatment system components is further described below.

4.3.1 Treatment Trailer

A 53-foot long by 8-foot wide by 9-foot high treatment trailer is used to house the controls/instrumentation, LRPs, DPVE zone manifold and actuated valves, transfer pumps, oil water separator (OWS), liquid phase organoclay and carbon units, treated water holding tank, interconnecting piping, and valves. Three personnel doors and a double-wide door provide access to the treatment trailer. Stairs with handrails are provided for each personnel door. There are no doors between the control room and process room. The double-wide doors are at the back of the trailer and will be used to access the organoclay and liquid carbon units for change outs, etc. The vapor phase carbon treatment units and the product storage tank are installed outside and adjacent to the trailer. The controls and electrical equipment are provided in a separate room. The main electrical disconnect is mounted on the trailer exterior in the

front of the trailer (adjacent to the control room). A schematic showing the treatment trailer layout is provided in Appendix B.

4.3.1.1 Control Room

The control room has been designed to be non-explosion proof and houses the motor control panel (MCP), motor control center (MCC), and an Allen Bradley CompactLogix programmable logic controller (PLC) with a G310 Red Lion human machine interface (HMI) touchscreen. The control panel layout drawings are provided in Appendix C. The control room has an exhaust fan and heater. The thermostats for both the control and process room exhaust fans and heaters are located in the control room.

A single phase circuit breaker panel is provided to control power to the fans, heaters, interior and exterior lights, MCP panel lights, air compressor, ground fault circuit interrupter (GFCI) outlet, and the actuated valve manifold. The single phase electrical schematic is provided in Appendix D.

The control room also houses the 2-Hp Ingersoll Rand air compressor, Model No. P1.5IU-A9. The air compressor is used to control the pneumatic valves and the double-diaphragm product pump. A compressed air line has also been installed in the process room to assist with the replacement of the bag filters. Additional information for the air compressor is provided in Appendix E.

4.3.1.1.1 Electrical Equipment and Controls

The MCP, PLC and the HMI touchscreen will be used to control operation of the DPVE treatment system. The MCP houses the following:

- PLC;
- HMI touchscreen control panel interface;
- ZIP port (panel interface connector);
- Main system disconnect switch;
- Running (green) and alarm (red) indicating lights;
- Alarm reset button;

- Emergency stop button (E-Stop)button; and
- HAND/OFF/AUTO (HOA) switches for the control room and process room exhaust fans.

The PLC receives inputs (discrete and analog) from the various switches and transmitters located throughout the DPVE system and responds in accordance with the program loaded for this specific application. The PLC discrete input/output and analog drawings are provided in Appendix F.

The HMI uses a liquid crystal display (LCD) for displaying text and graphics. The HMI has an eight-button keypad for the on-screen menus. The on-screen menus will display the DPVE system operating conditions and allow the operator to modify the DPVE system operating conditions using the touchscreen. The HMI touchscreen has the following menu pages:

- Main menu;
- DPE Valves 1-5 (AV-1 TO AV-5);
- DPE Valves 6-9 (AV-6 TO AV-9);
- DPE Valves 10-14 (AV-10 TO AV-14);
- KO Tank TP-200 TP-202;
- OWS/TP-300;
- TP-301/Bag Filters/Clay Vessels;
- Carbon Vessel/Treated Water;
- LRP-101/102;
- Current Runtimes and Flow Totals;
- ACC Runtimes and Flow Totals;
- Mode Select;
- Trend Select;
- System Setup; and
- Alarms.

A cellular modem (wireless router, Multitech Model No. MTCBA-EV2-EN2-N3) allows for communication with the PLC and HMI via the internet to allow for remote access (password

protected) to the DPVE system operating conditions. A dedicated laptop computer is also housed in the control room.

4.3.1.2 Process Room

The process room of the treatment trailer has been designed according to the NFPA Class 1 Division 2 requirements and houses the DPVE well manifold header with pneumatic actuated valves, LRPs, OWS, transfer pumps, organoclay and liquid phase carbon units, and treated water holding tank. Two floor sumps are located in the process room (one sump is located next to the 220-gallon knock-tank and the other is located next to the liquid phase carbon units) and have a level switch to shut down the treatment system if liquid were to accumulate in the floor sumps. The process room has an exhaust fan and two explosion-proof heaters.

4.3.2 DPVE Well Manifold

The 6-inch diameter steel piping manifold header consists of 14 pneumatic actuated valves (AV-1 to AV-14) to control vacuum and flow to the zones. Each line on the manifold header has a gate valve, clear PVC piping and vacuum transmitters (VT-1 to VT-14). Each actuated valve and number is associated with the same DPE valve and number on the HMI screen, for example, DPE-1 is associated with AV-1. The following table shows the DPVE well zone and corresponding actuated valve:

Actuated Valve Schedule

Actuated Valve	DPVE Zone and Wells
AV-1	B8 (CONTINGENCY)
AV-2	B7 (CONTINGENCY)
AV-3	B5 (DP-35B TO DP-37B)
AV-4	B3 (DP-25B, DP-28B TO DP-30B, AND MW-93)
AV-5	B4 (DP-26B, DP-31B TO DP-34B)
AV-6	B2 (DP-22B TO DP-24B, AND DP-27B)
AV-7	B1 (DP-17B TO DP-21B)
AV-8	A3 (DP-11A TO DP-14A, AND DP-19A)

Actuated Valve Schedule	
AV-9	A4 (DP-15A TO DP-18A)
AV-10	A1 (DP-1A TO DP-4A, AND DP-10A)
AV-11	A2 (DP-5A TO DP-9A)
AV-12	A7 (CONTINGENCY)
AV-13	A6 (CONTINGENCY)
AV-14	A5 (CONTINGENCY)

4.3.3 Liquid Ring Pumps

The LRPs will draw vapor, product and groundwater via the buried and abovegrade piping connected to the DPVE well zones to the manifold header located at the treatment trailer. Two 40-Hp Travaini Model No. TRO-600V liquid ring pumps (LRPs), LRP-101 and LRP-102, are used to apply the vacuum to the DPVE wells. Each LRP is capable of a vacuum of up to 28 in. of Hg and an air flow of 600 cfm. Each LRP has the following components:

- Oil seal fluid reservoir tank with sight level indicators, temperature gauges, back pressure gauge and drain valve;
- Discharge separator element;
- High efficiency air-cooled heat exchanger with cooling fan;
- Sealing fluid inline Y-strainer;
- High temperature switch;
- High and low oil level switches;
- Inlet check valve;
- Vacuum gauge;
- Pressure transducer;
- Inlet Filter assembly;
- Auto unloading valve with filter assembly; and
- Vacuum relief valve with filter assembly.

A 2-inch manual air dilution valve is provided on the manifold header. The manifold header is connected to a common 220-gallon knock-out tank via 6-inch diameter carbon steel pipe with a 6-inch Y-strainer. Additional information for the LRPs is provided in Appendix G.

The vapor flow rate from each LRP is measured utilizing a pitot tube in-line flow sensor, Dwyer Model No. DS-300 with a Dwyer Model No. ISDP flow transmitter and display. Additional information on the Dwyer flow meter and transmitter is provided in Appendix H.

4.3.3.1 220-Gallon Knock-Out Tank

The common 220-gallon knock-out tank has level switches located in the side-mounted site glass, and a 6-inch Solberg Model No. CSL-375P-601 L-Style vacuum filter. The vacuum filter has a differential pressure transducer, DPT-1 (Dwyer Model No. ISPD). The knock-out tank also has a vacuum relief valve (Kunkel Model No. 215), and vacuum transducer (American Sensor Technologies, Inc. Model No. AST4400).

4.3.3.2 Knock-Out Tank Transfer Pumps TP-200 and TP-202

The recovered total fluids (groundwater and product) are pumped from the knockout tank to the oil water separator (OWS) via two 1-Hp Moyno Model No. 35601 progressive cavity transfer pumps, TP-200 and TP-202, each capable of producing a design flow rate of 20 gallons per minute (gpm) at 15 feet of total dynamic head (TDH). Additional information for transfer pumps TP-200 and TP-202 is provided in Appendix I.

4.3.4 Oil/Water Separator

The OWS is sized for 200 gpm and has a coalescing pack constructed of hydrocarbon resistant polypropylene to assist with separation. The separator design was oversized to improve performance and accommodate the potential for oil emulsification. The parallel-corrugated plate, coalescer oil water separator is manufactured by the Hydro Quip, Inc. (Model No. HQI AG-5CS-IP). The OWS will remove non-emulsified oil droplets larger than 20 microns in diameter with a specific gravity of 0.90 or less. The separator is constructed of 3/16" thick carbon steel and is 66 inches wide, 64 inches high and 10 feet long. The OWS includes the following:

- 2-inch inlet – female nominal pipe thread (FNPT) fitting;

- 2-inch groundwater outlet – FNPT fitting;
- 1-inch oil outlet – FNPT fitting;
- 1-inch vent nominal pipe thread (NPT) fittings and (2) 1-inch drain NPT fittings;
- product level switches;
- treated groundwater level switches;
- Parallel-corrugated plate coalescer designed to remove oil droplets greater than 20 microns;
- with a Reynolds Number of less than 500;
- sludge baffle;
- 75-gallon capacity integral oil storage compartment; and
- Gasketed removable vapor tight covers for access to chamber compartments.

Additional information for the OWS is provided in Appendix J.

4.3.5 Treated Groundwater Transfer Pump TP-301

After the OWS, the groundwater is pumped using TP-301, a 2-Hp Goulds Model No. 2ST1H7B centrifugal pump rated for 40 gpm and 65 feet of TDH to the skid-mounted bag filters arranged in parallel. Please note that this pump has been sized to pump through the organoclay and liquid phase carbon units to the treated effluent water storage tank. Additional information on TP-301 is provided in Appendix K.

4.3.6 Bag Filtration

The bag filtration system consists of two (2) downward flowing carbon steel units manufactured by Rosedale Products, Inc. (Model No. NLC08). Each filtration unit utilizes P12 filter bag sizes (10 microns), for the removal of suspended solids. The bag filters have a differential pressure transducer, DPT-2 (Inter Technology, Inc. Model No. 315Z). The maximum suggested flow rate by the manufacturer through each unit is 40 gpm and the suggested maximum pressure is 150 psi. Additional information on the bag filters is provided in Appendix L.

Each filter has the ability to be isolated, via 2-inch butterfly valves located upstream and downstream of the filters, to allow for the replacement of filter bags without shutting down the

process water flow throughout the treatment system. In addition, a compressed airline (from air compressor in control room) has been provided to assist with the bag filter removal and replacement. Following the bag filters, the process water passes through two 1,000-pound organoclay units and two 1,000-pound liquid phase carbon units (arranged in series) prior to discharge to a 750-gallon aboveground groundwater holding tank.

4.3.7 Organoclay Units

The two 1,000 pound stainless steel organoclay units are arranged in series. The process water is pumped through the bag filters by TP-301 to the top of the first organoclay unit and out the bottom to the top of the second organoclay unit and discharged out the bottom. The organoclay units consist of the following:

- 2-inch cam lock male fittings for influent and effluent connections;
- 2-inch diameter interconnecting hoses;
- 1-inch manual drain valves;
- ¼-inch hose barb sample ports (SP-22 and SP-23) with ball valves;
- pressure gauges (PI-16 and PI-17) with 0 to 60 pounds per square inch [psi] scale;
- pressure transmitters (PT-7 and PT-8); and
- air bleed valve.

The organoclay is an 8 x 30 mesh zeolite based clay material manufactured by Hydrosil, Part Number HS-200. Additional information on the organoclay and units is provided in Appendix M.

4.3.8 Liquid Phase Carbon Units

The two 1,000 pound stainless steel liquid phase carbon units are arranged in series. The process water is pumped through the organoclay units by TP-301 to the top of the first liquid phase carbon unit and out the bottom to the top of the second liquid phase carbon unit and discharged out the bottom to the 750-gallon aboveground groundwater holding tank. The liquid phase carbon units consist of the following:

- 2-inch cam lock male fittings for influent and effluent connections;

- 2-inch diameter interconnecting hoses;
- 1-inch manual drain valves;
- ¼-inch hose barb sample ports (SP-24 and SP-25) with ball valve;
- pressure gauges (PI-18 and PI-19) with 0 to 60 psi scale;
- pressure transmitters (PT-9 and PT-10); and
- air bleed valve.

The liquid phase carbon is granular reactivated carbon manufactured by Envirotrol, Product Number EI-30R. Additional information on the liquid phase carbon and units is provided in Appendix N.

4.3.9 Treated Water Discharge

The treated groundwater is gravity discharged from the 750-gallon aboveground groundwater holding tank, via a 2-inch diameter PVC pipe, to the below-grade 4-inch diameter PVC line that is connected to the sewer manhole (Amtrak Manhole MH-6) for discharge to the NYCDEP sewer.

The flow rate and total number of gallons of treated water is measured utilizing a 1-inch Blancett turbine flow meter, Model No. B111-110 outfitted with a Blancett Flow Monitor, Model No. B2800, to measure the flow rate and the total volume of treated water being pumped to the 750-gallon treated water holding tank. Additional information on the Blancett flow meter is provided in Appendix O.

4.3.10 Product Recovery

The recovered product is pumped from the OWS to the existing 2,000-gallon product holding tank with secondary containment, located outside near the treatment trailer, via buried 2-inch double-walled PVC pipe using the pneumatic double-diaphragm pump, TP-300, Dayton Model No. 6PY44 rated for 35 gpm. Additional information on TP-300 is provided in Appendix P. The recovered product will ultimately be pumped out using a vacuum truck as necessary, and transported and properly disposed off-site. The product storage tank has a one position high high level float switch and alarm (LSHH-15).

The flow rate and total number of gallons of recovered product is measured utilizing a 1-inch Blancett turbine flow meter (Model No. B111-110) outfitted with a Blancett Flow Monitor (Model No. B2800), to measure the flow rate and the total volume of product being pumped from the OWS to the exterior aboveground 2,000-gallon product holding tank. Additional information on the Blancett flow meter is provided in Appendix O.

4.3.11 Off-Gas Treatment

The extracted vapor is transferred by the LRPs to the vapor phase treatment system prior to discharge to the atmosphere. The vapor phase treatment system consists of two 1,000-pound vapor phase carbon (VPGAC) units (arranged in series) prior to discharge to the atmosphere. The VPGAC units are located outside the treatment trailer. The vapor phase carbon units consist of the following:

- 4-inch cam lock male fittings for influent and effluent connections;
- 6-inch diameter interconnecting hoses;
- ¼-inch hose barb sample ports (SP-16 and SP-17) with ball valves; and
- pressure gauges (PI-4 to PI-7) with 0 to 160 inches of water scale.

The vapor phase carbon is granular activated carbon manufactured by Envirotrol, Product Number EI-410. Additional information on the vapor phase carbon and units is provided in Appendix Q.

4.3.12 Utilities

Amtrak has provided the electrical power for the treatment trailer and it is a 200 Amp, 3-phase, 60-Hertz, 3-wire, 480 Volt service. The power is transferred via underground conduit from the power pole and transformer to the treatment trailer. The electrical power wiring drawings are provided in Appendix R.

5.0 OPERATIONAL PROCEDURES

The following sections describe operational procedures for the following activities:

- DPVE Treatment System Start-Up Procedure;
- DPVE Treatment System Alarms; and
- DPVE Treatment System Shutdown Procedure.

Each of these is described below.

5.1 DPVE Treatment System Start-Up Procedure

Prior to system start-up, the appropriate personnel (i.e., system operator) and the equipment manufacturer representative will walk-through the treatment system to verify equipment installation was performed in accordance with the Technical Specifications, approved Shop Drawings and P&ID. Several equipment checks will be performed by the OM&M personnel. These equipment checks will be performed after any extended shutdown period and after routine maintenance shutdown periods. The treatment equipment checks are listed below:

- Check individual DPVE well piping and vaults for tightness and evidence of leaks;
- Check that the valves at each DPVE well or vault are closed;
- Check the equipment in the treatment trailer for evidence of leaks or unsafe conditions;
- Verify that the valve positions are in the appropriate position for the treatment system piping and components;
- Confirm hook-up of electrical service;
- Confirm presence of air supply from the air compressor to all pneumatic actuators and double-diaphragm pump;
- If initial start-up, ensure sufficient quantity of potable water is available to perform the following:
  - Prime transfer pumps TP-200 and TP-202; and
  - "Wetting" the organoclay and liquid phase carbon units to remove any trapped air by pumping water through with the units.
- Verify main disconnect on the MCC is in ON position, and the main power switch on the control panel is ON;
- Verify all equipment breakers in MCC and control panel are in ON position;

- Check for any alarm conditions and clear any alarms, if needed; and
- Verify PLC and HMI are working correctly.

Following the treatment equipment checks, the observation and DPVE wells will be gauged for product. Once it is determined which DPVE wells to operate in each zone, the valves at the selected DPVE wells or DPVE well vaults will be opened.

The system checks described above will be conducted if, in the course of the DPVE system lifetime, significant changes are made to the system, and the system must be restarted.

Upon completing the mechanical and electrical start-up activities listed above, the DPVE system will be started using the following sequence. The manufacturer's operating instructions should be reviewed prior to operating the system. It should be noted that the DPVE wells and/or zones that will be operated has already been determined through product gauging of the observation and DPVE wells and the proper valves to the DPVE wells, and/or zones have been opened or closed as necessary.

1. Turn on circuit breaker (CB240) in the MCP to supply power to the single phase transformer. The appropriate circuit breakers in the single phase panel should be turned on. These include the lights, fans, heaters, and air compressor.

2. Energize the air compressor in the control room. Allow tank pressure to build and adjust pressure regulator to desired pressure to operate solenoid manifold and double-diaphragm pump.

3. Activate the appropriate manifold automated valves (AV-1 to AV-14) by placing the appropriate manifold icons in the HMI in the AUTO position. This will activate the pneumatic actuated valves. As discussed above, the DPVE wells and/or zones valves will be opened or closed in the field based on the product gauging.

4. Verify valves (i.e., unloading valve) on the LRPs are in the proper open or closed position. Activate the LRPs, LRP-101 and LRP-102, by placing the LRP icons in the HMI in the AUTO position. This will contact motor starters MS-206 and MS-211 which will signal the PLC that the motor starters are energized. The green run light on the MCP should activate.

5. Activate the knockout transfer pumps, TP-200 and TP-202, by placing the transfer pump icons in the HMI in the AUTO position (please note these pumps are self-priming). This will contact motor starters MS-216 and MS-221 which will signal the PLC that the motor starters are energized. In AUTO, the primary transfer pump will operate when the knockout tank level switch high, LSH-2, is contacted and the secondary transfer pump will

turn on when the knockout tank level switch high high, LSHH-3 is contacted. The transfer pumps will alternate between primary and secondary at the end of each cycle when the transfer pump icons are placed in AUTO.

6. Activate the product transfer pump, TP-300, by placing the transfer pump icon in the HMI in the AUTO position. This will provide compressed air (from the air compressor) to operate the double-diaphragm pump. In AUTO, the product transfer pump will operate when the OWS product high float switch, LSH-13 is contacted. The product transfer pump will shut down when the OWS product low float switch, LSL-12 is contacted.

7. Prior to activating OWS groundwater transfer pump, the pump needs to be primed. After the pump has been primed, activate the OWS groundwater transfer pump, TP-301, by placing the transfer pump icon in the HMI in the AUTO position. This will contact motor starter MS-228 which will signal the PLC that the motor starter is energized. In AUTO, the groundwater transfer pump will operate when the OWS high float switch, LSH-10 is contacted. The groundwater transfer pump will shut down when the OWS low float switch, LSL-9 is contacted.

5.2 DPVE Treatment System Alarms

The following devices and alarm conditions will shut down the entire DPVE treatment system and send an alarm signal to the PLC:

- E-stop Contact. There is an E-stop contact in the control room (on the MCP) and two in the process room (one by each personnel door).
- Power fail alarm (power relay contact).

The following devices and alarm conditions will shut down the LRPs and send an alarm signal to the PLC:

- Overload contacts (MS-206 and MS-211).
- High Temperature Switches (TSH-1 and TSH-2) for each LRP to indicate high temperature in case oil seal flow to each LRP is interrupted.
- Float Switch Low (LSL-5 and LSL-7) and Level Alarm Low (LAL) for each LRP oil seal reservoir to indicate a low oil level.
- Float Switch High (LSH-6 and LSH-8) and Level Alarm High (LAH) for each LRP oil seal reservoir to indicate a high oil level.
- LRP high pressure discharge transmitters (PT-1 and PT-2) and combined high pressure transmitter (PT-3).
- LRP vacuum transmitters (VT-16 and VT-17) are high or low.

- Float Switch High High High (LSHHH-4) and Level Alarm High High High (LAHHH) for the knock out tank to indicate a high liquid level in the knock out tank.
- Knock-out tank vacuum filter differential pressure transducer (DPT-1).
- Knock-out tank vacuum transmitter (VT-15) is high or low.
- Floor sumps high float switches (LSH-17 and LSH-18).

The following devices and alarm conditions will shut down transfer pumps TP-200 and TP-202 and send an alarm signal to the PLC:

- Overload contacts (MS-216 and MS-221).
- Float Switch High High (LSHH-11) and Level Alarm High High (LAHH) for the OWS to indicate a high water level.
- Float Switch High High (LSHH-14) and Level Alarm High High (LAHH) for the OWS to indicate a high product level in the oil water separator and prevent product from entering the water chamber.
- Floor sumps high float switches (LSH-17 and LSH-18).
- Transfer pumps high pressure discharge transducers (PT-4 and PT-5).

The following device and alarm condition will shut down transfer pump TP-300 and send an alarm signal to the PLC:

- Float Switch High High (LSHH-15) and Level Alarm High High (LAHH) for the product holding tank to indicate a high product level in the holding tank.

The following devices and alarm conditions will shut down transfer pump TP-301 and send an alarm signal to the PLC:

- Overload contact (MS-228).
- Float Switch High (LSH-16) and Level Alarm High High (LAHH) for treated groundwater storage tank to indicate a high water level in the storage tank.
- Pre and mid organoclay units high pressure transmitters (PT-7 and PT-8).
- Pre, mid and post liquid phase carbon units high pressure transmitters (PT-9 to PT-11).
- Bag filter housing high pressure differential transmitter (DPT-2).

If an alarm condition occurs, the red alarm banner at the bottom of the HMI screen will be activated. The cause of the alarm should be investigated and if corrected, the alarm reset button on the MCP should be pressed and the alarm acknowledged and cleared, if warranted.

5.3 DPVE Treatment System Shutdown Procedure

The DPVE system components should be shut down separately (one at a time) as follows:

- De-energize LRPs, and transfer pumps by turning each to their icon on the HMI to "off".
- De-energize the air compressor.
- Turn the main power switch on the MCP to off.
- Turn the main disconnect on the MCP off.

If the DPVE system is to be shut down for an extended period, the following should be performed:

- Inspect and clean all clear piping on the valve manifold;
- Inspect and clean all flow elements; and
- Check the oil seal level at each LRP.

In addition, if the system is shut down in the winter, any accumulated liquid in the aboveground piping shall be drained to the appropriate DPVE well(s). The manual drain valves in the DPVE pre-cast concrete well vaults shall be opened and any liquid collected and introduced to the DPVE treatment system. The heaters in the control and process rooms shall be kept on.

6.0 MAINTENANCE AND INSPECTIONS

This section provides a brief description of the required equipment maintenance and inspections. Records of all maintenance and inspections should be maintained at the Site. Detailed maintenance manuals prepared by the equipment manufacturers for each major component of the DPVE system are provided in their respective appendix. Additional information on miscellaneous treatment system components are provided on the attached CD.

6.1 Routine Maintenance and Inspections

The routine maintenance activities will include general maintenance and visual inspections. Visual inspection is the routine part of the system operator's activities. The system operator will note any conditions on the inspection checklist (Table 1) which present a potential hazard or could cause future system shutdown. In the field, special attention will be paid to the condition of the DPVE wellheads, DPVE well vaults, and DPVE aboveground piping and supports specifically for evidence of damage and accumulation of dirt or water in the DPVE wellheads or vaults. At the treatment trailer, special attention should be given to any unusual or excessive noise or vibrations from the piping, LRPs, and transfer pumps. The piping and valves should be inspected for leaks.

Several system components require routine maintenance to ensure proper performance. All equipment maintenance will be performed in accordance with manufacturer's instructions. Specific routine maintenance tasks are outlined below:

- Electric motors with grease fittings should be greased, as per the manufacturer's instructions, with a lithium-based grease.
- Inspect DPVE manifold to confirm operation of appropriate valves.
- Inspect flow meters for both air, water, and product for proper operation.
- Check lubricant level on air compressor and fill as needed. Inspect air compressor filter element and clean or replace if needed. Inspect air compressor mist separator. Drain air compressor receiver tank condensate.
- Check and clean sediment strainer on knockout tank discharge piping (prior to transfer pumps TP-200 and TP-202).
- Check coalescing filter on each LRP for accumulation of oil particles and replace if needed.

- Check oil reservoir on each LRP by visually inspecting sight gauge to ensure adequate supply of oil is present and make-up oil if needed.
- Check for sludge accumulation in the sludge chamber of the OWS.
- Check OWS for presence of recovered product in the water effluent chamber.
- Check differential pressure gauge on particulate bag filter housing and replace bag filters, if needed.
- Check volume and clarity of the water in the treated water holding tank.
- Check volume of recovered product in the product storage tank and arrange for transportation and disposal, if needed.

6.2 Non-Routine Equipment Maintenance

Non-routine equipment maintenance consists of maintenance activities that will be performed with less frequency than the routine (i.e., semi-annually) on several system components. Non-routine equipment maintenance will be performed in accordance with manufacturer's instructions. Specific non-routine maintenance tasks are outlined below:

- Change the oil in each LRP oil reservoir for every 10,000 working hours;
- Lubricate bearings on each LRP for every 2,000 working hours with grease as per manufacturer's instructions; and
- Change air compressor oil for every 500 working hours, as per the manufacturer's instructions.

6.3 Routine Maintenance Reports

As discussed in Section 6.1, an inspection checklist will be filled out for each routine maintenance event. A copy of the checklist is provided as Table 1. The checklist includes, but not limited, to the following information:

- Date;
- Name of person(s) conducting maintenance activities;
- Maintenance activities conducted;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and

- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist).

6.4 Non-Routine Maintenance Reports

During each non-routine maintenance event, a non-routine maintenance form (Table 2) will be completed which will include, but not be limited to, the following information:

- Date;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Presence of leaks;
- Date of leak repair;
- Other repairs or adjustments made to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Unscheduled inspections and/or sampling may take place when a suspected failure of the DPVE system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. Monitoring deliverables for the DPVE system are specified later in this OM&M manual.

7.0 MONITORING

To ensure that the DPVE treatment system performs as designed and meets the performance objectives, a monitoring and sampling plan will be implemented. The system monitoring will be performed by collecting operating data such as flow rates, vacuums and pressures from the treatment system components on a weekly basis. In addition, the product levels in the DPVE wells and/or observation wells will be monitored every two weeks. The monitoring frequency may be adjusted based on system operational performance after the initial operation period of three months.

The product levels will be used to optimize the performance of the system by selecting DPVE wells, as needed, to optimize product recovery (i.e., DPVE wells with no measurable product will be taken off-line). The product levels will be recorded using Table 3.

Treated groundwater samples will be collected from the clean water holding tank to evaluate the performance and effectiveness of the treatment system in treating the groundwater to acceptable levels for the discharge to the NYCDEP sewer system (Refer to Appendix S for the NYCDEP Discharge Permit and Sewer Discharge Limits). The treated groundwater samples will be collected on a monthly basis. The effluent of the VPGAC units will be monitored periodically with a PID to determine breakthrough. Air samples of the effluent of the VPGAC units will also be collected at start-up and on a quarterly basis to verify achievement of the air discharge criteria as specified in the NYSDEC Division of Air Resources. The air samples will also be collected using 6-liter Summa Canisters and analyzed for USEPA TO-15 to verify achievement of the air discharge criteria as specified in the NYSEC Division of Air Resources.

7.1 Sampling Event Protocol

All DPVE system sampling activities will be recorded in the dedicated field book for the Site. The sampling protocol will follow the procedures discussed in the OU-3 Site Management Plan (SMP) (under separate cover).

7.2 General Equipment Monitoring

General equipment monitoring will be conducted during each routine O&M visit. DPVE system components to be monitored include, but are not limited to, the following:

- Vacuum readings at the DPVE well manifold;
- Vacuum and air flow at each LRP;
- Product flow rate;
- Treated water flow rate; and
- PID readings of effluent of VPAC units.

A complete list of components to be checked is provided in the DPVE Treatment System Operating Log (Table 4). If any equipment readings are not within their typical range, any equipment is observed to be malfunctioning, or the system is not performing within specifications, maintenance and repair activities will be performed immediately (as per Section 6.0 of this OM&M manual), and the DPVE system restarted.

8.0 RECORD KEEPING

Maintenance reports and any other information generated during regular operations at the site will be kept on-Site on a dedicated laptop computer. All reports, forms, and other relevant information generated will be available upon request to the NYSDEC and submitted as part of the Periodic Review Report, as specified in the SMP.

In order to properly maintain the DPVE treatment system and minimize downtime, record keeping must be performed. Detailed records for the DPVE treatment system will be recorded as per Tables 1, 3 and 4 and filed electronically on the laptop computer.

8.1 Field Book

A daily field book will be kept in the control room for a time-specific daily record of maintenance and operations of the treatment system and the DPVE wells. The field book will be kept by the Roux Associates' technicians whenever personnel are on-Site.

8.2 System Monitoring

System monitoring will be achieved through system trend monitoring and the operations log. The DPVE treatment system operations log, the DPVE well gauging log and the product storage tank pump out log will be completed each day work is performed.

8.2.1 DPVE Aboveground Piping Checklists

DPVE well inspection checklists are completed on a weekly basis to ensure that the recovery well components are functioning correctly and that the recovery wells are accessible and covers are intact.

9.0 HEALTH AND SAFETY

As a result of the hazards at the Site and the conditions under which operations are conducted, the possibility of an emergency exists. A Health and Safety Plan (HASP) is required by OSHA (29 CFR 1910.120) to be available for use. The HASP for OU-3 is available and a copy is kept in the control room. The HASP identifies and assesses potential hazards associated with work in OU-3, and outlines steps and procedures to mitigate such hazards. Further, the HASP contains Job Safety Analyses (JSAs) of specific work tasks that are expected to be completed in OU-3. JSAs identify existing or potential hazards associated with each step of a work task, and determine the best actions to follow in order to avoid those hazards.

Within the OU-3 HASP is a detailed Emergency Plan, which outlines the critical actions that should be followed in the event of an emergency, such as a fire, explosion, or a spill or release to the environment. In the event of an emergency, the procedures described in the Emergency Plan should be followed.

9.1 Emergency Response Overview

In the case of an emergency (i.e., spill or release, fire or immediate threat to personal or public health), immediately contact the police and fire authorities to inform them of the possible or immediate need for assistance and if there is a need for an evacuation. If a significant release (above the reportable quantity as described in 40 CFR 302) has occurred, the National Response Center and other appropriate groups (such as NYSDEC) should be contacted. Those groups will alert National or Regional Response Teams as necessary. Below is a list of personnel that shall be notified as necessary.

Emergency Telephone Numbers

Type	Name	Telephone #
Fire Department / HazMat Emergency Response / Ambulance	New York City Fire Department	**911** 718-965-8283
Law Enforcement	New York City Police Department	**911**
Law Enforcement	Amtrak Police	**800-331-0008**
Hospital	Mount Sinai Hospital of Queens 25-10 30th Avenue Long Island City, Queens, New York 11102	**911** 718-932-1000

Type	Name	Telephone #
National Response Center (Release or Spill)		800-424-8802
NYSDEC Spills Hotline		800-457-7362
NYSDEC Case Manager	Hasan Ahmed	Office: 718-482-6405
Electric Utility (Amtrak)	Fred Ascoli	Office: 718-643-4050 Cell: 347-245-8027
Amtrak Project Manager	Richard Mohlenhoff	Office: 212-630-7249 Cell: 917-692-2127
Amtrak –Superintendent NY Mechanical Dept.	Frank Ross	Office: 212-630-7776
Amtrak – SSY Environmental, Health and Safety Officer	Chris Benson	Office: 212-630-7039 Cell: 917-538-2982
Amtrak – Penn Station Control Center		212-630-7465
Roux Project Manager	Rob Kovacs	Office: 631-232-2600 Cell: 516-250-0359
Roux Senior Field Technician	John LoMeli	Office: 631-232-2600 Cell: 631-445-8643
Roux Corporate Health and Safety Manager	Joseph Gentile, CIH	Office: 856-423-8800 Cell: 610-844-6911
Roux Office Health and Safety Officer	Ray Fitzpatrick	Office: 631-232-2600 Cell: 631-445-4498

In addition to the Emergency Response information provided in the HASP, additional information regarding the 2,000 gallon product recovery AST can be found in the Integrated Spill Prevention Control and Countermeasures Plan and Hazardous Waste Contingency Plan for Sunnyside Yard.

10.0 FIELD TEAM REVIEW / TRAINING SECTION

Each person performing work or visiting at this Site shall sign this section after Site-specific training is completed and before being permitted to access the Site.

I have read and understand this Operations, Monitoring and Maintenance manual. I will comply with the provision contained therein.

Site / Project: Amtrak / OU-3 DPVE Treatment System

Name Printed	Signature	Date

TABLES

1. DPVE System Inspection Checklist
2. DPVE System Non-routine Maintenance Form
3. DPVE Well Gauging Data Sheet
4. DPVE Treatment System Operating Log

Table 1. DPVE System Inspection Checklist, Amtrak, OU-3, Sunnyside Yards, Queens, New York

Date: _____

Completed By: _____

Description	Status			Actions Taken / Comments
	Ok	Action Req.	N/A	
A. Treatment Area and Treatment Trailer				
1 Inspect condition of fence and locks.				
2 Remove and dispose of debris, garbage adjacent to treatment trailer.				
3 Inspect condition of stairs and handrails (damage/missing parts).				
4 Check overall condition of treatment trailer for damage.				
5 Check emergency contact sign (condition / correctness).				
B. DPVE Vaults				
1 Check condition of vault.				
2 Inspect condition and operation of vault doors and vault locks.				
3 Inspect vaults for presence of water or product / staining and remove / clean as necessary				
4 Inspect condition of piping and valves and clean as necessary				
5 Inspect drainage valve for leaks.				
C. Piping and Mechanical				
1 Inspect aboveground piping for cracks, leaks and support issues.				
2 Inspect and test operation of shut-off / control valves, check valves, and sample ports				
3 Inspect manifold piping and valves for staining / leaks, corrosion and proper operation				
4 Inspect vacuum/pressure gauges and flowmeters for proper operation				
5 Inspect and test vacuum release valves.				
6 Check that all piping, valves, gauges and flowmeters are clearly labeled with ID and flow direction (vapor/water/product piping, shutoff valves, gauges, meters, etc.).				
D. Electrical				
1 Check that all electrical / control panels and are closed / secured and clearly labeled				
2 Check that circuit breaker panel(s) is assembled properly and all breakers are labelec				
3 Check that treatment trailer lights are operational and provide adequate lighting.				
E. Controls				
1 Check that all control panel lights and switches are clearly labeled				
2 Check that all control panel lights are operational.				
3 Check for proper operation of HMI screen (Operator Screen).				
4 Check that operation data on HMI Screen matches local sensor measurements (i.e., pressure gauges / transmitters, flowmeters).				
F. Heating and Ventilation				
1 Inspect proper operation and temperature setting for control and process room heaters and thermostats during heating season (October through March). Turn heat off during warmer seasons.				
2 Inspect condition of control and process rooms fans and shutters.				
G. 220-Gallon Knock-out Tank				
1 Check condition of vacuum filter.				
2 Check and clean Y-Strainer, if needed.				
3 Check dilution valve for noises or leaks.				
4 Check sight tube for sediment accumulation.				
H. LRPs				
1 Check oil reservoir on each LRP.				
2 Check that oil temperature is between 140 and 175°F.				
3 Check for abnormal vibrations or noises.				
4 Check for leaks from mechanical seals, joints, piping.				
5 Check the vacuum gauges for proper operation.				
6 Check air flow meters for proper operation.				
I. OWS				
1 Check for sludge accumulation in sludge chamber.				
2 Check for product in water effluent chamber.				
3 Check operation of float switches.				
4 Check condition of coalescing pack.				
J. Organoclay and Liquid Carbon Units				
1 Check for any piping leaks.				
2 Inspect and check pressure gauges.				
K. Vapor Phase Carbon Units				
1 Inspect and check pressure gauges.				
2 Check for any leaks on piping, fittings, etc.				
L. Clean Water Holding Tank				
1 Check for presence of product in tank.				
2 Check the float switch for proper operation.				
M. Product Holding Tank				
1 Visually confirm volume of product in tank.				
2 Check for leaks from piping.				
3 Check float switch for proper operation.				

Table 2. DPVE System Non-Routine Maintenance Form, Amtrak, OU-3, Sunnyside Yard, Queens, New York

DATE	DESCRIPTION OF WORK DONE	CAUSE *(Use as many lines as required to define the problem)*	Completed By

Table 3. DPVE System Well Gauging Data Sheet, Amtrak, OU-3, Sunnyside Yard, Queens, NY

Date: _____

Gauged by: _____

Well	DTP (FT)	DTW (FT)	PT (FT)	DPVE Well Valve Status	Actuated Valve Manifold Number
OW-1				N/A	N/A
OW-2				N/A	N/A
OW-3				N/A	N/A
OW-4				N/A	N/A
OW-5				N/A	N/A
OW-6				N/A	N/A
OW-7				N/A	N/A
OW-8				N/A	N/A
OW-9				N/A	N/A
Zone A1					
DP-1A					AV-12
DP-2A					AV-12
DP-3A					AV-12
DP-4A					AV-12
DP-10A					AV-12
Zone A2					
DP-5A					AV-11
DP-6A					AV-11
DP-7A					AV-11
DP-8A					AV-11
DP-9A					AV-11
Zone A3					
DP-11A					AV-10
DP-12A					AV-10
DP-13A					AV-10
DP-14A					AV-10
DP-19A					AV-10
Zone A4					
DP-15A					AV-9
DP-16A					AV-9
DP-17A					AV-9
DP-18A					AV-9
Zone B1					
DP-17B					AV-8
DP-18B					AV-8
DP-19B					AV-8
DP-20B					AV-8
DP-21B					AV-8
Zone B2					
DP-22B					AV-7
DP-23B					AV-7
DP-24B					AV-7
DP-27B					AV-7
Zone B3					
DP-26B					AV-6
DP-31B					AV-6
DP-32B					AV-6
DP-33B					AV-6
DP-34B					AV-6
Zone B4					
DP-25B					AV-5
DP-28B					AV-5
DP-29B					AV-5
DP-30B					AV-5
MW-93					AV-5
Zone B5					
DP-35B					AV-4
DP-36B					AV-4
DP-37B					AV-4

Note: AV-1 to AV-3, and AV-13 and AV-14 are spare (contingency) actuated valves.

Table 4. DPVE Treatment System Operating Log, Amtrak, OU-3, Sunnyside Yards, Queens, New York

Source of Reading	Units	Values	Comments
Air Compressor Discharge Pressure	PSI		
Vacuum Transmitter VT-1	Inches of Hg		
Vacuum Transmitter VT-2	Inches of Hg		
Vacuum Transmitter VT-3	Inches of Hg		
Vacuum Transmitter VT-4	Inches of Hg		
Vacuum Transmitter VT-5	Inches of Hg		
Vacuum Transmitter VT-6	Inches of Hg		
Vacuum Transmitter VT-7	Inches of Hg		
Vacuum Transmitter VT-8	Inches of Hg		
Vacuum Transmitter VT-9	Inches of Hg		
Vacuum Transmitter VT-10	Inches of Hg		
Vacuum Transmitter VT-11	Inches of Hg		
Vacuum Transmitter VT-12	Inches of Hg		
Vacuum Transmitter VT-13	Inches of Hg		
Vacuum Transmitter VT-14	Inches of Hg		
Knock-Out Tank Vacuum	Inches of Hg		
LRP-101 Inlet Vacuum	Inches of Hg		
LRP-101 Discharge Pressure	PSI		
LRP-101 Air Flow	SCFM		
LRP-102 Inlet Vacuum	Inches of Hg		
LRP-102 Discharge Pressure	PSI		
LRP-102 Air Flow	SCFM		
Knockout Tank Transfer Pump (TP-200/TP-202) Discharge Pressure	PSI		
Product Transfer Pump TP-300 Discharge Pressure	PSI		
Groundwater Transfer Pump TP-301 Discharge Pressure	PSI		
Product Flow Rate	GPM		
Groundwater Flow Rate	GPM		
Inlet Pressure Bag Filter Housing 1	PSI		
Inlet Pressure Bag Filter Housing 2	PSI		
Differential Pressure Bag Filters	PSI		
Inlet Pressure First Liquid Carbon Unit	PSI		
Outlet Pressure Second Liquid Carbon Unit	PSI		
Inlet Pressure First Organoclay Unit	PSI		
Outlet Pressure Second Organoclay Unit	PSI		
Inlet Pressure First VPGAC Unit Outlet Pressure Second VPGAC Unit	PSI PSI		
Second VPGAC Unit PID Reading	PPMV		
Product Storage Tank Volume	GALLONS		

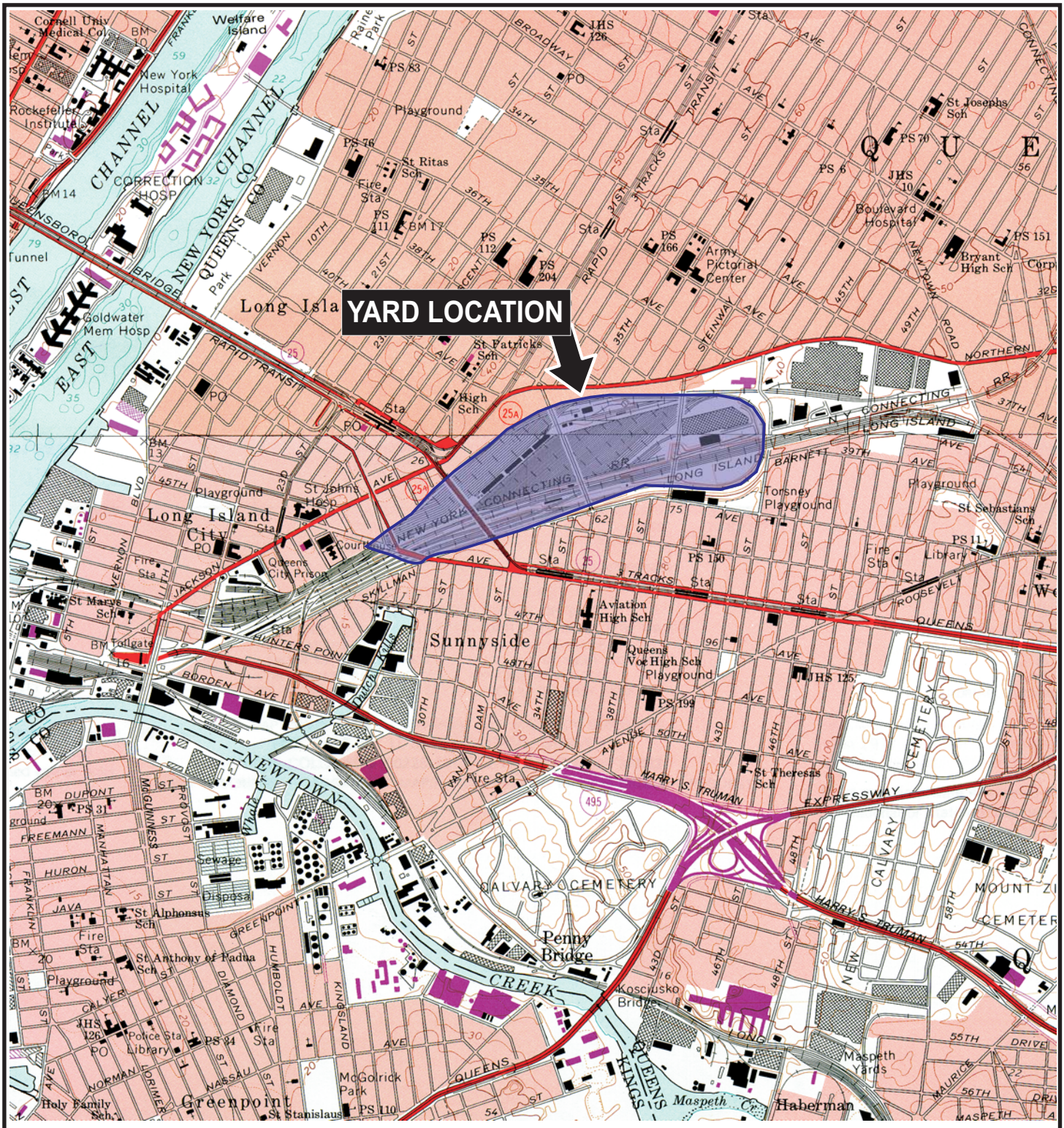
Is the System operating within the acceptable conditions? _____

If no, was the condition corrected and how? _____

Form Completed By: _____ Signature: _____ Date & Time: _____

FIGURE

1. Site Plan



SOURCE:
CENTRAL PARK AND BROOKLYN, NEW YORK
QUADRANGLE 7.5 MINUTE SERIES (TOPOGRAPHIC)

Title:

LOCATION OF SITE

OPERATION, MAINTENANCE, AND MONITORING MANUAL OU-3
SUNNYSIDE YARD, QUEENS, NEW YORK

Prepared for:

AMTRAK

Remedial Engineering, P.C. ENVIRONMENTAL ENGINEERS	Compiled by: D.M.H.	Date: 05NOV13	FIGURE 1
	Prepared by: J.A.D.	Scale: AS SHOWN	
	Project Mgr.: H.G.	Project No.: 0055.0045Y018	
	File: 0055.0045Y298.01.CDR		

V:\CAD\PROJECTS\0055Y\0045Y\298\0055.0045Y298.01.CDR

APPENDICES

A. Process and Instrumentation Diagram
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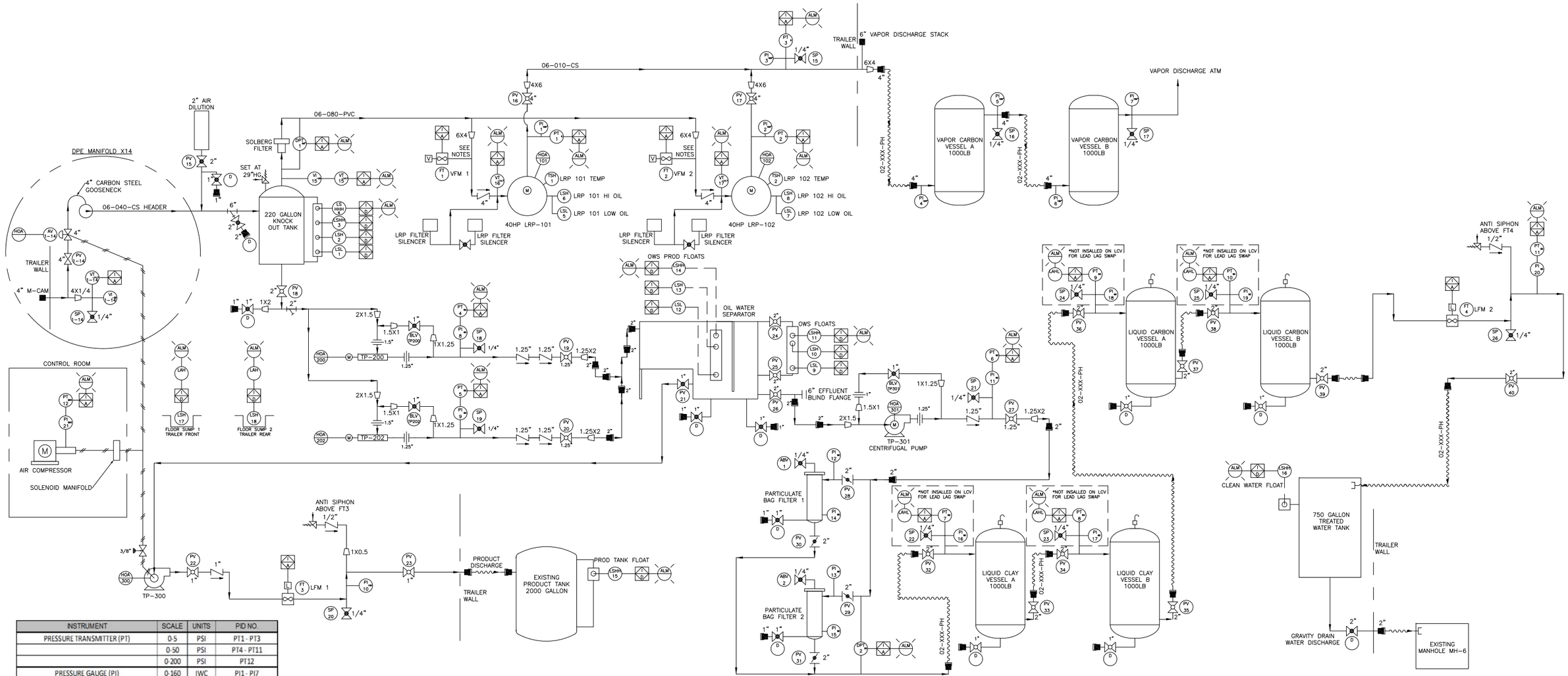
R. Electrical Power Wiring Drawings
S. NYCDEP Discharge Permit Limits

APPENDIX A

Process and Instrumentation Diagram

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO



INSTRUMENT	SCALE	UNITS	PID NO.
PRESSURE TRANSMITTER (PT)	0-5	PSI	PT1 - PT3
	0-50	PSI	PT4 - PT11
	0-200	PSI	PT12
PRESSURE GAUGE (PI)	0-160	IWC	PI1 - PI7
	0-60	PSI	PI8 - PI9, PI11 - PI20
	0-100	PSI	PI10
	0-200	PSI	PI21
VACUUM TRANSMITTER (VT)	-14.7 - 30	PSI	VT1 - VT17
VACUUM GAUGE (VI)	-30 - 0	HG	VI1 - VI15
DIFFERENTIAL PRESSURE TRANSMITTER (DPT)	0 - 50	IWC	DPT1
DIFFERENTIAL PRESSURE TRANSMITTER (DPT)	0 - 50	PSID	DPT2

LRP-101

TRAVAINI
TRO600V-1A-XP
40HP 480VAC 3PHASE

LRP-102

TRAVAINI
TRO600V-1A-XP
40HP 480VAC 3PHASE

TP-200

MOYNO 35601
1 HP MOTOR
480VAC 3PHASE

TP-202

MOYNO 35601
1 HP MOTOR
480VAC 3PHASE

TP-300

DAYTON 6PY44
35 GPM
PNEUMATIC DIAPHRAGM

TP-301

GOULDS 2ST1H7B
3HP
480VAC 3PHASE

NOTES:
1.) 40" MIN BEFORE VFM 1, VFM 2
2.) 20" MIN AFTER VFM 1, VFM 2

REV	DATE	DESCRIPTION	DRW	APPR
7	3/22/13	AS BUILT	SMT	
6	2/25/13	ADD BALL VALVE TP300, DISCHARGE RENUMBER PV25 TO PV40	SMT	
5	1/25/13	REVISE PLUMBING LRP, TP-301 PV GAC IN AND OUT, INSTRUMENTS	SMT	
4	1/15/13	PLUMBING BETWEEN KO TANK & LRP MATERIAL TO CS	SMT	
3	10/1/12	CHANGE TP-300 TO DIAPHRAGM REMOVE TP-300 PT	SMT	
2	9/24/12	REMOVE MID VAPOR CARBON PT, 750GAL TANK REPLACE 4000GAL	SMT	

ProAct Services Corporation

ALL INFORMATION CONTAINED IN THIS DOCUMENT ARE PROPRIETARY AND CONFIDENTIAL AND THE PROPERTY OF PROACT SERVICES CORPORATION.

PATENT PENDING

PROCESS & INSTRUMENTATION DIAGRAM
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK

DRAWING NO.

SIZE B | SCALE N/A

JOB NO. 1630 | UNIT NO.

REV 7

CUSTOMER AMTRAK

MATERIAL

DRAWN BY STEVE TURNER | DATE 9/20/12

SHEET 2

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO

PUMPS, BLOWERS, AND COMPRESSORS (MOTOR DRIVEN)

- BLOWER (CENTRIFUGAL FAN)
- LIQUID RING VACUUM PUMP
- CENTRIFUGAL PUMP
- CHEMICAL PUMP
- PROGRESSIVE CAVITY PUMP
- HEAT EXCHANGER
- SUMP PUMP
- AIR COMPRESSOR

MEDIA SEPARATORS, FILTERS, AND CONTAINMENT

- KNOCK OUT TANK
- OIL WATER SEPARATOR
- AIR STRIPPER
- CARBON VESSEL (LIQUID/VAPOR)
- SAND FILTER
- BAG FILTER
- PRODUCT DRUM
- FLOOR SUMP CONTAINMENT
- FILTER (IN LINE)

PIPING AND LINE SYMBOLS

- PROCESS LINE
- FLEX HOSE
- ELECTRICAL
- PNEUMATIC
- HYDRAULIC
- TRAILER LIMITS
- PROCESS FLOW

PROCESS LINE DESIGNATION

04–010–SS

- PIPE SIZE — XX
- PIPE SCH — XXX
- MATERIAL — XX

MATERIAL GUIDE:

SS – STAINLESS STEEL
GS – GALVANIZED STEEL
CS – CARBON STEEL
FH – FLEX HOSE
PVC – POLYVINYL CHLORIDE
CPV – CHLORINATED POLYVINYL CHLORIDE

ABBREVIATIONS:

GPM – GALLONS PER MINUTE
CFM – CUBIC FEET PER MINUTE
PRV – PRESSURE RELIEF VALVE
VRV – VACUUM RELIEF VALVE
XP – EXPLOSION PROOF

VALVES – PROCESS, CONTROL, AND RELIEF

- BALL VALVE (OPEN)
- BALL VALVE (CLOSED)
- 3 WAY BALL VALVE
- GATE VALVE (OPEN)
- GATE VALVE (CLOSED)
- BUTTERFLY VALVE
- CHECK VALVE
- SOLENOID VALVE (S)
- MOTOR OPERATED (M)
- VAPOR CONTROL VALVE
- PRESSURE REGULATOR VALVE
- PRESSURE/VACUUM RELIEF VALVE
- ANTI SIPHON VALVE
- AUTO AIR BLEED
- FCV — FLOW CONTROL VALVE
- FA — FLAME ARRESTOR
- CONTROL VALVE (2 WAY)
- CONTROL VALVE (3 WAY)

PLUMBING PARTS AND CONNECTORS

- REDUCER
- MALE CAM LOCK HOSE CONNECTOR
- FEMALE CAM LOCK HOSE CONNECTOR
- CAM LOCK CAP
- SITE GLASS
- UNION
- FLANGE
- PIPE PLUG
- FURNCO (F)
- Y STRAINER
- BASKET STRAINER

FLOW METERS

- L — LIQUID FLOW METER
- V — VAPOR FLOW METER

TRANSDUCERS (4–20mA)

- PT — PRESSURE TRANSDUCER
- VT — VACUUM TRANSDUCER
- TT — TEMPERATURE TRANSDUCER
- DPT — DIFFERENTIAL PRESSURE TRANSDUCER
- LT — LEVEL TRANSDUCER
- PHT — PH METER TRANSDUCER
- TMT — TURBIDITY METER TRANSDUCER
- FT — FLOW TRANSDUCER
- MT — HUMIDITY TRANSDUCER

GAUGE INDICATORS

- PI — PRESSURE GAUGE INDICATOR
- VI — VACUUM GAUGE INDICATOR
- TI — TEMPERATURE GAUGE INDICATOR
- PDI — DIFFERENTIAL PRESSURE GAUGE INDICATOR
- LI — LEVEL GAUGE INDICATOR
- FI — FLOW GAUGE INDICATOR
- MI — HUMIDITY GAUGE INDICATOR

VALVE TAGS

- PV — PROCESS VALVE
- SP — SAMPLE PORT VALVE
- D — DRAIN VALVE
- BLV — BYPASS LOOP VALVE
- PROD — PRODUCT VALVE
- ABV — AMBIENT BREATHER VALVE
- AV — AUTOMATED VALVE
- IPV — INJECTION PORT VALVE
- BDV — BLOW DOWN COMPRESSED AIR VALVE

SWITCHES

- LSL — LEVEL SWITCH LOW
- LSH — LEVEL SWITCH HIGH
- LSHH — LEVEL SWITCH HIGH/HIGH
- TSH — TEMPERATURE SWITCH HIGH
- PSH — PRESSURE SWITCH HIGH
- FS — FLOW SWITCH
- T — THERMOSTAT

ELECTICAL CONTROLS

- HOA — HAND–OFF–AUTO SWITCH
- I/D — DISCRETE INPUT
- I/A — ANALOG INPUT
- O/D — DISCRETE OUTPUT
- O/A — ANALOG OUTPUT
- I/E — INTERLOCK CONTROL
- LALL — ALARM LEVEL LOW/LOW SET POINT
- LAL — ALARM LEVEL LOW SET POINT
- LAH — ALARM LEVEL HIGH SET POINT
- LAHH — ALARM LEVEL HIGH/HIGH SET POINT
- ALM — ALARM INDICATOR
- ESD — EMERGENCY SHUT DOWN CONTROL ROOM
- ESD — EMERGENCY SHUT DOWN PROCESS ROOM

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PATENT PENDING

P&ID LEGEND

DUAL PHASE EXTRACTION SYSTEM

SUNNYSIDE YARD QUEENS, NEW YORK

DRAWING NO.	SIZE	SCALE	JOB NO. 1630	UNIT NO.	REV
	B	N/A			1

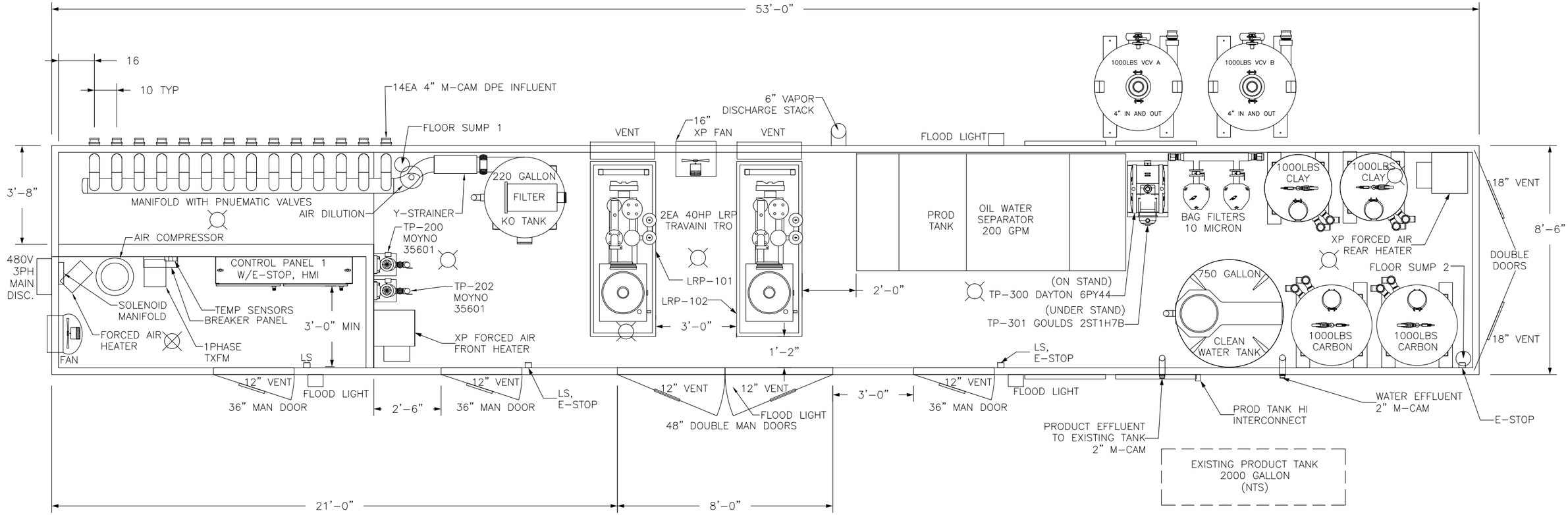
REV	DATE	DESCRIPTION	DRW	APPR	CUSTOMER	MATERIAL	DRAWN BY STEVE TURNER	DATE 2/3/12	SHEET 3

APPENDIX B

Treatment Trailer Layout

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO

CONTROL ROOM – UNCLASSIFIED
PROCESS ROOM – CLASS I DIV 2



TRAILER CONSTRUCTION:
INTERIOR WALLS WILL BE INSULATED
½" PLYWOOD LAYER COVERING INSULATION
INTERIOR WALLS WILL BE PAINTED WHITE
RUBBER FLOORING INSTALLED OVER EXISTING FLOOR AND 3" UP SIDEWALL
CARBON STEEL DIAMOND PLATE INSTALLED ON FLOOR AND 3" UP SIDEWALL
NON-SLIP EPOXY COATING COVERING ALL DIAMOND PLATE
EXTERIOR OF TRAILER WILL BE WHITE

REV	DATE	DESCRIPTION	DRW	APPR
13	3/22/13	AS BUILT	SMT	
12	2/18/13	AIR DILUTION ON MANIFOLD HEADER	SMT	
11	1/22/13	ADD Y-STRAINER TO MANIFOLD CLAY, CARBON VESSELS PLUMBING	SMT	
10	1/15/13	MOVE TP-200, TP-202	SMT	
9	1/14/13	ADD (2) 36 MAN DOORS, REMOVE 54 MAN DOORS – PROCESS ROOM	SMT	

REV	DATE	DESCRIPTION	DRW	APPR
8	1/11/13	ADD 36 MAN DOOR, CONTROL ROOM & MANIFOLD OPPOSITE	SMT	
7	1/7/13	INCLUDE ACTUAL TRAILER LAYOUT MIRROR SYSTEM	SMT	
6	11/21/12	CONTROL ROOM CHANGES ADDED NOTES	SMT	
5	11/13/12	MOVE TP 200, TP 202, TANKS ON REAR OF TRAILER MOVE	SMT	
4	11/7/12	MAN DOOR LAYOUTS, OWS RESIZE TRAILER AXLE LOCATIONS	SMT	
3	10/1/12	CHANGE TP-300 TO DIAPHRAGM MOVE TP-200, TP-202, AIR COMP	SMT	
2	9/24/12	MIRROR TRAILER LAYOUT	SMT	

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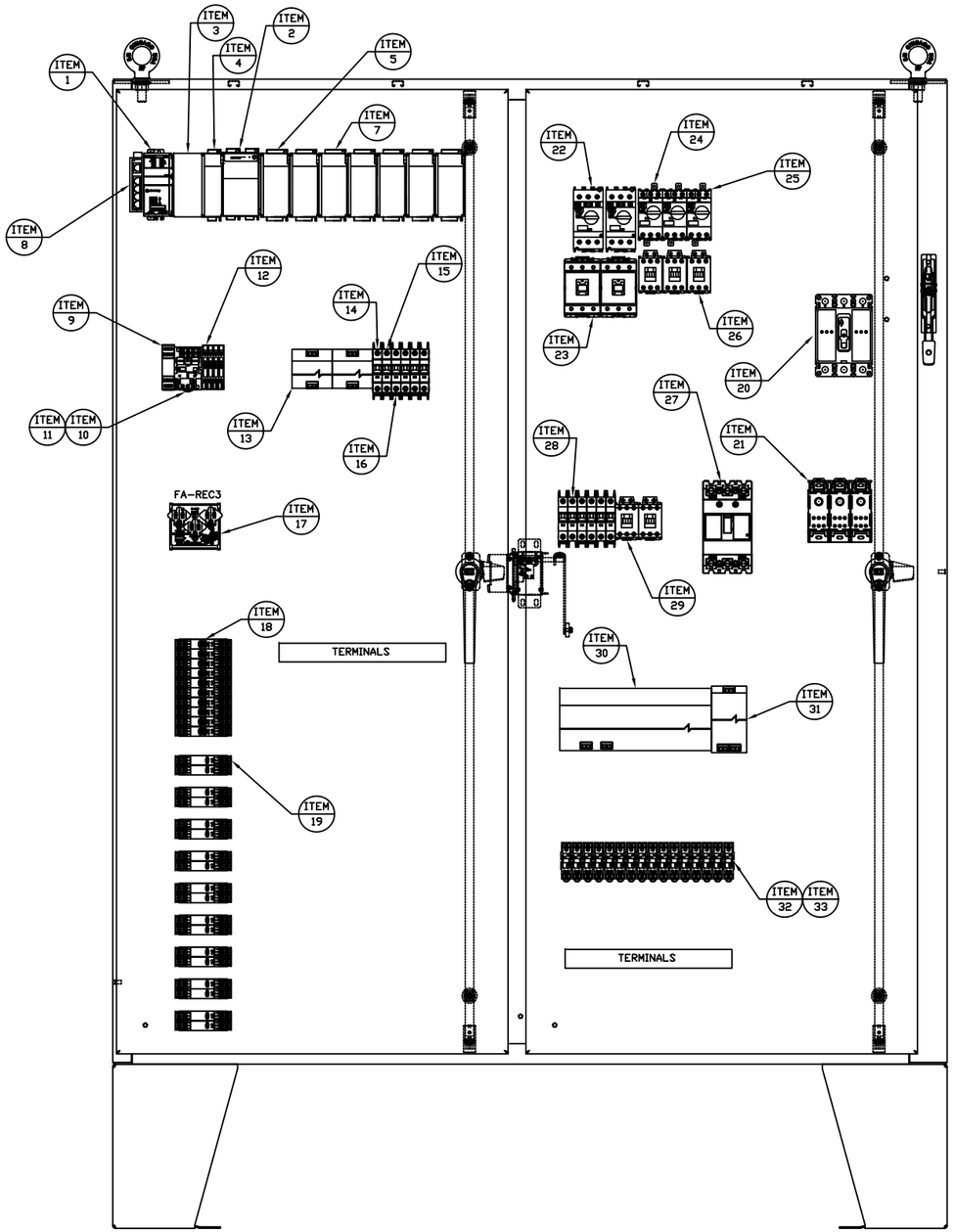
PATENT PENDING

PLAN VIEW LAYOUT
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK

DRAWING NO.	SIZE	SCALE	JOB NO. 1630	UNIT NO.	REV
	B	N/A			13
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/20/12	SHEET 1

Control Panel Parts Layout



ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO
1	1	PROGRAMMABLE LOGIC CONTROLLER COMPACTLOGIX	ALLEN BRADLEY	1769-L32E
2	1	PLC POWER SUPPLY 120/240 VAC INPUT 4A @ 5VDC, 2A @ 24VDC	ALLEN BRADLEY	1769-PA4
3	1	32 POINT 24VDC DISCRETE INPUT MODULE	ALLEN BRADLEY	1769-IQ32
4	1	16 POINT 24VDC DISCRETE INPUT MODULE	ALLEN BRADLEY	1769-IQ16
5	2	16 POINT VAC/VDC RELAY OUTPUT MODULE	ALLEN BRADLEY	1769-OW16
7	5	8 CHANNEL ANALOG CURRENT INPUT MODULE	ALLEN BRADLEY	1769-IF8
8	1	ETHERNET SW 5-PORT PLAS UNMGD	STRIDE	SE-SW5U
9	1	E-STOP SAFETY MODULE	BANNER	ES-FA-9AA
10	1	CUBE RELAY 15A 4PDT 24VDC COIL LED INDICATOR TEST PUSHBUTTON	AUTOMATIONDIRECT	784-4C-120A
11	1	RELAY SOCKET 784 SERIES	AUTOMATIONDIRECT	784-4C-SKT-1
12	4	FUSEBLOCK 10/PK 30A 20-6AWG 24V LED USE 1-1/4x1/4in FUSES	AUTOMATIONDIRECT	DN-F6L24
13	2	POWER SUPPLY, DIN RAIL MOUNT, 24-28 VDC	SOLA	SDP 4-24-100LT
14	1	CIRCUIT BREAKER, 1P, 10A, D CURVE, DIN RAIL MOUNT	EATON	WMZT1D10
15	1	CIRCUIT BREAKER, 1P, 1A, D CURVE, DIN RAIL MOUNT	EATON	WMZT1D01
16	4	CIRCUIT BREAKER, 1P, 3A, D CURVE, DIN RAIL MOUNT	EATON	WMZT1D03
17	1	TRIPLE REC CONV OUTLET 125V 15A	AUTOMATIONDIRECT	FA-REC3
18	10	ISOLATING SWITCHING AMPLIFIER - DISCRETE INPUTS 2 CHANNEL	TURCK	IM1-22EX-R/24VDC
19	18	ANALOG SIGNAL ISOLATOR - ANALOG INPUTS 2 CHANNEL	TURCK	IM31-22EX-I
20	1	MCCB, 200A 3P, 600VAC, F-FRAME	AUTOMATIONDIRECT	F3P-200
21	3	DIST BLK, FINGER SAFE, 380A, 6-OUT, 1-IN, 1-POLE, UL LISTED, 1/PK	EDISON	EPDB 306
22	2	MMS 63A 55MM ROTARY	FUJI	BM3VHB-063
23	2	CONTACTOR 65A, 220-240VAC COIL, 67mm	FUJI	SC-E3
24	2	MMS 2.5A 45MM ROTARY	FUJI	BM3RHB-2P5
25	1	MMS 1.6A 45MM ROTARY	FUJI	BM3RHB-1P6
26	3	CONTACTOR 9A, 110-120VAC COIL, 43mm	FUJI	SC-E02-110VAC
27	1	MCCB 50 AMP 3P 600V 125AMP FRAME FUJI BW125 SERIES UL489	FUJI	BW125JAGU-3P050SB
28	2	CIRCUIT BREAKER, 3P, 15A, D CURVE, DIN RAIL MOUNT	EATON	WMZT3D15
29	2	CONTACTOR 9A, 440-480VAC COIL, 43 mm	FUJI	SC-E02
30	1	UPS - AC, DINRAIL MOUNT	SOLA	SDU850
31	1	SURGE PROTECTOR - DIN RAIL MOUNT	SOLA	STV 25K-10S
32	16	CUBE RELAY 15A SPDT 120VAC COIL LED INDICATOR TEST PUSHBUTTON	AUTOMATIONDIRECT	781-1C-120A
33	16	RELAY SOCKET FOR 781 SERIES	AUTOMATIONDIRECT	781-1C-SKT

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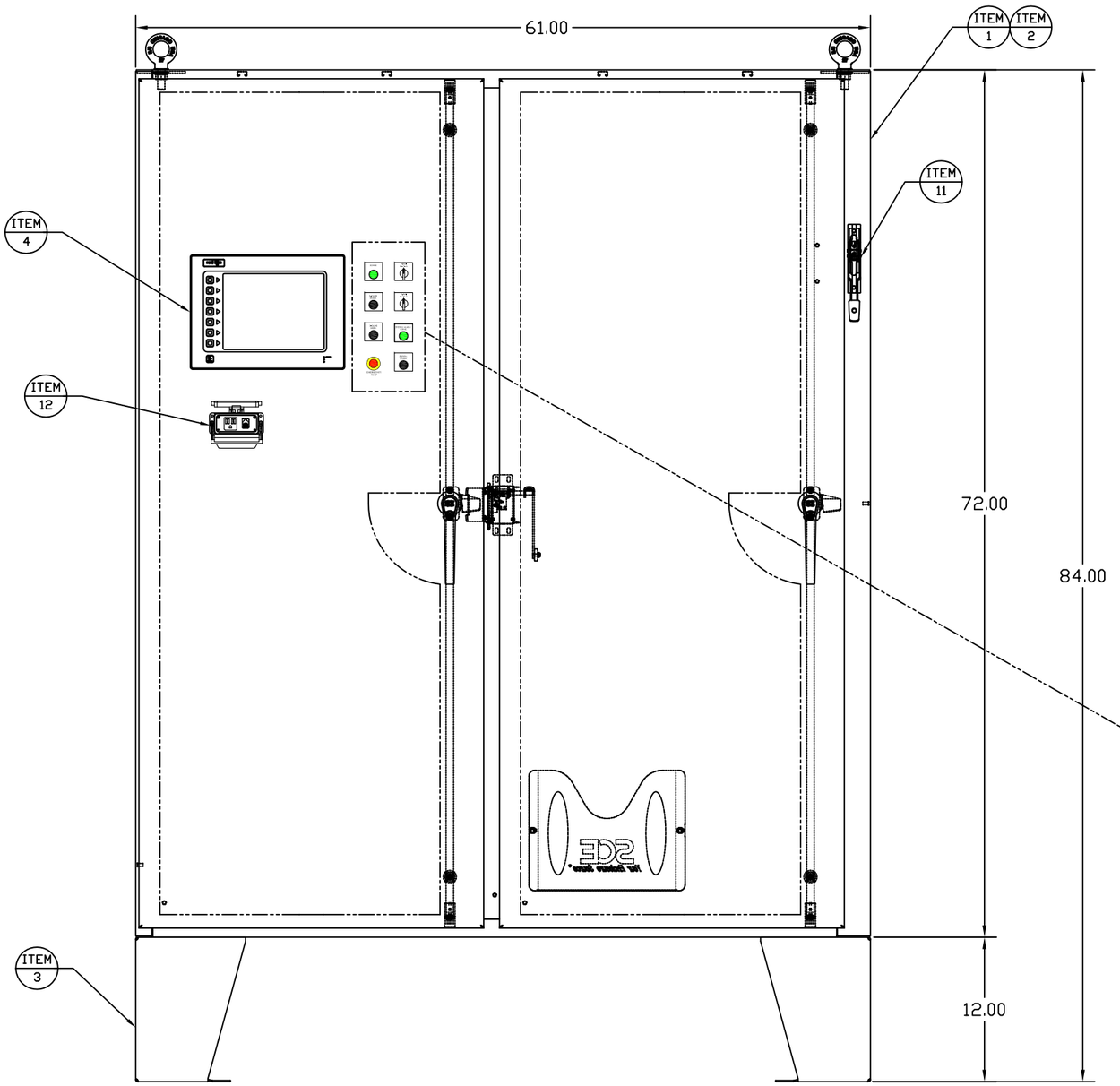
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
CONTROL PANEL PARTS LAYOUT INT

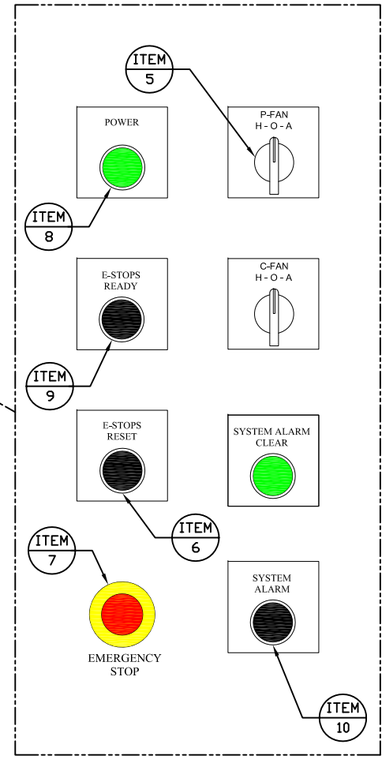
DRAWING NO. E-010 | SIZE B | SCALE | JOB NO. 1630 | UNIT NO. | REV 1

CUSTOMER AMTRAK | MATERIAL | DRAWN BY STEVE TURNER | DATE 9/24/12 | SHEET

REV	DATE	DESCRIPTION	DRW	APPR

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO
1	1	CONTROL PANEL ENCLOSURE – 72"H X 61"W X 12"D NEMA 12, DUAL DOOR, WALL MOUNT	SAGINAW CONTROL & ENGINEERING	SCE-72XEL6112LP
2	1	CONTROL PANEL SUBPANEL – 68"H X 56"W X 0.875"D	SAGINAW CONTROL & ENGINEERING	SCE-72P60
3	1	FLOOR KIT – 12"H X 12"W X 9.125"D	SAGINAW CONTROL & ENGINEERING	SCE-FK1212
4	1	HMI TOUCHSREEN CONTROL PANEL INTERFACE	RED LION	G310C210
5	2	SELECTOR SWITCH – 3 POSITION, MAINTAINED 22mm BLACK	AUTOMATION DIRECT	GCX1320-22
6	1	PUSHBUTTON, MOMENTARY 22mm BLACK	AUTOMATION DIRECT	GCX1100
7	1	MUSHROOM PUSHBUTTON, MOMENTARY 40mm RED	AUTOMATION DIRECT	GCX1135
8	2	INDICATING LIGHT – 120VAC 22mm GREEN	AUTOMATION DIRECT	ECX1052-120
9	1	INDICATING LIGHT – 24VDC 22mm AMBER	AUTOMATION DIRECT	ECX1053-24
10	1	INDICATING LIGHT – 120VAC 22mm RED	AUTOMATION DIRECT	ECX1051-120
11	1	DISCONNECT SWITCH	AUTOMATION DIRECT	F1S03C
12	1	ZIP PORT	AUTOMATION DIRECT	ZP-PSA-16-101





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DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
CONTROL PANEL PARTS LAYOUT EXT

REV	DATE	DESCRIPTION	DRW	APPR
2	1/10/13	UPDATE CONTROL PANEL ENCLOSURE	SMT	

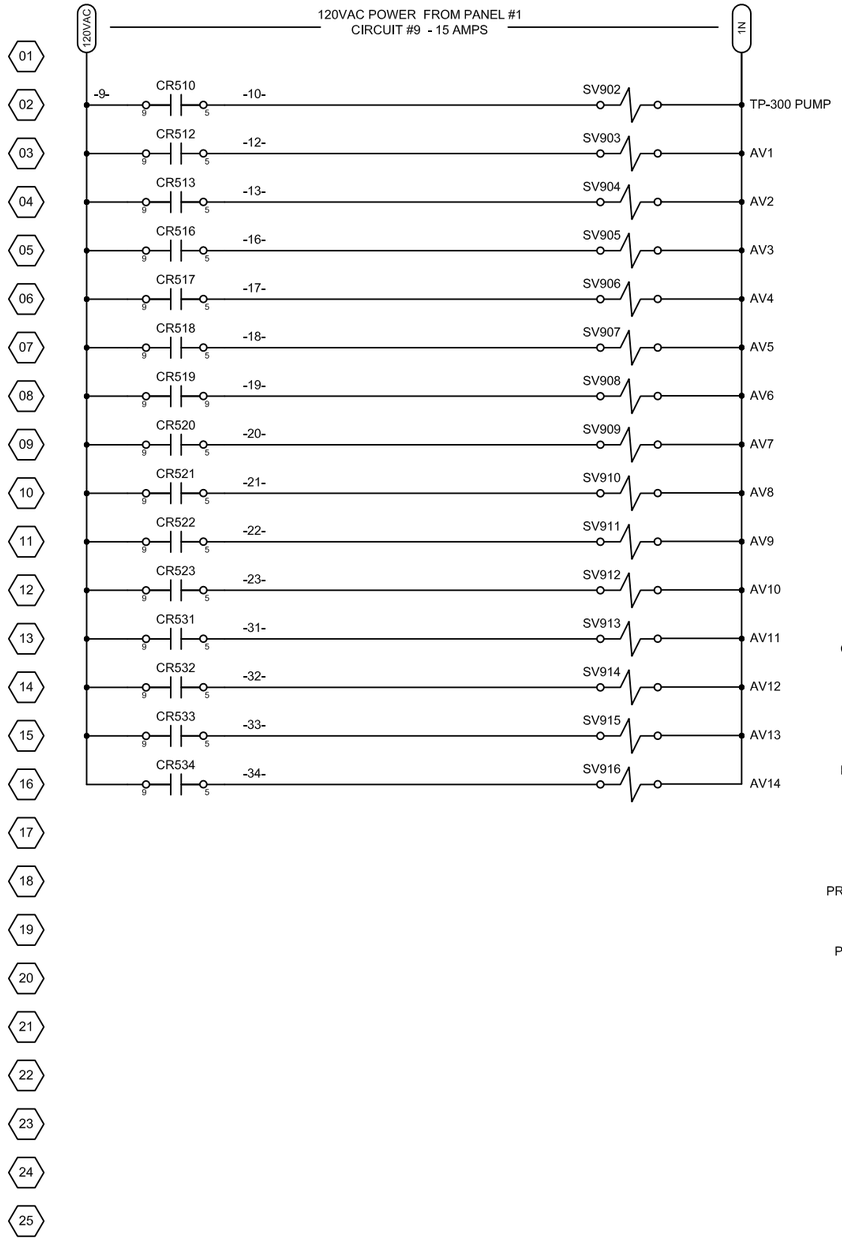
DRAWING NO. E-011 | SIZE B | SCALE | JOB NO. 1630 | UNIT NO. | REV 2

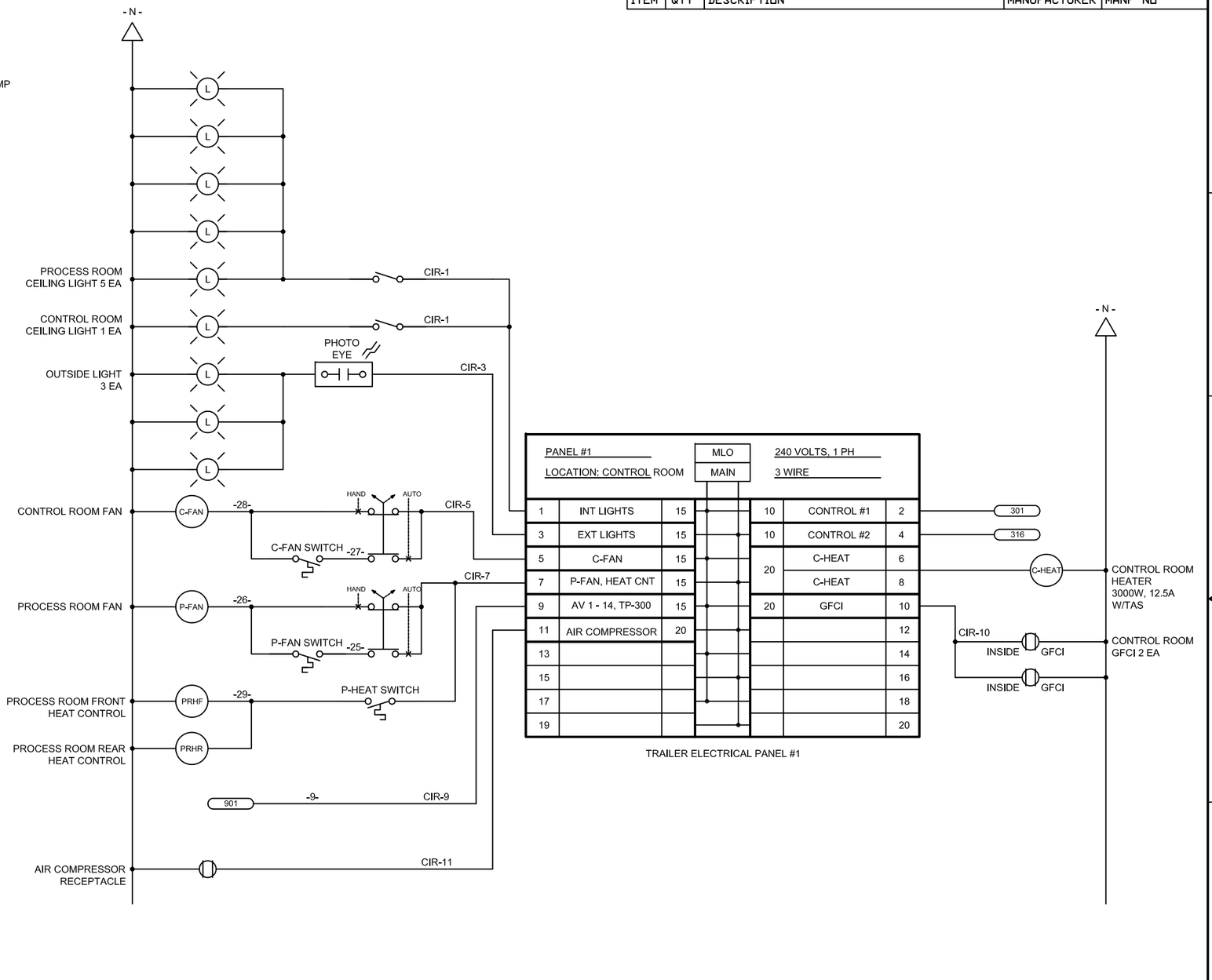
CUSTOMER AMTRAK | MATERIAL | DRAWN BY STEVE TURNER | DATE 9/24/12 | SHEET

APPENDIX D

Panel 1 Electrical Schematic

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO





REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	BREAKER 9 WIRING INCLUDED	SMT	
2	1/17/13	BREAKER 7 ADD P-HEAT CONTROLS	SMT	

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DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PANEL 1 ELECTRICAL SCHEMATIC

DRAWING NO. E-009	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

Air Compressor Information

Ingersoll Rand

Reciprocating Single- and Two-stage Air Compressors
2-25 hp

Innovation

Reliability

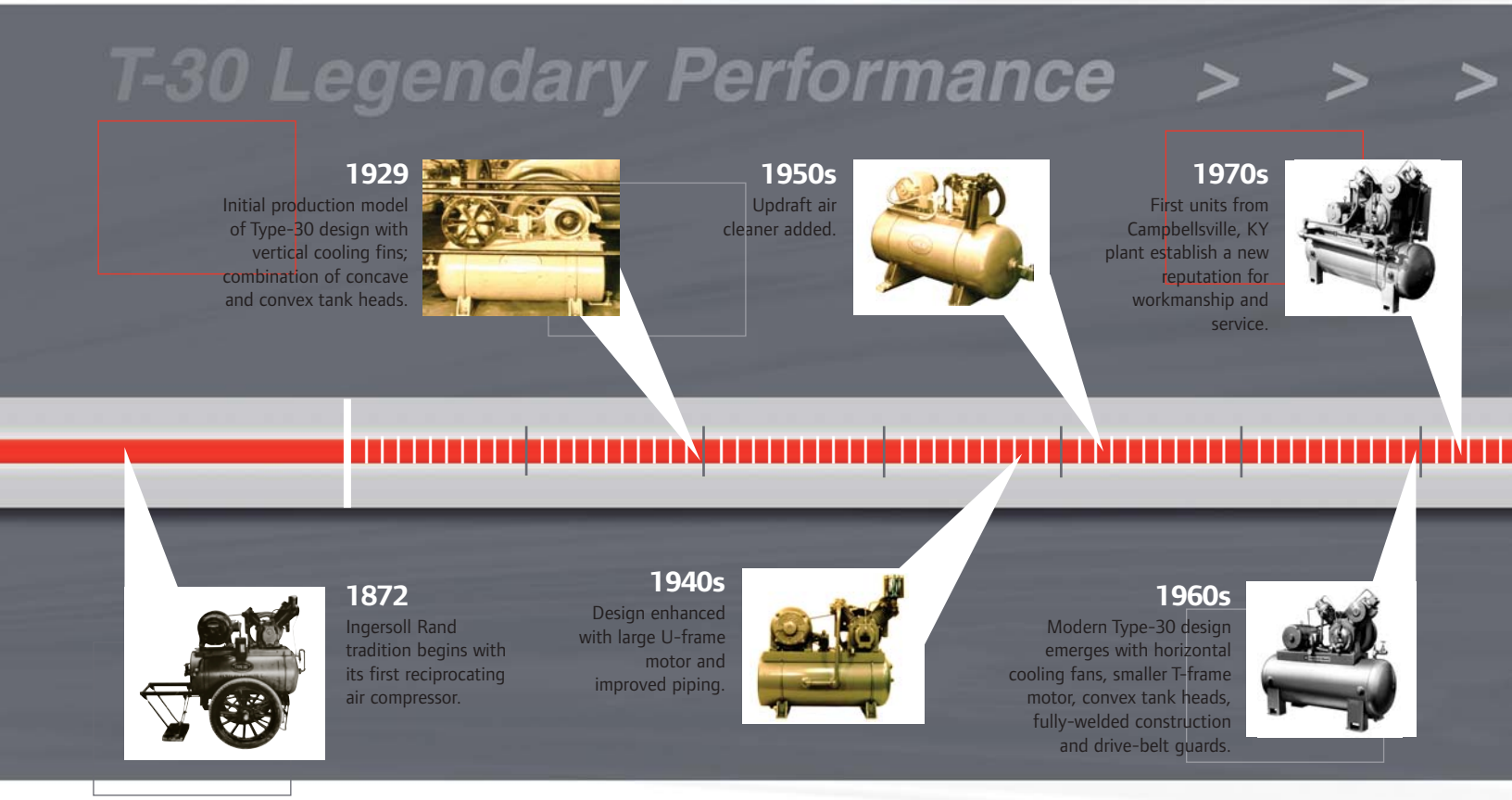
Efficiency

Ingersoll Rand
Industrial Technologies

Legendary Performance

For more than a century, Ingersoll Rand has inspired progress by driving innovation through revolutionary technology and talented people.

It's a legacy of creating new standards for how the world gets work done. We're the technology leader in compressed air not only because we develop best-in-class products, but also because we stand behind our customers in all aspects of what we do. No matter what your product, process or location, Ingersoll Rand has the expertise, the technology and the unmatched service to meet your needs.



Providing Customer-driven Compressor Solutions

When you've been delivering reliable reciprocating compressor results for more than 100 years, it's natural that your corporate culture supports a strong tradition of evolutionary enhancements. Every new generation of employees builds on the experience and insights of their mentors. Today's legendary Ingersoll Rand air compressors started with an original rock-solid design and have steadily improved with added control and performance upgrades over the years.

They are world-renowned for their impressive legacy of long-life performance, ease of service and evolutionary design enhancements.

Efficient. Reliable. Built to last.

Ingersoll Rand has sold millions of reciprocating compressors worldwide.

1980s
First blue-colored units feature new enhancements.

1990s
Fully packaged units with E-series starters and CSA package certification are introduced.

2000
Premier Series packaging adds dual controls, deluxe starter, and liquid-filled pressure gauge.

2002
Compact single-stage compressors introduced.

2003
Pressure-lubricated model with industrial-grade two-stage air cleaner added.

2006
Fully packaged model with aftercooler, automatic tank drain, and low-oil-level shutdown is top choice for round-the-clock applications.

Efficiency, Reliability, Built to Last

Ingersoll Rand

Time-tested design and enhancements establish Ingersoll Rand single- and two-stage reciprocating compressors as the benchmark for:

Efficiency and Reliability

With a proven design and stellar track record, the Ingersoll Rand reciprocating compressor family has earned worldwide recognition for reliable, trustworthy performance that saves money and enhances business success through:

- Lower life-cycle costs
- An ability to thrive in punishing applications
- Optimum solutions for greater efficiency
- Configurations that meet varying needs

Built to Last

Due to the laws of physics, there are certain aspects of reciprocating compressor design, construction and performance that have never changed – like cast-iron durability, copper-finned cooling coils, reliable lubrication and easy maintenance. That's where Ingersoll Rand design and operating experience really pays off in terms of long-term productivity and return on investment. Ask any one of the millions of active Ingersoll Rand reciprocating compressor users around the world.

Serviceability

Ingersoll Rand designed the reciprocating compressors to last a lifetime – thanks to quick, easy maintenance with renewable components. Easy access to the pump components allows for quick routine maintenance and replacement of parts like the stainless steel valve, individually cast cylinders, piston rings and gaskets, and the 15,000-hour bearings. This key serviceability aspect extends the life of the compressor and lets you amortize your initial capital cost over a much longer equipment life span for a superior payback on your investment.

Innovation

For more than 100 years, Ingersoll Rand has maintained the delicate balance between known performance and new developments by keeping the best features and upgrading others as new technology becomes available. The result is higher efficiency for today's energy-conscious world and enhanced value for the extended life of your investment.

Customer-driven Solutions

Another residual benefit of compressor longevity is our cumulative experience with how different users prefer, need and operate their compressors. Years of experience in the reciprocating compressor business and servicing a variety of users have taught us what is most important to compressor users. And that means more choices for you to satisfy your specific needs.

Your choices range from the size of the units and the sophistication of the features to popular packaged solutions. There are even gas-powered packages perfect for field service, fleet maintenance, remote pneumatic applications or emergency back-up needs.

The Ideal Design for Applications Where Air is Taken for Granted

Ingersoll Rand single- and two-stage reciprocating air compressors are an ideal choice for applications that demand a reliable air supply for everyday use, but where running an air compressor ranks a distant second to running your business.

- **Automotive Shops**
- **Light Manufacturing**
- **Construction**
- **Commercial Applications**
- **Fabrication**
- **Pneumatic Equipment**
- **Processing Lines**

It's All About Choices

Better choices lead to better solutions for saving money and improving overall return on investment in your unique application.

That's why Ingersoll Rand single- and two-stage reciprocating compressors offer you more choices of compressor sizes and compressor features to suit your needs. If you define unsurpassed performance by maximum operating pressure, increased air flow and extended duty cycles, count on an Ingersoll Rand reciprocating air compressor to deliver it reliably.

Take advantage of Ingersoll Rand expertise, product selection, service and system solutions to help you identify the optimum compressor size, performance features and package options for your applications. And learn how you can strengthen your business through:

- Lower operating costs
- Increased productivity
- Improved quality
- A better working environment

Two-stage Electric-powered Air Compressors			
Feature	**Value Package (5, 7.5, 10 & 15hp)**	**Value Plus Package (10 & 15hp)**	**Premium Package (5, 7.5, 10, 15 & 20hp)**
100% Cast Iron Pump	✔	✔	✔
ASME Coded Receiver Tank	✔	✔	✔
NEMA 1 & ODP Motor	✔	✔	✔
Magnetic Motor Starter	✔ (Except 2340 packages with single-phase voltage)	✔	✔ (Except 2340 packages with single-phase voltage)
Automatic Start/Stop Control with Pressure Switch	✔	✔	✔ (5 & 7.5hp only)
Oil Sight Glass	✔ (10 & 15hp only)	✔	
Manual Drain	✔		
Electric Drain		✔	✔
Air-Cooled Aftercooler		✔	✔
Low Oil Level Switch			✔
Dual Control with Centrifugal Unloader			✔ (10 & 15hp only)

Value Package (5, 7.5, 10 & 15hp) An economical choice in a dependable compressed air source, the Value Package offers the perfect solution for commercial, automotive and light industrial applications with intermittent load demands.

Value Plus Package (10 & 15hp) For applications that demand a heavier-duty cycle. Step up to this enhanced version of our base package. It is ideal for light industry applications. The Value Plus Package comes factory-fitted with options shown above for unmatched reliability in most diversified applications.

Premium Package (5, 7.5, 10, 15 & 20hp) For applications that are the most demanding or require greater control over compressed air supply. Step up to our top-of-the-line Premium Package. These air compressors come standard with factory-fitted options shown above for unmatched reliability in 100% continuous-duty applications.

Single-stage Air Compressor

Configured in space-saving stationary and portable models, these durable compressors are a favorite with DIY homeowners and in the construction industry.

Key features include:

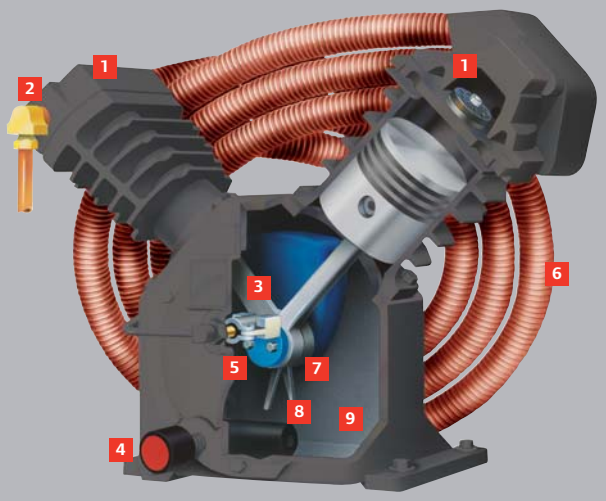
- Industry-leading 5,000-8,000 hour design life
- Industrial-quality cast iron construction
- Reliable high-speed valve design
- Fully-balanced crankshaft that reduces vibration
- 135 psi max. discharge pressure
- Honda engine-driven wheel barrow compressor

Two-stage Gas-powered Air Compressors

Ingersoll Rand's two-stage gasoline engine driven air compressors are designed to provide compressed air where electric power is not readily available. They're used in fleet and field service applications, remote pneumatic applications and emergency production lines.

- Available with easy-starting Honda, or Kohler engines
- Fuel-efficient idle control
- Advanced safety features including low oil level shutdown for gas engines

Why Ingersoll Rand Pumps Are Better... Excellence in Design!



1. **Two-stage Design:** Delivers pressures up to 175 psig
2. **Radial Fins for Maximum Cooling:** Even 360° cooling of barrel cylinders eliminates hot spots
3. **One-piece Connecting Rod:** Fewer wearing parts
4. **Low Oil Level Switch:** Provides constant protection
5. **Centrifugal Unloader:** Ensures loadless starts, for maximum starter protection
6. **Integral Fan Blade/Finned Copper Intercooler:** Runs cooler, even in the most demanding conditions
7. **Overhung Crankshaft:** Precision balanced to run smoothly and quietly; simplifies maintenance and wear-sleeve replacement
8. **Splash Lubrication:** Simple and reliable.
9. **100% Cast Iron:** Designed for a lifetime

Selection Guide
for Electric-drive Stationary Air Compressors

1. Select Your Compressor

Stationary Compressors	
Applications	**Recommended Package**
Intermittent Duty	Two-stage Value
Medium Duty	Two-stage Value Plus
100% Continuous Duty	Two-stage Premium
DIY	Single-stage

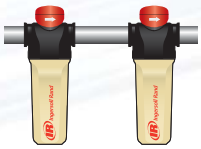
Portable Compressors	
Applications	**Recommended Package**
Remote/Fleet/ Field Service	Two-stage Gas-driven
DIY/Construction	Single-stage

2. Choose Your Air Quality

Ingersoll Rand compressed air treatment equipment is used to remove contaminants present in a compressed air system.

Shop Quality Air

General system protection removes bulk liquid and solid contaminates:

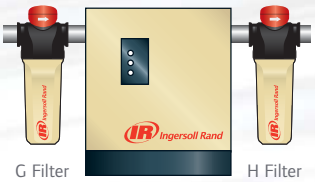


G Filter H Filter

- Light manufacturing
- Light auto service shop
- Pneumatic tools
- Dry cleaning

Dry, Clean Air

Complete system protection removes liquid and solid contaminates:



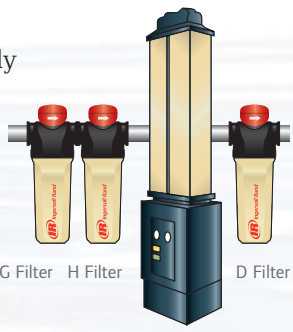
G Filter H Filter

Refrigerated Dryer

- Medium-to-heavy manufacturing
- Large auto service shop
- Auto body shop
- Printing
- Laundry
- Instrumentation

Critical Quality Air

Applications that require virtually no water vapor or contaminates:

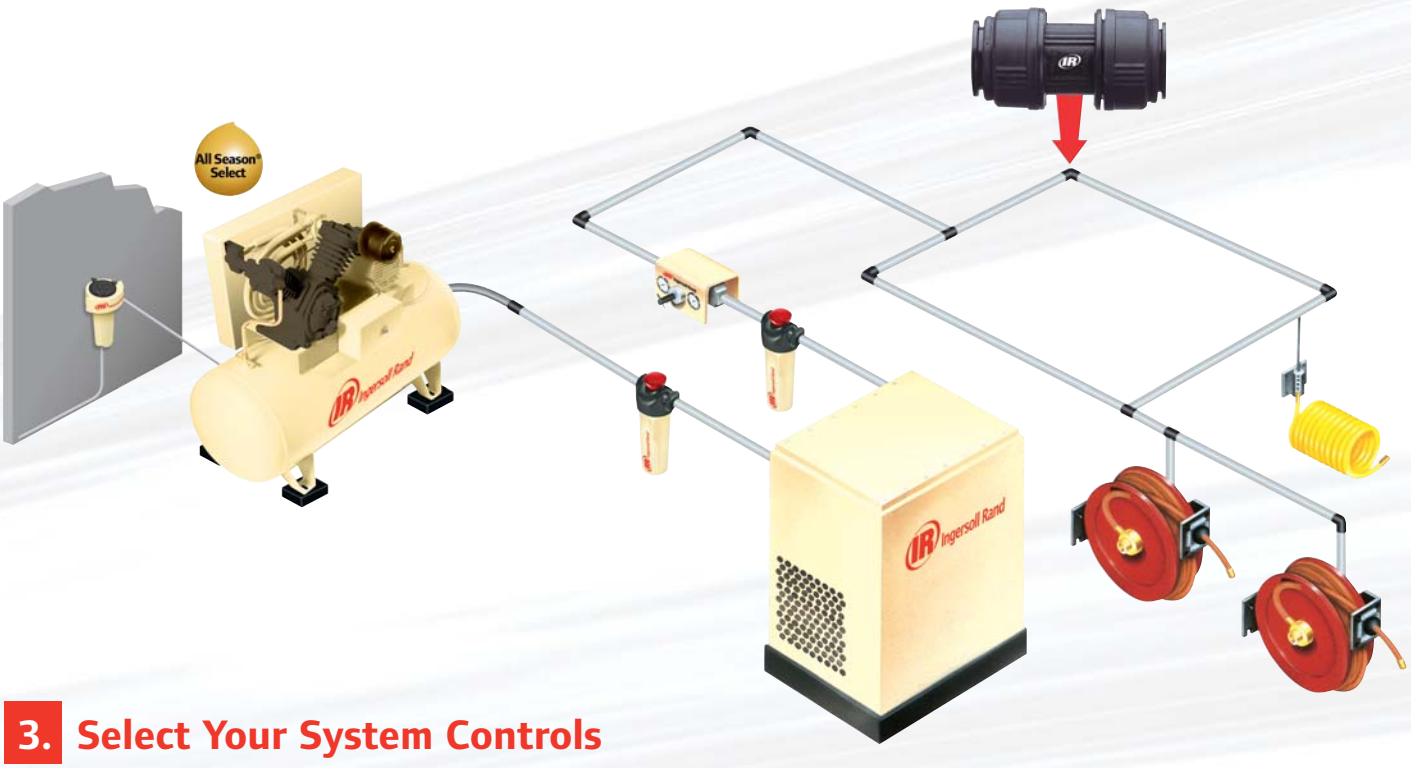


G Filter H Filter D Filter

Desiccant Dryer

- Advanced pneumatics and instrumentation
- Spray application booths
- Piping exposed to freezing temperatures

G - General Purpose H - High Efficiency D - Dust Protection



3. Select Your System Controls and Accessories

Ingersoll Rand accessories are available for all power sources.

IntelliFlow Pneumatic Flow Controller

- Energy savings
- Control pressure ± 1 psig (.07 bar g)
- Single point control system
- Reduce leak losses
- Increase system productivity
- Protect all downstream equipment

EZ-line SimplAir Compressed Air Piping

- High-quality anodized aluminum pipe
- Non-corrosive piping
- Reduced pressure loss
- Higher flow rates than other piping
- Easy and fast installation

EDV Electronic Drain Valve

- Automatically removes moisture from tanks, compressors, filters, drip legs

Filters, Regulators and Lubricators (FRLs)

FRLs provide point-of-use air conditioning to enhance tool longevity and process quality. Filters remove rust, scale and condensation that increase wear on tools regulators and provide constant pressure with varying upstream pressure. Lubricators provide lubricating oil to tools, cylinders, valves and other equipment.

Oil Water Separators

- Removes oil from drain condensate
- Allows for clean water discharge

Global Reach, Local Touch

No matter what the industry or location, Ingersoll Rand is committed to serving you 24 hours a day, seven days a week. Our worldwide network of distributors, engineers and certified, factory-trained technicians, are a phone call away — ready to support you with innovative and cost-effective service solutions that will keep you running at peak performance.

Start-up Kits

Ingersoll Rand offers All Season Select® start-up kits to provide improved protection. Each kit contains all the parts needed to correctly start up and maintain your compressor for the first year. The start-up kits provide everything you need for 2,000 hours of service between changes under normal operating conditions, along with the added protection of a two-year extended warranty.

All start-up kits include:

- All Season Select® lubricant, our synthetic, all-temperature blend designed to increase efficiency, reduce wear and prevent carbon build-up
- Replacement air filter elements

Specifications

Two-stage Electric-powered – Value Package

Model	hp	Tank Size/ Configuration	Stationary or Portable	Capacity (cfm) @ 175 psig	Max Pressure (psig)	Dimensions (L x W x H in)	Net Weight (lbs)	Tank Outlet (in)	Startup Kit
2340L5-V	5.0	60-Gal. Vertical	S	14.0	175	48 x 40 x 76	435	0.50	32305880
2340N5-V	5.0	80-Gal. Vertical	S	14.0	175	48 x 40 x 76	505	0.50	32305880
2475N5-V	5.0	80-Gal. Vertical	S	16.8	175	48 x 40 x 76	505	0.75	32305880
2475N7.5-V	7.5	80-Gal. Vertical	S	24.0	175	48 x 40 x 76	611	0.75	32305880
2545E10-V	10.0	120-Gal. Horizontal	S	35.0	175	83 x 36 x 65	920	0.75	32305898
2545K10-V	10.0	120-Gal. Vertical	S	35.0	175	51 x 46 x 83	1,104	1.00	32305898
7100E15-V	15.0	120-Gal. Horizontal	S	50.0	175	83 x 36 x 65	1,239	0.75	32305898

Available voltages: 230/1/60 (5-7.5 hp only), 200/3/60, 230/3/60, 460/3/60 and 575/3/60 voltages
Packages include magnetic starter (except 2340 models with single-phase voltage), manual drain, automatic start/stop control with pressure switch

Two-stage Electric-powered – Value Plus Package

Model	hp	Tank Size/ Configuration	Stationary or Portable	Capacity (cfm) @ 175 psig	Max Pressure (psig)	Dimensions (L x W x H in)	Net Weight (lbs)	Tank Outlet (in)	Startup Kit
2545E10-VP	10.0	120-Gal. Horizontal	S	35.0	175	83 x 36 x 65	1,104	0.75	32305898
2545K10-VP	10.0	120-Gal. Vertical	S	35.0	175	51 x 46 x 83	1,104	1.00	32305898
7100E15-VP	15.0	120-Gal. Horizontal	S	50.0	175	83 x 36 x 65	1,297	0.75	32305898

Available voltages: 200/3/60, 230/3/60, 460/3/60 and 575/3/60 voltages
Packages include magnetic starter, electric drain, Automatic start/stop control with pressure switch, air-cooled aftercooler

Two-stage Electric-powered – Premium Package

Model	hp	Tank Size/ Configuration	Stationary or Portable	Capacity (cfm) @ 175 psig	Max Pressure (psig)	Dimensions (L x W x H in)	Net Weight (lbs)	Tank Outlet (in)	Startup Kit
2475N5-P	5.0	80-Gal. Vertical	S	16.8	175	48 x 40 x 76	597	0.75	32305880
2475N7.5-P	7.5	80-Gal. Vertical	S	24.0	175	48 x 40 x 76	611	0.75	32305880
2545E10-P	10.0	120-Gal. Horizontal	S	35.0	175	83 x 36 x 65	1,104	0.75	32305898
2545K10-P	10.0	120-Gal. Vertical	S	35.0	175	51 x 46 x 83	1,104	1.00	32305898
7100E15-P	15.0	120-Gal. Horizontal	S	50.0	175	83 x 36 x 65	1,297	0.75	32305898

Available voltages: 230/1/60 (5-7.5 hp only), 200/3/60, 230/3/60, 460/3/60 and 575/3/60 voltages
Packages include magnetic starter, electric drain, automatic start/stop control with pressure switch (5 hp & 7.5hp), dual control with centrifugal unloader (10hp & 15hp), air-cooled aftercooler, low oil level switch

Single-stage Electric-powered

Model	hp	Tank Size/ Configuration	Stationary or Portable	Capacity (cfm) @ 90 psig	Max Pressure (psig)	Dimensions (L x W x H in)	Net Weight (lbs)	Tank Outlet (in)	Startup Kit
P1IU-A9	2.0	4-Gal. Twin	P	4.30	135	19 x 19 x 19	77	0.25	–
P1.5IU-A9	2.0	20-Gal. Vertical	P	5.20	135	22 x 23 x 43	200	0.25	–
SS3J2-WB	2.0	8-Gal. Twin	P	5.70	135	43 x 18 x 25	175	0.25	97338099
SS3J3-WB	3.0	8-Gal. Twin	P	11.3	135	43 x 18 x 25	175	0.25	97338099
SS3L3	3.0	60-Gal. Vertical	S	11.3	135	20 x 23 x 66	300	0.50	97338099
SS5L5	5.0	60-Gal. Vertical	S	18.1	135	20 x 30 x 71	310	0.50	20100251

Available voltages: 120/1/60 (P1IU-A9), 115/1/60 (P1.5IU-A9), and 230/1/60 (SS3, SS5) voltages

Two-stage Gas-powered

Model	hp	Engine	Tank Size/ Configuration	Stationary or Portable	Capacity (cfm) @ 175 psig	Max Pressure (psig)	Dimensions (L x W x H in)	Net Weight (lbs)	Tank Outlet (in)	Startup Kit
2475F13GH	13	Honda	30-Gal. Horizontal	P	25.0	175	51 x 33 x 44	469	0.50	32312936
2475X13GH	13	Honda	Baseplate Mounted	P	25.0	175	33 x 36 x 36	440	0.50	32312936
2475F12.5G	13	Kohler	30-Gal. Horizontal	P	24.0	175	51 x 33 x 44	469	0.50	32305872
2475X12.5G	13	Kohler	Baseplate Mounted	P	24.0	175	33 x 36 x 36	440	0.50	32305872

Single-stage Gas-powered

Model	hp	Engine	Tank Size/ Configuration	Stationary or Portable	Capacity (cfm) @ 90 psig	Max Pressure (psig)	Dimensions (L x W x H in)	Net Weight (lbs)	Tank Outlet (in)	Startup Kit
SS3J5.5GH-WB	5.5	Honda	8-Gal. Twin	P	11.8	135	43 x 18 x 26	175	0.25	97339501

Ingersoll Rand
Industrial Technologies

Ingersoll Rand Industrial Technologies provides products, services and solutions that enhance our customers' energy efficiency, productivity and operations. Our diverse and innovative products range from complete compressed air systems, tools and pumps to material and fluid handling systems and environmentally friendly microturbines. We also enhance productivity through solutions created by Club Car®, the global leader in golf and utility vehicles for businesses and individuals.

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Owner's Manual

for Model P1.5IU-A9

IMPORTANT INFORMATION! READ AND FOLLOW THESE INSTRUCTIONS. RETAIN FOR REFERENCE.

SAFETY

DEFINITIONS

⚠ DANGER **WILL cause DEATH, SEVERE INJURY or substantial property damage.**

⚠ WARNING **CAN cause DEATH, SEVERE INJURY or substantial property damage.**

⚠ CAUTION **WILL or CAN cause MINOR INJURY or property damage.**

GENERAL SAFETY PRECAUTIONS

⚠ DANGER **INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. Ingersoll Rand air compressors are not designed, intended or approved for breathing air. Compressed air should not be used for breathing air applications unless treated in accordance with all applicable codes and regulations.**

⚠ WARNING **HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from tank before servicing. Lockout/Tagout machine. Compressor must be connected to properly grounded circuit. See grounding instructions in manual. Do not operate compressor in wet conditions. Store indoors.**

MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.

HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not touch hot compressor or tubing.

HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank daily or after each use. Drain valve located at bottom of tank.

⚠ CAUTION **RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.**

GENERAL INFORMATION

Your air compressor unit is suitable for operating air tools, caulking guns, grease guns, sandblasters, etc. Depending on your application, the following accessories may be required:

- An air pressure regulator to adjust the air pressure entering the tool or accessory.
- An air line filter for removal of moisture and oil vapor in compressed air.
- An in-line lubricator to prolong the life of air tools.
- Separate air transformers which combine the functions of air regulation and/or moisture and dirt removal.

Contact your nearest authorized dealer or call 1-800-AIR-SERV for more information on air tools and accessories for your application.

PREPARATION FOR USE

TRANSPORTING THE UNIT

⚠ CAUTION **The wheels and handle do not provide adequate clearance, stability or support for pulling the unit up and down stairs or steps. The unit must be lifted or pushed up a ramp. Do not use the handle to lift the unit.**

SELECTING A LOCATION

GENERAL. Select a clean, dry, well-lighted area with plenty of space for proper cooling air flow and accessibility. Locate the unit on a solid level surface at least 12 inches (30 cm) from walls. Ensure unit is as level as possible.

TEMPERATURE. Ideal operating temperatures are between 32°F and 104°F (0°C and 40°C). In lower temperatures, you must protect safety/relief valves and drain valves from freezing.

⚠ CAUTION **Never operate in temperatures below 20°F (-6.6°C) or above 125°F (51.0°C).**

HUMID AREAS. In frequently humid areas, moisture may form in the bare pump and produce sludge in the lubricant, causing running parts to wear out prematurely. Excessive moisture is especially likely to occur if the unit is located in an unheated area that is subject to large temperature changes. Two signs of excessive humidity are external condensation on the bare pump when it cools down and a "milky" appearance in petroleum compressor lubricant. You may be able to prevent moisture from forming in the bare pump by increasing ventilation or operating for longer intervals.

NOISE CONSIDERATIONS. Consult local officials for information regarding acceptable noise levels in your area. To reduce excessive noise, use vibration mounts or intake silencers, relocate the unit or construct total enclosures or baffle walls. Contact your dealer for assistance.

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REV. : B
DATE : FEBRUARY 2008

INSTALLING THE AIR INLET FILTER

⚠ **CAUTION** **Do not operate without air inlet filter.**

Install the air inlet filters at the inlet connections at the bare pump. If heavy duty filtration is required, contact your dealer for information.

INSTALLING DISCHARGE PIPING

If it is necessary to install air discharge piping or condensate discharge piping, adhere to the following general guidelines. Contact your dealer for more information.

⚠ **WARNING** **If an aftercooler, check valve, block valve, or any other restriction is added to the compressor discharge, install a properly-sized ASME approved safety/relief valve between the compressor discharge and the restriction.**

⚠ **CAUTION** **If you will be using All Season Select synthetic compressor lubricant, all downstream piping material and system components must be compatible. Refer to the following material compatibility list. If there are incompatible materials present in your system, or if there are materials not included in the list, contact your dealer.**

Suitable:

Viton®, Teflon®, Epoxy (Glass Filled), Oil Resistant Alkyd, Fluorosilicone, Fluorocarbon, Polysulfide, 2-Component Urethane, Nylon, Delrin®, Celcon®, High Nitrile Rubber (Buna N. NBR more than 36% Acrylonitrile), Polyurethane, Polyethylene, Epichlorohydrin, Polyacrylate, Melamine, Polypropylene, Baked Phenolics, Epoxy, Modified Alkyds
(® indicates trademark of DuPont Corporation)

Not Recommended:

Neoprene, Natural Rubber, SBR Rubber, Acrylic Paint, Lacquer, Varnish, Polystyrene, PVC, ABS, Polycarbonate, Cellulose Acetate, Low Nitrile Rubber (Buna N. NBR less than 36% Acrylonitrile), EPDM, Ethylene Vinyl Acetate, Latex, EPR, Acrylics, Phenoxy, Polysulfones, Styrene Acrylonitrile (San), Butyl

GENERAL REQUIREMENTS. The piping, fittings, receiver tank, etc. must be certified safe for at least the maximum working pressure of the unit. Use hard-welded or threaded steel or copper pipes, cast iron fittings and hoses that are certified safe for the unit's discharge pressure and temperature. DO NOT USE PVC PLASTIC. Use pipe thread sealant on all threads, and make up joints tightly to prevent air leaks.

CONDENSATE DISCHARGE PIPING. If installing a condensate discharge line, the piping must be at least one size larger than the connection, as short and direct as possible, secured tightly and routed to a suitable drain point. Condensate must be disposed of in accordance with local, state, and federal laws and regulations.

NOTE: All compressed air systems generate condensate which accumulates in any drain point (e.g. tanks, filters, drip legs, aftercoolers, dryers). This condensate contains lubricating oil and/or substances which may be regulated and must be disposed of in accordance with local, state, and federal laws and regulations.

ELECTRICAL WIRING & GROUNDING

⚠ **WARNING** **Any electrical installation and service required should be performed by a qualified electrician who is familiar with all applicable local, state and federal laws and regulations.**

GENERAL. The motor rating, as shown on the motor nameplate, and the power supply must have compatible voltage, phase and hertz characteristics.

FUSES. Refer to the National Electric Code to determine the proper fuse or circuit breaker rating required. When selecting fuses, remember the momentary starting current of an electric motor is greater than its full load current. Time-delay or "slow-blow" fuses are recommended.

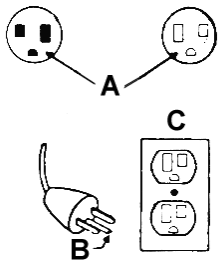
GROUNDING. The unit is equipped with a power cord having a grounding wire an an appropriate grounding plug. The plug must be used with an outlet that has been installed and grounded in accordance with all local codes and ordinances. The outlet must have the same configuration as the plug. DO NOT USE AN ADAPTER.

⚠ **WARNING** **In the event of a short circuit, grounding reduces the risk of shock by providing an escape for the electric current. The unit must be properly grounded.**

⚠ **DANGER** **Improper installation of the grounding plug can result in a risk of electric shock. If repair or replacement of the cord or plug is necessary, do not connect the grounding wire to either flat blade terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.**

Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if in doubt as to whether the product is properly grounded. Do not modify the plug provided; if it will not fit the outlet, have the proper outlet installed by a qualified electrician.

This product is for use on a nominal 120-volt circuit and has a grounding plug that looks like the plug illustrated below. Make sure the product is connected to an outlet having the same configuration as the plug. No adapter should be used with this product.



A=Ground
B=Grounding Pin
C=Outlet

EXTENSION CORDS. It is preferable to use extra air hose instead of an extension cord to avoid voltage drop and power loss to the motor, and to prevent overheating. If an extension cord must be used, ensure it meets the following criteria:

- Three wire cord with a three blade grounding plug, and a three slot receptacle that will accept the plug on the unit.
- Good condition
- No longer than 50 feet.
- 12 gauge or larger.

NOTE **Wire size increases as gauge number decreases. For example, 10 AWG and 8 AWG wire is acceptable, whereas 14 or 16 AWG are NOT acceptable.**

COMPRESSOR LUBRICATION

⚠ **CAUTION** **Do not operate without lubricant or with inadequate lubricant. Ingersoll Rand is not responsible for compressor failure caused by inadequate lubrication.**

SYNTHETIC LUBRICANT. We recommend All Season Select synthetic compressor lubricant from start-up. See the WARRANTY section for extended warranty information.

ALTERNATE LUBRICANTS. You may use a petroleum-based lubricant that is premium quality, does not contain detergents, contains only anti-rust, anti-oxidation, and anti-foam agents as additives, has a flashpoint of 440°F (227°C) or higher, and has an auto-ignition point of 650°F (343°C) or higher.

See the petroleum lubricant viscosity table below. The table is intended as a general guide only. Heavy duty operating conditions require heavier viscosities. Refer specific operating conditions to your dealer for recommendations.

Temperature Around Unit		Viscosity @ 100°F (37.8°C)		Viscosity Grade	
°F	°C	SUS	Centistokes	ISO	SAE
40 & below	4.4 & below	150	32	32	10
40 - 80	4.4 - 26.7	500	110	100	30
80 - 125	26.7 - 51.0	750	165	150	40

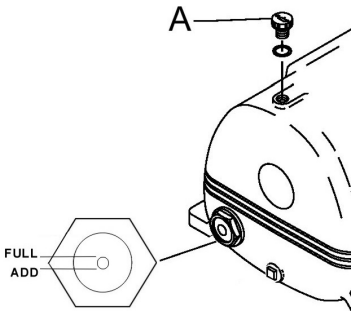
If you use a petroleum-based compressor lubricant at start-up and decide to convert to All Season Select synthetic compressor lubricant later on, the compressor valves must be thoroughly decarbonized and the crankcase must be flushed before conversion.

COMPRESSOR PUMP FILLING PROCEDURES:

⚠ **WARNING** **HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and Lockout/Tagout machine.**

1. Unscrew and remove the oil fill plug (A).
2. Slowly fill the crankcase with lubricant until the lubricant reaches the “full” level of the sight glass as shown. Crankcase capacity is one (1) pint (0.5 liters).
3. Replace the oil fill plug HAND TIGHT ONLY.

Filling Procedures



OPERATION

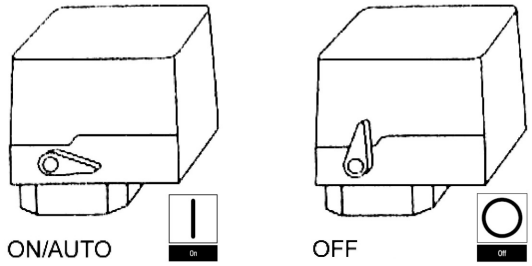
GENERAL

Your air compressor was designed for 100% continuous duty operation with the use of All Season Select synthetic compressor lubricant and 60% continuous duty operation with the use of petroleum lubricant. In other words, synthetic lubricant allows the compressor to pump continuously without cycling. Petroleum lubricant limits the compressor to a maximum of 36 minutes of pumping time per hour. The compressor should not cycle more than 10 times per hour.

NORMAL START-UP

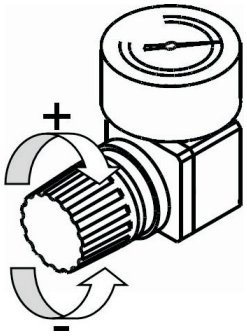
1. Set the pressure switch lever to “OFF”.

Pressure Switch Lever



2. Close the regulator by turning it fully counterclockwise (-).

Regulator



3. Attach hose and accessory.
4. Move the pressure switch lever to “ON/AUTO”. The unit will start.
5. Allow tank pressure to build. The motor will stop when tank pressure reaches cut-out pressure.
6. Adjust the regulator to the desired secondary pressure by turning it clockwise (+) to increase the pressure or counterclockwise (-) to decrease the pressure.

NOTE: **When the receiver tank pressure drops below the factory pre-set minimum, the pressure switch resets and restarts the unit.**

SHUTDOWN

1. Set the pressure switch lever to “OFF”.
2. Close the service valve fully.
3. Remove the air tool or accessory.
4. Slowly open the service valve to bleed air pressure down to 20 psig.
5. Slowly open the manual drain valve at the bottom of the tank to drain all condensate (water).
6. Close the drain valve and the service valve for the next use.
7. Wrap the power cord firmly around the handle.
8. Store the unit indoors.

MAINTENANCE

⚠ WARNING **Unplug the unit and release air pressure from the tank before performing maintenance.**

⚠ WARNING **Wear appropriate personal safety equipment such as safety glasses and gloves.**

NOTE **All compressed air systems contain maintenance parts (e.g. lubricating oil, filters, separators) which are periodically replaced. These used parts may be, or may contain, substances that are regulated and must be disposed of in accordance with local, state, and federal laws and regulations.**

NOTE **Take note of the positions and locations of parts during disassembly to make reassembly easier. The assembly sequences and parts illustrated may differ for your particular unit.**

NOTE **Follow engine owner's manual for engine maintenance schedules and procedures.**

NOTE **Any service operations not included in this section should be performed by an authorized service representative.**

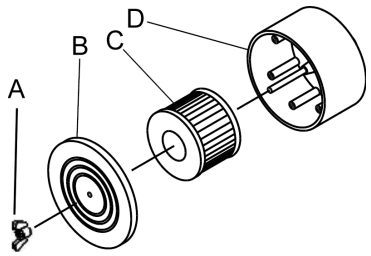
ROUTINE MAINTENANCE SCHEDULE

Daily or Before Each Operation	● Check lubricant level. Fill as needed. ● Drain receiver tank condensate. Open the manual drain valve and collect and dispose of condensate accordingly. ● Check for unusual noise and vibration. ● Ensure and covers are securely in place. ● Ensure area around compressor is free from rags, tools, debris, and flammable or explosive materials.
Weekly	● Inspect air filter element. Clean or replace if necessary.
Monthly	● Inspect for air leaks. Squirt soapy water around joints during compressor operation and watch for bubbles. ● Check tightness of screws and bolts. Tighten as needed. ● Clean exterior.
3/500 *	● Change petroleum lubricant while crankcase is warm.
12/2000 *	● Change synthetic lubricant while crankcase is warm. ● Replace filter element.

* indicates months/operating hours, whichever occurs first.

FILTER REPLACEMENT

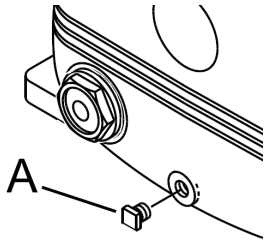
1. Unscrew and remove the wing nut (A).
2. Remove the filter cover (B) and element (C) from the base (D).
3. Install a new element and reassemble the filter assembly.



Filter Replacement

COMPRESSOR PUMP OIL CHANGE

1. Remove the oil drain plug (A) and allow the lubricant to drain into a suitable container.
2. Replace the oil drain plug.
3. Follow the filling procedures in PREPARATION FOR USE section.



Compressor Pump Oil Change

BELT ADJUSTMENT

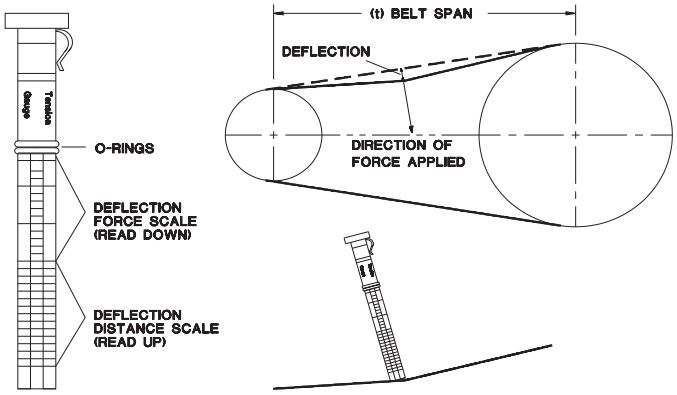
CHECKING BELT TENSION Check belt tension occasionally, especially if looseness is suspected. A quick check to determine if adjustment is proper may be made by observing the slack side of the belt for a slight bow when the unit is in operation. If a slight bow is evident, the belt is usually adjusted satisfactorily.

TENSIONING BELTS Belt tensioning can be achieved by loosening the motor anchor screws, pushing the motor away from the pump, and retightening the motor anchor screws. The motor can be easily moved by placing a prying tool beneath it. A commercially available spreader or other belt tensioning device can also be helpful should tensioning be necessary.

Follow the procedures outlined below to correctly set and measure belt tension.

1. Lay a straight edge across the top outer surface of the belt drive from pulley to sheave.
2. At the center of the span, perpendicular to the belt, apply pressure to the outer surface of the belt with a tension gauge. Force the belt to the deflection indicated in the table at right. Compare the reading on the tension gauge to the table below.

Deflection in Inches	Min. Tension (Lbs.)	Max. Tension (Lbs.)
0.17	3.0	6.0



Ensure the pulley and sheave are properly aligned and the motor anchor screws are adequately retightened prior to restarting the compressor.

⚠ **CAUTION** **Improper pulley/sheave alignment and belt tension can result in motor overload, excessive vibration, and premature belt and/or bearing failure.**

To prevent these problems from occurring, ensure the pulley and sheave are aligned and belt tension is satisfactory after installing new belts or tensioning existing belts.

TANK INSPECTION

The life of an air receiver tank is dependent upon several factors including, but not limited to, operating conditions, ambient environments, and the level of maintenance. The exact effect of these factors on tank life is difficult to predict; therefore, Ingersoll Rand recommends that you schedule a certified tank inspection within the first five years of compressor service. To arrange a tank inspection, contact the nearest Ingersoll Rand Customer Center or distributor, or call 1-800-AIR SERV.

If the tank has not been inspected within the first 10 years of compressor service, the receiver must be taken out of service until it has passed inspection. Tanks that fail to meet requirements must be replaced.

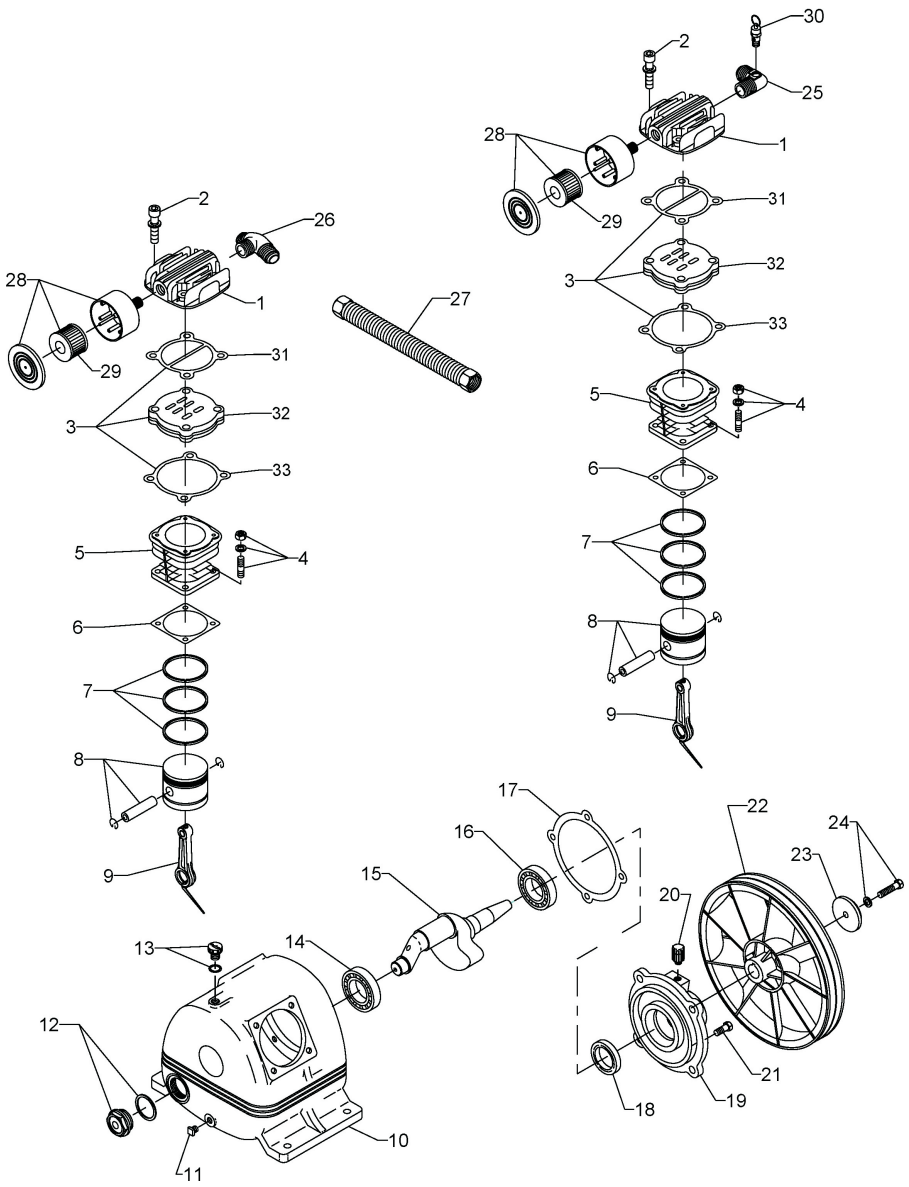
⚠ **WARNING** **Failure to replace a rusted air receiver tank could result in air receiver tank rupture or explosion, which could cause substantial property damage, severe personal injury, or death. Never modify or repair tank. Obtain replacement from service center.**

TROUBLESHOOTING

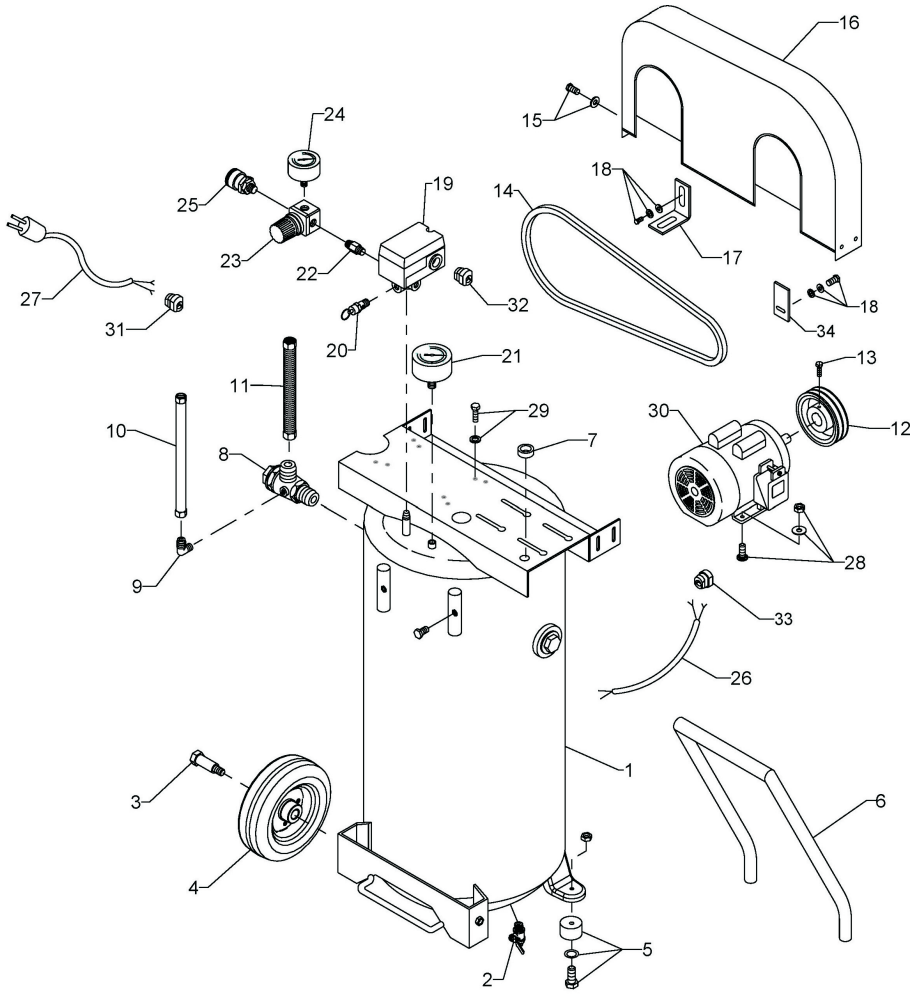
PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Abnormal piston, ring or cylinder wear	1. Lubricant viscosity too low. 2. Lubricant level too low. 3. Detergent type lubricant being used. 4. Cylinder(s) or piston(s) scratched, worn or scored. 5. Extremely dusty atmosphere. 6. Worn cylinder finish.	1. Drain existing lubricant and refill with proper lubricant. 2. Add lubricant to crankcase to proper level. 3. Drain existing lubricant and refill with proper lubricant. 4. Repair or replace as required. 5. Install remote air inlet piping and route to source of cleaner air. Install more effective filtration. 6. Deglaze cylinder with 180 grit flex-hone.
Air delivery drops off	1. Clogged or dirty inlet and/or discharge line filter. 2. Air leaks in air discharge piping. 3. Lubricant viscosity too high. 4. Compressor valves leaky, broken, carbonized or loose. 5. Piston rings damaged or worn (broken, rough or scratched). Excessive end gap or side clearance. 6. Piston rings not seated, are stuck in grooves or end gaps not staggered. 7. Cylinder(s) or piston(s) scratched, worn or scored. 8. Defective safety/relief valve.	1. Clean or replace. 2. Check tubing and connections. 3. Drain existing lubricant and refill with proper lubricant. 4. Inspect valves. Clean or replace as required. Install valve kit. 5. Install ring kit. 6. Adjust piston rings. 7. Repair or replace as required. 8. Replace.
Unit does not come up to speed	1. Loose beltwheel or motor pulley, excessive end play in motor shaft or loose drive belts. 2. Lubricant viscosity too high. 3. Improper line voltage. 4. Compressor valves leaky, broken, carbonized or loose. 5. Defective ball bearings on crankshaft or motor shaft.	1. Check beltwheel, motor pulley, crankshaft, drive belt tension and alignment. Repair or replace as required. 2. Drain existing lubricant and refill with proper lubricant. 3. Check line voltage and upgrade lines as required. Contact electrician. 4. Inspect valves. Clean or replace as required. Install valve kit. 5. Inspect bearings and replace crankshaft assembly if required.
Unit is slow to come up to speed	1. Lubricant viscosity too high. 2. Leaking check valve or check valve seat blown out. 3. Ambient temperature too low. 4. Bad motor.	1. Drain existing lubricant and refill with proper lubricant. 2. Replace check valve. 3. Relocate unit to warmer environment. Install crankcase heater kit. 4. Replace.
Unit runs excessively hot	1. Inadequate ventilation around beltwheel. 2. Drive belts too tight or misaligned. 3. Compressor valves leaky, broken, carbonized or loose. 4. Wrong beltwheel direction of rotation.	1. Relocate unit for better air flow. 2. Adjust belts to proper tension and alignment. 3. Inspect valves. Clean or replace as required. Install valve kit. 4. Check motor wiring for proper connections. Reverse two leads on three-phase motors.
Excessive noise during operation	1. Loose beltwheel or motor pulley, excessive end play in motor shaft or loose drive belts. 2. Lubricant viscosity too high. 3. Lubricant level too low. 4. Compressor valves leaky, broken, carbonized or loose. 5. Carbon build-up on top of piston(s). 6. Defective ball bearings on crankshaft or motor shaft. 7. Leaking check valve or check valve seat blown out.	1. Check beltwheel, motor pulley, crankshaft, drive belt tension and alignment. Repair or replace as required. 2. Drain existing lubricant and refill with proper lubricant. 3. Add lubricant to crankcase to proper level. 4. Inspect valves. Clean or replace as required. Install valve kit. 5. Clean piston(s). Repair or replace as required. 6. Inspect bearings and replace crankshaft assembly if required. 7. Replace check valve.
Excessive starting and stopping	1. Air leaks in air discharge piping. 2. Pressure switch differential too narrow. 3. Leaking check valve or check valve seat blown out. 4. Excessive condensate in receiver tank.	1. Check tubing and connections. 2. Adjust pressure switch to increase differential, if differential adjustment is provided. Install pressure switch with differential adjustment feature if differential adjustment is desired. 3. Replace check valve. 4. Drain receiver tank with manual drain valve.
High oil consumption	1. Clogged or dirty inlet and/or discharge line filter. 2. Lubricant viscosity too low. 3. Detergent type lubricant being used. 4. Piston rings damaged or worn (broken, rough or scratched). Excessive end gap or side clearance. 5. Piston rings not seated, are stuck in grooves or end gaps not staggered. 6. Cylinder(s) or piston(s) scratched, worn or scored. 7. Connecting rod, piston pin or crankpin bearings worn or scored. 8. Crankshaft seal worn or crankshaft scored. 9. Worn cylinder finish.	1. Clean or replace. 2. Drain existing lubricant and refill with proper lubricant. 3. Drain existing lubricant and refill with proper lubricant. 4. Install ring kit. 5. Adjust piston rings. 6. Repair or replace as required. 7. Inspect all. Repair or replace as required. 8. Replace seal or crankshaft assembly. 9. Deglaze cylinder with 180 grit flex-hone.
Knocking or rattling	1. Loose beltwheel or motor pulley, excessive end play in motor shaft or loose drive belts. 2. Compressor valves leaky, broken, carbonized or loose. 3. Carbon build-up on top of piston(s). 4. Cylinder(s) or piston(s) scratched, worn or scored. 5. Connecting rod, piston pin or crankpin bearings worn or scored. 6. Defective ball bearings on crankshaft or motor shaft.	1. Check beltwheel, motor pulley, crankshaft, drive belt tension and alignment. Repair or replace as required. 2. Inspect valves. Clean or replace as required. Install valve kit. 3. Clean piston(s). Repair or replace as required. 4. Repair or replace as required. 5. Inspect all. Repair or replace as required. 6. Inspect bearings and replace crankshaft assembly if required.

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Lights flicker or dim when running	1. Improper line voltage. 2. Wiring or electric service panel too small. 3. Poor contact on motor terminals or starter connections. 4. Improper starter overload heaters. 5. Poor power regulation (unbalanced line).	1. Check line voltage and upgrade lines as required. Contact electrician. 2. Install properly sized wire or service box. Contact electrician. 3. Ensure good contact on motor terminals or starter connections. 4. Install proper starter overload heaters. Contact electrician. 5. Contact power company.
Moisture in crankcase or “milky” appearance in petroleum lubricant or rusting in cylinders	1. Detergent type lubricant being used. 2. Extremely light duty cycles. 3. Unit located in damp or humid location.	1. Drain existing lubricant and refill with proper lubricant. 2. Run unit for longer duty cycles. 3. Relocate unit.
Motor overload trips or draws excessive current	1. Lubricant viscosity too high. 2. Improper line voltage. 3. Wiring or electric service panel too small. 4. Poor contact on motor terminals or starter connections. 5. Improper starter overload heaters. 6. Poor power regulation (unbalanced line). 7. Drive belts too tight or misaligned. 8. Compressor valves leaky, broken, carbonized or loose. 9. Cylinder(s) or piston(s) scratched, worn or scored. 10. Connecting rod, piston pin or crankpin bearings worn or scored. 11. Defective ball bearings on crankshaft or motor shaft. 12. Leaking check valve or check valve seat blown out. 13. Ambient temperature too low. 14. Bad motor.	1. Drain existing lubricant and refill with proper lubricant. 2. Check line voltage and upgrade lines as required. Contact electrician. 3. Install properly sized wire or service box. Contact electrician. 4. Ensure good contact on motor terminals or starter connections. 5. Install proper starter overload heaters. Contact electrician. 6. Contact power company. 7. Adjust belts to proper tension and alignment. 8. Inspect valves. Clean or replace as required. Install valve kit. 9. Repair or replace as required. 10. Inspect all. Repair or replace as required. 11. Inspect bearings and replace crankshaft assembly if required. 12. Replace check valve. 13. Relocate unit to warmer environment. Install crankcase heater kit. Convert to synthetic lubricant. 14. Replace
Motor will not start	1. Improper line voltage. 2. Wiring or electric service panel too small. 3. Poor contact on motor terminals or starter connections. 4. Improper starter overload heaters. 5. Bad motor.	1. Check line voltage and upgrade lines as required. Contact electrician. 2. Install properly sized wire or service box. Contact electrician. 3. Ensure good contact on motor terminals or starter connections. 4. Install proper starter overload heaters. Contact electrician. 5. Replace
Oil in discharge air (oil pumping)	1. Lubricant viscosity too low. 2. Detergent type lubricant being used. 3. Piston rings damaged or worn (broken, rough or scratched). Excessive end gap or side clearance. 4. Piston rings not seated, are stuck in grooves or end gaps not staggered. 5. Cylinder(s) or piston(s) scratched, worn or scored. 6. Worn cylinder finish. 7. Excessive condensate in receiver tank.	1. Drain existing lubricant and refill with proper lubricant. 2. Drain existing lubricant and refill with proper lubricant. 3. Install ring kit. 4. Adjust piston rings. 5. Repair or replace as required. 6. Deglaze cylinder with 180 grit flex-hone. 7. Drain receiver tank with manual drain valve.
Oil leaking from shaft seal	1. Crankshaft seal worn or crankshaft scored.	1. Replace seal or crankshaft assembly.
Safety/relief valve “pops”	1. Clogged or dirty inlet and/or discharge line filter. 2. Compressor valves leaky, broken, carbonized or loose. 3. Defective safety/relief valve.	1. Clean or replace. 2. Inspect valves. Clean or replace as required. Install valve kit. 3. Replace

PARTS LIST



PUMP



RECEIVER TANK

PUMP COMPONENTS

REF. NO.	PART NO.	DESCRIPTION	QTY.
1	23191851	HEAD - CYLINDER	2
2	23191869	SET - ALLEN BOLT	8
3	23191877	SET - IN. & EX. VALVE	2
4	23191885	SET - DOUBLE HEAD SCREW	8
5	23191893	CYLINDER	2
6	23191901	GASKET - CYLINDER	2
7	23191919	SET - PISTON RING	2
8	23191927	SET - PISTON	2
9	23191935	SET - ROD	2
10	23191943	CRANKCASE	1
11	23191950	PLUG - OIL DRAINING	1
12	23191968	SET - OIL SIGHT GAUGE	1
13	23191976	SET - OIL FILLING PLUG	1
14	23191984	BEARING	1
15	23191992	CRANKSHAFT & BALANCER	1
16	23192008	BEARING	1
17	23192016	GASKET - REAR BEARING SEAT	1
18	23192024	SEAL - OIL	1
19	23192032	SEAT - REAR BEARING	1
20	23194442	COVER - BREATHING	1
21	23192057	BOLT - HEXAGON	4
22	23192065	PULLEY	1
23	23192073	WASHER - PLATE	1
24	23192081	SET - HEXAGON BOLT	1
25	23192099	ELBOW - EXHAUST	1
26	23192107	PIPE - THREE WAY EXHAUST	1
27	23192115	SET - EXHAUST TUBE	1
28	23192123	SET - AIR FILTER	2
29	23192131	ELEMENT - FILTER	2
30	23192149	VALVE - PRESSURE RELIEF	1
31	23192040	GASKET - CYLINDER HEAD	2
32	23213044	ASSEMBLY - IN. & EX. VALVE	2
33	23213051	GASKET - VALVE SEAT	2

NOTE: FOR COMPLETE PUMP ORDER PART NO. 42660597

RECEIVER TANK COMPONENTS

REF. NO.	PART NO.	DESCRIPTION	QTY.
1	23192305	TANK - AIR	1
2	23192313	VALVE - BALL	1
3	23192321	BOLT - TANK WHEEL	2
4	23192339	WHEEL - TANK	2
5	23192347	SET - RUBBER PAD	2
6	23192354	GRIP	1
7	23192362	BUSHING	1
8	23192370	VALVE - CHECK	1
9	23192388	ELBOW - UNLOADING	1
10	23192396	TUBE - UNLOADING	1
11	23192404	SET - EXHAUST TUBE	1
12	23192412	PULLEY - MOTOR	1
13	23192420	BOLT - ALLEN	2
14	23192438	BELT - V	1
15	23192446	SET - HEXAGON BOLT	4
16	23192453	GUARD - BELT	1
17	23192461	BRACKET	1
18	23192479	SET - HEXAGON BOLT	6
19	23192487	SWITCH - PRESSURE	1
20	23192495	VALVE - PRESSURE RELIEF	1
21	23192503	GAUGE - PRESSURE	1
22	23192511	NIPPLE	1
23	23192529	REGULATOR	1
24	23192537	GAUGE - PRESSURE	1
25	23192545	COUPLER - QUICK	1
26	23192552	CABLE	1
27	23192560	CABLE - POWER	1
28	23192578	SET - MOTOR FEET BOLT	4
29	23192586	SET - HEXAGON BOLT	4
30	23192594	MOTOR	1
31	23244411	BUSHING - STRAIN RELIEF	1
32	23244429	BUSHING - STRAIN RELIEF	1
33	23244437	BUSHING - STRAIN RELIEF	1
34	23244445	BRACKET	2

REPAIR KITS

DESCRIPTION	PART NO.	KIT CONTENTS
START UP AND MAINTENANCE KIT	42661561	(1) LITER OF OIL — PART NO. 38436721 (2) INLET FILTER COMPLETE — PART NO. 70243399
GASKET KIT	42665463	(2) CYLINDER GASKET — PART NO. 23191901 (1) REAR BEARING SEAT GASKET — PART NO. 23192016 (2) CYLINDER HEAD GASKET — PART NO. 23192040 (2) VALVE SEAT GASKET — PART NO. 23213051
COMPLETE PUMP	42660597	ALL PARTS IN “PUMP COMPONENTS” ILLUSTRATION, COMPLETELY ASSEMBLED.
VALVE KIT	23191877	(2) CYLINDER HEAD GASKETS — PART NO. 23192040 (2) IN. & EX. VALVE ASSEMBLY — PART NO. 23213044 (2) VALVE SEAT GASKETS — PART NO. 23213051
PISTON RING KIT	42665950	(2) CYLINDER GASKETS — PART NO. 23191901 (2) PISTON RING SETS — PART NO. 23191919

WARRANTY

Ingersoll-Rand Company warrants that the Equipment manufactured by it and delivered hereunder shall be free of defects in material and workmanship for a period of twelve (12) months from the date of delivery to the customer. Should any failure to conform to this Warranty be reported in writing to the Company within said period, the Company shall, at its option, correct such nonconformity by suitable repair to such Equipment, or furnish a replacement part F.O.B. point of shipment, provided the purchaser has installed, maintained and operated such equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturer conveyed to Ingersoll-Rand Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser without the Company's prior written approval.

The Company makes no performance warranty unless specifically stated within its proposal and the effects of corrosion, erosion and normal wear and tear are specifically excluded from the Company's Warranty. In the event performance warranties are expressly included, the Company's obligation shall be to correct in the manner and for the period of time provided above.

THE COMPANY MAKES NO OTHER WARRANTY OF REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED.

Correction by the Company of nonconformities, whether patent or latent, in the manner and for the period of time provided above, shall constitute fulfillment of all liabilities of the Company and its Distributors for such nonconformities with respect to or arising out of such Equipment.

LIMITATION OF LIABILITY

THE REMEDIES OF THE PURCHASER SET FORTH HEREIN ARE EXCLUSIVE, AND THE TOTAL LIABILITY OF THE COMPANY, ITS DISTRIBUTORS AND SUPPLIERS WITH RESPECT TO CONTRACT OR THE EQUIPMENT AND SERVICES FURNISHED, IN CONNECTION WITH THE PERFORMANCE OR BREACH THEREOF, OR FROM THE MANUFACTURE, SALE, DELIVERY, INSTALLATION, REPAIR OR TECHNICAL DIRECTION COVERED BY OR FURNISHED UNDER CONTRACT, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE SHALL NOT EXCEED THE PURCHASE PRICE OF THE UNIT OF EQUIPMENT UPON WHICH SUCH LIABILITY IS BASED.

THE COMPANY, ITS DISTRIBUTORS AND ITS SUPPLIERS SHALL IN NO EVENT BE LIABLE TO THE PURCHASER, ANY SUCCESSORS IN INTEREST OR ANY BENEFICIARY OR ASSIGNEE OF THE CONTRACT FOR ANY CONSEQUENTIAL, INCIDENTAL, INDIRECT, SPECIAL OR PUNITIVE DAMAGES ARISING OUT OF THIS CONTRACT OR ANY BREACH THEREOF, OR ANY DEFECT IN, OR FAILURE OF, OR MALFUNCTION OF THE EQUIPMENT, WHETHER OR NOT BASED UPON LOSS OF USE, LOSS PROFITS OR REVENUE, INTEREST, LOST GOODWILL, WORK STOPPAGE, IMPAIRMENT OF OTHER GOODS, LOSS BY REASON OF SHUTDOWN OR NON-OPERATION, INCREASED EXPENSES OF OPERATION, COST OF PURCHASE OF REPLACEMENT POWER, OR CLAIMS OF PURCHASER OR CUSTOMERS OF PURCHASER FOR SERVICE INTERRUPTION WHETHER OR NOT SUCH LOSS OR DAMAGE IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE.

Retain your receipt as proof of purchase in the event of a claim under warranty.

Questions? Parts? Service?

1-800 AIR SERV

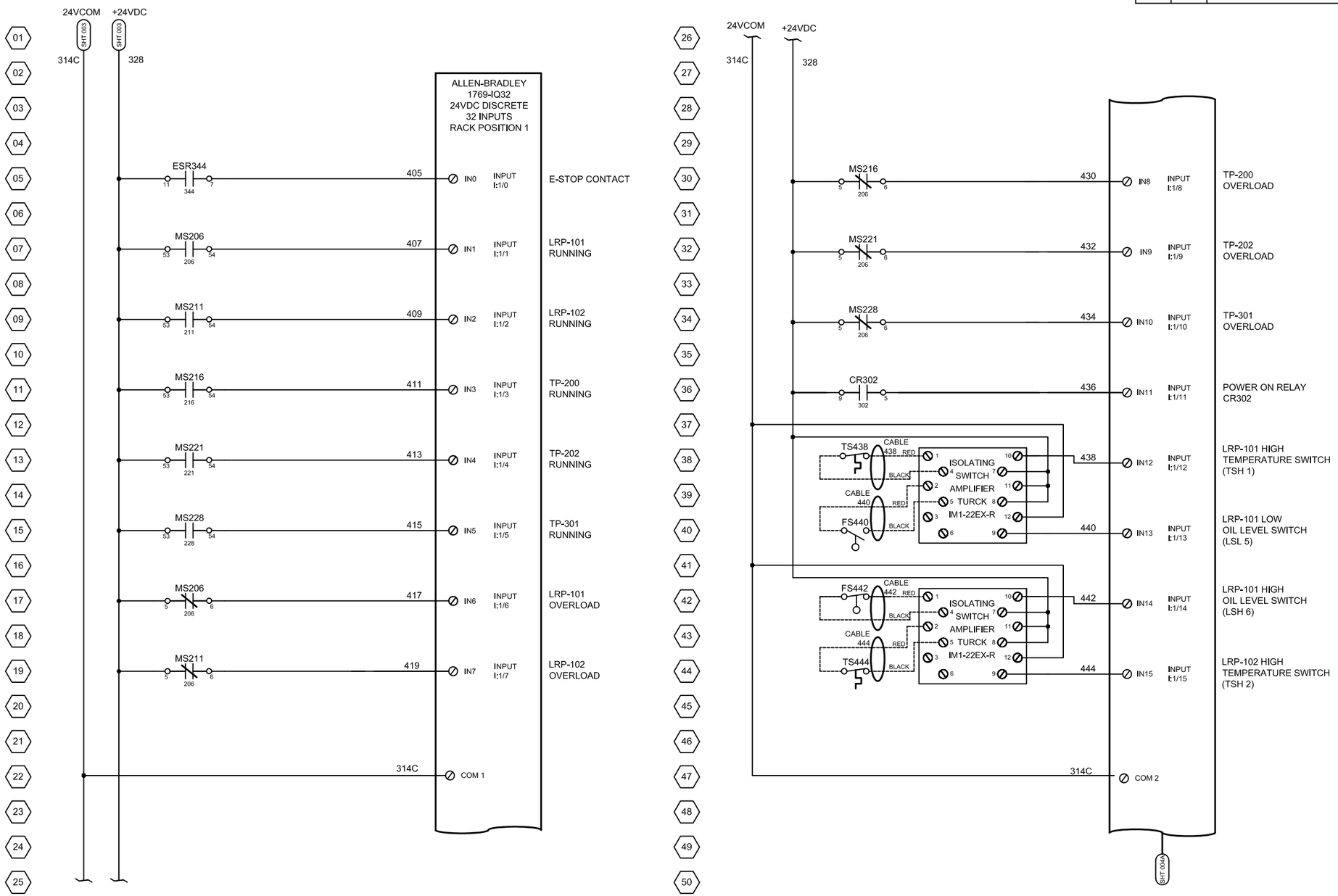
Visit our website:

www.air.irco.com

APPENDIX F

PLC Input/Output/ Analog Wiring Drawings

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO



REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	CR344 TO ESR344 CR302 PIN NUMBER	SMT	
2	1/17/13	TURCK ISOLATOR WIRING CR PIN NUMBERS	SMT	

ProAct Services Corporation

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DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC INPUT CARD WIRING

DRAWING NO. E-004	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO

24VCOM (314C) +24VDC (328)

ALLEN-BRADLEY 1769-IQ32 24VDC DISCRETE 32 INPUTS RACK POSITION 1

FS4A05	4A05	IN16	INPUT I:1/16	LRP-102 LOW OIL LEVEL SWITCH (LSL 7)
FS4A07	4A07	IN17	INPUT I:1/17	LRP-102 HIGH OIL LEVEL SWITCH (LSH 8)
FS4A09	4A09	IN18	INPUT I:1/18	KO TANK LOW FLOAT SWITCH (LSL 1)
FS4A11	4A11	IN19	INPUT I:1/19	KO TANK HIGH FLOAT SWITCH (LSH 2)
FS4A13	4A13	IN20	INPUT I:1/20	KO TANK HI HI FLOAT SWITCH (LSHH 3)
FS4A15	4A15	IN21	INPUT I:1/21	KO TANK HI HI HI FLOAT SWITCH (LSHHH 4)
FS4A17	4A17	IN22	INPUT I:1/22	OWS LOW FLOAT SWITCH (LSL 9)
FS4A19	4A19	IN23	INPUT I:1/23	OWS HIGH FLOAT SWITCH (LSH 10)
	314C	COM 3		

24VCOM (314C) +24VDC (328)

FS4A30	4A30	IN24	INPUT I:1/24	OWS HI HI FLOAT SWITCH (LSHH 11)
FS4A32	4A32	IN25	INPUT I:1/25	OWS PRODUCT LOW FLOAT SWITCH (LSL 12)
FS4A34	4A34	IN26	INPUT I:1/26	OWS PRODUCT HIGH FLOAT SWITCH (LSH 13)
FS4A36	4A36	IN27	INPUT I:1/27	OWS PRODUCT HI HI FLOAT SWITCH (LSHH 14)
FS4A38	4A38	IN28	INPUT I:1/28	PRODUCT HI HI FLOAT SWITCH (LSHH 15)
FS4A40	4A40	IN29	INPUT I:1/29	CLEAN WATER TANK HIGH FLOAT SWITCH (LSHH 16)
FS4A42	4A42	IN30	INPUT I:1/30	FLOOR SUMP 1 HIGH FLOAT SWITCH (LSH 17)
FS4A44	4A44	IN31	INPUT I:1/31	FLOOR SUMP 2 HIGH FLOAT SWITCH (LSH 18)
	314C	COM 4		

REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	FS4A11, FS4A13 NORMALL OPEN COM3, COM4 INPUT CARD	SMT	
2	1/17/13	TURCK ISOLATOR WIRING	SMT	

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DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC INPUT CARD WIRING

DRAWING NO. E-004A	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO

24VCOM (SHT 003) — 314C

+24VDC (SHT 003) — 328

ALLEN-BRADLEY
1769-IQ16
24VDC DISCRETE
16 INPUTS
RACK POSITION 2

4B05	IN0	INPUT I:3/0	SPARE	
4B07	IN1	INPUT I:3/1	SPARE	
4B09	IN2	INPUT I:3/2	SPARE	
4B11	IN3	INPUT I:3/3	SPARE	
4B13	IN4	INPUT I:3/4	SPARE	
4B15	IN5	INPUT I:3/5	SPARE	
4B17	IN6	INPUT I:3/6	SPARE	
4B19	IN7	INPUT I:3/7	SPARE	
314C	COM 1			

4B30	IN8	INPUT I:3/8	SPARE	
4B32	IN9	INPUT I:3/9	SPARE	
4B34	IN10	INPUT I:3/10	SPARE	
4B36	IN11	INPUT I:3/11	SPARE	
4B38	IN12	INPUT I:3/12	SPARE	
4B40	IN13	INPUT I:3/13	SPARE	
4B42	IN14	INPUT I:3/14	SPARE	
4B44	IN15	INPUT I:3/15	SPARE	
314C	COM 2			

REV	DATE	DESCRIPTION	DRW	APPR
2	1/17/13	ADD TERMINAL BLOCK CONNECTORS TO SPARES	SMT	

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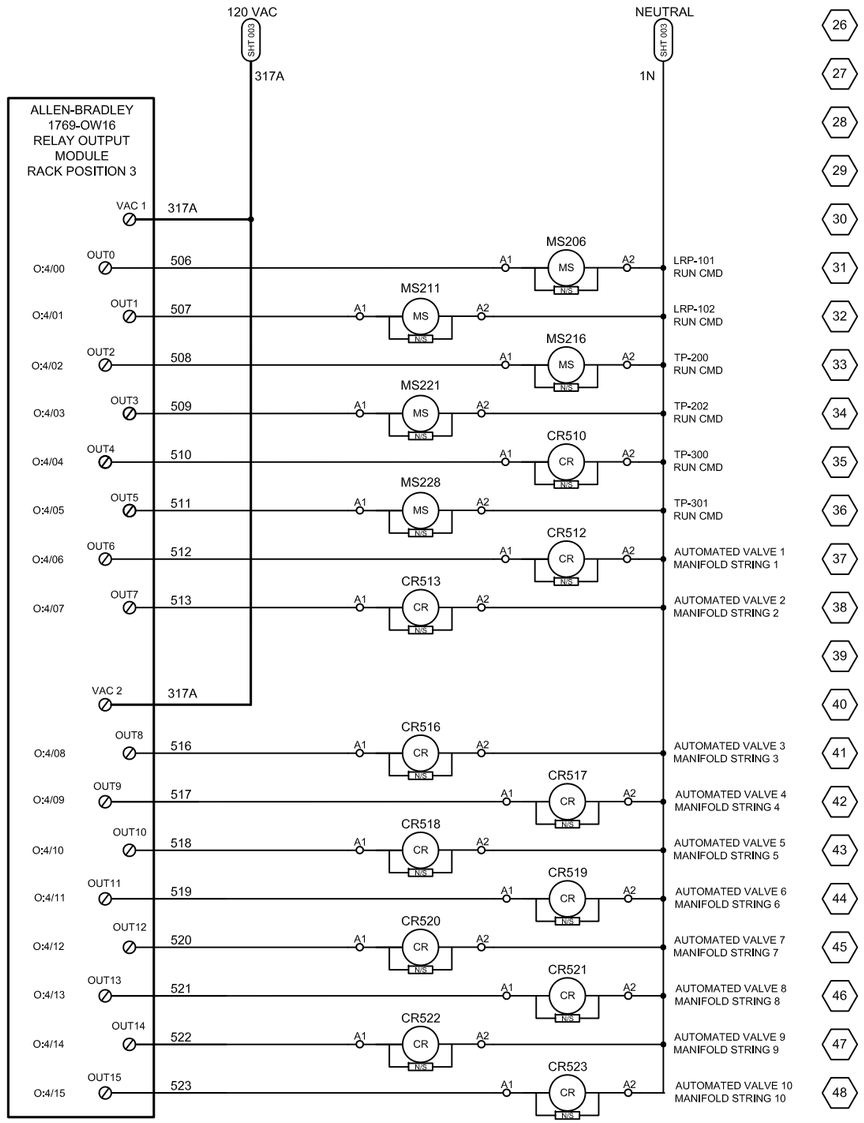
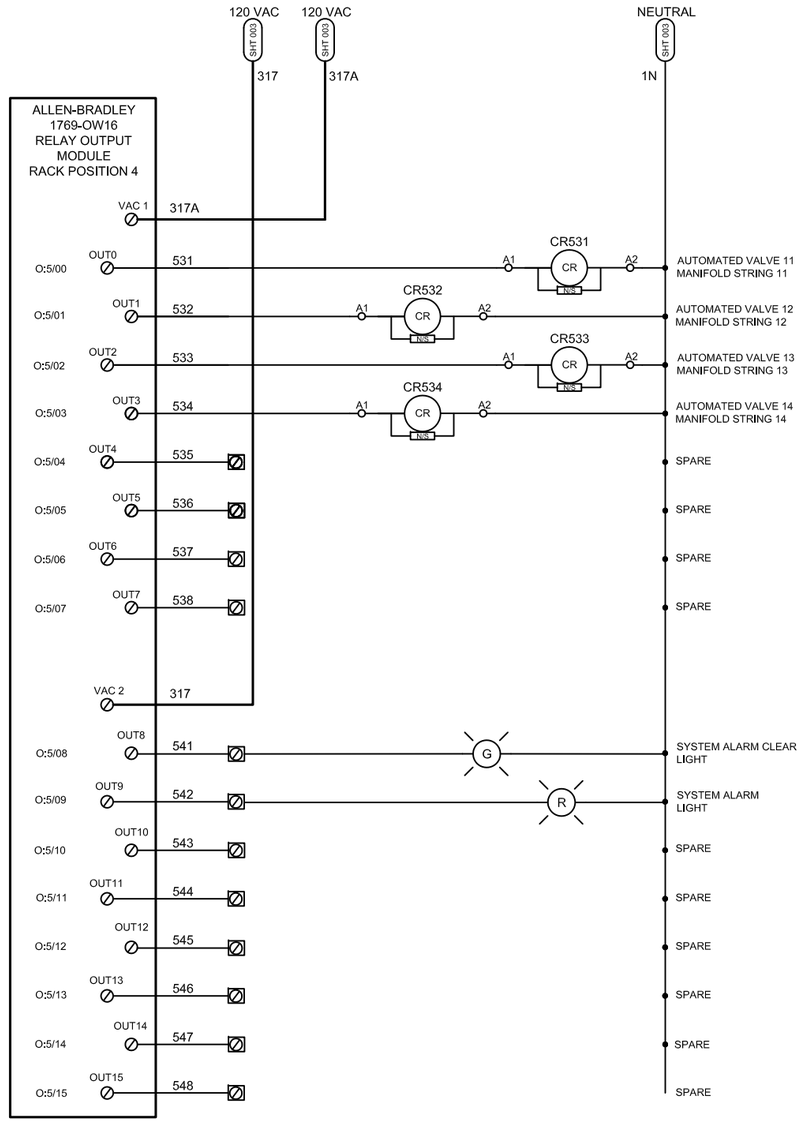
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC INPUT CARD WIRING

DRAWING NO. E-004B | SIZE B | SCALE | JOB NO. 1630 | UNIT NO. | REV 2

CUSTOMER AMTRAK | MATERIAL | DRAWN BY STEVE TURNER | DATE 9/24/12 | SHEET

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO





REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	WIRE 317A TO CARD #4 VAC 1	SMT	
2	1/17/13	IND LIGHTS TO OUT8, OUT9 RACK (3) 317A, RACK (4) 317	SMT	

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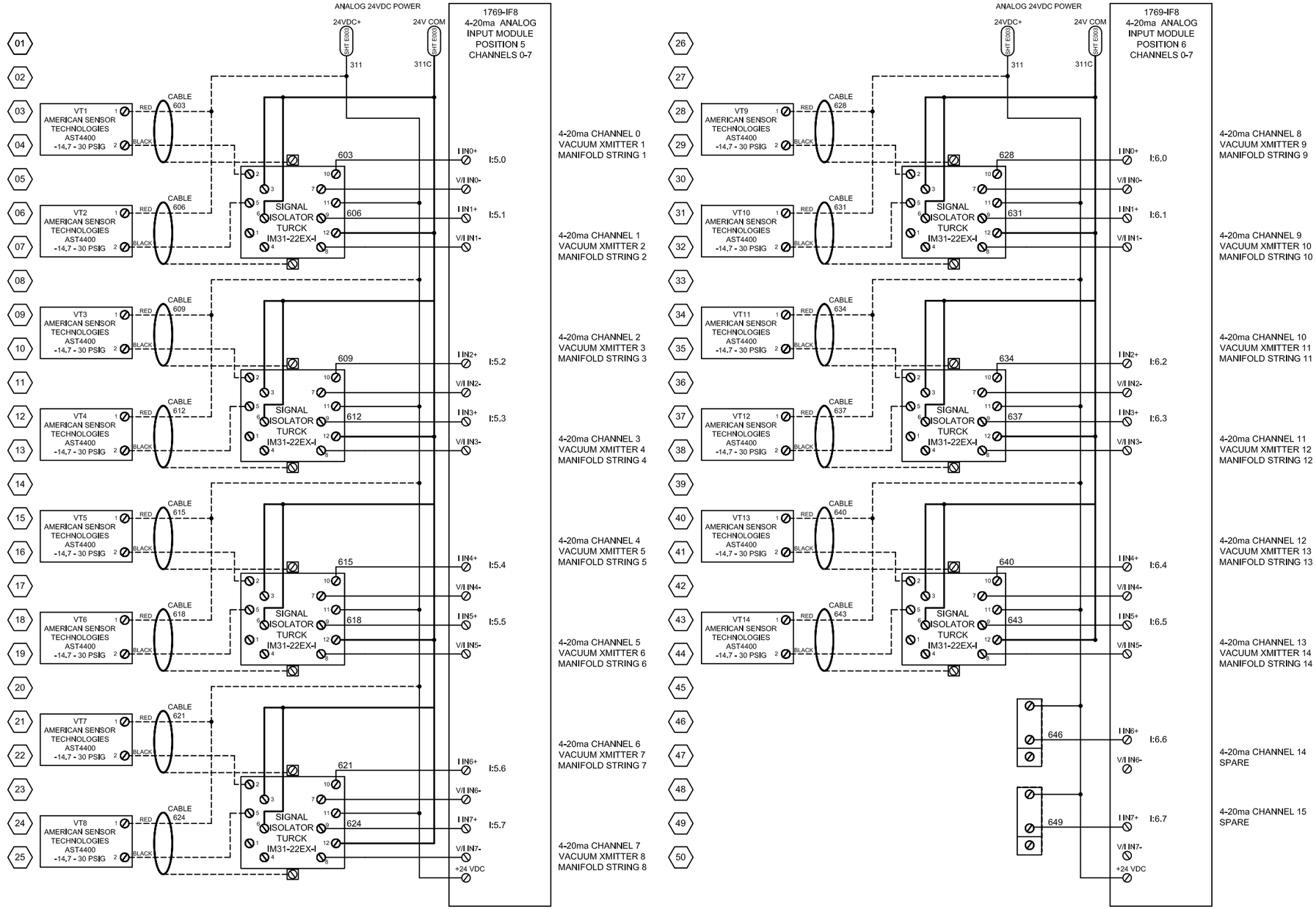
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC OUTPUT CARD WIRING

DRAWING NO. E-005	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO



REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	UPDATE SPARE TEMINAL BLOCK WIRE 311, NO RED	SMT	
2	1/17/13	TURCK ISOLATOR WIRING	SMT	

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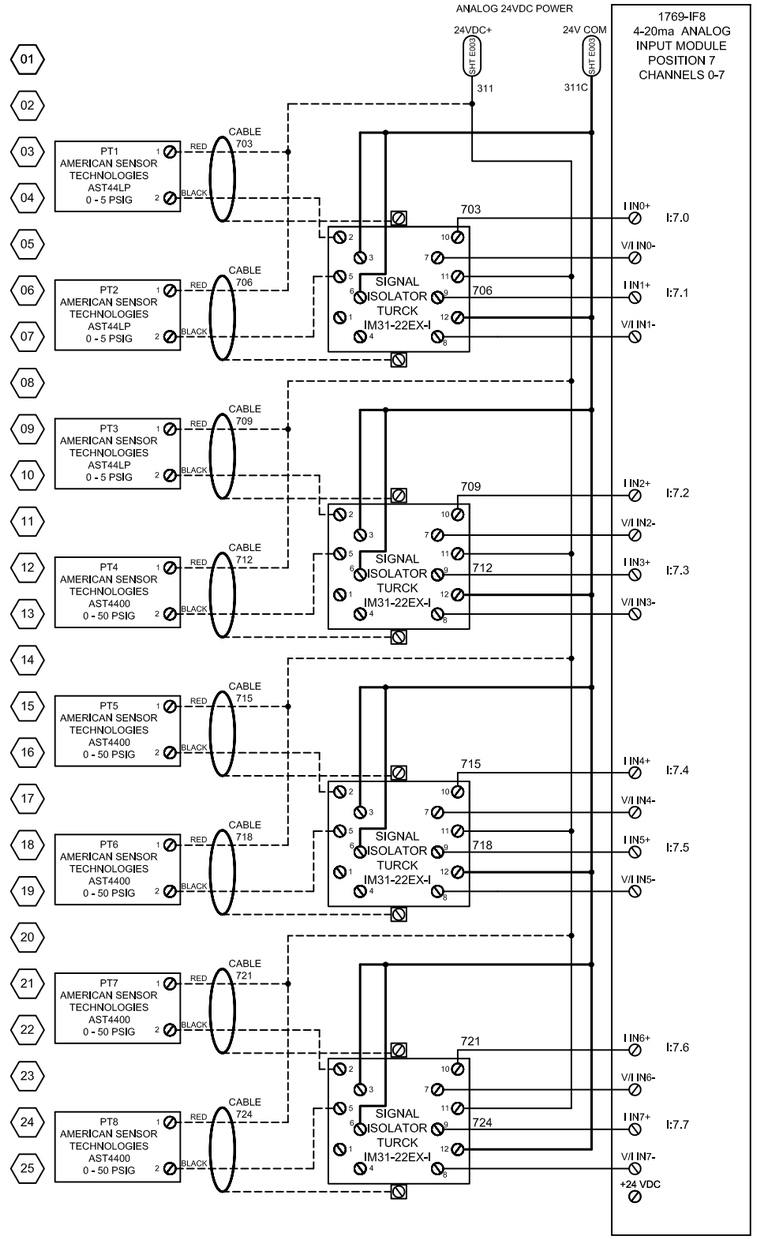
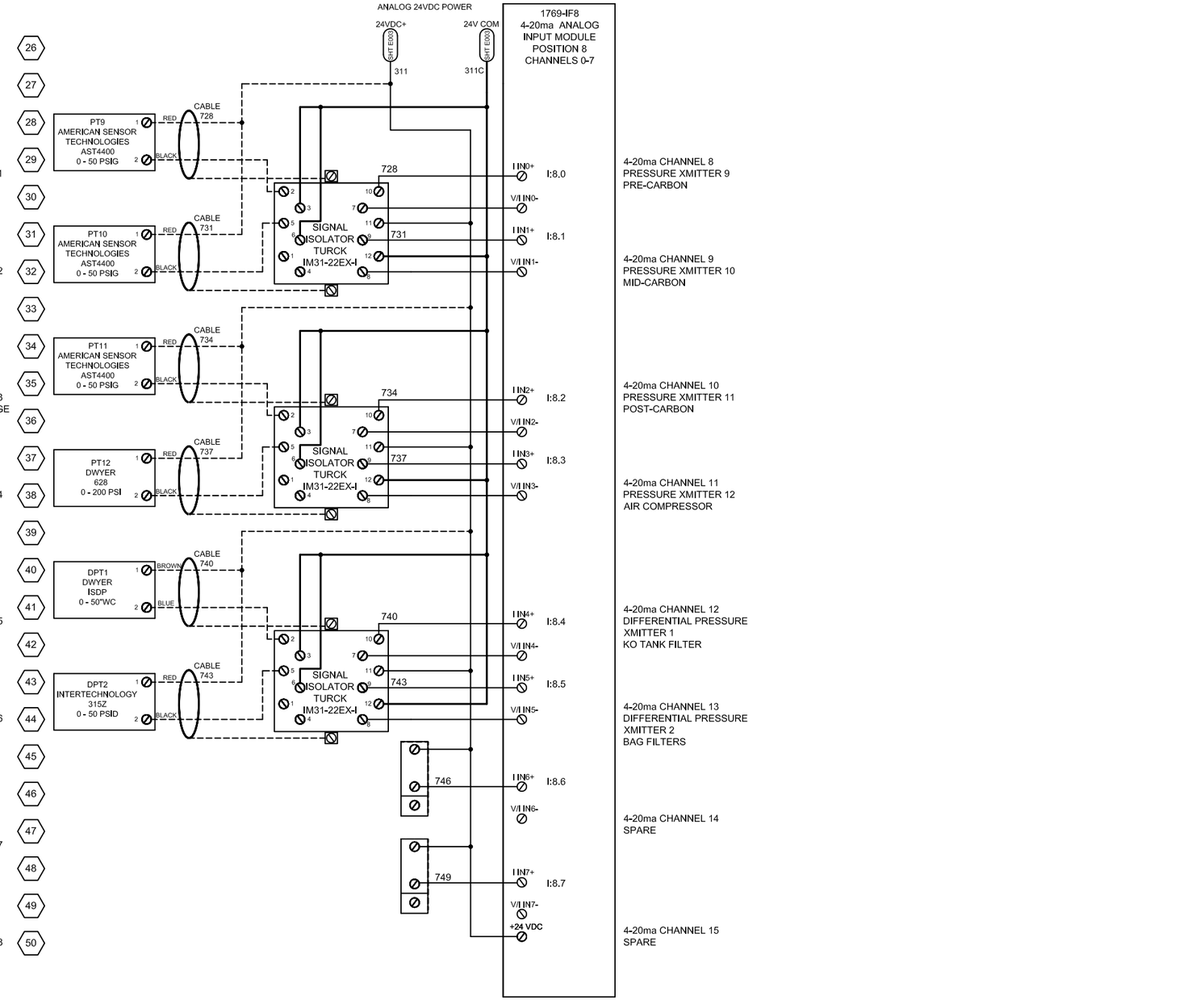
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC ANALOG INPUT CARD WIRING

DRAWING NO. E-006	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET





ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO

REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	UPDATE SPARE TEMINAL BLOCK WIRE 311, NO RED	SMT	
2	1/17/13	TURCK ISOLATOR WIRING	SMT	

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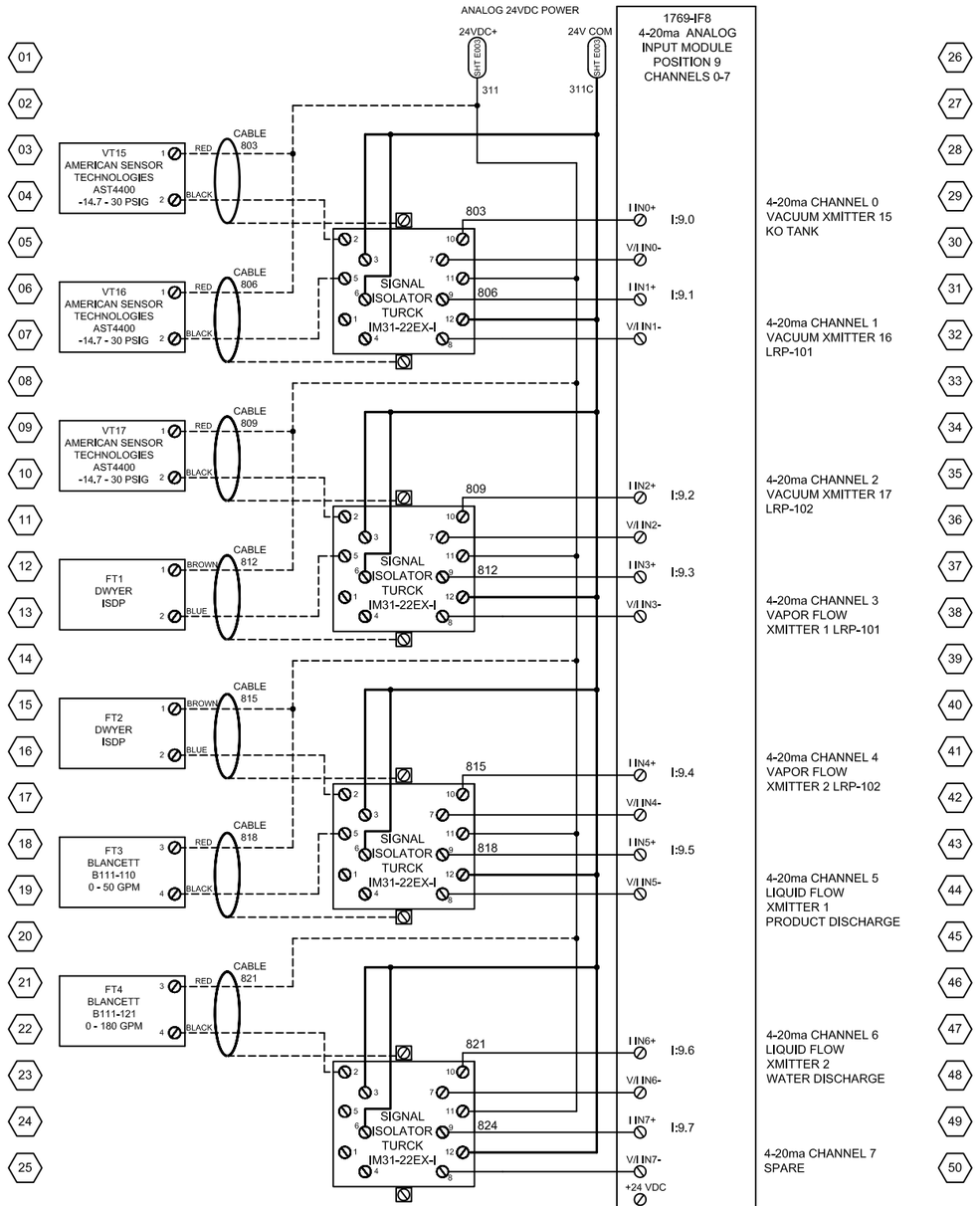
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC ANALOG INPUT CARD WIRING

DRAWING NO. E-007 | SIZE B | SCALE | JOB NO. 1630 | UNIT NO. | REV 3

CUSTOMER AMTRAK | MATERIAL | DRAWN BY STEVE TURNER | DATE 9/24/12 | SHEET

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO



REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	REMOVE SPARE TEMINAL BLOCK WIRE 311, NO RED	SMT	
2	1/17/13	TURCK ISOLATOR WIRING	SMT	

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DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
PLC ANALOG INPUT CARD WIRING

DRAWING NO. E-008	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

LRPs 101/102 Information

TRAVAINI PUMPS USA

Liquid Ring & Rotary Vane Vacuum Pumps and Systems

DynaSeal™ Liquid Ring Vacuum Systems

www.travaini.com

TRAVAINI PUMPS USA

Liquid Ring & Rotary Vane Vacuum Pumps and Systems

www.travaini.com

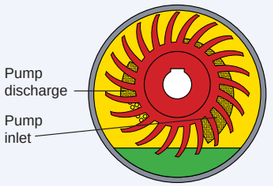


Figure 1

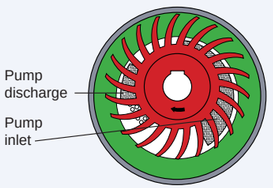


Figure 2

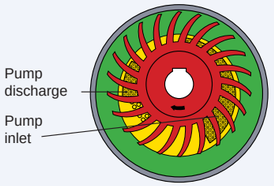


Figure 3

Principle of Operation

A multi-bladed impeller mounted on a shaft is positioned eccentrically in a cylindrical housing, partially filled with liquid. Portplates with inlet and discharge openings are positioned on each side of the impeller (Figure 1). As the impeller rotates, centrifugal force pushes the liquid outward, forming a liquid ring (Figure 2). Looking at the YELLOW area of the impeller chambers (Figure 3), we see that on the right hand side, from the top down, the chamber volume increases as the liquid ring moves outward, creating a vacuum in the impeller chamber. on the left hand side, the volume decreases as the liquid moves inward, increasing the pressure in the chambers until the discharge takes place through the discharge opening. A continuous flow of fresh sealing liquid is supplied to the pump.

Seal Fluid Technology

In our ongoing search for better solutions, we can offer alternative sealing fluids that are environmentally friendly. Unlike other types of vacuum pumps, our liquid ring design requires no internal lubrication because there is no metal to metal contact between rotating and stationary parts and the bearings are located external to the pumping chamber. This allows for more diversity when choosing the sealing fluid because the lubricating properties of the fluid are not critical.

The Travaini **DynaSeal**™ system offers a simple, low maintenance design with low noise and vibration levels, as well as reduced operating costs.

Count on Travaini for in-depth experience, technology and innovation. Our extensive inventory of pumps and replacement parts can, in most instances, be shipped the same day. Superior service is our #1 goal.

DynaSeal™, you can't beat the system.

DynaSeal™ Benefits

DynaSeal™ Standard Specifications:

≥ 15" Hg Vacuum; 60-120° F Ambient Temperatures; 180° F Inlet Gas Temperature Max; 180° F Discharge Gas/Oil Temperature; If conditions differ, consult factory for recommended design modifications.

200° F Inlet Gas – Consult factory.

Capacity Range Standards

15-1000 ACFM. Larger systems available **upon request**.

Low Noise Level.

Unlike rotary screw vacuum pumps, which run at rotor speeds as high as 9000-rpm, **DynaSeal™** systems operate at conservative speeds (1750-rpm) resulting in low noise levels (75-80 dBA at 3-ft.) acceptable to the environment without the need for sound enclosures.

Minimal Maintenance.

DynaSeal™ systems typically only require an oil change and replacement of discharge filter every 10,000 hours under normal operating conditions. No other maintenance is required except for periodic greasing of bearings.

Not affected by carry-over of soft solids or liquids.

DynaSeal™ systems can handle carry-over of soft solids and liquids without damage to the system components. We do however recommend to install an inlet filter/strainer or knock-out pot in those applications where a high carry-over of either solids or liquids is expected.

Designed for continuous operation.

DynaSeal™ systems are designed for continuous operation over the full vacuum range without overheating.

Automatic Temperature Control.

Prevents low temperature operation, reduces accumulation of water and other liquids in the reservoir and decreases the risk of bacteria growth. This optional feature is very important in hospital and other intermittent duty applications.

Low Vibration.

DynaSeal™ systems require no special foundations or anti-vibration mountings as a standard.

High-Quality Manufacturing Standards.

Travaini pumps are manufactured under ISO 9001 quality control standards.

Quality Control

DynaSeal™ systems are a "proven design". Combine this with our inline quality procedures and outgoing inspection, this provides you with the leading quality in the industry.

Custom Solutions

DynaSeal™ systems can be provided in single or multiple system configurations with programmable controllers to meet your specific requirements. Explosion proof designs for those stringent environments. Wide range of materials including stainless steel, copper, etc.

DynaSeal™

Air-cooled Liquid Ring Vacuum Systems

Made in the USA. DynaSeal™ systems are designed, built, and tested at our facility in Yorktown, Virginia.

Typical System Features & Options

1 ADVANCED LIQUID RING VACUUM PUMP DESIGN Offers high efficiency, reliability and minimum maintenance. External bearings and ample clearance between rotating parts eliminate the need for internal lubrication.

2 ELECTRIC CONTROL PANEL Each system includes a NEMA 12 electrical control panel complete with magnetic starter and overload protection, 110-volt control circuit and hour meter as standard. Wiring to motor and control switches is completed at the factory.

3 HIGH TEMPERATURE SWITCH Shuts unit down at 225˚F in case oil flow to unit is interrupted.

4 BACK PRESSURE GAUGE Shows condition of demister element and if element requires service. It also indicates back pressure from piping system.

5 AIR/OIL SEPARATOR Includes a highly efficient demister element to remove oil mist from discharge air. Exhaust is 99.9% oil-free.

6 OIL RESERVOIR Mounted overhead for positive oil flow pressure and sized for adequate oil capacity, cooling and efficient separation by internal baffles. A sight gauge complete with temperature gauge is included.

7 INLET CHECK VALVE Properly sized and suitable for vacuum.

8 HIGH EFFICIENCY AIR-COOLED HEAT EXCHANGER Allows system to operate at moderate temperatures with ambient temperatures as high as 110˚. Water-cooled units are available.

9 PUMP OR MOTOR-MOUNTED COOLING FAN Provides high air flow for maximum cooling without the need for a separate fan motor, except for units of 50-hp and larger which have electric-drive fan units.

10 SOLENOID VALVE Shuts down oil flow to pump when unit is stopped.

11 MONOBLOCK MOTOR MOUNTING DESIGN Standard up to 25-hp, eliminates misalignment problems by flange mounting to a standard NEMA C-face motor. (TEFC motors with a 1.15 service factor are standard) a heavy-duty flexible coupling ensures trouble-free service.

12 MANUAL UNLOADER VALVE WITH FILTER SILENCER Aids in vacuum unloading and/or relief of the pump prior to start-up and shutdown. (Electric unloading–optional)

13 VACUUM RELIEF VALVE WITH SILENCER (OPTIONAL) Field adjustable to control maximum vacuum level.

14 TEMPERATURE CONTROL VALVE (OPTIONAL) Allowing the system to reach operating temperature very quickly which is important especially for outdoor installations and intermittent duties.

15 HIGH AND LOW OIL LEVEL SWITCH (OPTIONAL) To protect pump from loss of oil.

EXPLOSION PROOF DESIGN (Optional)

DynaSeal™ Systems are used extensively in industries such as:

- Hospitals, healthcare and pharmaceutical
- Solvent and vapor recovery
- Soil remediation
- Wood working and wood impregnation
- Electronics and semi-conductors
- Printing and paper converting
- Food and meat processing
- Plastics, automotive and aircraft
- Sterilization and impregnation
- Plus numerous others

The "Mini" Series

Models – TRO-075VM, TRO-110VM AND TRO-160VM

Latest concept of our patented DynaSeal™ System

Features:

- Space Saving
- Vastly Improved Mist Elimination
- Cost Savings
- 3 Models Available

1 Using our 3 monoblock vari-ported pump designs, models TRM 40-110, 40-150, and 40-200, we offer these three systems, 5, 7.5, and 10 hp, configured to incorporate the above features.

2 The traditional oil sealed systems has a footprint almost twice the length and 50% wider than the "MINI" Series. By incorporating the monoblock pump design, we have developed the "MINI" package to fit within equipment or locations that require economies of space.

3 Traditional oil-sealed packages have been designed to handle vacuums beyond 15" HgV, as the majority of applications require. Below 15" HgV, the coalescing filters are not designed to fully handle the oil mist. The new "MINI" Series was designed to coalesce from 0-30" Hg vacuum through our unique filter element and specially formulated synthetic oil.

4 The simplicity of the "MINI" design has resulted in reduced costs which allow us to pass the savings on to you, our customers. Cost is always a priority without sacrificing the quality you've come to expect from Travaini products.

Standard DynaSeal™ Models

System Model	Nominal Capacity ACFM	Motor HP	Maximum End Vacuum in. Hg	Approximate Dimensions (in) L x W x H	Approximate Weight (Lbs)
TRO015H	15	2	29	38 x 17 x 40	340
TRO015S	15	1.5	26	38 x 17 x 40	340
TRO035S	35	3	26	38 x 17 x 40	340
TRO035H	35	3	29	38 x 17 x 40	340
TRO050H	50	5	29.5	38 x 17 x 40	435
TRO075S	75	5	27	43 x 17 x 40	530
TRO075-VM**	75	5	29	32 X 25 X 43	500
TRO110V	110	7.5	29.5	55 x 25 x 51	920
TRO110-VM**	110	7.5	29	32 X 25 X 43	540
TRO140H	140	10	29.5	55 x 25 x 51	1005
TRO160V	160	10	29.5	65 x 26 x 51	1070
TRO160-VM**	160	10	29	32 X 25 X 43	570
TRO200V	200	15	29.5	65 x 26 x 56	1300
TRO200H	200	15	29.5	65 x 26 x 56	1325
TRO250H	250	20	29.5	65 x 26 x 56	1350
TRO300V	300	20	29.5	65 x 26 x 56	1355
TRO300H	300	25	29.5	65 x 26 x 56	1430
TRO400S	380	25	28	83 x 35 x 64	1900
TRO425H	425	40	29.5	83 x 35 X 64	2250
TRO500S	500	40	28	83 x 35 x 64	2150
TRO700S*	700	50	26	80 X 63 X 58	3550
TRO750H*	750	50	29.5	80 X 63 X 58	3750
TRO900S*	900	60	26	80 X 63 X 58	3650
TRO950H*	950	60	29.5	80 X 63 X 58	4016
TRO1000S*	1000	75	26	80 X 63 X 58	3750
TRO1000H*	1050	100	29.5	80 X 63 X 58	4302

**VM = Mini Series
*PUMPS ARE V-belt driven.

DynaSeal™ Standard Specifications:

≥ 15" Hg Vacuum; 60-120° F Ambient Temperatures; 180° F Inlet Gas Temperature Max; 180° F Discharge Gas/Oil Temperature; If conditions differ, consult factory for recommended design modifications.

- Explosion proof designs are available upon request.
- **Larger capacity systems are available upon request.**
- **DynaSeal™** systems are available in multiple pump configurations with a wide range of optional accessories.
- **DynaSeal™** systems can be customized per O.E.M. specification and for special applications.
- **DynaSeal™** systems are sold and serviced through a nation-wide distributor network.

WARRANTY

TRAVAINI PUMPS USA

Subject to the terms and conditions hereof, Travaini Pumps U.S.A., Inc. (hereafter referred to as the "Company") warrants that the products and parts of its manufacture specified below, when shipped, and its services when performed, will be free from defects in material and workmanship for following warranty time periods:

PRODUCT DESCRIPTION	WARRANTY PERIOD FROM DATE OF SHIPMENT
Liquid Ring Vacuum Pump system or pump products	Two (2) years
Rotary vane system or pump products	24 / 18 months if TPUSA oil used / not used
Centrifugal pump products	18 months, or 12 months from date of installation, whichever occurs first
Mechanical seals	3 months
Repaired pumps / systems	6 months for the repair / work performed

This Warranty shall apply to liquid ring vacuum products only if they are operated with Company approved seal fluids and to rotary vane products only if they are operated with Company approved lubricants. In-warranty repaired or replaced products are warranted only for the remaining unexpired portion of the warranty period applicable to the repaired or replaced product(s).

This Warranty does not extend to equipment such as electric motors, starters, heat exchangers and other accessories furnished to the Company by third party manufacturers and/or suppliers. Said accessories are warranted only to the extent of any warranty extended to the Company by such third party manufacturers and/or suppliers. Replacement of maintenance items, including, in particular, seals, bearings, filters, etc. supplied in connection with standard maintenance service provided by the Company are not covered by this Warranty. Any technical assistance, advice, or comments provided by the Company regarding system components, other than those manufactured by the Company, are not covered under this Warranty; the Company disclaims any liability in connection with same. The Company disclaims any liability in connection with the malfunctioning of any system(s) or component(s) of system(s) which conform to designs, specifications and/or instructions mandated by purchasers.

This Warranty is limited exclusively to products and/or parts of the Company properly installed, serviced and maintained in full compliance with the Operating and Maintenance manual of the Company. This Warranty shall not extend to products and/or parts which have been misused or neglected or not used for the purpose(s) for which they were intended, including, in particular, products operated at/in excessive temperature or dirty environments, products used in conjunction with corrosive, erosive or explosive liquids or gasses, and/or products malfunctioning as a result of build-up of material in the internal parts thereof. Products which are disassembled without the prior written consent of the Company and/or which are repaired, modified, altered or otherwise tampered with in any manner inconsistent with the Operating and Maintenance manual of the Company are not covered under this Warranty. Products and/or parts which are kept in "long term" storage, as such terms are defined in the Operations & Maintenance manual of the Company, and not maintained in accordance with Company long term care procedures specified by the Company are not covered under this Warranty.

Warranty claims must be made within the warranty period specified above for each of the Company's products and services and include the serial number thereof. The Company's obligations under this Warranty are limited, in the Company's sole discretion, to repair, replacement or refund of the purchase price received by the Company for the product, part or service. Notwithstanding the foregoing, the Company shall have the option to provide alternative solutions of a different design. In no event shall the purchaser and/or any subsequent owner or beneficiary of the products, parts and/or services be entitled to recover incidental, special or consequential damages arising out of the breach of this Warranty or any defect, failure or malfunction of the products and/or services supplied by the Company.

A written return authorization must be obtained from the Company prior to the return of any product and/or part under this Warranty. Products and parts are to be returned only to the Company's facilities or such facilities as the Company may designate in writing. Costs of uninstalling/ reinstalling the product and/or any part under Warranty, as well as all costs associated with the shipment thereof to and from the facilities of the Company shall be at the owner's sole expense.

THIS WARRANTY AND THE COMPANY'S OBLIGATIONS HEREUNDER ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. ALL WARRANTIES WHICH EXCEED THE AFOREMENTIONED OBLIGATIONS ARE HEREBY DISCLAIMED BY THE COMPANY AND EXCLUDED FROM THIS WARRANTY, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE. NO EMPLOYEE OF THE COMPANY OR OTHER PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR TO ASSUME ANY OTHER LIABILITY ON THE COMPANY'S BEHALF.

Effective as of January 2007

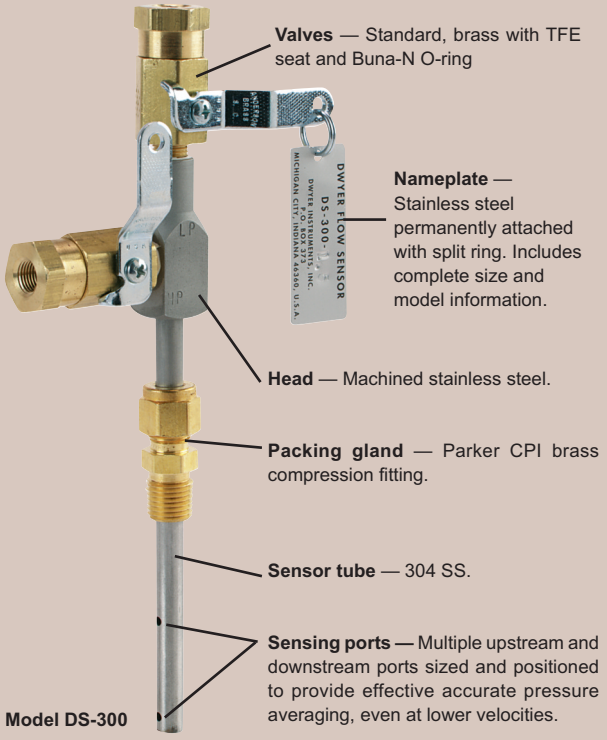
APPENDIX H

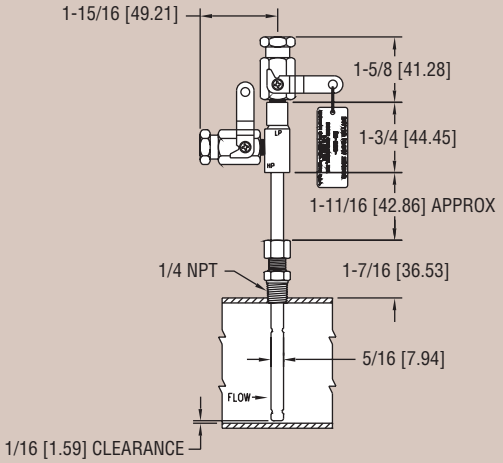
Air Flow Meter/Transmitter Information

Series DS

In-Line Flow Sensors

Use with the Dwyer® Differential Pressure Gages or Transmitters





In-Line Flow Sensors are averaging Pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer® Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.
Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer® flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

The Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® gage kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1″ to 10″.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are 1/8″ female NPT. A pair of 1/8″ NPT X 1/4″ SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a Threaded Branch Connection.

Select model with suffix which matches pipe size
Model DS-300-1″
Model DS-300-1-1/4″
Model DS-300-1-1/2″
Model DS-300-2″
Model DS-300-2-1/2″
Model DS-300-3″
Model DS-300-4″
Model DS-300-6″
Model DS-300-8″
Model DS-300-10″

Model DS-400-6″
Model DS-400-8″
Model DS-400-10″
Model DS-400-12″
Model DS-400-14″
Model DS-400-16″
Model DS-400-18″
Model DS-400-20″
Model DS-400-24″

OPTIONS & ACCESSORIES
DS-300 or DS-400 Less Valves. To order, add suffix **-LV**
A-160, Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi
A-161, Brass Bushing, 1/4″ x 3/8″

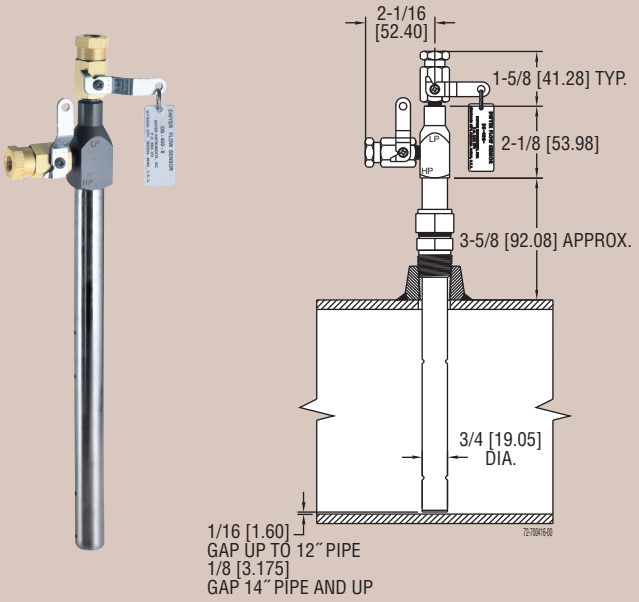
How To Order

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2″ pipe would be a Model No. DS-300-2″.

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



DS-400

Gage Range (in w.c.)	Media @ 70°F	Full Range Flows by Pipe Size (Approximate)									
		1″	1-1/4″	1-1/2″	2″	2-1/2″	3″	4″	6″	8″	10″
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
	Air @ 100 PSIG (SCFM)	83.0	142.0	190.0	340.0	610	820	1600	3300	5700	10000
10	Water (GPM)	11.0	19.0	25.5	45.5	67	110	195	450	800	1260
	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
	Air @ 100 PSIG (SCFM)	120.0	205.0	275.0	470.0	740	1100	2000	4600	8100	15000
25	Water (GPM)	18.0	32.0	40.5	72.0	108	173	310	720	1250	2000
	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
	Air @ 100 PSIG (SCFM)	185.0	325.0	430.0	760.0	1200	1800	3300	7200	13000	22000
50	Water (GPM)	25.0	44.0	57.5	100.0	152	247	435	1000	1800	
	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
	Air @ 100 PSIG (SCFM)	260.0	460.0	620.0	1050.0	1700	2600	4600	10000	18500	
100	Water (GPM)	36.5	62.0	82.0	142.0	220	350	620	1500		
	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

Model A-471 Portable Kit

The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5″ w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32 to 200°F (0 to 93.3°C). Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic® gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1-1/4″- 2″ horizontal or vertical pipe.

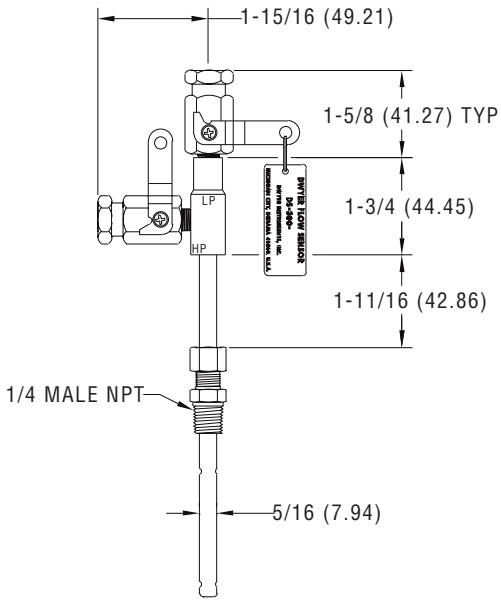
For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings.

See pages 10 and 11 for complete information on the Capsuhelic® gage

Capsuhelic® Gage Shown Instaled In A-471 Portable Kit

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 **www.dwyer-inst.com**
Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**

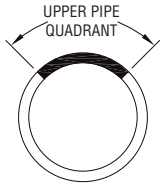
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

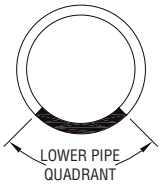
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4˝ x 3/8˝) will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16˝ to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

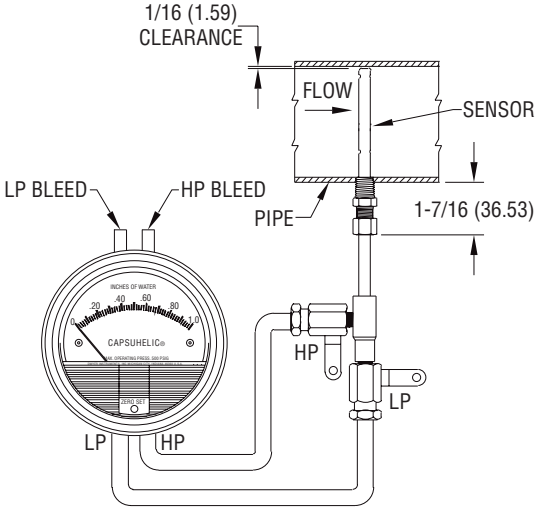
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

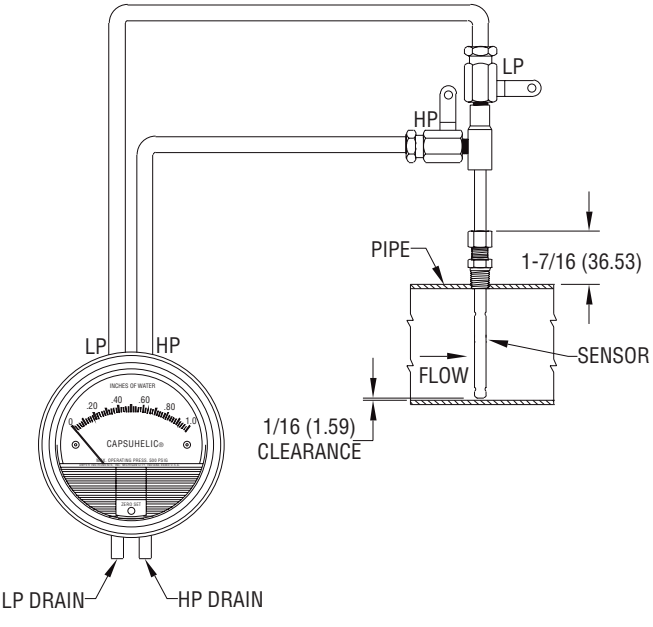
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

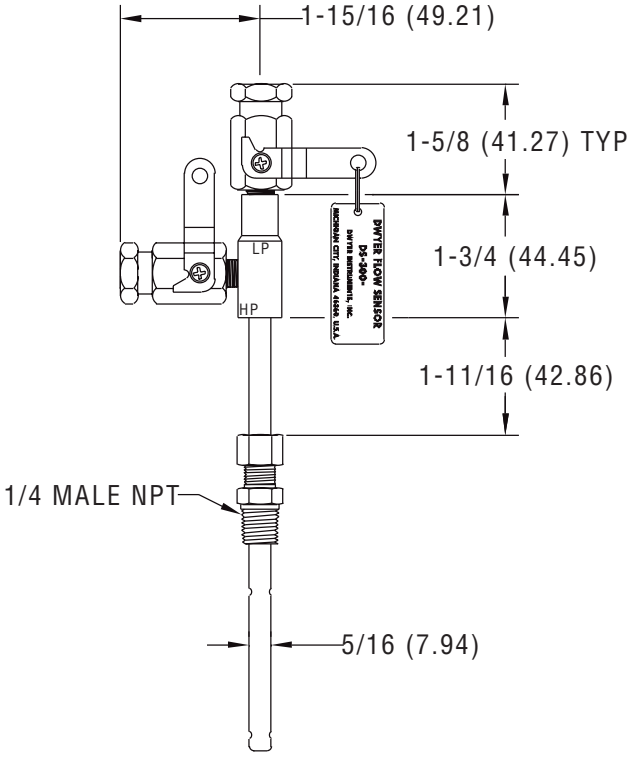
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 “Flow of Fluids Through Valves, Fittings and Pipe.” It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient “K”	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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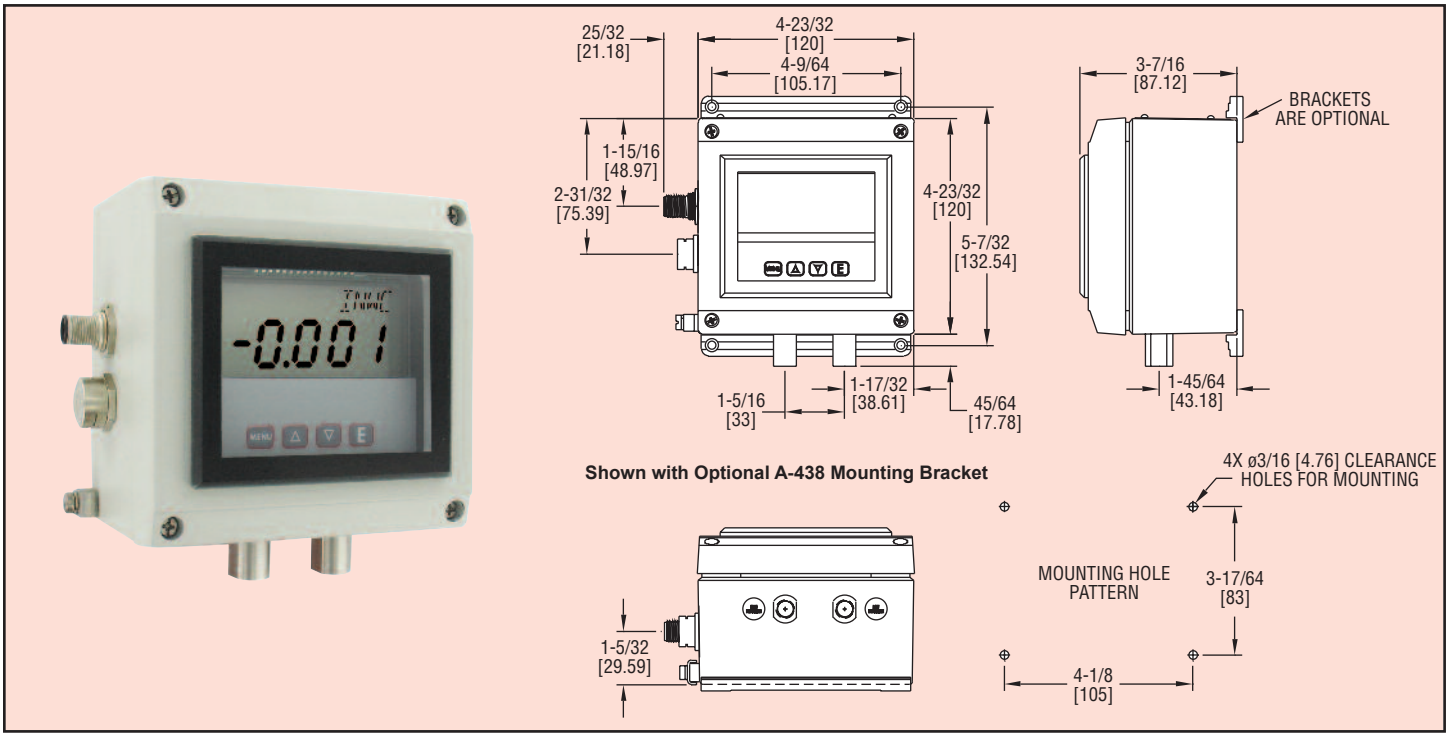
DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

Series ISDP

Intrinsically Safe Differential Pressure Transmitter

For Hazardous Zone Pressure and Flow Applications



The ISDP Differential Pressure Transmitter provides a 4-20 mA process output, a robust NEMA 4X enclosure, plus a large LCD display that can be programmed to read in pressure, velocity or flow. The ISDP offers simplified programming via a Menu key that enables the user to select: security level; English or Metric engineering units; pressure, velocity or flow operation, K-factor for use with various Pitot tubes and flow sensors, circular or rectangular duct size for volumetric flow operation plus many more. The Series ISDP Differential Pressure Transmitter is powered on its two wire loop with 10-35 VDC via its integral M-12 four pin male connector. The ISDP provides a 0.5% full scale accuracy on ranges from 0.25˝ w.c. to 100˝ w.c. as well as bi-directional models up to 10˝ w.c. These features make the Series ISDP Differential Pressure Transmitter the ideal instrument for monitoring pressures or air flows in hazardous zones having a Class I Div. I Groups A, B, C, D; Class II Div. I Groups E, F, G; Class III Div. I ratings.

Model	Range
ISDP-002	0 - 0.25 in w.c.
ISDP-004	0 - 1 in w.c.
ISDP-006	0 - 5 in w.c.
ISDP-007	0 - 10 in w.c.
ISDP-008	0 - 25 in w.c.
ISDP-009	0 - 50 in w.c.
ISDP-010	0 - 100 in w.c.
ISDP-012	-0.25 / +0.25 in w.c.
ISDP-014	-1.0 / +1.0 in w.c.
ISDP-015	-2.5 / +2.5 in w.c.
ISDP-016	-5.0 / +5.0 in w.c.
ISDP-017	-10 / +10 in w.c.

ACCESSORIES

A-231, 16´ (5 m) Shielded Cable with 4 Pin Female M-12 Connection
A-486, 4.9´ (1 m) Shielded Cable with 4 Pin Female M-12 Connection
A-487, 9.8´ (3 m) Shielded Cable with 4 Pin Female M-12 Connection
A-488, 33´ (10 m) Shielded Cable with 4 Pin Female M-12 Connection
A-295, Female 4 Pin M-12 to Cable Gland Connector
MTL5041, Intrinsically Safe Galvanic Isolator
MTL7706, Intrinsically Safe Zener Barrier
A-438, Surface Mounting Brackets

SPECIFICATIONS

Service: Air and non-corrosive gases.
Wetted Materials: Ranges 5˝ and greater: glass, PVC, silicon, alumina ceramic, epoxy, RTV, gold, aluminum, stainless steel and nickel; Ranges 1˝ and lower: stainless steel, silicone, gold and ceramic.
Housing Materials: Aluminum, glass.
Accuracy: ±0.5% at 77°F (25°C) including hysteresis and repeatability (after 1 hour warm-up).
Stability: < ±1% per year.
Pressure Limits: Ranges ≤ 2.5 in. w.c. = 2 psi; 5˝: 5 psi; 10˝: 5 psi; 25˝: 5 psi; 50˝: 5 psi; 100˝: 9 psi.
Temperature Limits: 32 to 140°F (0 to 60°C).
Compensated Temperature Limits: 32 to 140°F (0 to 60°C).
Thermal Effects: 0.020%/°F (0.036/°C) from 77°F (25°C).
Power Requirements: 10-35 VDC.
Output Signal: 4-20 mA DC.
Zero & Span Adjustments: Accessible via menus.
Response Time: 250 ms (damping set to 1).
Display: 4 digit LCD 0.6˝ height.
Electrical Connections: M-12 4 PIN Connector.
Process Connections: 1/8˝ female NPT.
Enclosure Rating: Designed to meet NEMA 4X (IP66).
Mounting Orientation: Mount unit in horizontal plane.
Weight: 2 lb 10 oz (1.19 kg).
Agency Approvals: FM Intrinsically Safe CLI Div I GR: A, B, C, D; CLII Div I GR: E, F, G; CLIII Div I. CE: CENELEC EN 61326/55024: 2003; IEC 61000-4-2/3/4/6: 2001/2006/2004/2005; CENELEC EN 55011: 2006; 2004/108/EC EMC Directive.

APPENDIX I

Transfer Pumps
TP-200/202 Information

MOYNO

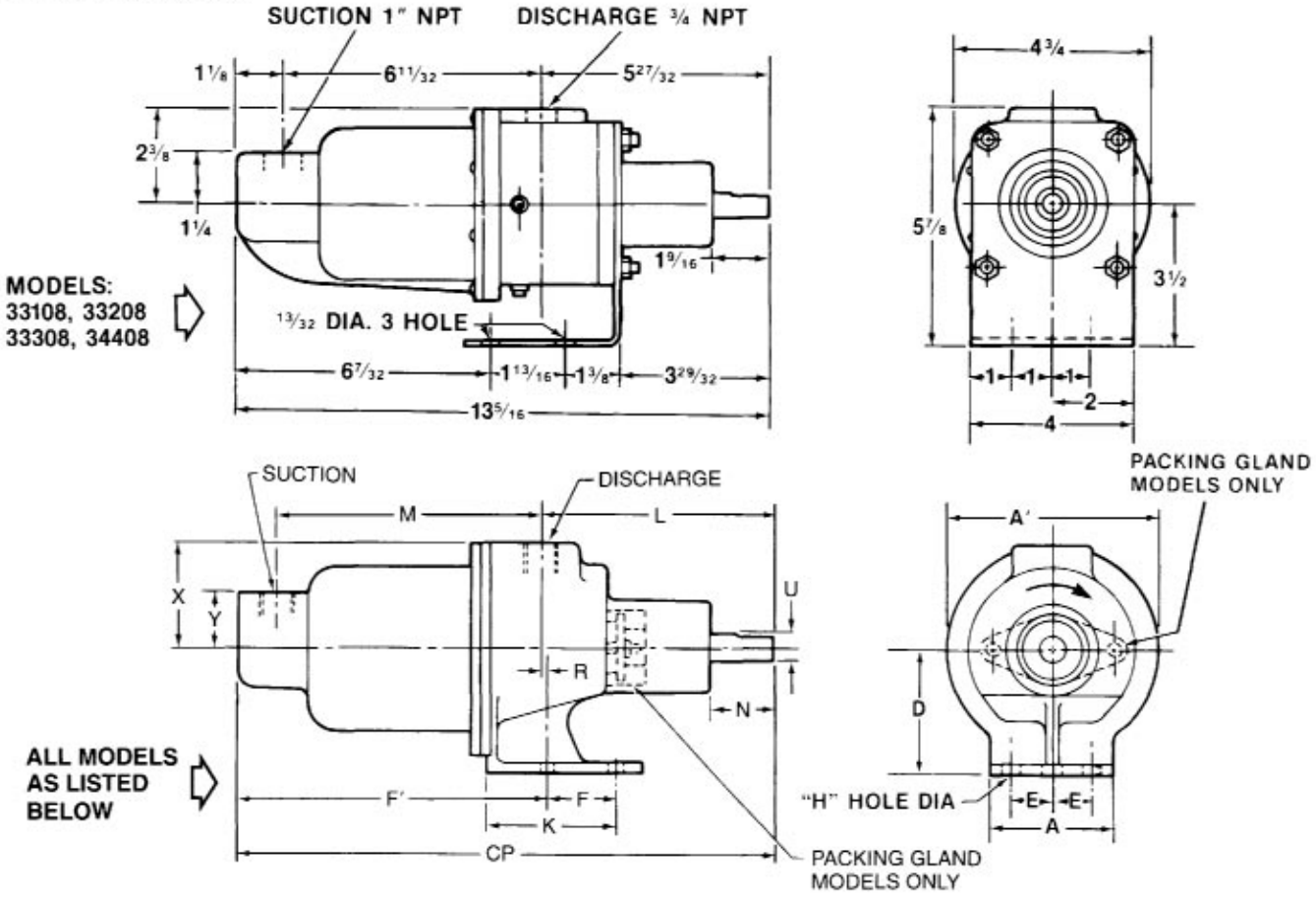
Always the Right Solution™

SPECIFICATION DATA

MOYNO® 500 PUMPS

300 SERIES
331, 332, 333, 344, 356 AND 367 MODELS

DIMENSIONS

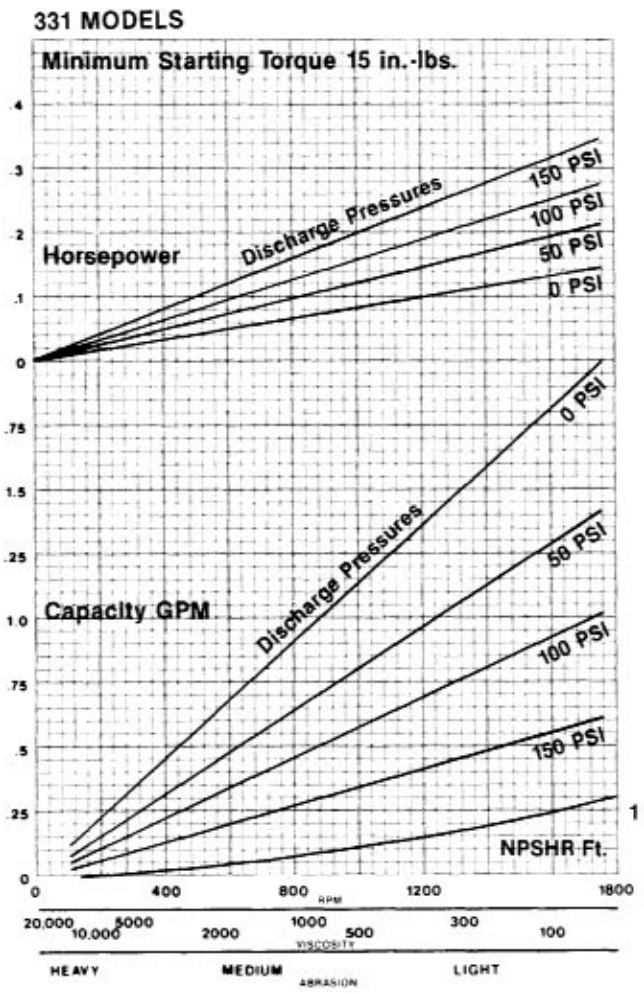


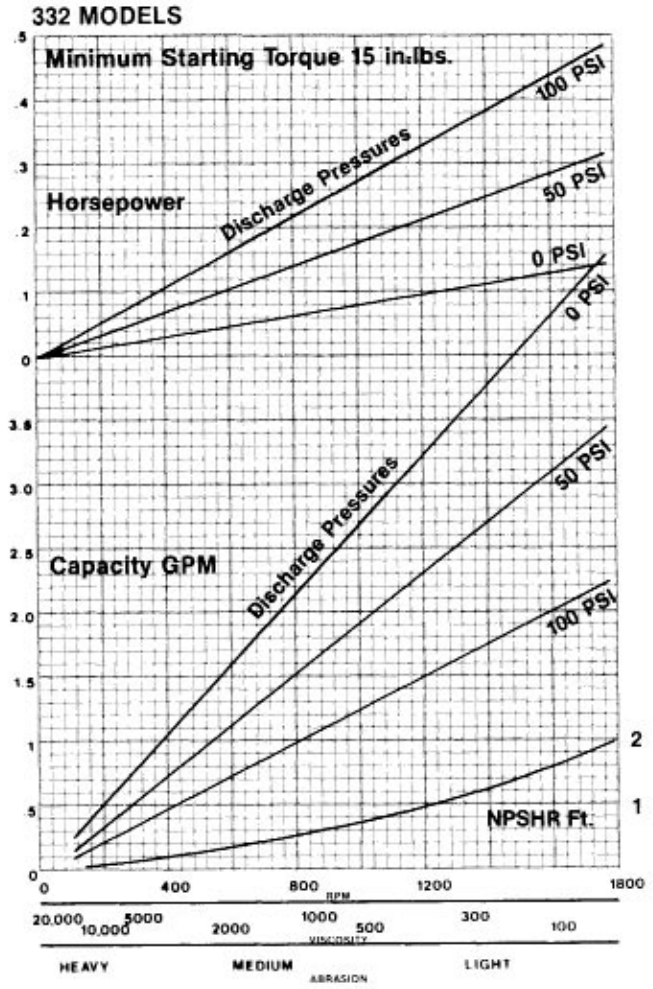
MODELS	CP	A	A[1]	D	E	F	F[1]	H	K	L	M	N	R	U	X	Y	SUCT (NPT)	DISCH (NPT)
33101, 33201 33301, 33104 33204, 33304 34401, 34404	12 5/8	3 1/8	4 3/4	2 3/4	1	1 13/16	6 15/16	13/32	3 1/32	5 11/16	6 1/16	1 7/16	—	5/8	2 3/8	1 1/4	3/4	3/4
*34411	13 15/16	3 1/4	4 3/4	2 3/4	1 1/8	—	7 3/16	13/32	2 7/8	7	6 1/16	1 3/8	1/4	5/8	2 5/16	1 1/4	3/4	3/4
35601, 35604	17 1/2	6 1/2	7 9/16	4 9/32	1 3/4	2	10 19/32	13/32	4 1/2	7 3/8	8 5/8	2 3/8	15/32	3/4	3 25/32	2 1/8	1 1/2	1 1/4
*35611, *35613	19 3/8	6 1/2	7 9/16	4 9/32	1 3/4	2 1/2	10 19/32	13/32	4	9 11/32	8 5/8	2 13/32	9/16	3/4	3 25/32	2 1/8	1 1/2	1 1/4
36701, 36704	20 15/16	5 1/4	8	4 1/2	2	2 5/16	13	9/16	4 1/16	7 15/16	11 3/16	2 1/8	—	1	4	2 1/2	2	2

*Packing Gland Model

All dimensions are in inches. Specifications subject to change without notice.

331, 332, 333 and 344 MODELS
PERFORMANCE (water at 70ºF)



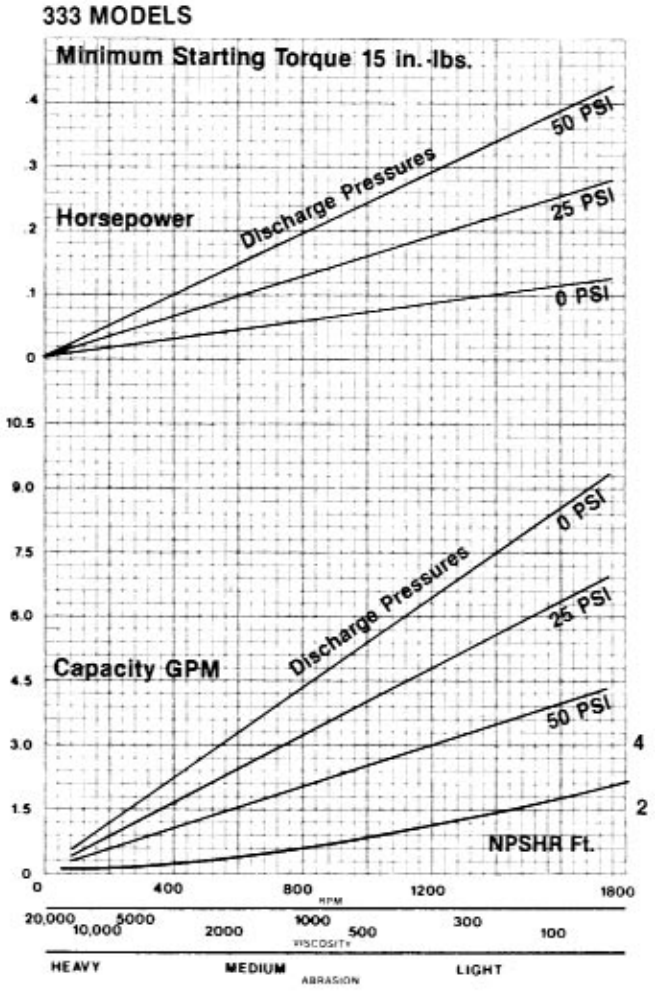


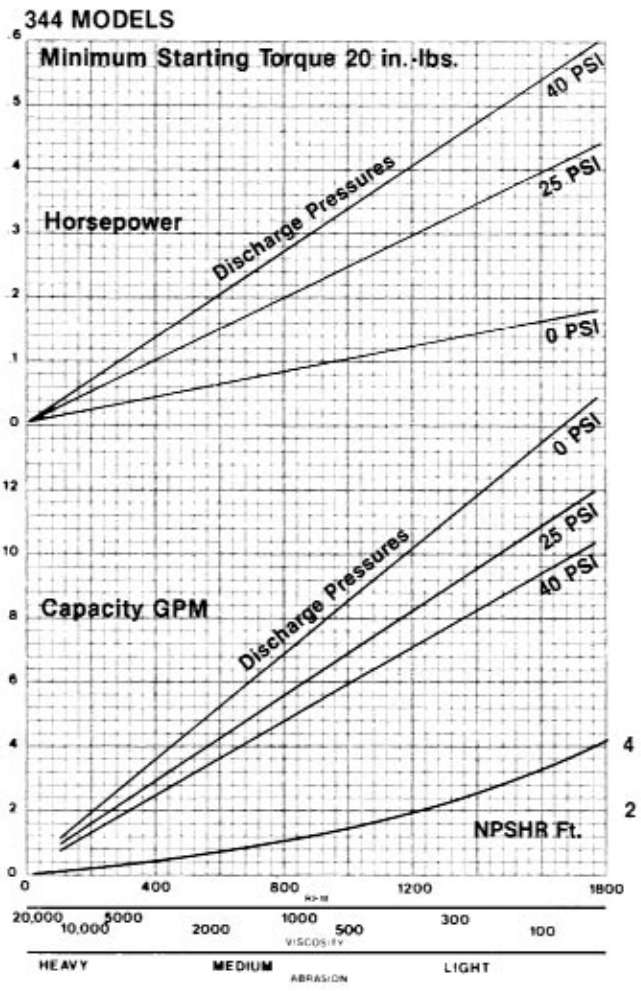
NOTE: For fluids with viscosity over 200 CP (1000 SSU), pump capacity is reduced by 20%.

MATERIALS OF CONSTRUCTION

COMPONENT	MODELS			
	33101, 33201 33301, 34401	**33104, 33204 33304, 34404**	**33108, 33208 33308, 34408**	***34411**
Housing	Cast iron	316 SS	Nylon	Cast iron
Rotor	416 SS/CP	316 SS/CP	416 SS/CP	416 SS/CP
Stator	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)
Weight (lbs)	16	16	8	16

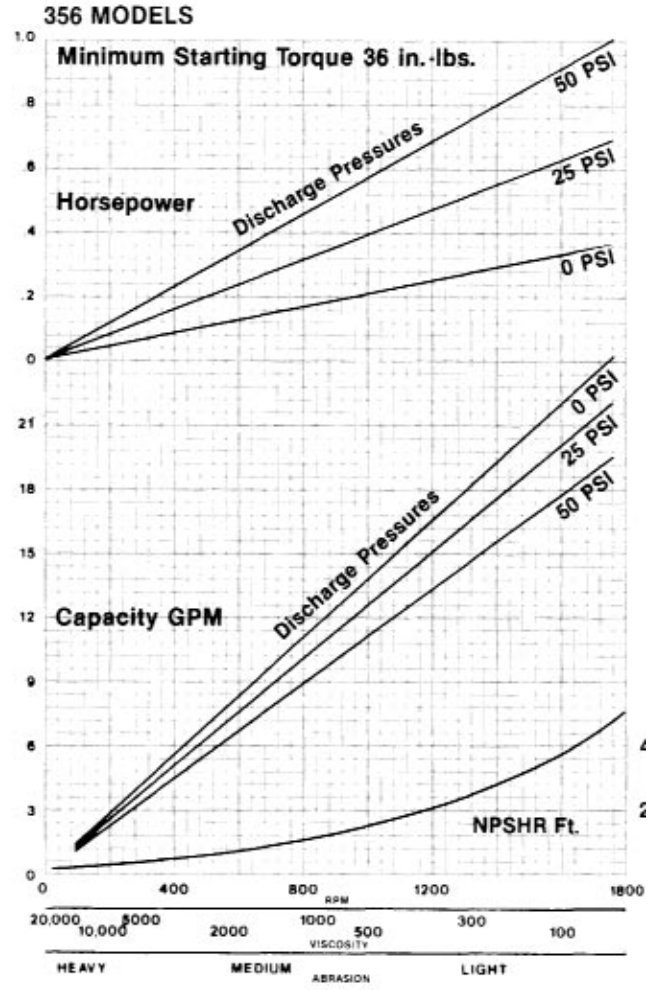
* Packing Gland Model
CP = Chrome plated

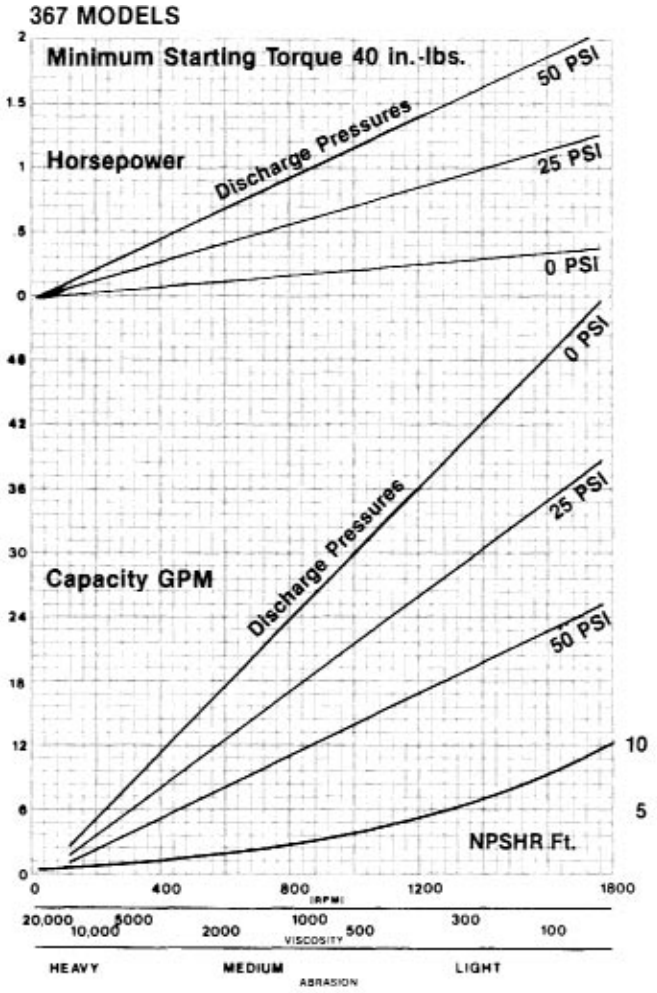




NOTE: For fluids with viscosity over 200 CP (1000 SSU), pump capacity is reduced by 20%.

356 and 367 MODELS PERFORMANCE (water at 70°F)





NOTE: For fluids with viscosity over 200 CP (1,000 SSU), pump capacity is reduced by 20%.

MATERIALS OF CONSTRUCTION

COMPONENT	MODELS					
	35601, 35611		35604, 35613		36701	36704
Housing	Cast iron		316 SS		Cast iron	316 SS
Rotor	416 SS/CP		316 SS/CP		416 SS/CP	316 SS/CP
Stator	NBR (Nitrile)		NBR (Nitrile)		NBR (Nitrile)	NBR (Nitrile)
Weight (lbs)	37	40	37	40	54	54

CP=Chrome plated

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Always the Right Solution™

SERVICE MANUAL

MOYNO® 500 PUMPS

300 SERIES
331, 332, 333, 344, 356 AND 367 MODELS

Mechanical Seal Models

Packing Gland Models

DESIGN FEATURES	MODELS				
	33101 34401 33201 35601 33301 36701	**33104 34404 33204 35604 33304 36704**	**33108 33308 33208 34408**	**34411 35611**	**35613**
Housing:	Cast Iron	AISI 316 SS	Nylon	Cast Iron	AISI 316 SS
Pump Rotor:	Chrome plated 416 SS	Chrome plated 316 SS	Chrome plated 416 SS	Chrome plated 416 SS	Chrome plated 316 SS
Pump Stator:	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)
Shaft:	416 SS	316 SS	416 SS	416 SS	316 SS
Flexible Joint:	Carbon steel/ NBR	316 SS/ NBR	Carbon steel/ NBR	Carbon steel/ NBR	316 SS/ NBR
Bearings:	Ball (sealed)	Ball (sealed)	Ball (sealed)	Ball (sealed)	Ball (sealed)
Mechanical Seal:	Carbon-ceramic	Carbon-ceramic	Carbon-ceramic	---	---
Packing:	---	---	---	Braided PTFE	Braided PTFE

Note: Alternate elastomers available. Refer to Repair/Conversion kit numbers, page 8.

INSTALLATION

Mounting Position. Pump may be mounted in any position. When mounting vertically, it is necessary to keep bearings above seals to prevent possible seal leakage into bearings.

Pre-Wetting. Prior to connecting pump, wet pump elements and mechanical seal or packing by adding fluid to be pumped into suction and discharge ports. Turn shaft over several times in a clockwise direction to work fluid into elements.

Piping. Piping to pump should be self-supporting to avoid excessive strain on pump housings. See Table 1 for suction and discharge port sizes of each pump model. Use pipe "dope" or tape to facilitate disassembly and to provide seal.

Drive. On belt driven units, adjust belt tension to point of non-slip. Do not overtighten.

On direct drive units, coupling components should be aligned and spaced at least 1/16" apart.

Pump rotation must be clockwise when facing shaft to prevent damage to pump. Check direction of rotation before startup.

Water Flush of Packing (356 Models Only). The packing may be either grease lubricated through a grease fitting in the stuffing box or have plumbing connected to the housing to allow a water flush.

Maximum speed is 1750 rpm.

When the material being pumped is abrasive in nature, it may be advantageous to flush the packing to prevent leakage under packing and excessive shaft wear.

Clean water can be injected through a 1/8" NPT tapped hole that normally houses the grease fitting for lubricating the packing. The water can be permitted to leak axially along the shaft in either direction or can be removed from the second tapped hole in the stuffing box. In both cases, the discharge from the stuffing box should be throttled slightly to maintain 10-15 PSI higher pressure in the stuffing box than is present in the discharge housing.

Table 1. Pump Data

Pump Models	331	332	333	344	356	367
Suction Port (NPT)	3/4*	*3/4**	*3/4**	3/4*	1-1/2	2
Discharge Port (NPT)	3/4	3/4	3/4	3/4	1-1/4	2
Discharge Pressure (psig)	150	100	50	40	50	50

*08 versions = 1" NPT

Table 2. Temperature Limits

Elastomer	Temperature Limits
*NBR	10°-160°F
*EPDM	10°-210°F
*FPM	10°-240°F

*NBR = Nitrile
*EPDM = Ethylene-Propylene-Diene Terpolymer
*FPM = Fluoroelastomer

OPERATION

Self-Priming. With wetted pumping elements, the pump is capable of 25 feet of suction lift when operating at 1750 rpm with pipe size equal to port size.

DO NOT RUN DRY. Unit depends on liquid pumped for lubrication. For proper lubrication, flow rate should be at least 10% of rated capacity.

Pressure and Temperature Limits. See Table 1 for maximum discharge pressure of each model. Unit is suitable for service at temperatures shown in Table 2.

Storage. Always drain pump for extended storage periods by removing suction housing bolts and loosening suction housing.

TROUBLE SHOOTING

WARNING: Before making adjustments, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.

Failure To Pump.

1. Belt or coupling slip: Adjust belt tension or tighten set screw on coupling.
2. Stator torn; possibly excessive pressure: Replace stator, check pressure at discharge port.
3. Wrong rotation: Rotation must be clockwise when facing shaft.
4. Threads in rotor or on shaft stripped: Replace part. Check for proper rotation.
5. Excessive suction lift or vacuum.

Pump Overloads.

1. Excessive discharge pressure: Check discharge pressure for maximum rating given in Table 1. Check for obstruction in discharge pipe.
2. Fluid viscosity too high: Limit fluid viscosity to 20,000 CP or 100,000 SSU.

Viscosity CP	Limit RPM
1-300	1750
300-1,000	1200
1,000-2,000	700
2,000-5,000	350
5,000-10,000	180
10,000-20,000	100

3. Insufficient motor HP: Check HP requirement.

Noisy Operation.

1. Starved suction: Check fluid supply, length of suction line, and obstructions in pipe.
2. Bearings worn: Replace parts; check alignment, belt tension, pressure at discharge port.
3. Broken flexible joint: Replace part, check pressure at discharge port.
4. Insufficient mounting: Mount to be secure to firm base. Vibration induced noise can be reduced by using mount pads and short sections of hose on suction and discharge ports.

Mechanical Seal Leakage (Mechanical Seal Models Only).

1. Leakage at startup: If leakage is slight, allow pump to run several hours to let faces run in.
2. Persistent seal leakage: Faces may be cracked from freezing or thermal shock. Replace seal.

Packing Leakage (Packing Models Only).

1. Leakage at startup: Adjust packing as outlined in maintenance instructions.

Note: Slight leakage is necessary for lubrication of packing.

2. Persistent leakage: Packing rings and/or shaft may be worn. Replace parts as required.

Pump Will Not Prime.

1. Air leak on suction side: Check pipe connections.

MAINTENANCE

General. These pumps have been designed for a minimum of maintenance, the extent of which is routine lubrication and adjustment of packing. The pump is one of the easiest to work on in that the main elements are very accessible and require few tools to disassemble.

Packing Lubrication (356 Models Only). The zerk fitting on the side of the suction housing leads to the lantern ring halves in the mid-section of the packings. At least once a week, inject a small quantity of good quality grease, such as MPG-2 Multi Purpose Grease (Du Bois Chemical), or equivalent, into the zerk fitting to lubricate the packings.

Note: For Model 34411, lubricate packing by applying a liberal amount of grease during assembly.

Packing Adjustment (Packing Models Only). Packing gland attaching nuts should be evenly adjusted so they are little more than finger tight. Over-tightening of the packing gland may result in premature packing failure and possible damage to the shaft and gland.

When the packing is new, frequent minor adjustments are recommended for the first few hours of operation in order to compress and seat the packing. Be sure to allow slight leakage for lubrication of packing.

When excessive leakage can no longer be regulated by tightening the gland nuts, remove and replace the packings in accordance with the DISASSEMBLY and REASSEMBLY instructions. The entire pump need not be disassembled to replace the packings.

Bearing Lubrication. The prelubricated, fully sealed bearings do not require additional lubrication.

PUMP DISASSEMBLY

WARNING: Before disassembling pump, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.

To Disassemble Mechanical Seal Models:

1. Disconnect suction and discharge piping.
2. Remove screws (112) holding suction housing (2) to pump body (1). Remove suction housing and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning counter-clockwise (RH thread). Use 3/16 inch diameter punch to remove rotor pin (45) on Model 36701.
4. Flexible joint (24) can be removed from shaft (26) by using a 3/16 inch allen wrench in end of joint (1/4 inch wrench on 356 Models) and turn counter-clockwise. Use 3/16 inch diameter punch to remove shaft pin (46) on Model 36701.
5. Carefully slide mechanical seal (69) off shaft (26). Carefully pry seal seat out of pump body (1). If any parts of mechanical seal are worn or broken, the complete seal assembly should be replaced. Seal components are matched parts and are not interchangeable.
6. The bearings (29) and shaft (26) assembly can be removed from pump body (1) after snap ring (66) has been removed. To remove the assembly, lightly tap the shaft at threaded end using a block of wood to protect the threads. The bearings may be pressed off the shaft.

To Disassemble Packing Models:

1. Disconnect suction and discharge piping.
2. Remove screws (112) which hold suction housing (2) to pump body (1). Remove suction housing and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning in a counter-clockwise direction (RH thread).
4. Flexible joint (24) can be removed by using a 3/16 inch allen wrench in end of joint (1/4 inch wrench on 356 Models) and turn in a counter-clockwise direction.
5. The packing (42) can be removed without removing the shaft (26) using the following procedure:
   a. Remove gland bolts (47).
   b. Slide gland (41) away from packing (42).
   c. Pull out packing (42) (and lantern ring halves (57) on 356 Models) using a packing removing tool.

   Note: Packing can be removed after shaft has been removed by pushing out from pump side of pump body after gland (41) has been detached.
6. The bearings (29) and shaft (26) assembly can be removed from pump body (1) after snap ring (66) has been removed. To remove the assembly, lightly tap the shaft at threaded end using a block of wood to protect the threads.
7. To disassemble shaft assembly, remove snap ring (66A) from shaft (26) and press bearings (29) and bearing spacer (33) off the shaft.

PUMP ASSEMBLY

To Assemble Mechanical Seal Models:

1. Press bearings (29) on shaft (26), and locate slinger ring (77) near bearing on threaded end of shaft.

Note: When replacing bearings, always press on the inner race when assembling to shaft, and on the outer race when pressing bearings into the housings.

2. Press shaft assembly into pump body (1) securing with snap ring (66).
3. Install mechanical seal (69) using the following procedure:
   a. Clean and oil sealing faces using a clean light oil (not grease).

Caution: Do not use oil on EPDM parts. Substitute glycerin or soap and water.

   b. Oil the outer surface of the seal seat, and push the assembly into the bore in the pump body (1), seating it firmly and squarely.
   c. After cleaning and oiling the shaft, slide the seal body along the shaft until it meets the seal seat.
   d. Install seal spring and spring retainer on shaft.
4. Thread flexible joint (24) into shaft (26) in a clockwise direction (RH thread). On 356 Models, install seal spacer (69A) and washer (116) before threading flexible joint onto shaft in a clockwise direction. On Model 36701, use shaft pin (46) to pin flexible joint (24) to shaft.
5. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread). On Model 36701, pin rotor (22) to joint using rotor pin (45).
6. Slide stator (21) on rotor (22). On 331 and 332 Models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
7. Secure stator (21) and suction housing (2), with suction port vertically up, to pump body (1) using screws (112).
8. Proceed as in installation instructions.

To Assemble Packing Models:

1. Press bearings (29), with bearing spacer (33) in between, on shaft (26) and secure in place using snap ring (66A).

Note: When replacing bearings, always press on the inner race when assembling to shaft, and on the outer race when pressing bearings into the housings.

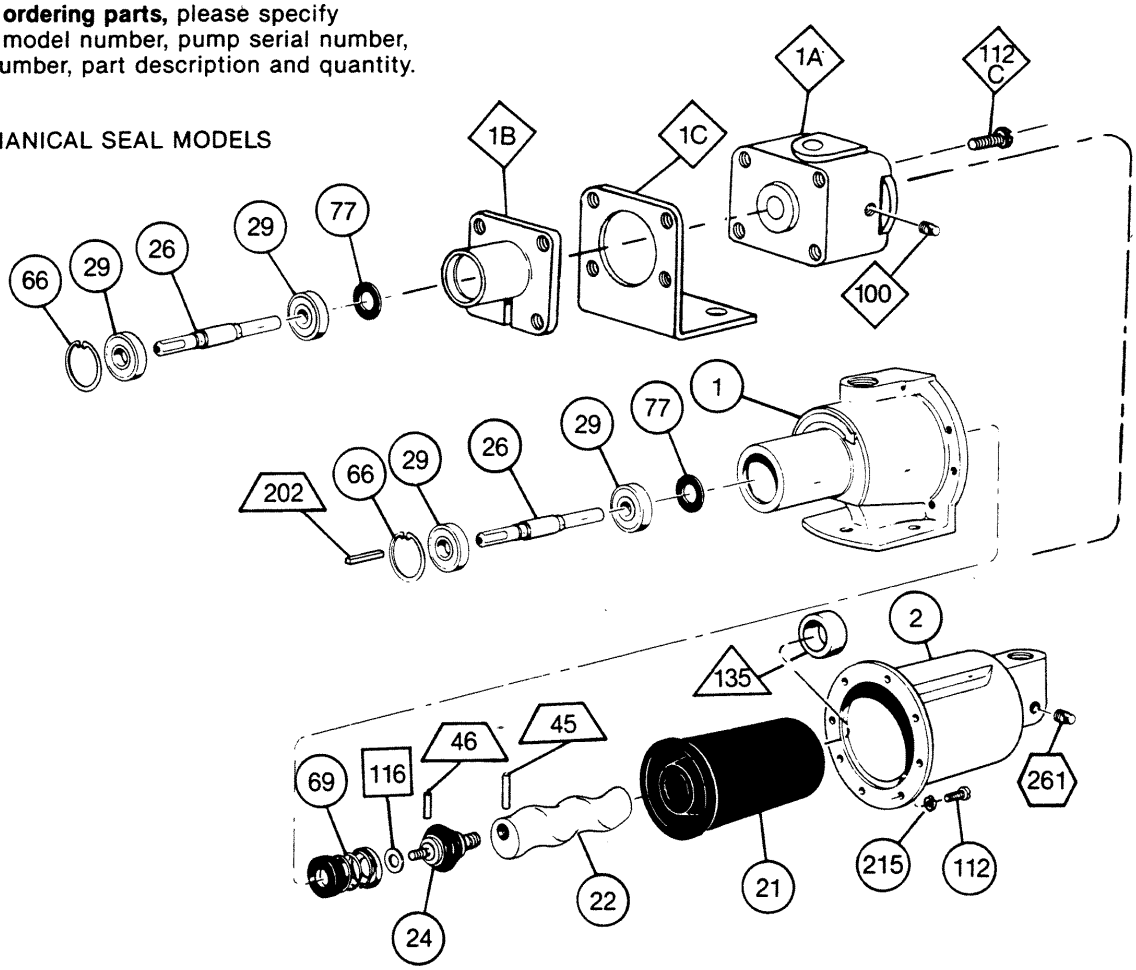
2. Install packing (42) before installing shaft assembly using the following procedure:
   a. Lubricate each individual ring of packing with a grease that is insoluble in the fluid being pumped.
   b. Individually assemble each ring of packing loosely in the packing chamber of the pump body (1). Stagger splits on rings. (Four rings, 3/16 inch square required on Model 34411; four rings, 1/4 inch square and two lantern ring halves (57) assembled between two rings on 356 Models).
   c. Loosely install packing gland (41) on pump body (1) using gland bolts (47).
3. Press shaft assembly into pump body (1) positioning slinger ring (77) between packing gland (41) and bearing end of pump body. Secure the shaft assembly with snap ring (66).
4. Thread flexible joint (24) into shaft (26) in a clockwise direction (RH thread).
5. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread).
6. Slide stator (21) on rotor (22). On 331 and 332 Models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
7. Secure stator (21) and suction housing (2), with suction port vertically up, to pump body (1) using screws (112).
8. Proceed as in installation instructions.

Note: Adjust newly installed packing as described in maintenance procedure.

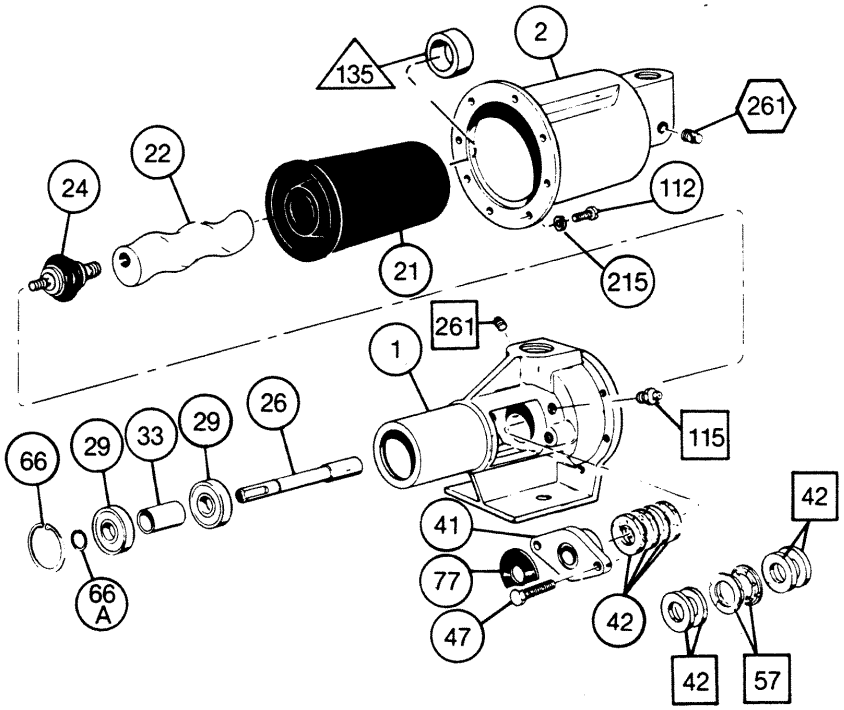
WARNING: Replace belt or coupling guards before reconnecting power.

When ordering parts, please specify pump model number, pump serial number, part number, part description and quantity.

MECHANICAL SEAL MODELS



PACKING MODELS



Used on 332 and 367 only.

Used on 356 only.

Used on 356 and 367 only.

Used on -08 only.

Used on 367 only.

PARTS LIST — 331, 332, 333, AND 344 MODELS

Item No.	Description	Mechanical Seal Models			Packing Gland Models
		33101 33201 33301 34401	**33104 33204 33304 34404**	**33108 33208 33308 34408**	**34411**
1	Pump Body	330-1065-002	330-1910-002		340-1000-001
1A	Discharge Housing			340-2362-000	
1B	Bearing Housing			330-4587-000	
1C	Pump Base			340-2369-000	
2	Suction Housing	330-1064-002	330-1911-002	330-4536-000	330-1064-002
*21	Stator	See Stator section below.			
*22	Rotor	See Rotor section below with circled numbers for each series.			
		(1)	(2)	(1)	(1)
24	Joint	Carbon Steel/NBR 320-1511-000	316 SS/NBR 320-3759-000	Carbon Steel/NBR 320-1511-000	
26	Drive Shaft	320-1499-000	320-2938-000	320-1499-000	320-2448-000
29	Bearing (2 req.)	630-0502-031			
33	Bearing Spacer				320-1900-000
41	Packing Gland				320-0101-004
42	Packing				340-3396-005
47	Gland Bolt				619-1520-161
66	Snap Ring	320-1506-000			
66A	Snap Ring				320-4182000
69	Mechanical Seal	320-2424-000			
77	Slinger Ring	320-6382-000			320-6384-000
100	Pipe Plug (3 req.)			610-0120-021	
112	Screws (8 req.)	619-1430-103	320-5968-000	619-0860-081	619-1430-103
112C	Screws (4 req.)			61 9-0890-281	
135	Stator Ring (331 -332 only)	320-7812-000			
215	Lock Washer (8 req.)	320-6464-000			

*Recommended spare parts.

STATORS		**Models**			
		331	**332**	**333**	**344**
21	Standard Stator, NBR All Models	340-3501-120	340-3502-120	340-3503-120	340-3504-120
21	EPDM Stator	340-3501-320	340-3502-320	340-3503-320	340-3504-320
21	FPM Stator	340-3501-520	340-3502-520	340-3503-520	340-3504-520
ROTORS					
22	(1) 416SS - All Models	320-2729-000	330-0906-000	320-1394-000	320-1841-000
22	(2) 316SS – All Models	320-2933-000	320-2942-000	320-2936-000	320-2934-000

See page 8 for Repair/Conversion Kits

PARTS LIST — 356 AND 367 MODELS

Item No.	Description	Mechanical Seal Models		Packing Gland Models		Mechanical Seal Model	
		35601	35604	35611	35613	36701	36704
1	Pump Body	Cast Iron 340-0636-000	316SS 340-1550-000	Cast Iron 350-0420-000	316SS 350-0491-000	Cast Iron 350-0423-000	316SS 350-0423-007
2	Suction Housing	350-0280-000	350-0489-000	350-0280-000	350-0489-000	350-0302-000	350-0302-007
*21	Stator	NBR 340-3505-120		NBR 340-3505-120		NBR 340-3506-120	
22	Rotor	416SS 320-2304-000	316SS 320-4431-000	416SS 320-2304-000	316SS 320-4431-000	416SS 330-2042-000	316SS 330-3077-000
24	Flex Joint	Carbon Steel 320-1583-000	316SS 320-4427-000	Carbon Steel 320-1583-000	316SS 320-4427-000	Carbon Steel 320-1749-000	316SS 320-4436-000
26	Drive Shaft	320-1759-000	320-4430-000	320-2765-000	320-4435-000	330-1805-000	330-1805-015
29	Bearing (2 req.)	630-0552-051				630-0552-061	
33	Bearing Spacer			320-2764-000			
41	Packing Gland			320-0003-004	320-0003-007		
*42	Packing			340-3396-008			
45	Rotor Pin					320-4439-002	
46	Shaft Pin					320-4439-001	
47	Gland Bolt			619-1530-241			
57	Lantern Ring Half**			320-6585-000			
66	Snap Ring	320-1758-000				320-2794-000	
66A	Snap Ring			320-3533-000			
*69	Mechanical Seal	320-3945-000				320-1750-000	
69A	Seal Spacer	320-4434-000					
77	Slinger Ring	320-6383-000		320-6385-000		320-6385-000	
112	Screws (6 req.)	619-1530-161				619-1530-161	
115	Zerk Fitting			320-2503-001			
135	Stator Spacer	330-7594-000					
202	Shaft Key					611-0040-240	
215	Lock Washer (6 req.)	623-0010-411					
261	Pipe Plug	610-0120-011	610-0420-010	610-0120-011	610-0420-010	610-0120-011	610-0420-010

*Recommended spare parts.
**2 Required

See page 8 for Repair/Conversion Kits

REPAIR/CONVERSION KIT NUMBERS

ELASTOMER REPAIR/CONVERSION KITS

Item No.	Description	331 Models			332 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No.	311-9026-000	311-9025-000	311-9054-000	311-9027-000	311-9038-000	311-9055-000
21	• Stator	340-3501-120	340-3501-320	340-3501-520	340-3502-120	340-3502-320	340-3502-520
24	• Joint	320-1511-000‡	320-6367-000†	320-4670-000†	320-1511-000‡	320-6367-000†	320-4670-000†
69	• Seal	320-2424-000	320-6379-000	320-6501-000	320-2424-000	320-6379-000	320-6501-000
Item No.	**Description**	**333 Models**			**344 Models**		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No.	311-9029-000	311-9028-000	311-9056-000	311-9031-000	311-9030-000	311-9057-000
21	• Stator	340-3503-120	340-3503-320	340-3503-520	340-3504-120	340-3504320	340-3504520
24	• Joint	320-1511-000‡	320-6367-000†	320-4670-000†	320-1511-000‡	320-6367-000†	320-4670-000†
69	• Seal	320-2424-000	320-6379-000	320-6501-000	320-2424-000	320-6379-000	320-6501-000

t316SS/with appropriate elastomer.
‡Carbon steel. NBR kits are available only with carbon steel joints; a 316SS/NBR joint for 331-344 Models is available as 320-3759-000.

Item No.	Description	356 Models			367 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No. (Mech. Seal Models)	311-9033-000	311-9032-000	311-9058-000	311-9060-000	311-9036-000	311-9124-000
21	• Stator	340-3505-120	340-3505-320	340-3505-520	340-3506-120	340-3506-320	340-3506-520
24	• Flex Joint	320-1583-000‡	320-6369-000†	320-4671-000†	320-1749-000‡	320-6378-000‡	3206515-000‡
69	• Seal	320-3945-000	320-6380-000	320-6510-000	320-1750-000	320-6390-000	320-6517-000
45	• Rotor Pins				320-4439-002	320-4439-002	320-4439-002
46	• Shaft Pin				320-4439-001	320-4439-001	320-4439-001
—	Kit No (Packing Gland Models)	311-9035-000	311-9034-000	311-9059-000			
21	• Stator	340-3505-120	340-3505-320	340-3505-520			
24	• Joint	320-1583-000‡	320-6369-000†	320-4671-000†			

†316SS/with appropriate elastomer.
‡Carbon steel. NBR kits are available only with carbon steel joints; a 316SS/NBR joint for Model 35604 and 35613 pumps is available as 320-4427-000; a 316SS/NBR joint for model 36704 is available as 320-4436-000.

ABRASION RESISTANT SEALS

Elastomer	Models		
	331-344	356	36701
NBR	3206460000	3206505000	3206511000
EPDM	3206502000	3206506000	3206512000
FPM	3206503000	3206507000	3206513000

NBR = Nitrile
EPDM = Ethylene-Propylene-Diene Terpolymer
FPM = Fluoroelastomer

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Product Information Packet

M7014T

1//.75HP,1750//1450RPM,3PH,60//50HZ,143T

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Part Detail

Revision:	F	**Status:**	INA/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	3516M	**Elec. Spec:**	35WGP674	**CD Diagram:**	
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	35E362	**Layout:**	
Frame:	143T	**Mounting:**	F1	**Poles:**	04	**Created Date:**	10-18-2007
Base:	RG	**Rotation:**	R	**Insulation:**	B	**Eff. Date:**	02-23-2011
Leads:	9#18	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP1426XP

NO.		**CC**			
SER.					
SPEC.	35E362P674H1				
CAT.NO.	EXPORT ONLY				
HP	1//.75	**T. CODE**	T3C		
VOLTS	230/460//190/380				
AMPS	3.2/1.6//3/1.5				
RPM	1750//1450				
HZ	60//50	**PH**	3	**CL**	B
SER.F.	1.00	**DES**	B	**CODE**	M
RATING	40C AMB-CONT				
FRAME	143T	**NEMA-NOM-EFF**	82.5	**PF**	73
USABLE AT 208V					

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Parts List

Part Number	Description	Quantity
SA164676	SA 35E362P674H1	1.000 EA
RA153102	RA 35E362P674H1	1.000 EA
35CB3001A02SP	EXPL PROOF CONDUIT BOX, 3/4"PIPE TAP LEA	1.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
HW3001B01	003SS CUP WASHER, FOR #8 SCREW	1.000 EA
35EP3700A01SP	FR ENDPLATE, XPFC	1.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
35EP3701A01	PU ENDPLATE, XPFC - 205 BRG	1.000 EA
XY3118A12	5/16-18 HEX NUT DIRECTIONAL SERRATION	4.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
35FH4005A01SP	IEC FH NO GREASER W/AUTOPHORETIC PRIMER	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
35CB3500A01SP	CONDUIT BOX LID, MACH	1.000 EA
10XN2520A16	1/4-20 X 1 HEX HEAD CAP SCR, ZINC PLATED	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A01	KEY RETAINER 7/8" DIA SHAFT	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	6.000 EA
NP0018	NP- XP CONDUIT BOX DO NOT MAKE SELLABLE	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.050 LB
35FN3002A05SP	EXFN, PLASTIC, 6.376 OD, .638 ID	1.000 EA
MG1025Z20	ACTIVATOR WILKOFAST 060.32	0.010 GA
MG1025G29	PAINT 789.205 DARK GRAY METALLIC (USE W/	0.017 GA
HA3104A06	THRUBOLT 5/16-18 X 8.50 OHIO ROD	4.000 EA

Parts List (continued)

Part Number	Description	Quantity
LB1119	WARNING LABEL	1.000 EA
LB1172A01	CUSTOM MTR CARTON LABEL LASER PRINTER	1.000 EA
LC0145B01	CONNECTION LABEL	1.000 EA
NP1426XP	UL/CSA, CLI GP-D,CLII GP-F&G,CC	1.000 EA
36PA1000	PACK GROUP W/LB5001	1.000 EA

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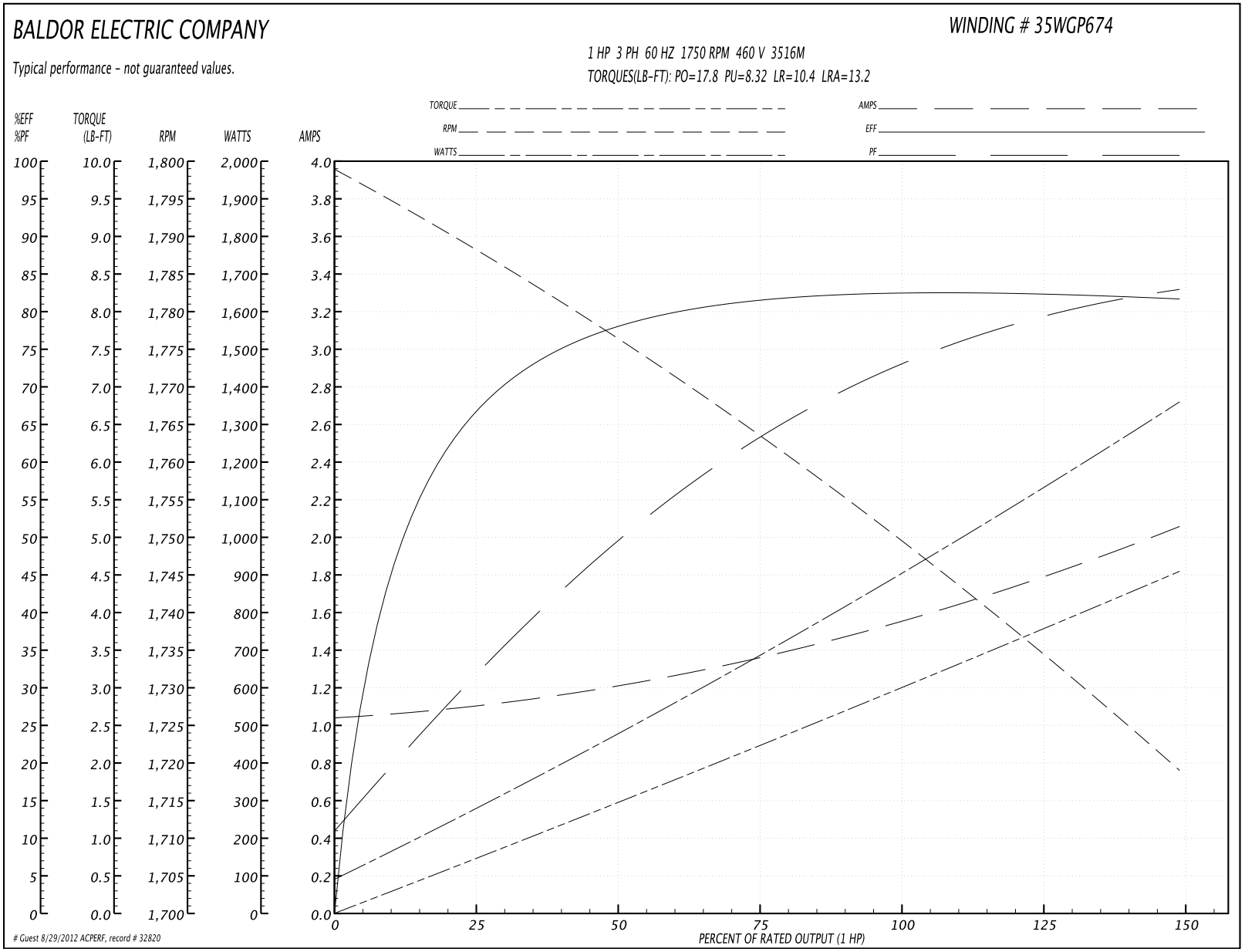
Performance Data at 460V, 60Hz, 1.0HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	2.99 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	1.04 Amps			**Break-Down Torque:**		17.8 LB-FT	
Line-line Res. @ 25°C.:	16.3 Ohms A Ph / 0.0 Ohms B Ph			**Pull-Up Torque:**		8.32 LB-FT	
Temp. Rise @ Rated Load:	41 C			**Locked-Rotor Torque:**		10.4 LB-FT	
Temp. Rise @ S.F. Load:				**Starting Current:**		13.2 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	32.0	50.0	63.0	72.0	79.0	83.0	0.0
Efficiency:	66.6	78.0	81.4	82.6	82.5	81.6	0.0
Speed:	1788.0	1776.0	1764.0	1750.0	1735.0	1719.0	0.0
Line Amperes:	1.11	1.2	1.36	1.56	1.77	2.06	0.0

Performance Graph at 460V, 60Hz, 1.0HP Typical performance - Not guaranteed values



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Performance Data at 380V, 50Hz, 0.75HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	2.7 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	1.02 Amps			**Break-Down Torque:**		16.0 LB-FT	
Line-line Res. @ 25°C.:	16.3 Ohms A Ph / 0.0 Ohms B Ph			**Pull-Up Torque:**		8.1 LB-FT	
Temp. Rise @ Rated Load:	37 C			**Locked-Rotor Torque:**		10.1 LB-FT	
Temp. Rise @ S.F. Load:				**Starting Current:**		12.1 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	31.0	48.0	61.0	71.0	78.0	82.0	0.0
Efficiency:	64.3	76.4	80.2	81.5	81.4	80.3	0.0
Speed:	1489.0	1478.0	1467.0	1454.0	1440.0	1426.0	0.0
Line Amperes:	1.08	1.16	1.29	1.47	1.66	1.92	0.0

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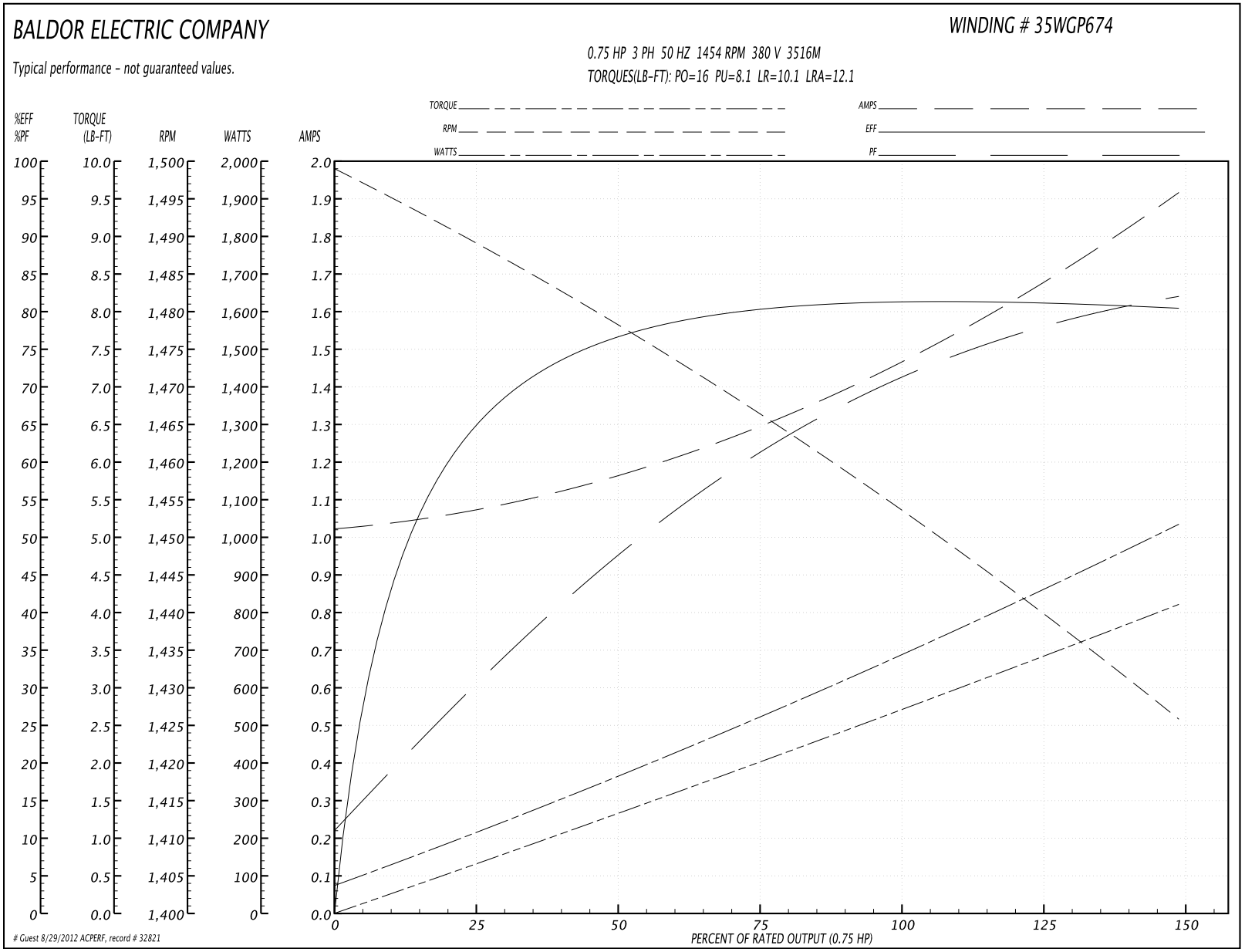
Performance Graph at 380V, 50Hz, 0.75HP Typical performance - Not guaranteed values



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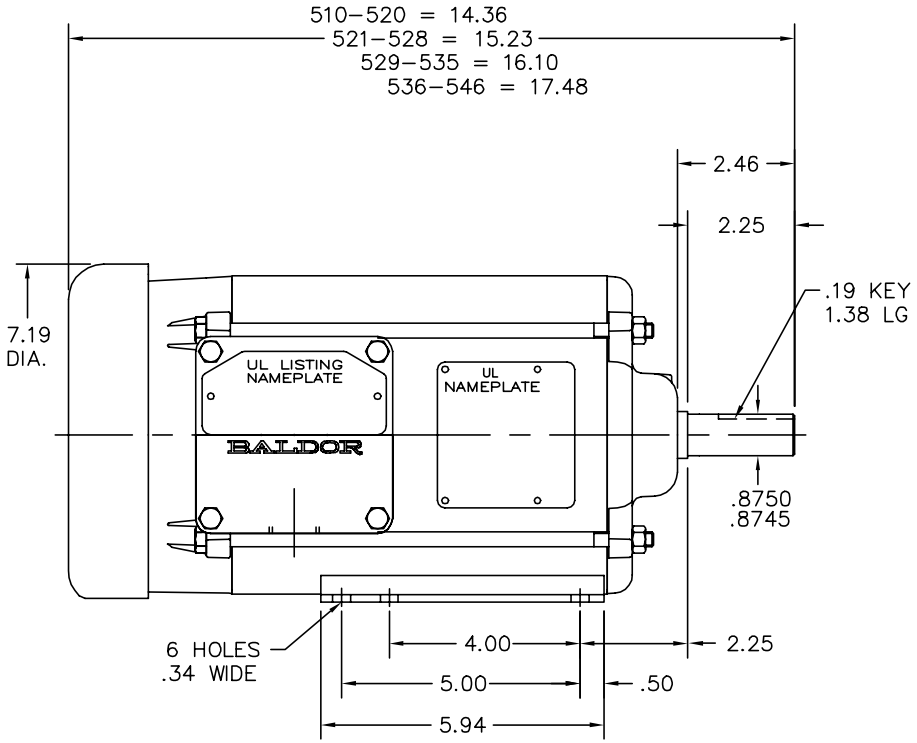
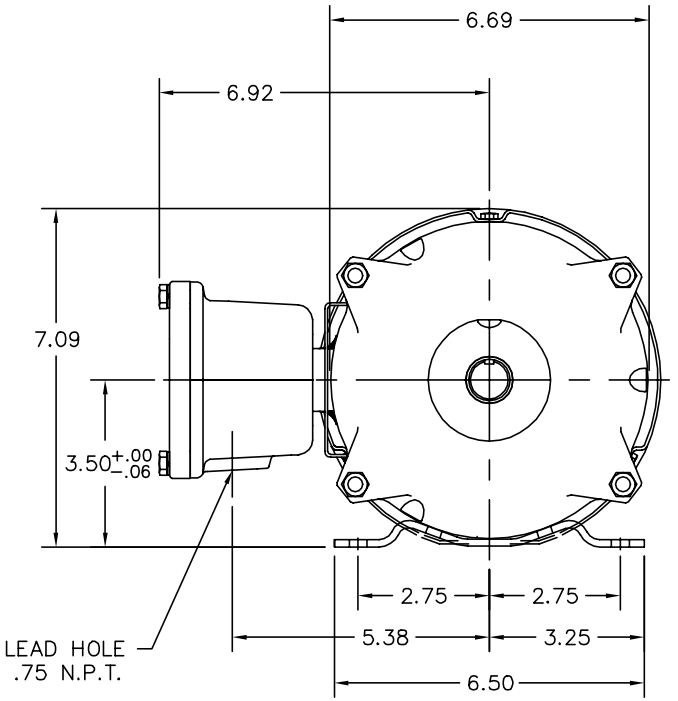
35LYE362





UL CLASS I – GROUP D – CLASS II – GROUPS F & G

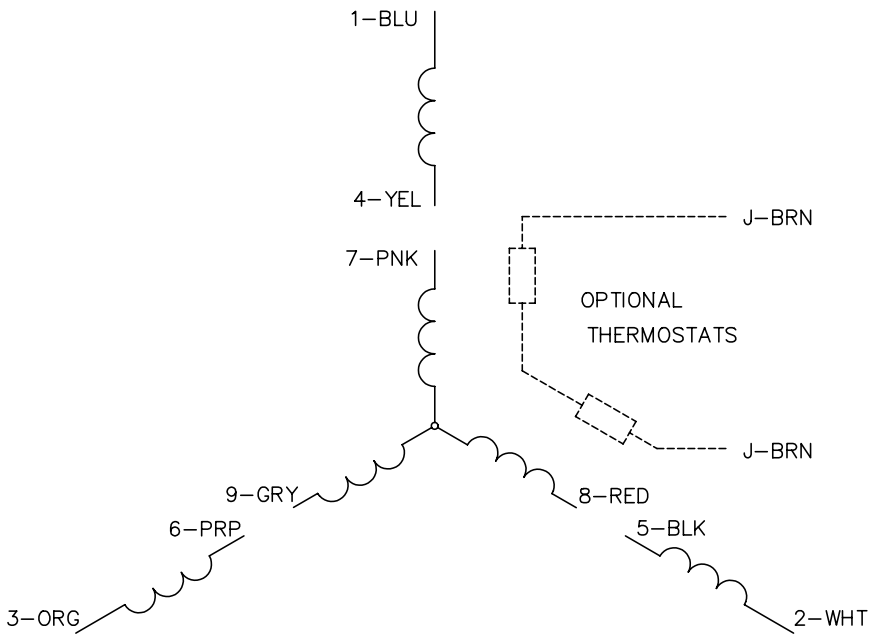
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

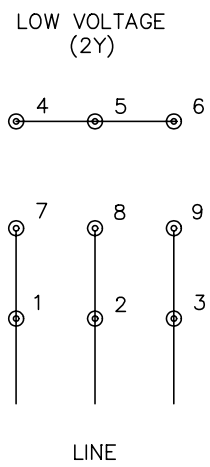
REV. DESC: REVISED DESCRIPTION (XPFC WAS TEFC)				BALDOR ELECTRIC Co.
REV. LTR: G	BY: DWG	REVISED: 14:00:09 01/11/2005	TDR: 353439	
35LYE362		FILE: AAA00005337	REF: 35LYE362	STD HORZ NEMA 143–5T XPFC X35M CL I–GP D–CL II–GP F&G
		MTL: –		

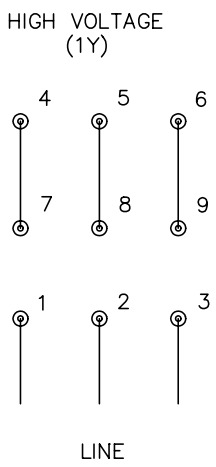
35LYE362

BALDOR A MEMBER OF THE ABB GROUP

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

BALDOR A MEMBER OF THE ABB GROUP

APPENDIX J

OWS Information

HYDRO QUIP, INC.

Water Treatment Equipment

11/7/2012

John Mackellar
ProAct Services Corp.
1140 Conrad Industrial Drive
Ludington, MI 49431

Phone: 231-843-2711
Fax: 231-843-4081

Subject: HQI Quotation # **AG-10-01-MI-12-3**

Dear John;

We are pleased to submit our revised proposal.

Item 1: (1) HQI AG-4CS-IP-1H parallel-corrugated plate Oil/Water Separator will remove essentially 100 % of all free and dispersed non-emulsified oil droplets larger than 20 microns in diameter with a specific gravity of 0.90 or less. The separator is designed for above-grade installation and will be constructed of 3/16" thick carbon steel and coated inside and out.

Included with the system:

- Design Flow: 1-200 GPM Size 52" Wide X 76" High X 120" Long.
- 6" Inlet/Outlet – FNPT fitting
- 2" Oil outlet - FNPT Fitting
- 2" vent NPT fittings and (2) 2" drain NPT fittings
- Parallel-corrugated plate coalescer designed to remove oil droplets greater than 20 microns with a Reynolds Number of less than 500.
- Sludge baffle to capture and contain settleable solids.
- 60 gallon integral oil storage compartment.
- Gasketed removable vapor tight covers for access to chamber compartments.

DESIGN DATA:

HQI will provide analysis, which indicates that, at the calculated overflow rate, the separator will be provided with the required square feet of projected plate separation area to achieve the specified performance under laminar flow (i.e. Reynolds number of less than 500) conditions. Calculations shall take into account the rate of flow, potential surge flow, influent concentrations, particle characteristics, fluid temperature, fluid specific gravities, and PH. If require, calculations signed by a registered professional engineer can be provided for an additional fee.

TERMS OF PAYMENT:

Net 30 days from date of shipment

WARRANTY:

a. Oil/Water Separator Tank per attached HQI Warranty
b. Oil/Water Separator Accessories and Treatment Equipment Two (2) year.

TAXES:

Our price does not include any taxes or duties that may apply to this transaction.

DELIVERY:

Delivery 4-5 weeks after receipt of purchase order or approved drawings.

We look forward to working with you on this project. If you have any questions or require additional information, please contact me.

Sincerely yours,

Paul Desmarais.

Product Manager.

1.0) INTRODUCTION

Hydro Quip, Inc. (HQI) Oil Water Separator (OWS) Model AG-4CS-IP-1H will remove essentially all free and dispersed, non-emulsified oil, and settleable solids from the oil water mixture at a flow rate of 200 GPM at a temperature of 55 degrees F. The design utilizes the difference in specific gravity between oil and water (buoyancy force) enhanced by the use of 60 cubic feet of 3/4" Unipack Plates and 20 cubic feet of HD Q-PAC coalescing plates. The separator is designed to receive oily water by gravity/pumped flow that will not mechanically emulsify the oil and will process it on a once through basis. The tank will be a single wall, rectangular unit installed above grade. It will be constructed of carbon steel and coated inside and out. The HD Q-PAC coalescing plates are manufactured of UV-Resistant Polypropylene material.

2.0 SYSTEM DESCRIPTION AND REQUIREMENTS

2.1 *FABRICATION:* The oil water separator is a special purpose prefabricated parallel corrugated plate, rectangular, gravity displacement, type oil water separator. The separator shall be comprised of a tank containing an inlet compartment, separation chamber, sludge chamber, and clean water outlet chamber.

2.2 *TANK:* The tank shall be a single wall construction of 3/16" thick carbon steel conforming to ASTM A36, carbon steel. Welding will be in accordance with AWS D1.1 to provide a watertight tank that will not warp or deform under load. Pipe connections to the exterior shall be as follows:

2.2.1 *PIPE CONNECTIONS*: All connections 3" and smaller are FNPT couplings. All connections 4" and larger are flat face flanges with ANSI 150 pound standard bolt circle. Use flanged piping connections that conform to ANSI B16.5.

2.3 *SEPARATOR CORROSION PROTECTION*: (For Carbon Steel Only) after shop hydrostatic test has been successfully completed, a coating system will be applied to the interior and exterior surfaces of the separator. Interior and exterior shall be sandblasted to SSPC-SP10 & SSPC-SP6; Interior lined with Potable Water Epoxy liner to 10 mils MDFT; Exterior coated with polyamide epoxy to 6 mils MDFT.

2.4 *LIFTING LUGS*: The tank shall be provided with properly sized lifting lugs for handling and installation.

2.5 *COVERS:* The tank will be provided with vapor tight covers for vapor control. Gas vents and suitable access openings to each compartment will be provided. The covers shall be constructed of marine grade aluminum and will be fastened in place. A gasket shall be provided for vapor tightness. 3/8-16 bolts and threaded knobs will be provided for cover attachment.

2.6 *INLET COMPARTMENT*: The inlet chamber shall be comprised of a non-clog diffuser to distribute the flow across the width of the separation chamber. The inlet compartment shall be of sufficient volume to effectively reduce influent suspended solids, dissipate energy and begin separation. The media will sit elevated on top of a sludge baffle. The sludge baffle will be provided to retain settleable solids and sediment from entering the separation chamber.

2.7 *SEPARATION CHAMBER*: The oil separation chamber shall contain HD Q-PAC Coalescing Media containing a minimum of 132 square feet per cubic foot of effective coalescing surface area. The medias needle like elements (plates) shall be at 90 degrees to the horizontal or longitudinal axis of the separator. Spacing between these elements shall be spaced 3/16” apart for the removal of a minimum of 99.9% of free droplets 20 micron in size or greater. The elements are positioned to create an angle of repose of 90 degrees to facilitate the removal of solids that may tend to build up on the coalescing surfaces, which would increase velocities to the point of discharging an unacceptable effluent. Laminar flow with a Reynolds Number of less than 500 at a maximum designed flow rate shall be maintained throughout the separator packed bed including entrance and exit so as to prevent re-entrainment of oils with water. Flow through the polypropylene coalescing media shall be crossflow perpendicular to the vertical media elements such that all 132 square feet/cubic foot of coalescing media is available for contact with the coalescing surfaces. None of the coalescing media surfaces shall be pointing upward so as not to be available for contact with the crossflowing oily water. The media shall have a minimum of 87% void volume to facilitate sludge and dirt particles as they fall off the vertical elements and settle in the sludge compartment. The media when installed in crossflow OWS shall meet US EPA Method 413.2 and also European Standard 858-1.

2.8 *BAFFLES:* An oil retention & underflow weir, and overflow weir. Position underflow weir to prevent resuspension of settled solids.

2.9 *SLUDGE BAFFLE*: The sludge baffle shall be located prior to the coalescing compartment for the settling of any solids. It shall also prevent any solids from entering the clean water chamber.

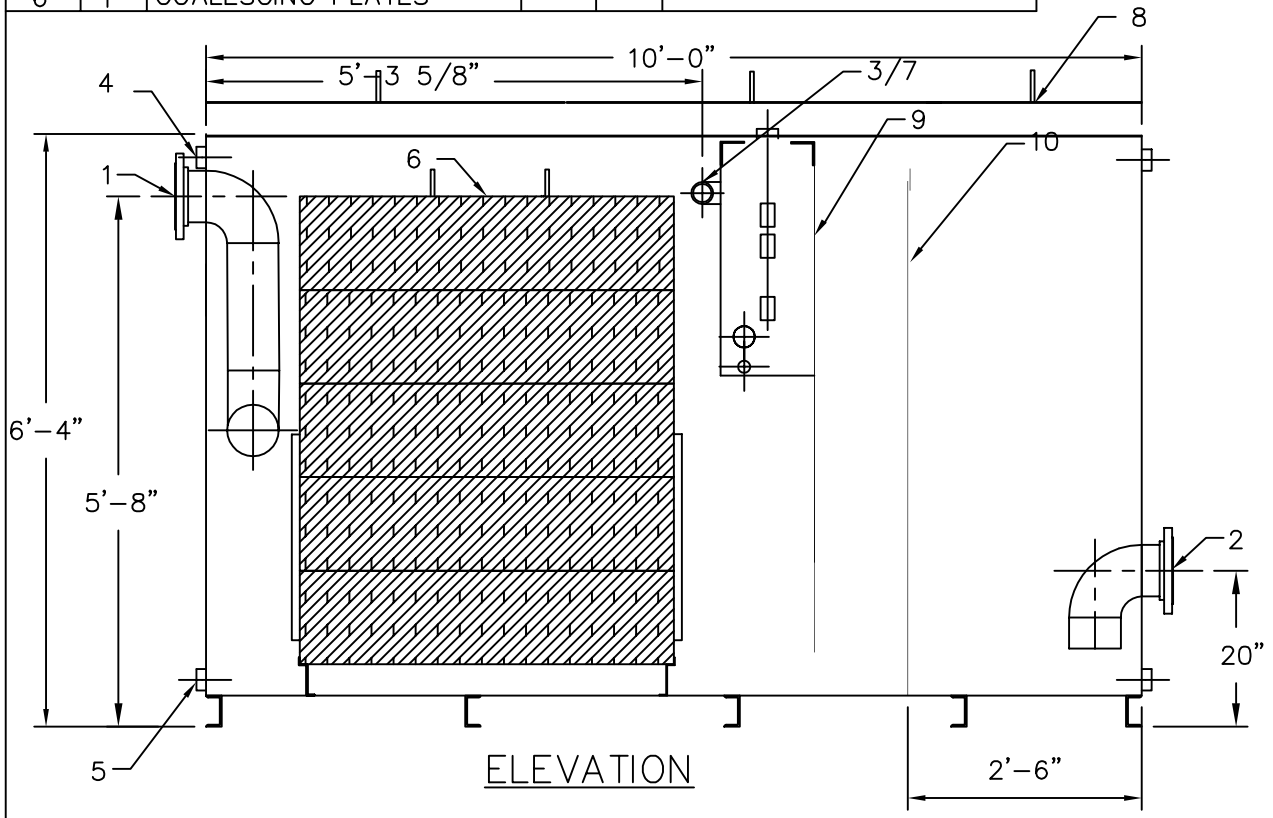
2.10 *OIL SKIMMER*: The oil separation chamber will be provided with a rotatable pipe skimmer for gravity decanting of the separated oil to a 60 gallon integral product storage tank.

2.11 *CLEAN WATER CHAMBER:* The tank will be provided with a 400-gallon clean water chamber that allows the water to leave the separator by pumped flow through the clean water outlet port.

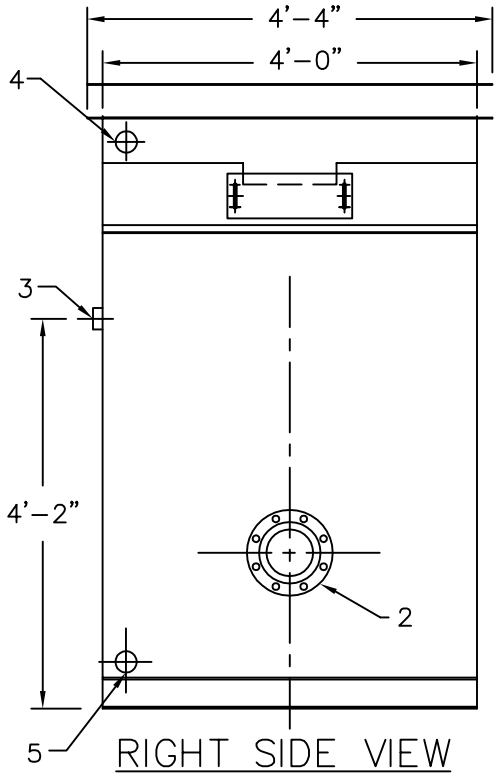
2.12 *VENTS:* 2" vents will be provided with vent piping to atmosphere.

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
1	1	6"–150# FLG. INLET	7	1	PVC OIL SKIMMER
2	1	6"–150# FLG. OUTLET	8	3	REMOVABLE COVER
3	1	2" FNPT OIL OUTLET	9	1	OIL STOP WEIR
4	2	2" FNPT VENT	10	1	ADJ. OVERFLOW WEIR
5	2	2" FNPT DRAIN	11	0	NOT USED
6	1	COALESCING PLATES			

SHIPPING WEIGHT	2691 LBS
OPERATING WEIGHT	16180 LBS
SEPARATOR VOLUME	1620 GALLONS
EFFLUENT TANK VOLUME	400 GALLONS
SLUDGE VOLUME	48 GALLONS
COALESCING AREA	80 FT^3
OIL STORAGE VOLUME	60 GALLONS



ELEVATION



RIGHT SIDE VIEW

NOTES

1. MATERIAL: 3/16" CARBON STEEL COATED INSIDE AND OUT.
2. GASKET: NEOPRENE.
3. HARDWARE: 18–8 STAINLESS STEEL
4. INTERNAL PIPE SCH 80 PVC

REV.	DESCRIPTION	DATE	INIT.

HYDRO QUIP. INC.

Water Treatment Systems

GENERAL ARRANGEMENT
MODEL AG–4CS–IP–2H

DRN. BY: PND

CHKD.BY:

PROJECT:

DATE: 5/26/05

REF:

FILE: AG–4CS–IP–2H

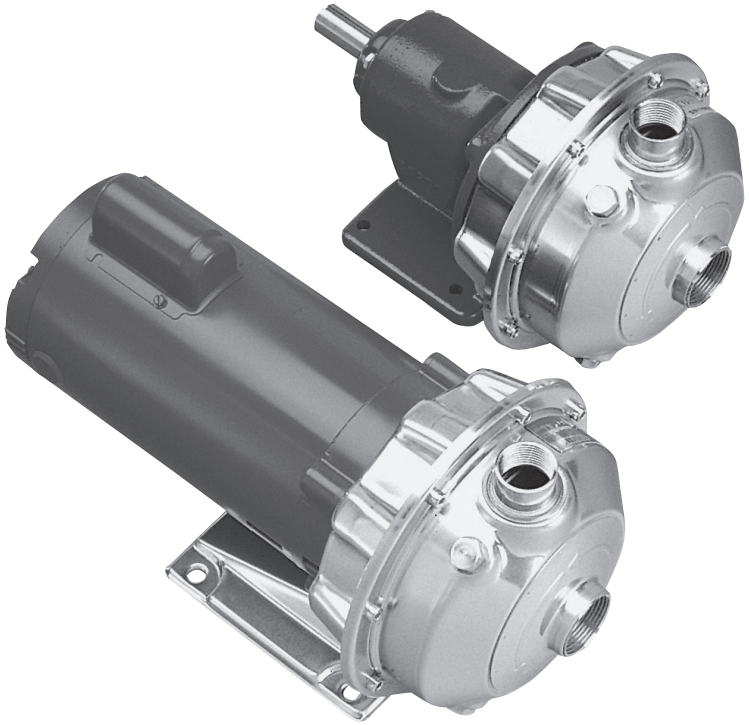
SCALE: 1/4" = 1'

THIS DRAWING IS PROPERTY OF HYDRO QUIP INC. AND MUST NOT BE COPIED, LOANED OR DISTRIBUTED WITHOUT WRITTEN PERMISSION.

REV: 0

Transfer Pump
TP-301 Information

TECHNICAL BROCHURE
BNPE



NPE

316L SS

NPE SERIES END SUCTION CENTRIFUGAL PUMPS
BOMBAS CENTRÍFUGAS DE SUCCIÓN FINAL SERIE NPE

GOULDS
WATER TECHNOLOGY
a xylem brand

A FULL RANGE OF PRODUCT FEATURES
UNA GAMA TOTAL DE CARACTERÍSTICAS DEL PRODUCTO

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE PRODUCT LINE NUMBERING SYSTEM
LÍNEA DE PRODUCTO NPE SISTEMA DE NUMERACIÓN

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal), *Sello Mecánico John Crane Tipo 21 (sello de ⅝")*					
Seal Code, *Código del Sello*	**Rotary, *Rotativo***	**Stationary, *Estacionario***	**Elastomers, *Elastómeros***	**Metal Parts, *Partes Metálicas***	**Part No., *Pieza Número***
2	Carbon	Silicon Carbide	EPR	316 SS	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del Impulsor*	**Pump Size, *Tamaño de la Bomba***		
	1 x 1¼ – 6	**1¼ x 1½ – 6**	**1½ x 2 – 6**
	Diameter	**Diameter**	**Diameter**
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

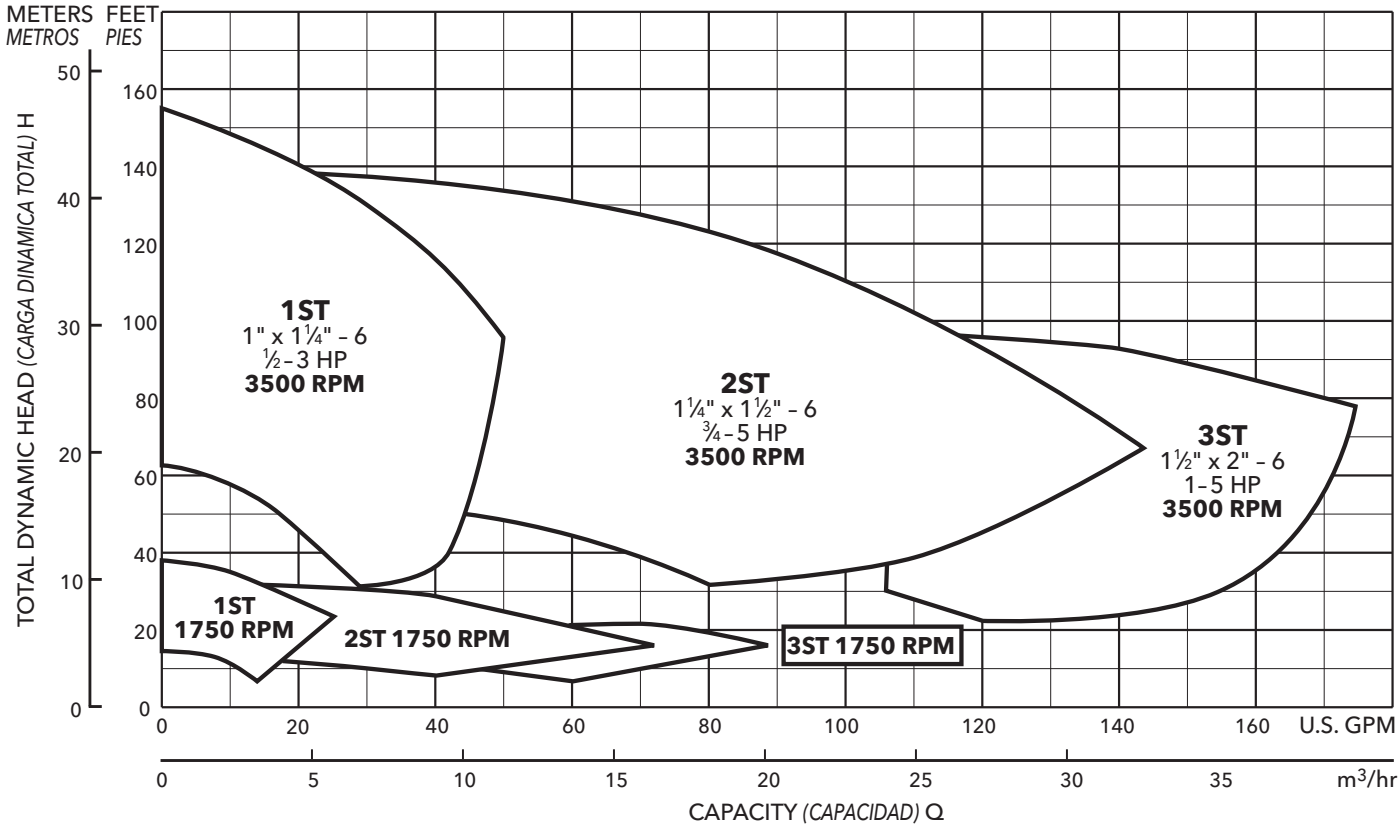
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

PERFORMANCE COVERAGE (60 HZ)
ALCANCE DE FUNCIONAMIENTO (60 HZ)



NOTES:
Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

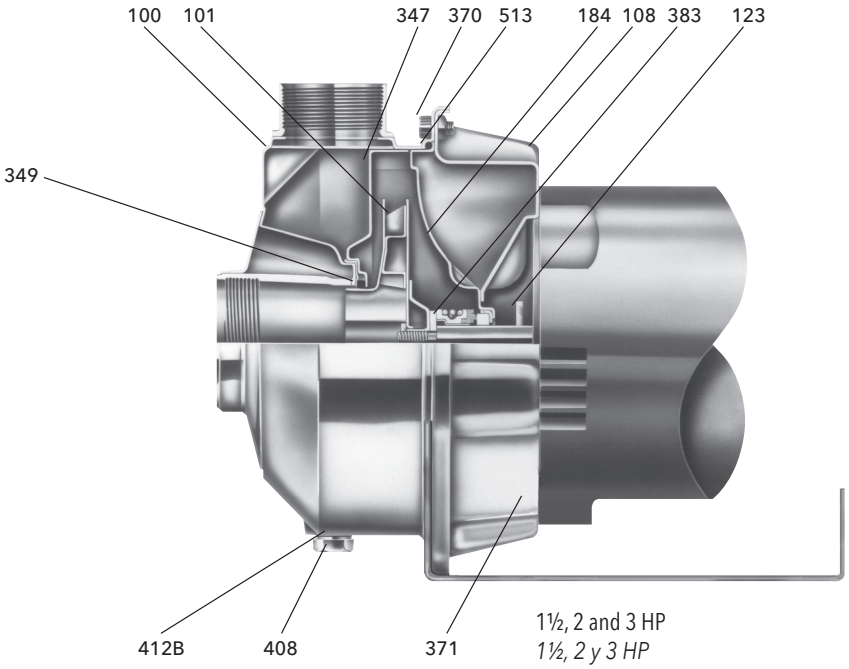
NOTAS:
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

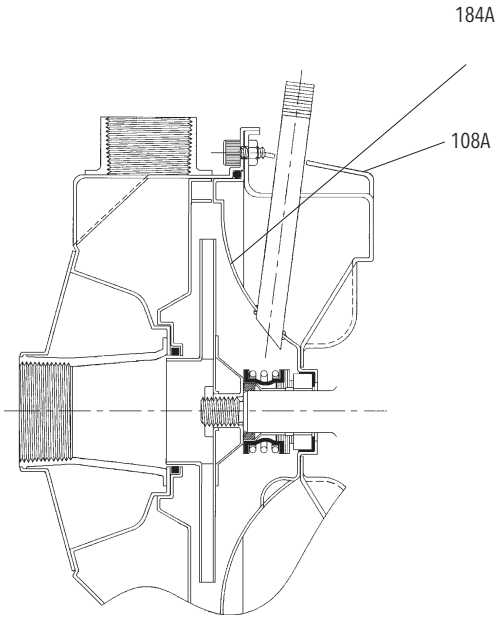
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE CLOSE COUPLED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA CERRADA ACOPLADA NPE COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

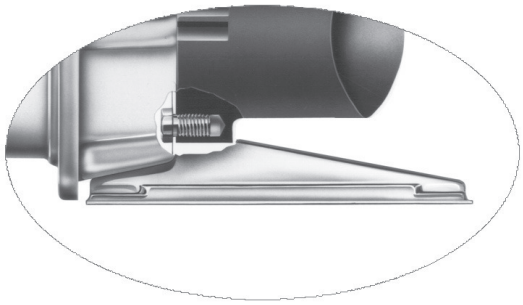


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxidable*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

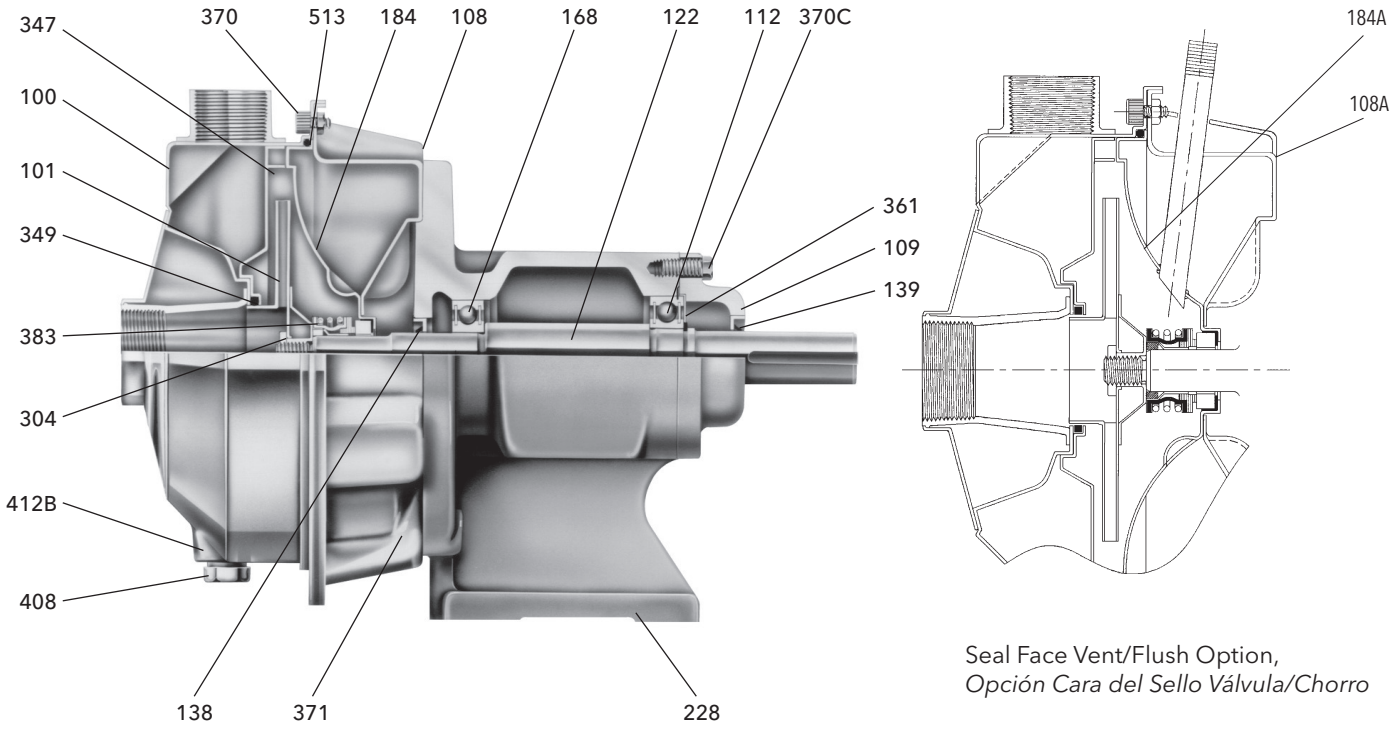


½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

NPE FRAME MOUNTED PUMP MAJOR COMPONENTS: MATERIALS OF CONSTRUCTION
BOMBA NPE DE ARMAZÓN MONTADO COMPONENTES PRINCIPALES: MATERIALES DE CONSTRUCCIÓN

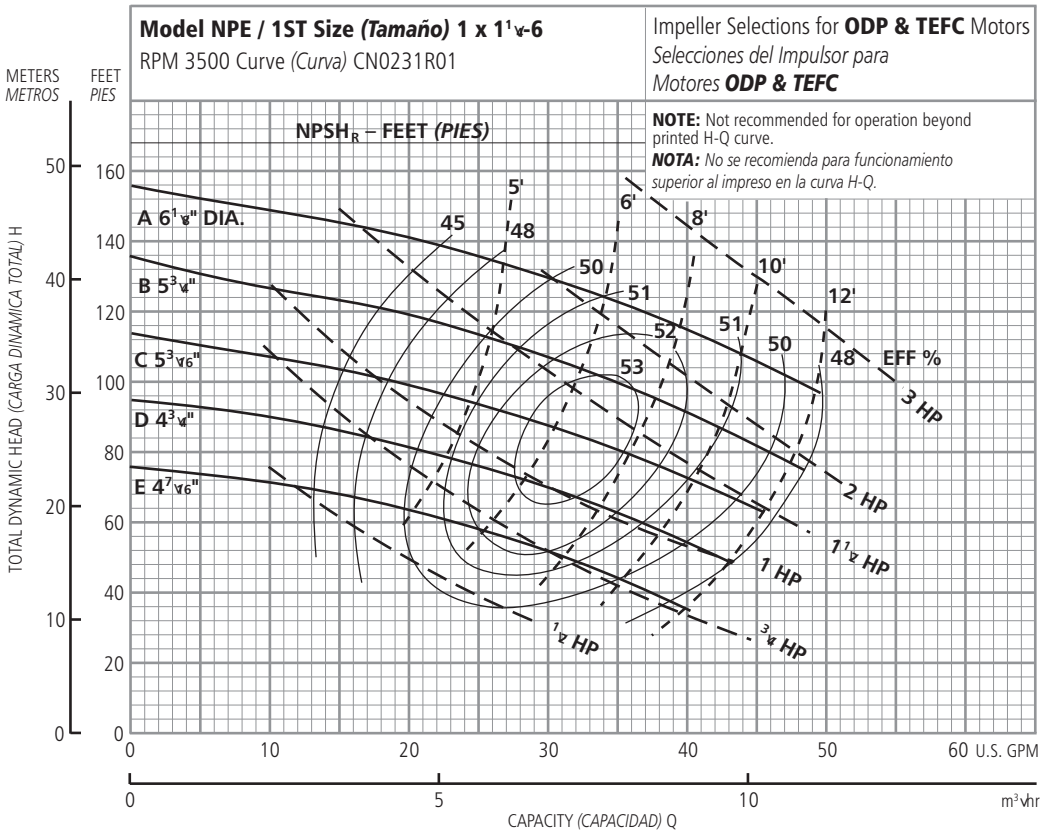


Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Adapter; *Adaptador*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
109	Bearing cover; *Cubierta de balineras*	Cast iron; *Hierro fundido*
112	Ball bearing (outboard); *Balineras de bolas (exterior)*	Steel; *Acero*
122	Shaft; *Eje*	AISI 316 SS; *AISI 316 Acero inoxidable*
138	Lip-seal (inboard); *Sello cubierto (interior)*	BUNA/steel; *BUNA/acero*
139	Lip-seal (outboard); *Sello cubierto (exterior)*	BUNA/steel; *BUNA/acero*
168	Ball bearing (inboard); *Balineras de bolas (interior)*	Steel; *Acero*
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
228	Bearing frame; *Armazón de balineras*	Cast iron, *Hierro fundido*

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
304	Impeller locknut; *Contratuerca del impulsor*	AISI 316 SS; *AISI 316 Acero inoxidable*
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
361	Retaining ring; *Anillo de retención*	Steel; Acero
370	Socket head screws, casing; *Encaje cabeza del tornillo, carcasa*	AISI 410 SS; *AISI 410 Acero inoxidable*
370C	Hex head screw, bearing cover; *Tornillo de cabeza hexagonal, cubierta de balineras*	Plated steel; *Acero chapeado*
371	Hex head screw, bearing frame; *Tornillo de cabeza hexagonal, armazón de balineras*	Plated steel; *Acero chapeado*
383	Mechanical seal; *Sello mecánico*	**see chart; ver tabla
400	Shaft key; *Llave del eje*	Steel; Acero
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316 SS; *AISI 316 Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	

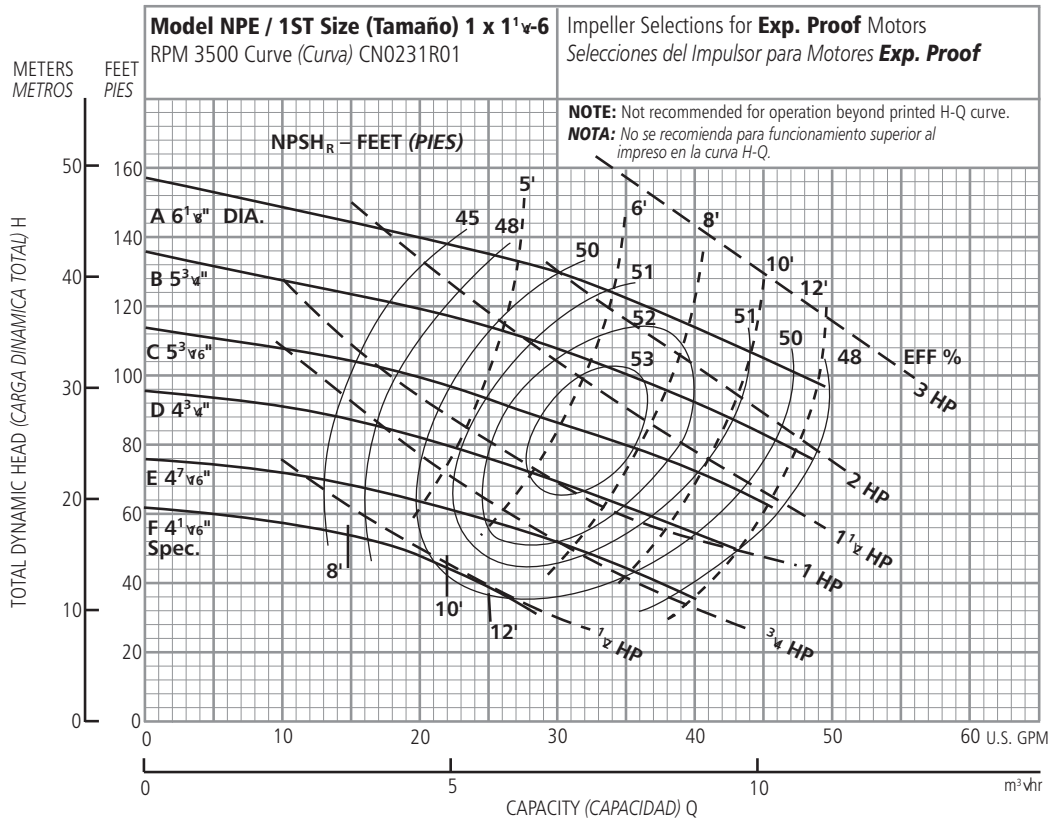
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4 7/16"
D	¾	4¾
C	1	5 3/16
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

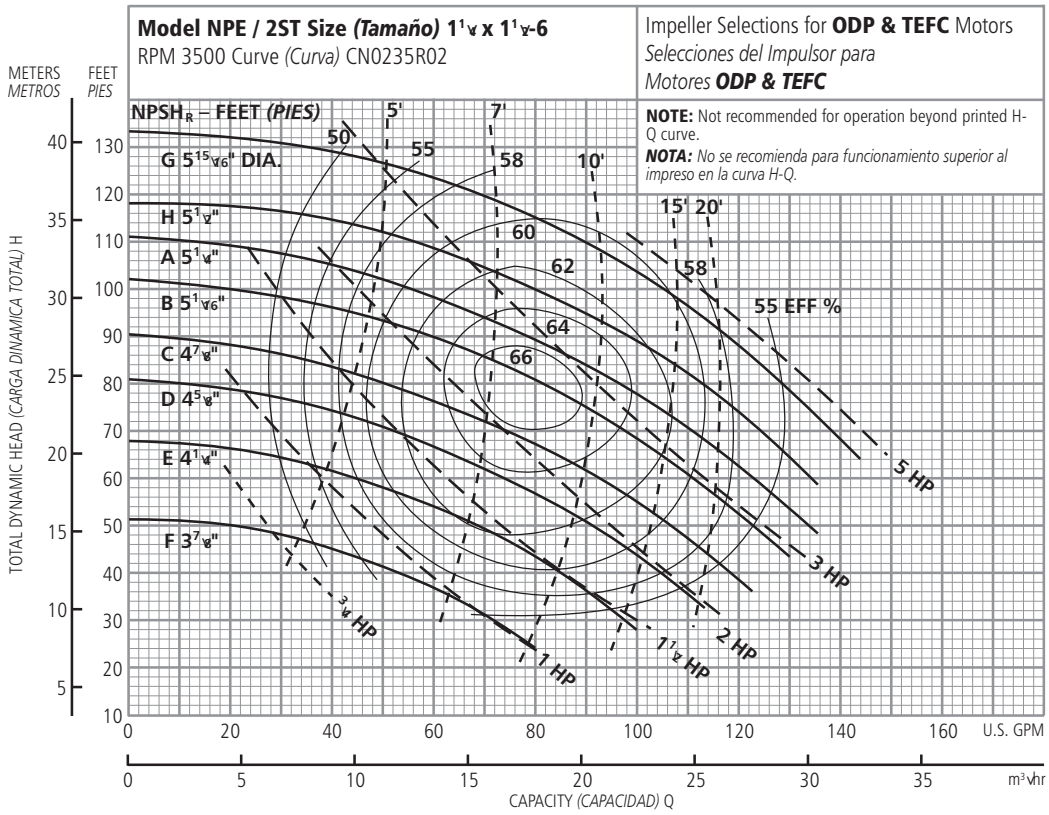


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4 1/16" spec.
E	¾	4 7/16
D	1	4¾
C	1½	5 3/16
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

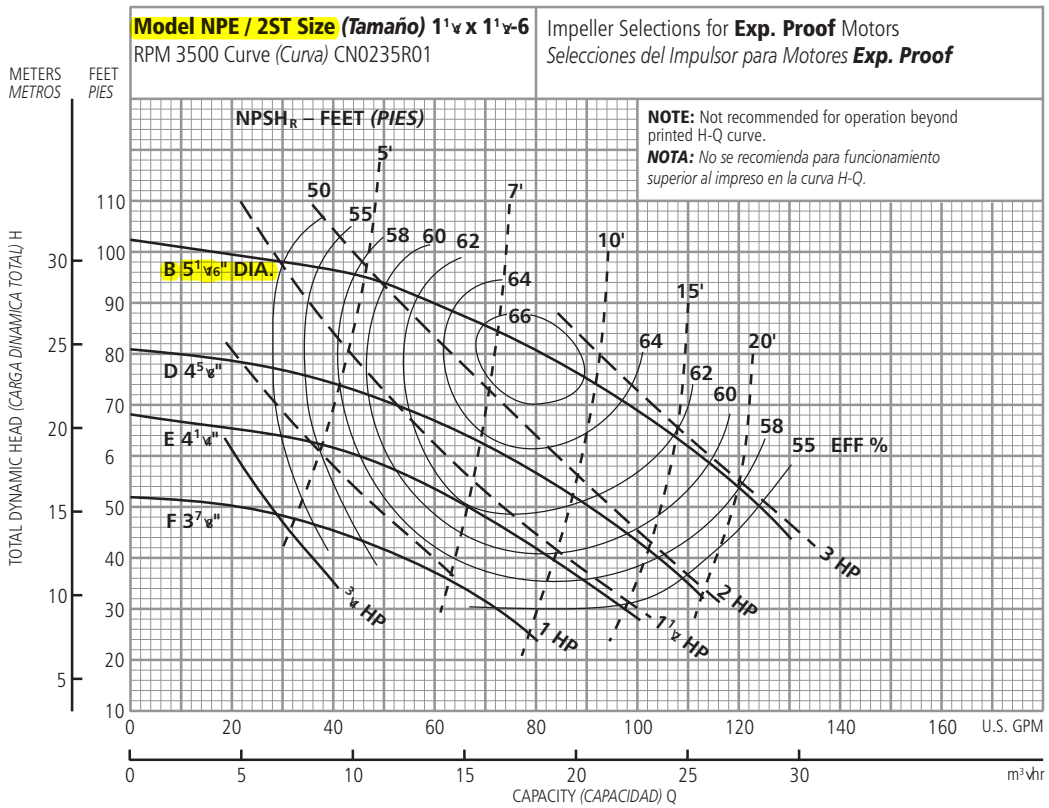
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	¾	3⅞"
E	1	4¼
D	1½	4⅝
C	2	4⅞
B	3	5¼16
A	3	5¼
H	5	5½
G	5	5¹⁵⁄₁₆

NOTE: Although not recommended, the pump may pass a 3⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3⁄16".*

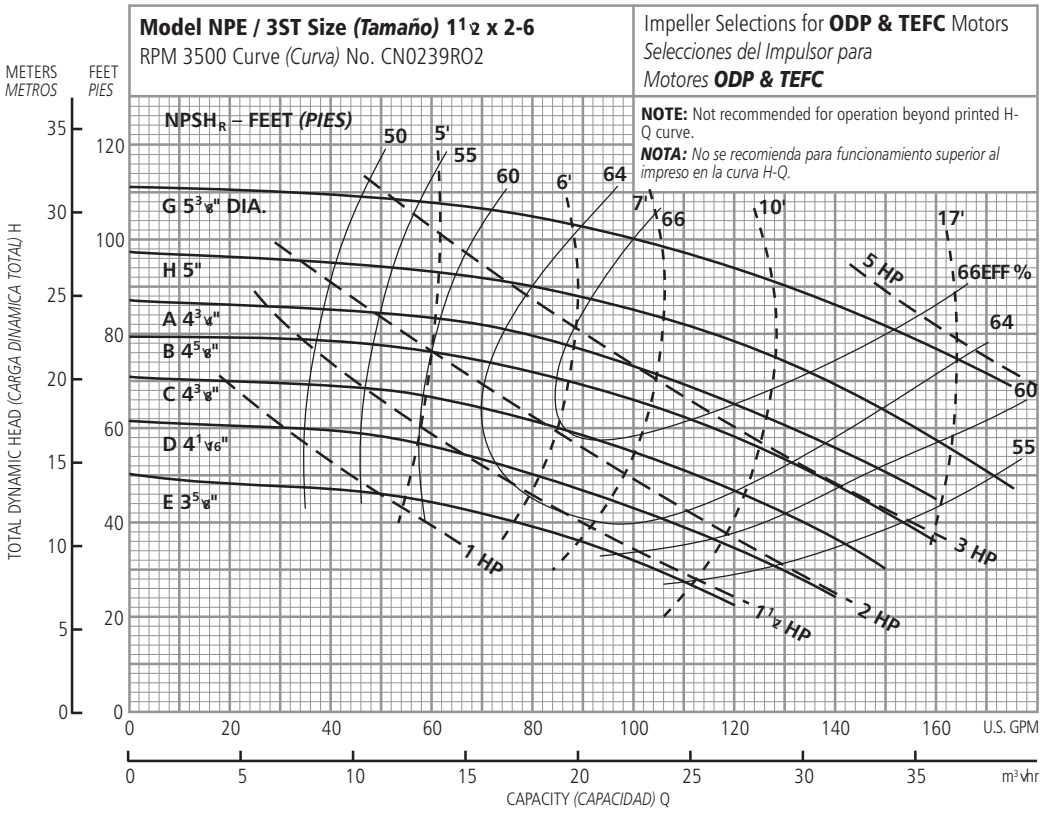


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	1	3⅞"
E	1½	4¼
D	2	4⅝
B	3	5¼16

NOTE: Although not recommended, the pump may pass a 3⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3⁄16".*

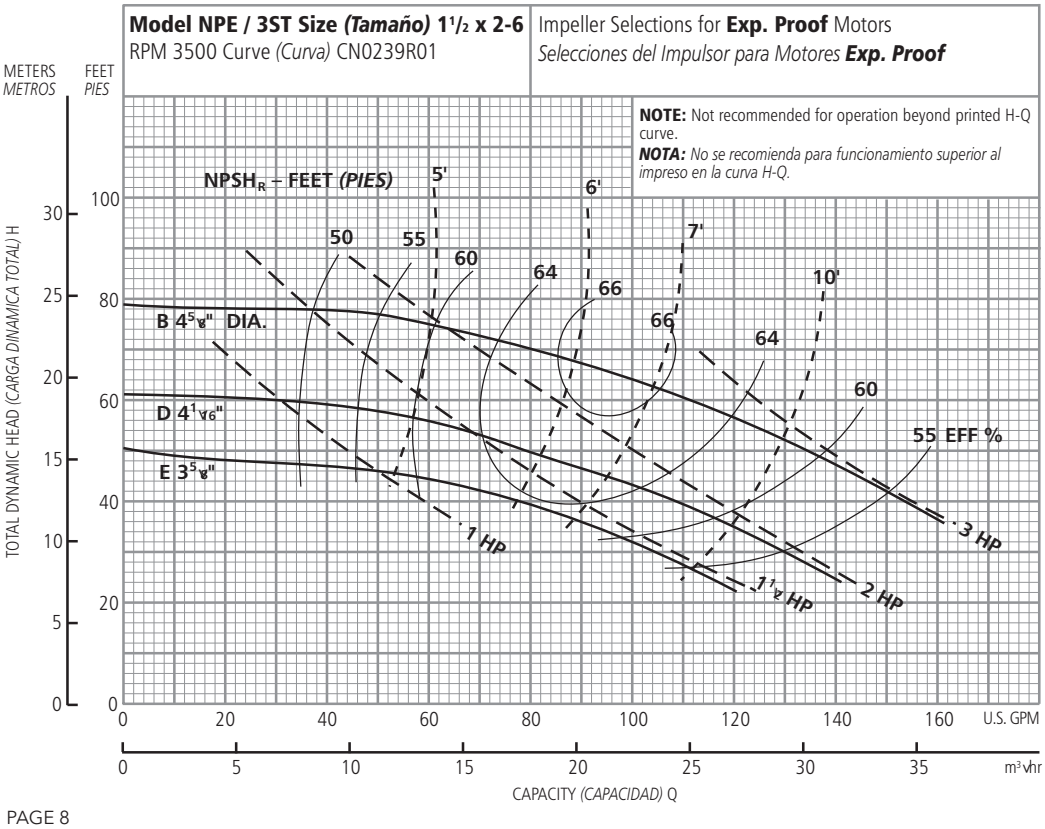
PERFORMANCE CURVES – 60 HZ, 3500 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	1	3⅝"
D	1½	4 1/16
C	2	4⅜
B	3	4⅝
A	3	4¾
H	5	5
G	5	5⅜

NOTE: Although not recommended, the pump may pass a 11/32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11/32".*

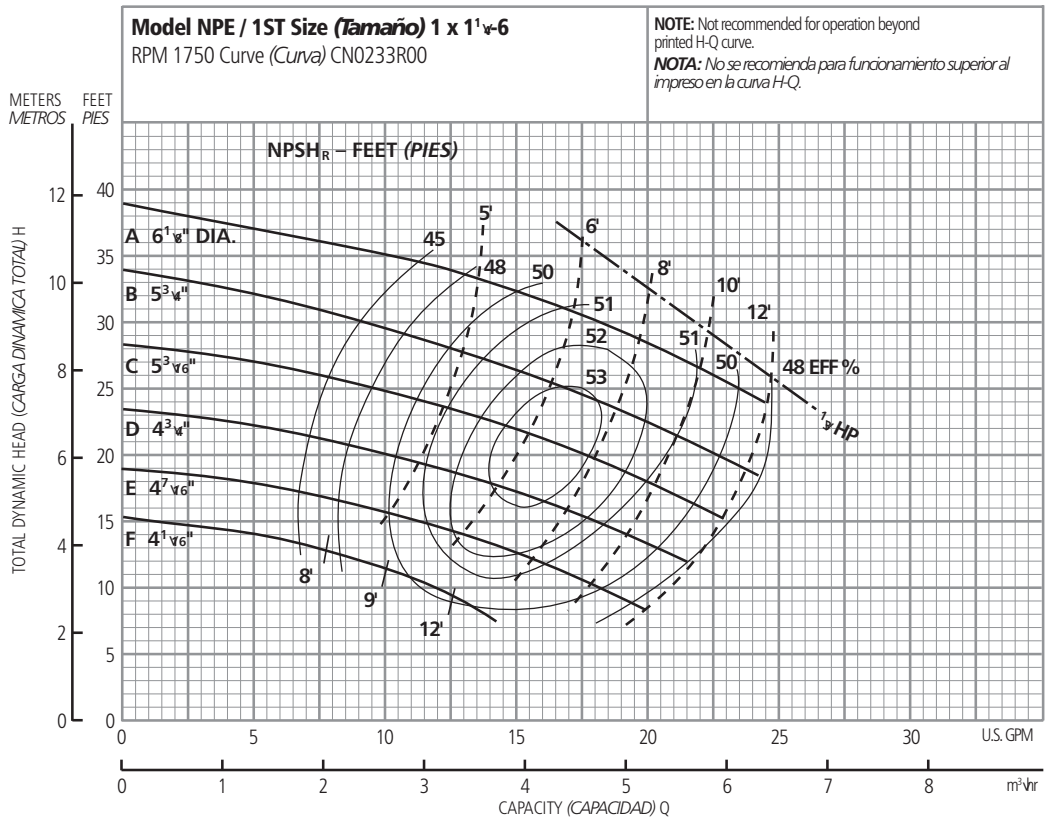


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	1½	3⅝"
D	2	4 1/16
B	3	4⅝

NOTE: Although not recommended, the pump may pass a 11/32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11/32".*

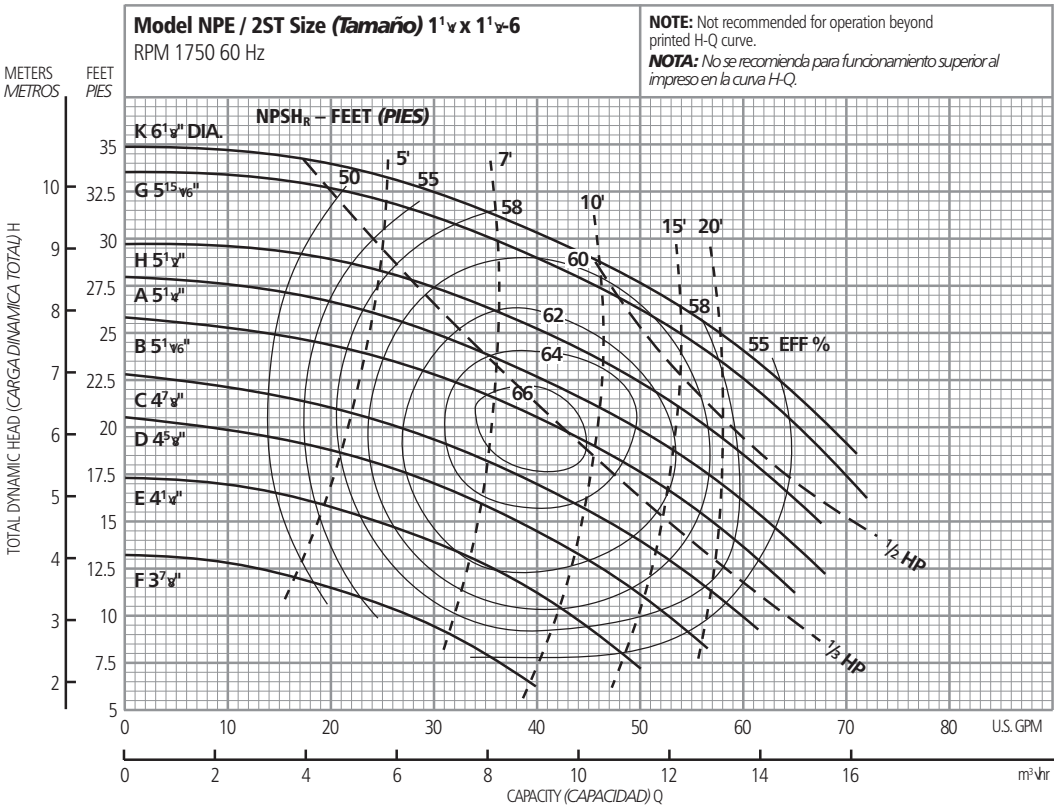
PERFORMANCE CURVES – 60 HZ, 1750 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 1750 RPM



Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
A	6⅛"
B	5¾
C	5⁹⁄₁₆
D	4¾
E	4⁷⁄₁₆
F	4¹⁄₁₆

NOTE: Although not recommended, the pump may pass a 1⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1⁄16".*

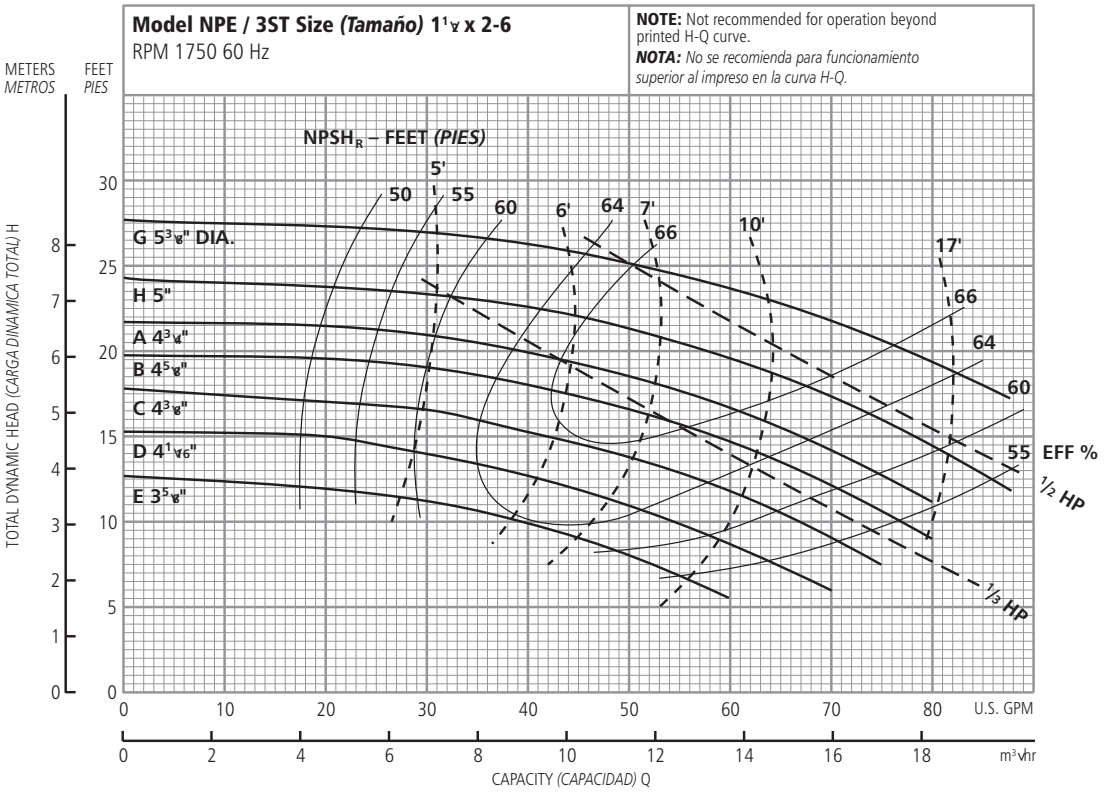


Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
K	6⅛"
G	5¹⁵⁄₁₆"
H	5½
A	5¼
B	5¹⁄₁₆
C	4⅞
D	4⅝
E	4¼
F	3⅞

NOTE: Although not recommended, the pump may pass a 3⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3⁄16".*

PERFORMANCE CURVES – 60 HZ, 1750 RPM
CURVAS DE FUNCIONAMIENTO – 60 HZ, 1750 RPM

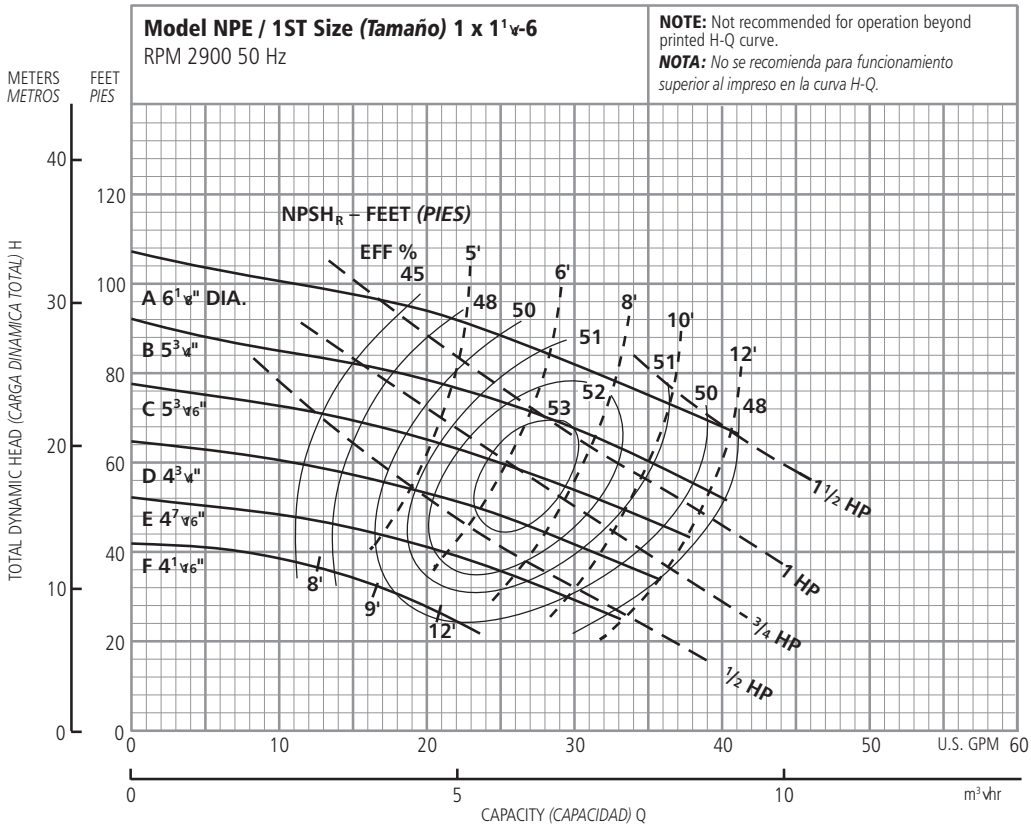


Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
G	5⅜"
H	5
A	4¾
B	4⅝
C	4⅜
D	4 1/16
E	3⅝

NOTE: Although not recommended, the pump may pass a 11/32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11/32".*

PERFORMANCE CURVES – 50 HZ, 2900 RPM
CURVAS DE FUNCIONAMIENTO – 50 HZ, 2900 RPM

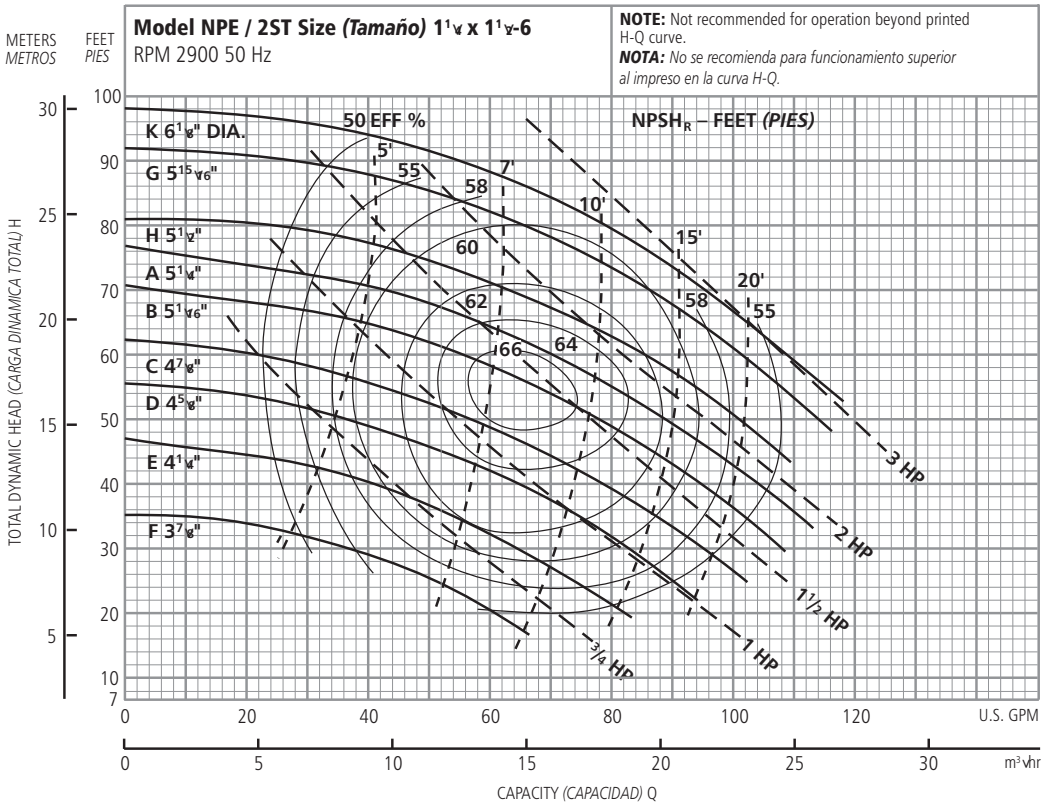


Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
A	6 1/8"
B	5¾
C	5 3/16
D	4¾
E	4 7/16
F	4 1/16

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

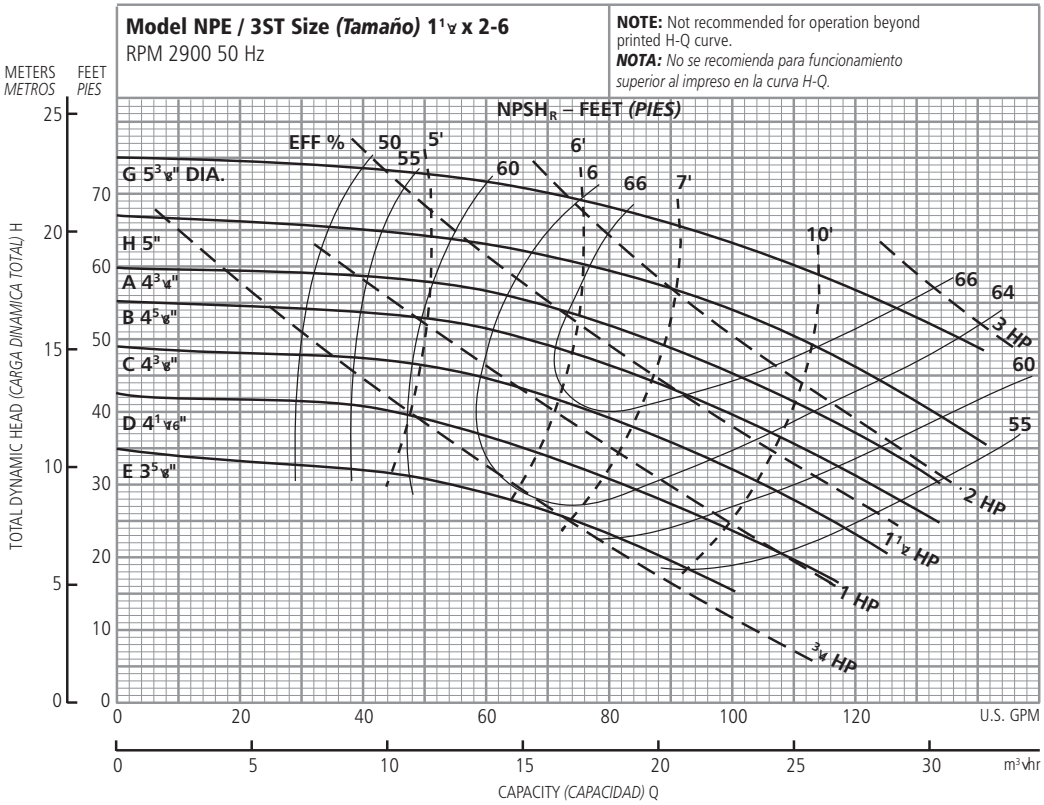
PERFORMANCE CURVES – 50 HZ, 2900 RPM
CURVAS DE FUNCIONAMIENTO – 50 HZ, 2900 RPM



Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
K	6⅛"
G	5 15/16"
H	5½
A	5¼
B	5 1/16
C	4⅞
D	4⅝
E	4¼
F	3⅞

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*



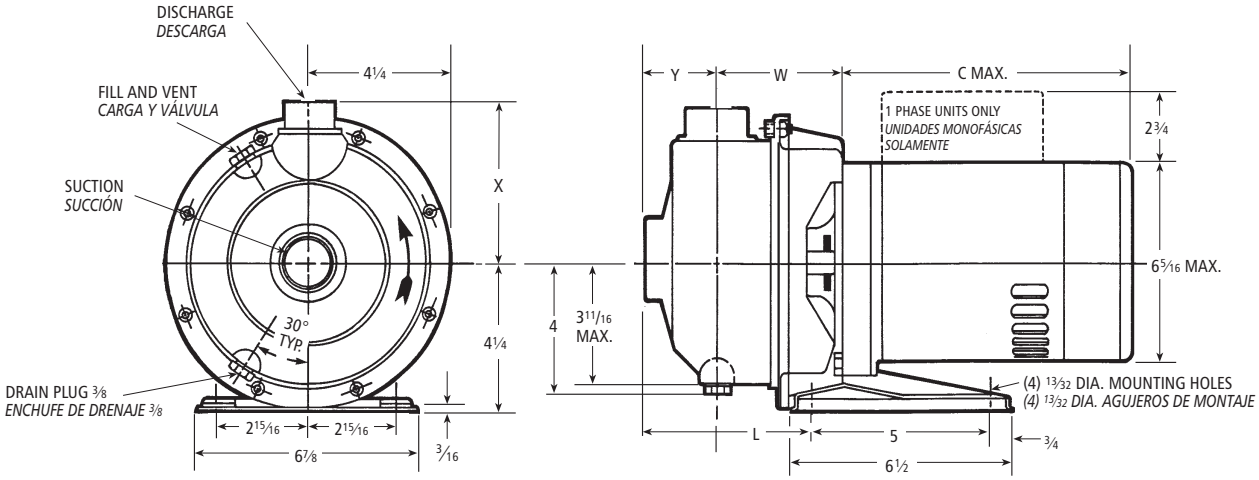
Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
G	5⅜"
H	5
A	4¾
B	4⅝
C	4⅜
D	4 1/16
E	3⅝

NOTE: Although not recommended, the pump may pass a 11/32" sphere.

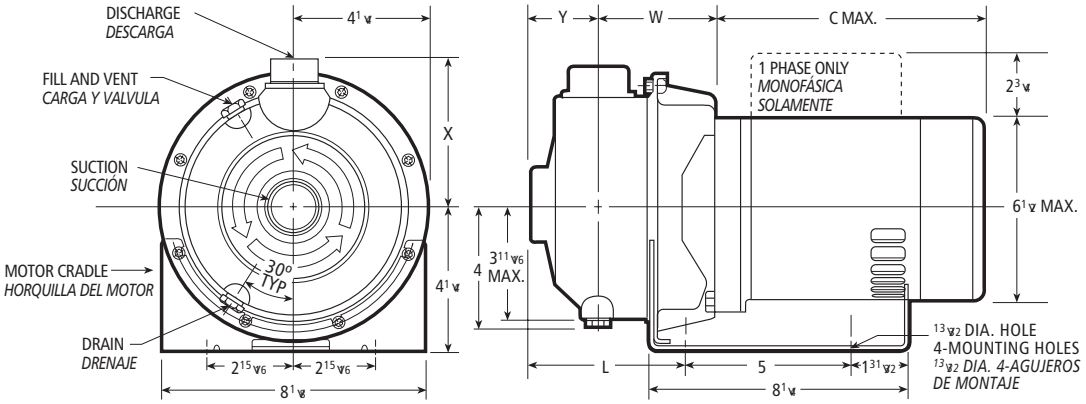
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11/32".*

NPE CLOSE COUPLED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ACOPLE CERRADO – DIMENSIONES, PESOS Y ESPECIFICACIONES

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

SPECIFICATIONS - *ESPECIFICACIONES*

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250 ° F (121° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

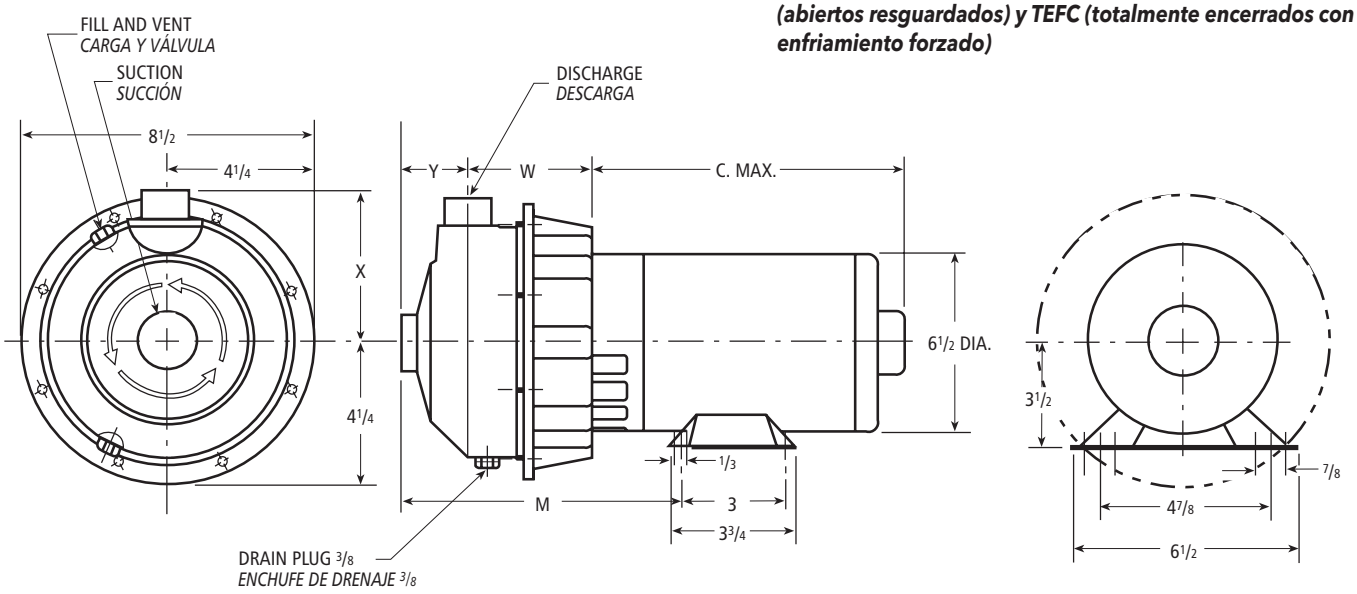
Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

NPE CLOSE COUPLED WITH FOOTED MOTOR, EXPLOSION-PROOF AND 5 HP MOTORS
NPE ACOPLE CERRADO CON MOTOR CON PATAS, MOTORES A PRUEBA DE EXPLOSIÓN Y 5 HP

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son a prueba de explosiones, 5 HP, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)



Dimensions – Determined by Pump,
Dimensiones – Determinadas por la Bomba

Pump, *Bomba*	Suction, *Succión*	Discharge, *Descarga*	HP	W	X	Y	L	M
1ST	1¼	1	½ – 3	3 5/16	4 3/8	2	4 9/16	7 5/16
2ST	1½	1¼	¾ – 5	3¾	4½	2 1/8	5 1/8	7 7/8
3ST	2	1½	1 – 5	3¾	4 5/8	2 1/8	5 1/8	7 7/8

Available Motor Weights and Dimensions
Pesos y Dimensiones Disponibles del Motor

HP	Motor Weights, *Pesos del Motor*						C Max. Length, *(Longitud)*
	1 Phase, *Monofásicos*			3 Phase, *Trifásicos*			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
½	16	21	47	19	18	27	10 3/16
¾	19	24	41	21	21	30	10 7/16
1	22	26	49	23	21	30	11 1/16
1½	28	35	56	27	27	37	11 15/16
2	33	39	60	32	33	44	12 11/16
3	40	43	–	41	37	–	13 9/16
5	42	–	–	42	45	–	13 9/16

Dimensions in inches, weights in pounds.
Dimensiones en pulgadas, pesos en libras.

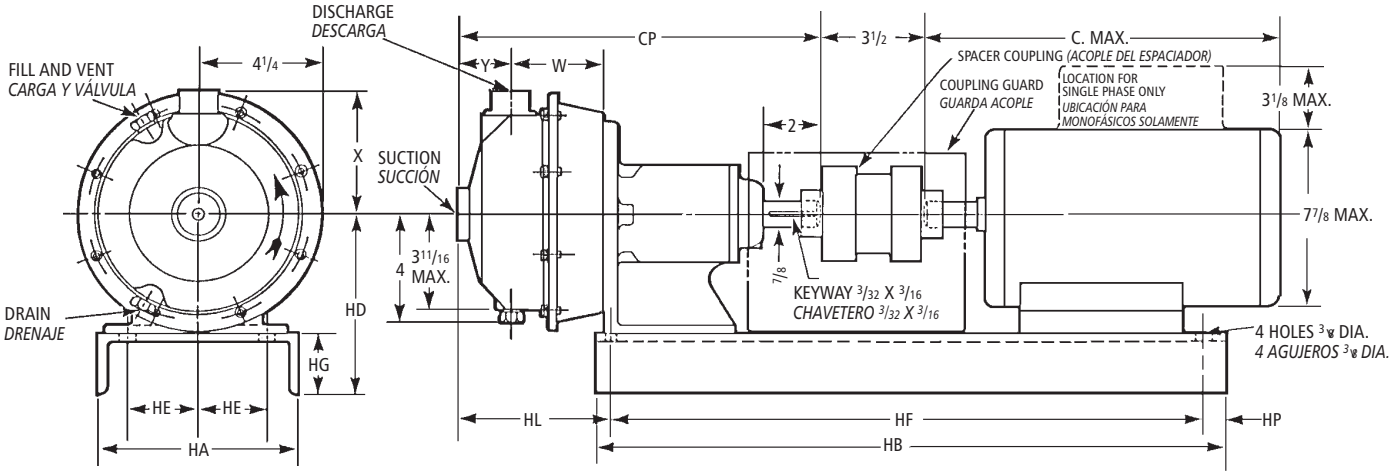
NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

NPE FRAME MOUNTED – DIMENSIONS, WEIGHTS AND SPECIFICATIONS
NPE ARMAZÓN MONTADO – DIMENSIONES, PESOS Y ESPECIFICACIONES



SPECIFICATIONS
ESPECIFICACIONES

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (47 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to: 250°F (121°C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
T-frame single and three phase. Open drip-proof, TEFC or explosion proof enclosures are available for 60 Hz, 3500 and 1750 RPM operation.

For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (47 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

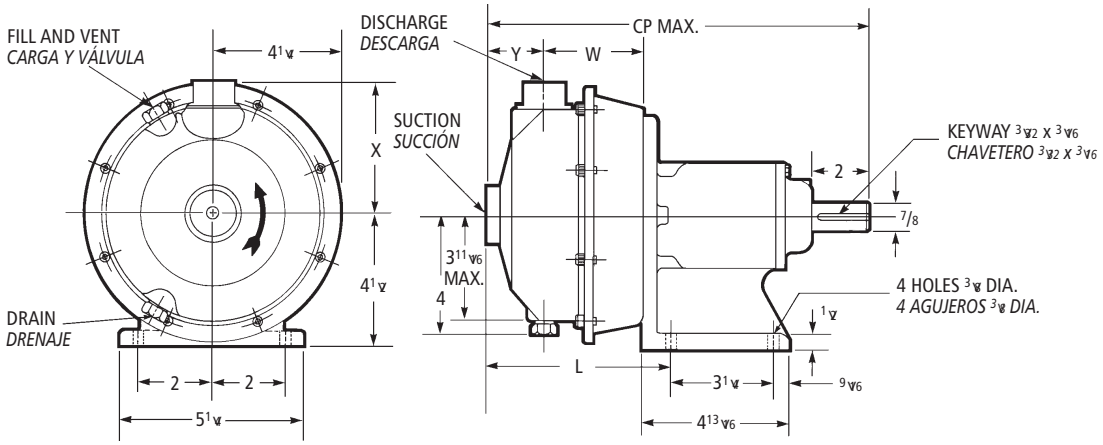
Temperatura máxima:
250°F (121°C)

Dirección de rotación: *En dirección de las agujas del reloj visto desde el extremo final del motor.*

Motores:
Armazón T- monofásico y trifásico. A prueba de goteo, TEFC o recintos a prueba de explosión están disponibles para funcionamiento de 60 Hz, 3500 y 1750 RPM.

Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.

NPE-F



Dimensions and Weights
Dimensiones y Pesos

Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón*		
									56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	–

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM				C Max.	Wt. Max., *Peso Máx.*
	Single Phase, *Monofásicos*		Three Phase, *Trifásicos*			
	ODP	TEFC	ODP	TEFC		
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	–	–	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	–	5	18 1/8	112

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

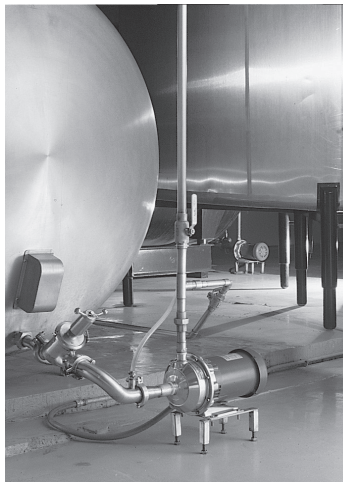
TYPICAL APPLICATIONS, *APLICACIONES TÍPICAS*

Specifically designed for a broad range of general applications traditionally requiring various materials such as all iron, bronze fitted or all bronze construction.

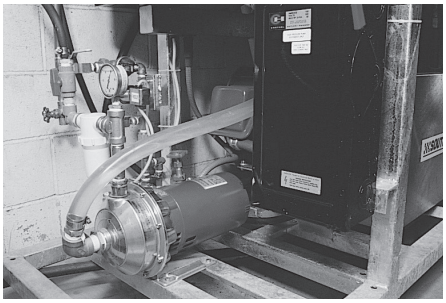
- Water circulation
- Booster service
- Liquid transfer
- Spray system
- Chillers
- Washing/cleaning systems
- Injection molding cooling
- Reverse osmosis
- Air scrubbers
- Heat exchangers
- Filtration systems
- Jockey pumps
- OEM applications
- General water services

Diseñadas específicamente para una amplia variedad de aplicaciones generales, requiriendo tradicionalmente varios materiales, tales como hierro, bronce empotrado o todas las construcciones de bronce.

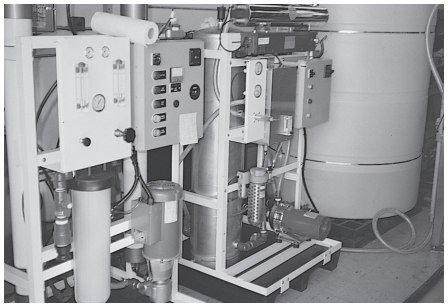
- *Circulación de agua*
- *Aumento de presión*
- *Transferencia de líquidos*
- *Sistemas de aspersión*
- *Enfriadores*
- *Sistemas de lavado/limpieza*
- *Enfriamiento con molde por inyección*
- *Osmosis reversa*
- *Depuradores de aire*
- *Termopermutadores*
- *Sistemas de filtración*
- *Bombas auxiliares*
- *Aplicaciones OEM*
- *Servicios generales de agua*



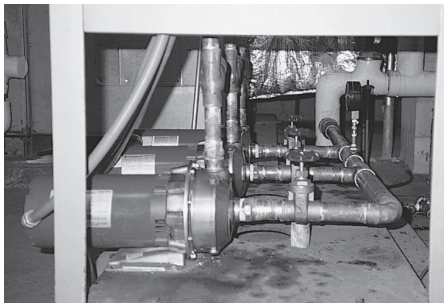
Brewery, *Fábrica de Cerveza*



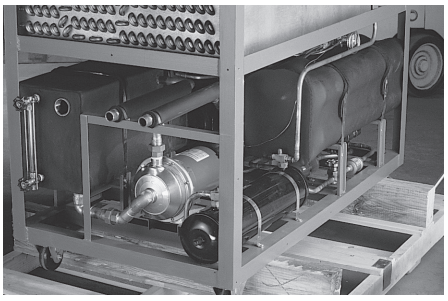
Car Wash, *Lavadero de Autos*



Pure Water/OEM, *Agua Pura/OEM*



Pressure Booster System, *Sistema de Aumento de Presión*



Chiller, *Enfriador*

xylem
Let's Solve Water

Xylem Inc.
2881 East Bayard Street Ext., Suite A
Seneca Falls, NY 13148
Phone: (866) 325-4210
Fax: (888) 322-5877
www.xyleminc.com/brands/gouldswatertechnology

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ITT

Commercial Water

Goulds Pumps

G&L SERIES

MODEL NPE/NPE-F

Installation, Operation and
Maintenance Instructions

GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

Engineered for life

Table of Contents

Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Dealer: _____

Dealer Phone No.: _____

Date of Purchase: _____

Date of Installation: _____

Current Readings at Startup:

1 Ø	3 Ø	L1-2	L2-3	L3-1
Amps: _____	Amps: _____	_____	_____	_____
Volts: _____	Volts: _____	_____	_____	_____

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.

This is a **SAFETY ALERT SYMBOL.** When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

⚠ DANGER Warns of hazards that **WILL** cause serious personal injury, death or major property damage.

⚠ WARNING Warns of hazards that **CAN** cause serious personal injury, death or major property damage.

⚠ CAUTION Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

⚠ WARNING

Hazardous fluids can cause fire, burns or death.

UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. IMPORTANT:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

⚠ CAUTION **Always disconnect electrical power when handling pump or controls.**

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	250° F (120° C)
Pressure:	125 PSI
Starts Per Hour:	20, evenly distributed

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. INSTALLATION:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

⚠ CAUTION **Never draw piping into place by forcing the pump suction and discharge connections.**

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units

2.2.1. Units may be installed horizontally, inclined or vertically.

⚠ CAUTION **Do not install with motor below pump. Any leakage or condensation will affect the motor.**

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.

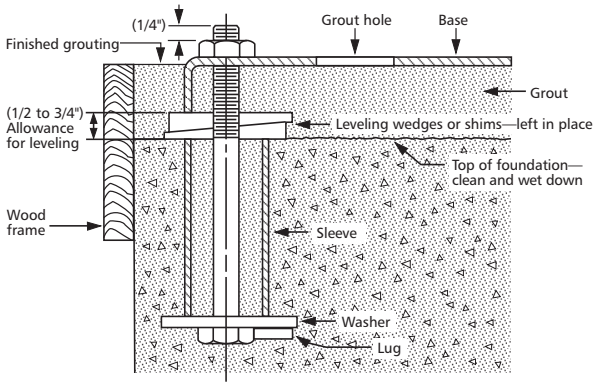


Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. SUCTION PIPING:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

⚠ CAUTION **Do not use suction isolation valve to throttle pump.**

3.5. Installation with pump above source of supply

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

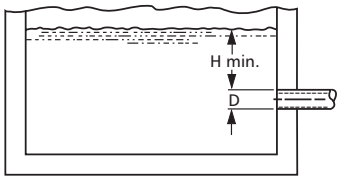


Figure 2

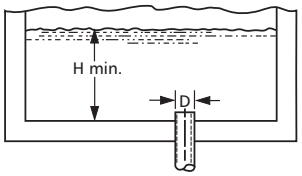


Figure 3

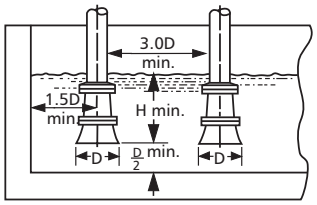


Figure 4

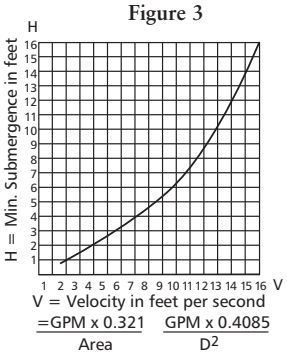


Figure 5

4. DISCHARGE PIPING:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.

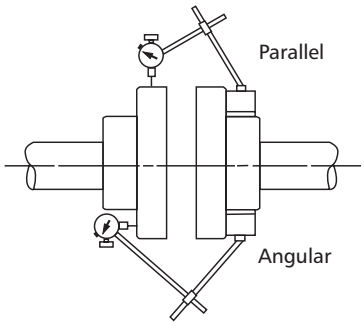


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

⚠ CAUTION **Always recheck both alignments after making any adjustment.**

6. ROTATION:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. OPERATION:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

⚠ CAUTION **Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.**

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. MAINTENANCE:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

⚠ CAUTION **Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.**

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

⚠ CAUTION **Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.**

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 and 168).

10. REASSEMBLY:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame.

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end.

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

⚠ CAUTION **Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.**

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. TROUBLE SHOOTING CHART:

MOTOR NOT RUNNING:
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

NPE STANDARD REPAIR PARTS LIST

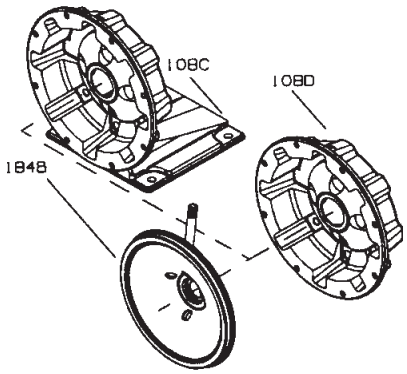
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and flush	
108D	Motor adapter less foot with flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton (standard)
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton (standard)
		EPR
		BUNA
513	O-Ring, casing	Viton (standard)
		EPR
		BUNA

MECHANICAL SEAL APPLICATION CHART

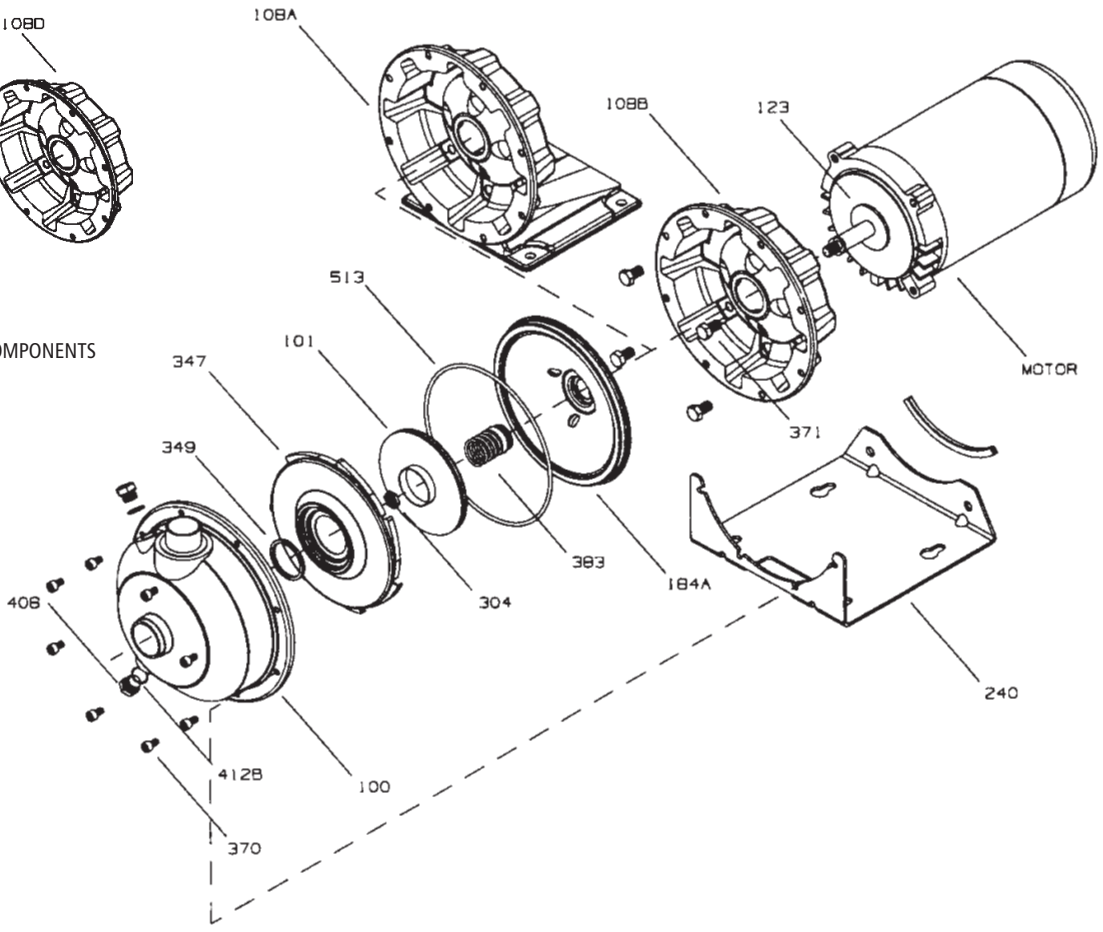
Item 383 Mechanical Seal (⅝" seal)				
Rotary	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

NOTE: Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



ITT

Commercial Water

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

GOULDS PUMPS

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

April, 2008

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Engineered for life

Bag Filter Information

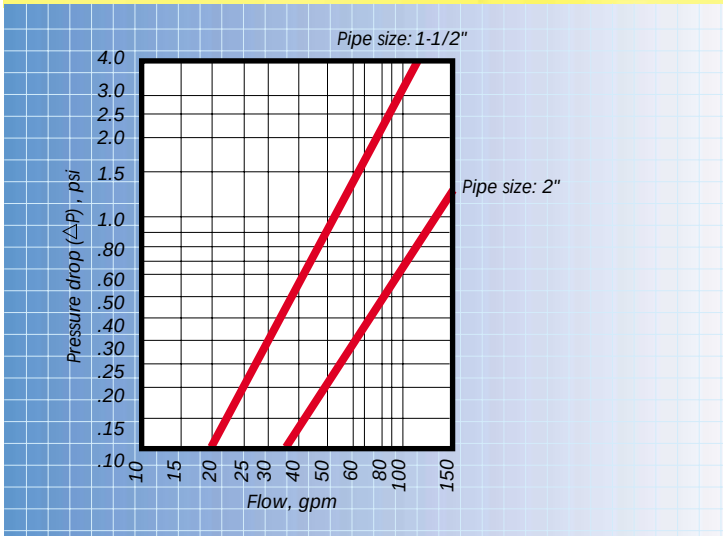
Model NCO Bag or Cartridge Filter Housings

*Low cost filter housings for flow rates to 100 gpm**

NCO high-capacity filters offer an exceptional value in basic filtration applications. Offered in a size 2 and size 12 bag housing, the NCO is also available with our Platinum 700 cartridge series.

NCO housings provide large dirt-holding capacity combined with a rugged design rated to 150 psi. The housings incorporate a newly designed hinged, eyenut cover that is easily removed, reducing time spent on bag or cartridge change-out. The NCO bag housing offers versatility for any piping arrangement, utilizing our unistyle design (side and bottom outlet). Two connection sizes are available for both bag and cartridge filters.

The NCO housings are electropolished creating a smooth, easy-to-clean surface. Customize them with several options including, gauges and switches. A variety of filter bags or cartridges (rated 0.5µ absolute to 100µ nominal) can be utilized in this housing. Keep your filtration process cost effective without sacrificing quality.



* Based on housing only. Fluid viscosity, filter bag used, and expected dirt loading should be considered when sizing a filter.

Features

- Permanently piped housings are opened without special tools
- Carbon or stainless steel housings
- Covers are O-ring sealed
- O-ring seals: Buna N, EPR and Viton®
- 150 psi rated housing
- Heavy-duty basket, over 50% open area
- Uses standard number 1, 2 or 12 size bags and 500 or 700 series cartridges
- Filter selection surface area is:
  2.3 square feet (number 1 size bag),
  4.4 square feet (number 2 size bag),
  5.6 square feet (number 12 size bag)
  85 square feet (500 series cartridge)
  125 square feet (700 series cartridge)
- 1-1/2-inch or 2-inch NPT inlet and outlet
- 1/4-inch NPT vent connection
- Adjustable leg assembly

How To Order

Build an ordering code as shown in the example.

QUALITY SYSTEM REGISTERED TO ISO 9001: 1994

Example : **NCO8-30 - 2P - * - 150 - C - B - PB**

(Housing: NCO8-30 - 2P - * - 150 | Options: C - B - PB)

MODEL
- ***NCO8*** *(#1, #2 bag & 500 cartridge)*
- ***NLCO8*** *(#12 bag)*
- ***NCO8135*** *(700 cartridge)*
- ***NCO8135*** *convertible*

BASKET SIZE
- *15-inch (NCO only)* = ***15***
- *30-inch (NCO or NLCO)* = ***30***
- *NCO8135* = ***No Symbol***

PIPE SIZE
- *1-1/2-inch female NPT* = ***1-1/2P***
- *2-inch female NPT* = ***2P***

OUTLET STYLE
- *Side/Bottom Unistyle (NCO or NLCO)* = *******
- *Bottom* = ***1***

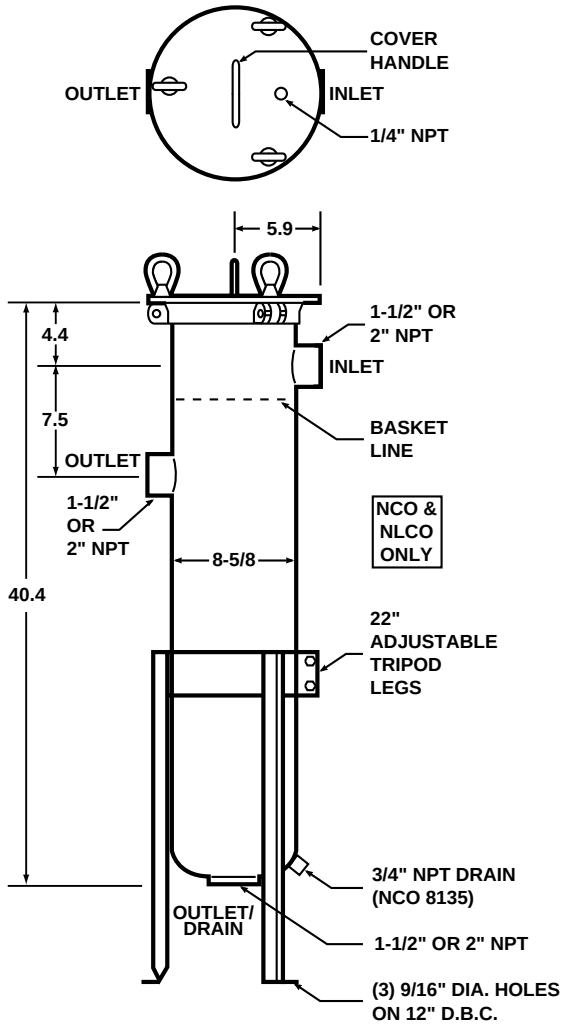
PRESSURE RATING
- *150 psi* = ***150***

HOUSING MATERIAL
- *Carbon steel* = ***C***
- *304 Stainless steel* = ***S***

COVER SEAL
- *Buna N* = ***B***
- *Ethylene propylene* = ***E***
- *Viton® Fluoroelastomer* = ***V***

BASKET TYPE
- *Filter bag basket (NCO or NLCO)* = ***PB***
- *700 Cartridge (NCO8135)* = ***700***
- *Convertible (NCO8135)* = ***700PB***

1. *Filter bags are specified separately. See Rosedale Master Catalog 3rd edition.*
2. *Basket material is compatible with housing.*
3. *Weight (approximately): 70 lbs.*

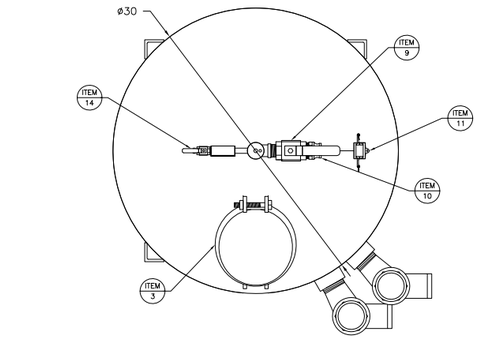


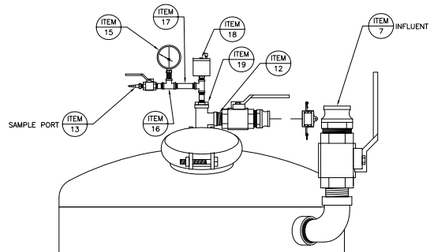
Rosedale Products, Inc.
3730 W. Liberty Rd, Ann Arbor, MI 48103
Tel: 800-821-5373 or 734-665-8201
Fax: 734-665-2214
http://www.rosedaleproducts.com/
E-mail: filters@rosedaleproducts.com

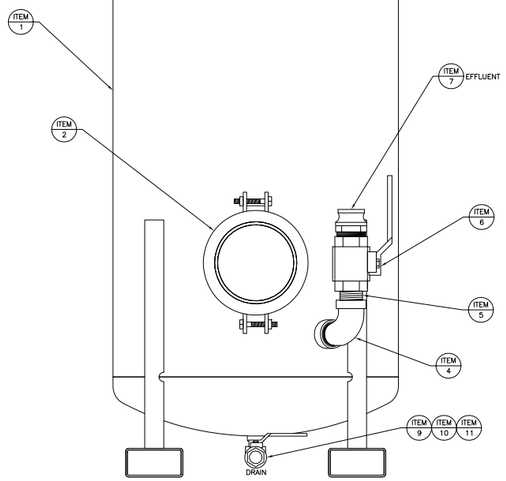
Call us today for our complete catalog or visit our web site to see our entire product line.

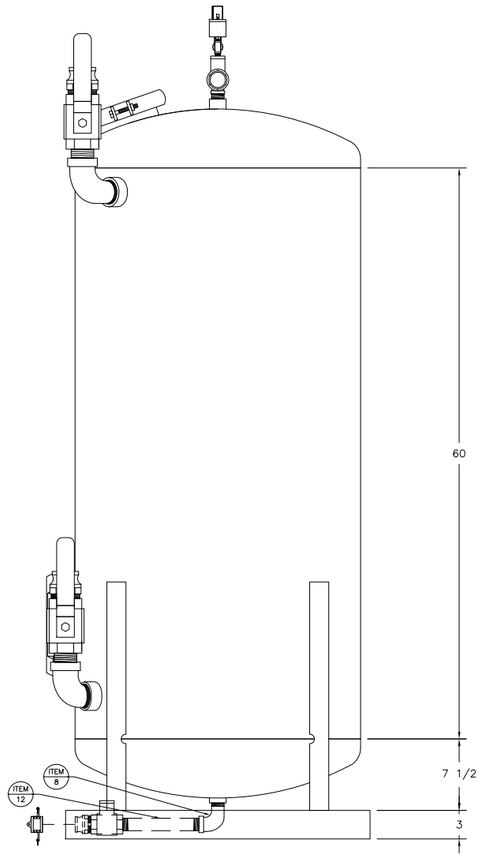
Sheet NCO-100 5M605 Printed in USA

Liquid Phase
Organoclay Information









ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO
1	1	1000 LB CLAY VESSEL ASSEMBLY – 30" OD X 60" HIGH SIDE WALL, STAINLESS STEEL	PROACT	
2	1	VICTAULIC END CAP FITTING – 8" DIAMETER GALVANIZED 60G		
3	1	VICTAULIC END CAP FITTING – 6" DIAMETER GALVANIZED 60G		
4	2	STREET ELBOW 90 – 2" NPT GALVANIZED STEEL		
5	2	NIPPLE – 2" NPT X NEAR GALVANIZED STEEL		
6	2	BALL VALVE – 2" NPT FULL PORT, BRASS, 94A SERIES	APOLLO	94A–108
7	2	CAM LOCK – 2" MALE X 2" MNPT ALUMINUM	DIXON	200–F–AL
8	1	STREET ELBOW 90 – 1" NPT GALVANIZED STEEL		
9	2	BALL VALVE – 1" NPT, DRAIN VALVE FULL PORT, BRASS, 94A SERIES	APOLLO	94A–105
10	2	CAM LOCK – 1" MALE X 1" MNPT ALUMINUM	DIXON	100–F–AL
11	2	CAM LOCK CAP – 1" ALUMINUM	DIXON	100–DC–AL
12	2	NIPPLE – 1" NPT GALVANIZED STEEL		
13	1	HOSE BARB FITTING – 1/4" NPT, QUICK CONNECT BRASS		
14	1	BALL VALVE – 1/4" NPT FULL PORT, BRASS, 94A SERIES	APOLLO	94A–101
15	1	PRESSURE GAUGE – 0–100 PSI, LIQUID FILLED, 1/4" MNPT BOTTOM MOUNT	PRECISION INSTRUMENT CO.	201L
16	2	TEE – 3 WAY, 1/4" NPT GALVANIZED STEEL		
17	3	NIPPLE – 1/4" NPT GALVANIZED STEEL		
18	1	AIR BLEED – 1/4" NPT		
19	1	REDUCER BUSHING – 1" X 1/4" NPT GALVANIZED STEEL		

ProAct Services Corporation

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PATENT PENDING

1000 LB CLAY VESSEL ASSEMBLY AND WELDMENT

DRAWING NO.	SIZE	SCALE	JOB NO.	UNIT NO.	REV
	B	1/12	1630		1

REV	DATE	DESCRIPTION	DRW	APPR	CUSTOMER AMTRAK	MATERIAL	DRAWN BY STEVE TURNER	DATE	SHEET
								11/20/12	1

HYDROSIL
INTERNATIONAL LTD.

1180 St. Charles Street
Elgin, IL 60120

Phone: 1-800-787-7531
Emergency Phone: 1-847-741-1600
Telex*: 1-847-741-1616

Hydrosil HS-200

Identity (Trade Name As Used On Label)

MSDS Number*

CAS Number*

January 1, 2012 to December 31, 2012

Date Prepared

William J. Waldschmidt

Prepared By*

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

COMPONENTS - Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%*	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
N-Hexadecyl-N,N,N-trimethylammonium chloride	4.16%	N/A	N/A	None
Non-Hazardous Ingredients zeolite/water	95.84%			
TOTAL	**100**			

SECTION 2 - PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point: N/A

Density: 57.0-59.0 pounds/cubic foot

Vapor Pressure (mm Hg and Temperature): N/A

Melting Point: N/A

Vapor Density (Air = 1): N/A

Evaporation Rate (_____ = 1): N/A

Solubility in Water: N/A

Water Reactive: N/A

Appearance and Odor: white irregularly shaped solid, no odor

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

Flash Point and Method Used	Auto-Ignition Temperature	Flammability Limits in Air % by Volume	LEL	UEL
N/A	N/A	N/A	N/A	N/A

Extinguisher Media: If involved in fire, flood with plenty of water

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: Products of combustion are toxic

SECTION 4 - REACTIVITY HAZARD DATA

STABILITY
■ Stable
☐ Unstable

Conditions To Avoid: None known

Incompatability (Materials to Avoid): Strong oxidizing and reducing agents

Hazardous Decomposition Products: Organic chlorides, amines, hydrogen chloride may be produced

HAZARDOUS POLYMERIZATION
☐ May Occur
■ Will Not Occur

Conditions To Avoid: None known

SECTION 5 - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY
☐ Inhalation ☐ Ingestion
☐ Skin Absorption ■ Not Hazardous

CARCINOGEN LISTED IN
☐ NTP ☐ OSHA
☐ IARC Monograph ■ Not Listed

HEALTH HAZARDS
Acute: None
Chronic: None

Signs and Symptoms of Exposure: None

Medical Conditions Generally Aggravated by Exposure: None

EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary

Eye Contact: Immediately flush with large amounts of water for 15 minutes

Get immediate medical attention

Skin Contact: Wash affected areas with plenty of water and soap if available, for several minutes. Seek medical attention if irritation develops.

Inhalation: Remove from area to fresh air. Seek medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion: Give 3-4 glasses of milk (if unavailable, give water), but do not induce vomiting. If vomiting does occur, give fluids again. Seek medical attention.

SECTION 6 - CONTROL AND PROTECTIVE MEASURES

Respiratory Protection (Specify Type): Treat as low level nuisance dust, Use NIOSH/MSA #TC-21C-132

Protective Gloves: Rubber or neoprene when needed

Eye Protection: Use safety glasses with side shields

VENTILATION TO BE USED
■ Local Exhaust ■ Mechanical (general) ☐ Special
☐ Other (specify) None

Other Protective Clothing and Equipment: Eye wash, safety shower, protective clothing as appropriate

Hygienic Work Practices: None

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE/ LEAK PROCEDURES

Steps to be Taken If Material is Spilled Or Released: Keep containers closed until used.

Waste Disposal Methods: Dispose of in accordance with local, state, and federal regulations.

Precautions to be Taken in Handling and Storage: Protect containers against physical damage. Store in a cool dry area in closed containers

Other Precautions and/or Special Hazards: Wet carbon/coal removes oxygen from air causing a severe hazard to workers inside carbon vessels or confined spaces

NFPA Rating* Health _____ Flammability _____ Reactivity _____ Special _____

HMIS Rating* Health _____ Flammability _____ Reactivity _____ Special _____

* Optional

HS-200 Series

Media to remove oil, heavy metals and similar organics from water.

The Key to successful water treatment and filtration is selecting the right combination of media and hardware. For treatment of hydrocarbons, heavy metals, and other organic contaminants, the optimal solution is eficient oil and water separation followed by the HS-200 series. Because HS-200 series can absorb up to 70% of its weight in hydrocarbons, its life inside a still bed canister is much longer than that of other process media such as granular activated carbon.

HS-200 King of Liquid Filtration

- No swelling upon water exposure
- More active ingredients per cubic foot then other organoclays
- Can be used at full strength or custom blended
- Prolongs life of activated carbon and resins thereby reducing costs and increasing efficiency
- Cost effective and environmentally sound technology

HS-200 Series Veratility

- **Free Standing Mode:**
  Used on its own, HS-200 series can be loaded in drums for use as an efficient stillbed filtration medium. Other applications include tank cleaning, oil spill mitigation, and lining/capping projects.
- **Pre-Treatment Mode**
  HS-200 Series can be used upstream to enhance the performance and extend the useful life of other filtration processes and media such as reverse osmosis, activated carbon and resins.
- **Post-Treatment Mode:**
  HS-200 Series utilized downstream of an oil-water separator or coalesce filter, has the ability to act as an effective cleaning and polishing agent.

The liquid phase filtration media HS-200 shall be 8 x 14 mesh zeolite impregnated with no less than 125 milimoles cetyl trimethyl ammonium chloride per kilogram of zeolite. The density of the product shall be 57-59 pounds per cubic foot.

HS-200 Removes

Oil and Grease

- All types

Heavy Metals

- Aluminum
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenate
- Zinc

Hydrocarbons and other contaminants

- Acenaphthene
- Ammonia
- Anthracene
- Benzo (a) Anthracene
- Benzo (b) Flouranthene
- Benzo (a) Pyrene
- Benzo (g,h,i) Perylene
- BOD’s
- BTEX
- 4-chloro-3-Methylphenol
- Chromate
- Chrysene
- COD’s

- 1,1 Dichloroethane
- 1,2 Dichloroethane
- 1,4 Dioxane
- Flouranthene
- Flourine
- Gas Range Hydrocarbons
- 2-Methylnaphthalene
- Motor Oil
- Naphthalene
- PCP (pentachlorophenol)
- Phenanthrene
- Phenolics (recoverable)
- Pyrene
- TCE
- TOC
- Total Phosphorus
- TPH (Total-Petroleum Hydrocarbons)
- TSS's
- Vinyl Chloride

Constituents have had a 95%+ Reductions when treated with these media

Water Filtration

HYDROSIL
INTERNATIONAL LTD.

The Media Is The Key....

The KEY to successful water treatment and filtration is selecting the right combination of media and hardware. For treatment of hydrocarbons, heavy metals, and other organic contaminants, the optimal solution is efficient oil and water separation followed by the HS-200 series. Because HS-200 series can adsorb up to 70% of its weight in hydrocarbons, its life inside a still bed canister is much longer than that of other process media such as granular activated carbon.

HS-200 *KING OF LIQUID FILTRATION*

- NO SWELLING UPON WATER EXPOSURE
- MORE ACTIVE INGREDIENTS PER CUBIC FOOT THEN OTHER ORGANOCLAYS
- CAN BE USED AT FULL STRENGTH OR CUSTOM BLENDED
- PROLONGS LIFE OF ACTIVATED CARBON AND RESINS THEREBY REDUCING COSTS AND INCREASING EFFICIENCY
- COST EFFECTIVE AND ENVIRONMENTALLY SOUND TECHNOLOGY

HYDROSIL INTERNATIONAL LIMITED is a modified Zeolite provider setting new standards in economical water treatment, including treatment of processed water and wastewater. Hydrosil's corporate headquarters and manufacturing facilities are located in Elgin, IL. With over 16 years of filtration experience, we specialize in our own Zeolite based organoclay products called HS-200.

ZEOLITE BASE Zeolite is the base of our filtration media. Zeolite belongs to a family of naturally occurring volcanic minerals with unique physical and chemical characteristics. Generally speaking, natural zeolites are hydrated aluminosilicates. They consist of an open, three-dimensional cage-like structure and a vast network of open channels extending throughout. Loosely bound, positively charged atoms called cations are attached at the junctures of the negatively charged aluminosilicate lattice structure. Zeolite has a crystalline structure (similar to a honeycomb) consisting of a network of interconnected tunnels and cages. Zeolite has a high specific surface area; it's rigid framework eliminates shrinking and swelling. Perhaps the most commercially valuable and dynamic property of zeolite is its cation exchange capacity. The most common exchangeable cations found in zeolite molecules are ammonia, sodium, calcium, potassium, and magnesium, many which are desirable in numerous biological and industrial processes. The ability to release beneficial elements while capturing and binding other, often less desirable, materials makes zeolite an ideal media for selective adsorption of certain elements and compounds from soil, water and air.

The cornerstone of Hydrosil International's success is the HS-200 series, the future of Zeolite based organoclays. Our proprietary modification process transforms high-grade Zeolite into a powerful, selective water treatment adsorbent that bonds with hydrocarbons, organics and other contaminants upon contact, locking them inside its molecular structure. Hydrosil's Contaminant Encapsulation Technology yields a granular filtration media capable of adsorping approximately 70% of its weight in hydrocarbons. Extensive application use and field testing of the HS-200 series, analyzed by independent laboratories, has demonstrated removal of a wide range of contaminants to nondetectable levels. The resulting discharge water meets or exceeds typical regulatory requirements.

HS-200 Applications

HS-200 series has been used against a wide array of industrial waste streams:

- Creosote Plants
- Wood Processing
- Pulp and Paper Mills
- Carbon Black Plants
- Oil Production
- Firefighting Academy
- Industrial Laundry Services
- Shipyards
- Plastic Manufactures
- Tank and Storage Vessel Cleaning
- Pesticide Manufacturers
- Condensate Systems
- Pipeline Pressure Testing Runoff
- Industrial Water Runoff


HS-200 series


HS-200 series blend

The HS-200 Series Blends

HS-250 a blend of HS-200 and 8x30 Anthracite Coal

- Contains 66% more active ingredient per cubic foot than activated clays on the market

HS-250-AC a blend of HS-200 and 6x12 Virgin Activated Carbon

- This blend is the best of both worlds with the added benefits of Virgin Activated Carbon

HS-270 a blend of HS-200 and 8x30 Anthracite Coal

- Was created to be a 1 to 1 replacement for Organoclays/Activated Clays on the market that have swelling issues

HS-200 Series, the Results Are In

The following Constituents have had a 95%+ Reduction when treated with the HS-200 series

Acenaphthene
Acenaphthylen
Ammonia
Anthracene
Arsenate
Arsenic
Benzo (a) Anthracene
Benzo (b) Fluoranthene
Benzo (a) Pyrene
Benzo (g,h,i) Perylene
BOD's
BTEX
Cadmium
4-Chloro-3-Methylphenol
Chromate
Chromium
Chrysene
COD's
Copper
1,1 Dichloroethane
1,2 Dichloroethene
1,4 Dioxane
Fluoranthene
Fluorene
Gasoline Range Hydrocarbons
Lead
Mercury
2-Methylnaphthalene
Motor Oil
Naphthalene
Nickel
Oil and Grease
PCP (Pentachlorophenol)
Phenanthrene
Phenolics (recoverable)
Pyrene
Selenate
TCE (Trichloroethylene)
TOC (Total Organic Compounds)
Total Phosphorous
TPH (Total-Petroleum Hydrocarbons)
TSS's
Vinyl Chloride
Zinc

HYDROSIL INTERNATIONAL LTD.
1180 St. Charles St. Elgin, IL 60120
phone: 1-847-741-1600
phone: 1-800-PURPLE.1
Hydrosilintl.com

HS-200 Series Versatility

- **Free Standing Mode:**
  Used on its own, HS-200 series can be loaded in drums for use as an efficient stillbed filtration medium. Other applications include tank cleaning, oil spill mitigation, and lining/capping projects.

- **Pre-Treatment Mode:**
  HS-200 Series can be used upstream to enhance the performance and extend the useful life of other filtration processes and media such as reverse osmosis, activated carbon and resins.

- **Post-Treatment Mode:**
  HS-200 Series utilized downstream of an oil-water separator or coalesce filter, has the ability to act as an effective cleaning and polishing agent.

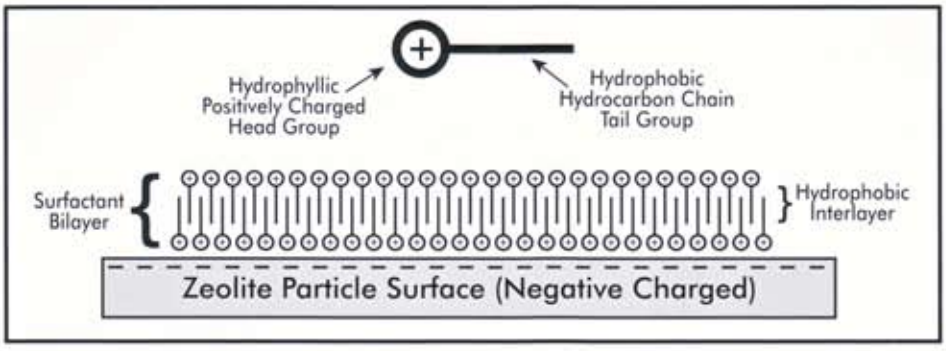
Application Parameters:

Bulk Density: 58 lbs/Ft^3 (928 kg/M^3)

10 - 15 minutes depending on solubility of contaminant(s) to be removed.

Temperature Range: 33 - 170 F° (1 - 77 C°)
pH Range: 4 - 10

Pre-treatment prior to activated carbon and ion exchange resin columns; Pre-treatment for RO systems; Polishing for oil and water separators and DAF units.

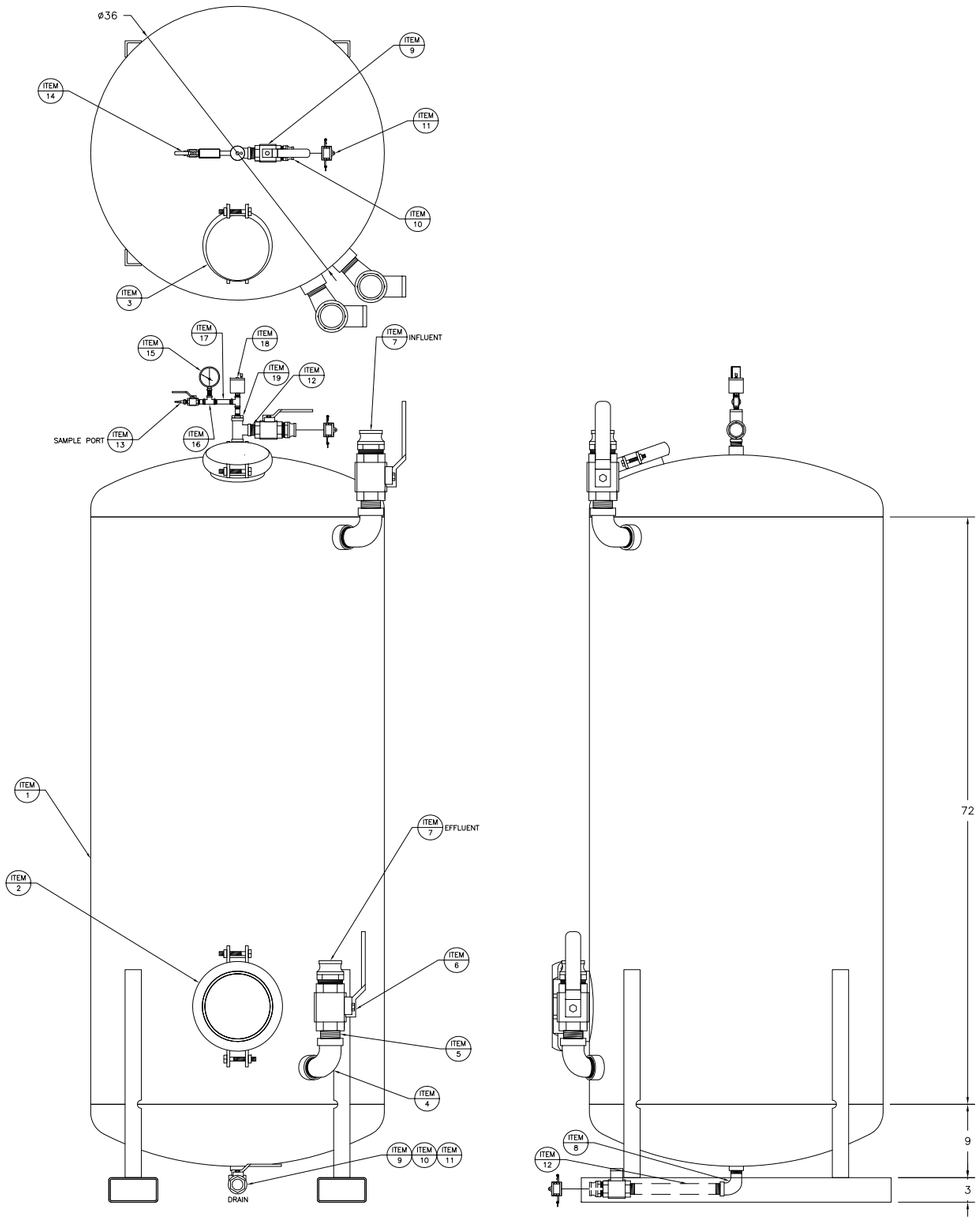


HYDROSIL
INTERNATIONAL LTD.

1180 St. Charles Street
Elgin, IL 60120

phone: 1-847-741-1600
phone: 1-800-PURPLE.1
Hydrosilintl.com

Liquid Phase
Carbon Information



ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO
1	1	1000 LB CARBON VESSEL ASSEMBLY – 36" OD X 72" HIGH SIDE WALL, STAINLESS STEEL	PROACT	
2	1	VICTAULIC END CAP FITTING – 8" DIAMETER GALVANIZED 60G		
3	1	VICTAULIC END CAP FITTING – 6" DIAMETER GALVANIZED 60G		
4	2	STREET ELBOW 90 – 2" NPT GALVANIZED STEEL		
5	2	NIPPLE – 2" NPT X NEAR GALVANIZED STEEL		
6	2	BALL VALVE – 2" NPT FULL PORT, BRASS, 94A SERIES	APOLLO	94A–108
7	2	CAM LOCK – 2" MALE X 2" MNPT ALUMINUM	DIXON	200–F–AL
8	1	STREET ELBOW 90 – 1" NPT GALVANIZED STEEL		
9	2	BALL VALVE – 1" NPT, DRAIN VALVE FULL PORT, BRASS, 94A SERIES	APOLLO	94A–105
10	2	CAM LOCK – 1" MALE X 1" MNPT ALUMINUM	DIXON	100–F–AL
11	2	CAM LOCK CAP – 1" ALUMINUM	DIXON	100–DC–AL
12	2	NIPPLE – 1" NPT GALVANIZED STEEL		
13	1	HOSE BARB FITTING – 1/4" NPT, QUICK CONNECT BRASS		
14	1	BALL VALVE – 1/4" NPT FULL PORT, BRASS, 94A SERIES	APOLLO	94A–101
15	1	PRESSURE GAUGE – 0–100 PSI, LIQUID FILLED, 1/4" MNPT BOTTOM MOUNT	PRECISION INSTRUMENT CO.	201L
16	2	TEE – 3 WAY, 1/4" NPT GALVANIZED STEEL		
17	3	NIPPLE – 1/4" NPT GALVANIZED STEEL		
18	1	AIR BLEED – 1/4" NPT		
19	1	REDUCER BUSHING – 1" X 1/4" NPT GALVANIZED STEEL		

ProAct Services Corporation

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PATENT PENDING

1000 LB LIQUID CARBON VESSEL ASSEMBLY AND WELDMENT

DRAWING NO.	SIZE	SCALE	JOB NO.	UNIT NO.	REV
	B	1/14	1630		1

REV	DATE	DESCRIPTION	DRW	APPR	CUSTOMER AMTRAK	MATERIAL	DRAWN BY STEVE TURNER	DATE	SHEET
								11/20/12	1

EI-30R | EI-840R

Envirotrol, Inc.

Product Description

Envirotrol's EI-30R and EI-840R are reactivated liquid phase carbons from Envirotrol's custom segregated reactivation process. EI-30R is our premium grade reactivated carbon which provides superior performance in the removal of a wide variety of organic contaminants in liquid applications. Our EI-840R is a reactivated carbon that has excellent adsorptive properties for a wide range of applications. These products will provide performance equivalent to virgin carbon but at a significant cost savings.

EI-30R and 840R grades of carbon are available in 1000 lb bulk sacks or in bulk. All other packaging is available at a premium. EI-30R and EI-840R are produced by steam activated process and are therefore excluded from IATA#395, IMCO CLass 4.2 or UN1362, Freight Classification: NMFC #40560; UFC - #20460.

WET ACTIVATED CARBON DEPLETES OXYGEN FROM AIR.

All precautions must be taken since dangerously low levels of oxygen may be encountered.

Product Specifications

	EI-30R	EI-840R
Iodine Number (mg/g) min.:	900	750
Molasses Number (Typical):	200	200
Abrasion Number (Ro-Tap) min.:	75	75
Moisture (as packed, weight %):	2.0%	2.0%
U.S. Standard Sieve Size:	8x30	8x40
Greater than 8 mesh (max.):	15%	15%
Less than 30 mesh (max.):	5%	5%
Apparent Density (dense packing, g/ml):	.47 - .52	.47 - .575
Total Surface Area (N_2 BET, m^2/g):	900-1000	750-900

The information and recommendations in this publication are, to the best of our knowledge, reliable. Suggestions made concerning uses or applications are only the opinion of Envirotrol Inc., and users should make their own tests to determine the suitability of these products for their own particular purposes. However, because of numerous factors affecting results, Envirotrol Inc., makes no warranty of any kind, expresses or implied, including those of merchantability and fitness for purpose, other than that the material conforms to its applicable current Standard Specifications. Statements herein, therefore, should not be construed as representations or warranties.

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Standards specifications, although, current at the time of publication, are subject to change without notice.

Shipping Infortmation: F.O.B. Points: Rochester, PA

Liquid Flow Meter/ Transmitter Information

Blancett®

Flow Meters

Model 1100 Turbine Flow Meter

- Accurate and repeatable flow measurement from 0.6 - 3 gpm (20 - 100 BPD) to 500 - 5,000 gpm (17,000 - 171,000 BPD)
- Capable of electronic integration, to provide displayed flow rate, totalization, current or voltage outputs
- Capable of measuring flow on piping systems from 1/2" to 10"
- Superior materials of construction for high performance in aggressive environments
- Only one moving part for reduced maintenance costs

1-800-235-1638 ■ www.blancett.com

RACINE FEDERATED INC. UL REGISTERED FIRM ISO 9001:2008 FILE NO. A16856

Introduction

The Model 1100 Turbine Flow Meter is designed to withstand the demands of the most rigorous flow measurement applications. Originally developed for the secondary oil recovery market, the Model 1100 is an ideal meter for liquid flow measurement on or off the oilfield.

The meter features a rugged 316 stainless steel housing and rotor support assemblies, CD4MCU stainless steel rotor, and abrasive-resistant tungsten carbide rotor shaft and journal bearings. The Model 1100 maintains measurement accuracy and mechanical integrity in the corrosive and abrasive fluids commonly found in oil field water flood projects and many industrial applications.

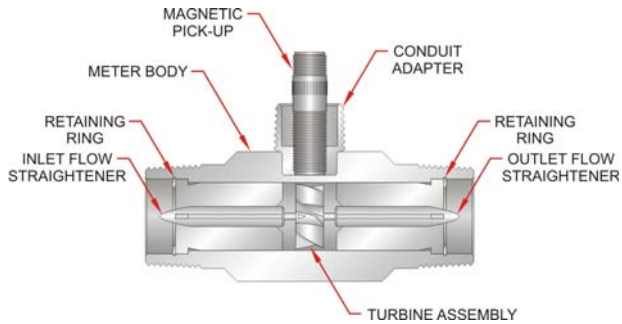
Designed to operate with the Model B2800 Flow Monitor, the Model 1100 turbine meter meets a wide range of measurement requirements. This makes it ideal for applications such as pipelines, production/injection fields, in-situ mining operations, offshore facilities, and other industrial applications.

Features

- Offers accurate and repeatable flow measurement in ranges from 0.6 to 5,000 GPM (20 to 171,000 BPD)
- Cost-effective solution for turbine flow meter applications
- Rugged 316 stainless steel construction offers long service life in severe operating environments
- Available in NPT, BSP, Victaulic®, Flange, or Hose Barbed end connections
- NIST traceable calibration
- Installation in pipe sizes from 1/2" to 10"
- Integrate electronically with B2800 Flow Monitor, K-factor Scaler, or the F to I/F to V Intelligent Converter
- Field replaceable repair kits allow for turbine replacement without loss of accuracy

Operating Principle

Fluid entering the meter passes through the inlet flow straightener which reduces its turbulent flow pattern and improves the fluid's velocity profile. Fluid then passes through the turbine, causing it to rotate at a speed proportional to fluid velocity. As each turbine blade passes through the magnetic field at the base of the transducer, an AC voltage pulse is generated in the pickup coil. These pulses produce an output frequency proportional to the volumetric flow through the meter.



Specifications

Materials of Construction:
Body; 316 Stainless Steel
Rotor; CD4MCU Stainless Steel
Rotor Support; 316 Stainless Steel
Rotor Shaft; Tungsten Carbide

Turndown Ratio: 10:1

Flow Accuracy: ±1% of reading for ⅞" and larger meters
±1% of reading over the upper 70% of the measuring range for ⅜", ½" and ¾" meters

Repeatability: ± 0.1%

Calibration: Water (NIST traceable calibration)

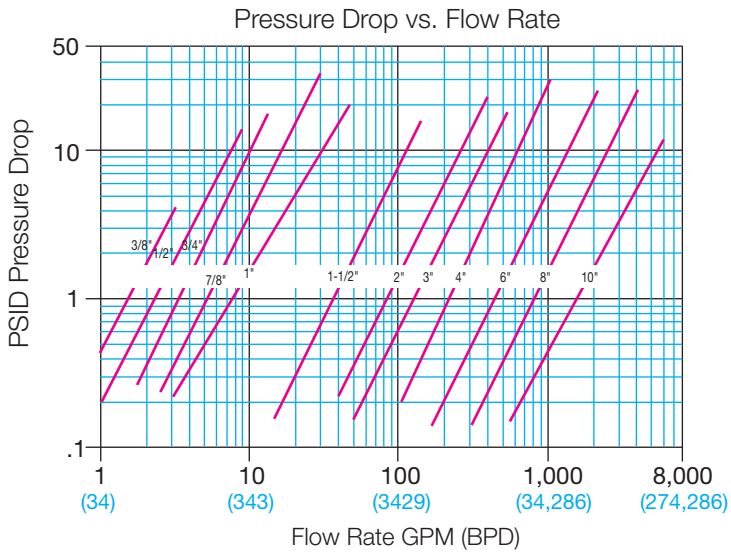
Pressure Rating: 5,000 psi (maximum)

Turbine Temperature: -150 °F to +350 °F (-101 °C to 177 °C)

End Connections: NPT, BSP, Victaulic®, Flange, Hose Barbed

Approvals: CSA Class I Div 1, Groups C & D;
Class II Div 1, Groups E, F & G: intrinsically safe*
CSA Class I Div 1 Groups C,D; Complies to UL 1203 and CSA 22.2 No. 30
Met Labs File No. E112860 (For Explosion proof models only)

*Contact factory for ordering options



Model 1100 Turbine Meters & Repair Kits

Part Number*	Bore Size	End Connections	Max. PSI	Flow Ranges			Recommended Strainer	Approx. K-Factor Pulses/Gal	Meter Weight	End to End Length	Repair Kit Part Number
				GPM	BPD	M^3/D	Mesh				
B110-375-1/2	3/8"	1/2" Male NPT	5,000	0.6 - 3	20 - 100	3.3 - 16	60	18,000	1	3"	B251-102
B110-500-1/2	1/2"	1/2" Male NPT	5,000	0.75 - 7.5	25 - 250	4.1 - 41	60	13,000	1	3"	B251-105
B110-750-1/2	3/4"	1/2" Male NPT	5,000	2 - 15	68 - 515	10.9 - 81.75	60	3,300	1	3"	B251-108
B110-375	3/8"	1" Male NPT	5,000	0.6 - 3	20 - 100	3.3 - 16	60	18,000	2	4"	B251-102
B110-500	1/2"	1" Male NPT	5,000	0.75 - 7.5	25 - 250	4.1 - 41	60	13,000	2	4"	B251-105
B110-750	3/4"	1" Male NPT	5,000	2 - 15	68 - 515	10.9 - 81.75	60	3,300	2	4"	B251-108
B110-875	7/8"	1" Male NPT	5,000	3 - 30	100 - 1,000	16 - 160	60	3,100	2	4"	B251-109
B111-110	1"	1" Male NPT	5,000	5 - 50	170 - 1,700	27.25 - 272.5	40	870	2	4"	B251-112
B111-115	1-1/2"	1-1/2" Male NPT	5,000	15 - 180	515 - 6,000	82 - 981	20	330	5	6"	B251-116
B111-121	1-1/2"	2" Male NPT	5,000	15 - 180	515 - 6,000	82 - 981	20	330	6	6"	B251-116
B111-120	2"	2" Female NPT	5,000	40 - 400	1,300 - 13,000	218 - 2,180	20	52	14	10"	B251-120
B111-130	3"	3" Grooved End	800	60 - 600	2,100 - 21,000	327 - 3,270	10	57	15	12-1/2"	B251-131
B111-140	4"	4" Grooved End	800	100 - 1,200	3,400 - 41,000	545 - 6,540	10	29	20	12"	B251-141
B111-160	6"	6" Grooved End	800	200 - 2,500	6,800 - 86,000	1,090 - 13,626	4	7	46	12"	B251-161
B111-180	8"	8" Grooved End	800	350 - 3,500	12,000 - 120,000	1,363 - 19,076	4	3	56	12"	B251-181
B111-200	10"	10" Grooved End	800	500 - 5,000	17,000 - 171,000	2,725 - 27,252	4	1.6	80	12"	B251-200

** Part number includes turbine meter and standard magnetic pickup. For other pickup options, see table below.*
Note: Insert a "C" before dash for turbine meters with explosion proof rating. No pick-up included. Example: B111C-110

Installation

The Model 1100 Turbine Meter is simple to install and service. It operates in any orientation (horizontal to vertical) as long as the "flow direction" arrow is aligned in the same direction as the actual line flow. For optimum performance, the flow meter should be installed with a minimum of 10 diameters upstream straight pipe length and 5 diameters downstream straight pipe length.

Repair Kits

Factory calibrated replacement kits are available for field or factory service. This is of particular importance when fluids contain abrasive contaminants and meters require frequent service.

A repair kit contains two retaining rings, two rotor supports, one rotor assembly, and a K-factor tag. The rotor support assembly is retained in proper position within the meter body by retainer rings. These rings allow for quick and easy disassembly and replacement of the meter's internal components. The Model 1100 repair kits are designed and manufactured for use with Blancett turbines and other flow meters of similar design; contact the factory or refer to Form #4300 for further details.

K-factor

The K-factor represents the number of output pulses transmitted per gallon of fluid passing through the turbine meter. Each turbine has a unique K-factor. However, turbine meters are not functionally consistent throughout the full flow range of the meter.

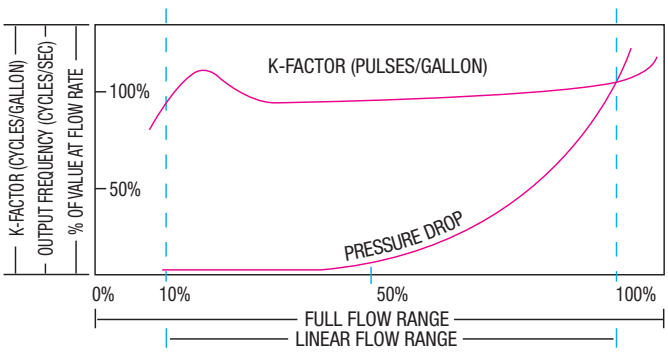
There are several forms of "friction" inherent in turbine meters that retard the rotational movement of the turbine rotor. These frictional forces include: magnetic drag, created by electromagnetic force of pickup transducers; mechanical drag, due to bearing friction; and viscous drag, produced by flowing fluid. See charts at right.

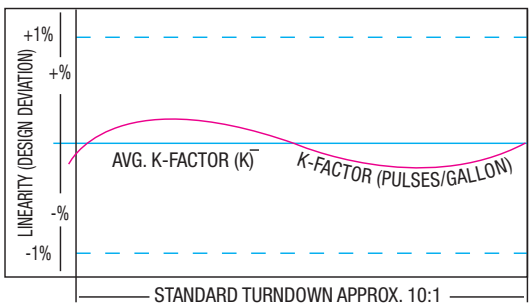
As flow increases, the frictional forces are minimized and the free-wheeling motion of the turbine rotor becomes more linear (proportional to flow). The K-factor becomes relatively constant and linear throughout the balance of the linear flow range. This is approximately a 10:1 turndown ratio from the maximum flow rate down to the minimum flow rate.

Model 1100 Pickup Options

Part Number	Magnetic Pickup	Temperature Range
B111109	Standard	-150 °F to +330 °F (-101 °C to +165 °C)
B220111	High Temperature	-150 °F to +450 °F (-101 °C to +232 °C)
B220210	with Preamplifier	-20 °F to +160 °F (-29 °C to +71 °C)
B220243	Intrinsically Safe, FM rated	-150 °F to +330 °F (-101 °C to +165 °C)
B111126	ATEX Ⓔx II 1G; EEx ia IIC T5	-58 °F to + 248 °F (-50 °C to +120 °C)

Typical K-factor Curve (Pulses per Gallon)





Related Blancett Products

B2800 Flow Monitor

- Microprocessor-based flow monitor and totalizer
- Use with Blancett turbine flow meters as well as other flow meters with a frequency output
- Battery (1.5 VDC) and loop-powered (4-20 mA) versions
- Meter, remote, panel and swivel mounting options
- Hand-held and explosion-proof models also available
- CSA and CE approved
- Class 1, Division 1 (Intrinsically Safe) certification

K-Factor Scaler Frequency Divider

- Scales turbine meter output to desired engineering units
- Amplifies turbine meter pulse output
- Converts frequency outputs into recognizable units for PLCs and other devices
- Switch-selectable or programmable versions available
- CSA approved

F to I / F to V Intelligent Converter

- Converts turbine frequency output into scaled analog output
- Linearized output capability
- Choice of 4-20 mA or 0-5 VDC output
- Enables integration with data acquisition devices
- Frequency measurement accuracy ±1%
- CSA approved

Blancett® Flow Meters

8635 Washington Avenue, Racine, WI 53406-3738 U.S.A.

Toll Free: 800-235-1638 Technical Toll Free: 877-722-4631
Tel: 262-639-6770 Fax: 262-639-2267

E-mail: info@blancett.com

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Victaulic is a registered trademark of Victaulic Company.
CSA is a registered trademark of Canadian Standards Association.
MET is a registered trademark of MET Laboratories, Inc.
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Printed in USA 11/09 Form No. 1100

Blancett®

Flow Meters

Model B2800 Flow Monitor

- Microprocessor-based flow monitor and totalizer
- Use with Blancett® turbine flow meters as well as other flow meters with a frequency output
- Battery (1.5 VDC) and Loop-powered (4-20 mA) versions available
- Meter, Remote, Panel and Swivel mount versions available
- Hand-Held and Explosion-Proof models also available

1-800-235-1638 ■ www.blancett.com

Introduction

The B2800 is a technologically advanced flow monitor designed to be comprehensive, user-friendly, flexible and cost efficient. This microprocessor-based display comes pre-calibrated by the factory when purchased with a Blancett turbine flow meter, or it can easily be configured in the field. The user may choose between the Simplified model which is programmed in seven simple steps and the Advanced model which provides additional programming options.

The B2800 is offered in six mounting configurations: meter, remote, swivel and hand-held, as well as a panel version and explosion-proof display allowing for flexible installation. The B2800, when paired with a rugged, reliable Blancett turbine flow meter, will provide dependable and accurate flow information for many years to come. The B2800 may also be used with almost any flow sensor that outputs a low-amplitude AC signal.

Features

- Displays rate and/or total
- Large 8 digit by 3/4" display for easy viewing (meter, remote and swivel mount plus hand-held versions)
- Battery-powered unit utilizes one “D” size 1.5 volt alkaline battery for up to 3-1/2 years of service
- Loop-powered, 4-20 mA version available
- User friendly front panel programming
- Ten point linearization (Advanced model only)
- NEMA 4X enclosure suitable for outdoor monitoring (meter, remote, and swivel mount versions)
- Intrinsically safe (meter, remote and swivel mount versions)
- Microprocessor-based, low power consumption
- Six mounting options: meter, remote, swivel, hand-held, panel or explosion-proof
- Simplified model displays in five selectable units of measure: GPM/gallons, LPM/liters, M3PD/cubic meters, BPD/barrels, or M3PH/cubic meters
- Advanced model offers thirteen selectable units of measure: gallons, oil barrels, liters, cubic meters, Mgal, MCF, MMCF, cubic ft, Mliters, acre ft, liquid barrels, lbs, or kgs
- Advanced model allows selection of time intervals for rate measurement in either day, hour, minute, or second
- Advanced model includes gas measurement with correction software for pressure and temperature

METER MOUNT VERSION

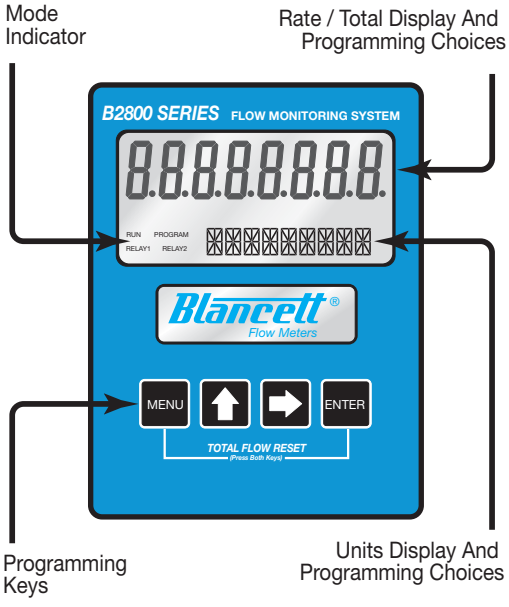
Operating Principle

The B2800 flow monitor accepts a low-level frequency input, such as the input from a Blancett turbine meter, to calculate flow rate and total. These calculations are then displayed in user selected units of measurement. All B2800 flow monitors come pre-calibrated from the factory if ordered with a Blancett flow meter. However, they can be easily reconfigured in the field. The B2800 is available in a battery-powered or loop-powered version. The battery version utilizes one “D” size, 1.5 volt alkaline battery that provides up to 3-1/2 years of service.

The loop-powered B2800 offers a 2-wire 4-20 mA output for electronic integration. The meter mount, remote, swivel and hand-held monitors are equipped with a large 8 digit by 3/4" numerical LCD making extended range viewing practical. The second 8 character by 3/8" alphanumeric display provides for selectable units viewing in run mode and prompts variables in programming mode. Additionally, the user can choose between displaying rate, total or alternating between both rate and total.

Specifications

LCD Display:	Rate & total, fixed or toggle modes of operation 8 digit, 0.7 inches (18 mm) numeric (top line) 8 character, 0.35 inches (9 mm) alphanumeric (bottom line); resettable
LCD Display: (Panel Mount & Explosion-Proof Models only)	Rate & total, fixed or toggle modes of operation 8 digit, 0.5 inches (13 mm) numeric (top line) 8 character, 0.25 inches (6.4 mm) alphanumeric (bottom line); resettable
Power:	
Battery	1 "D" size 1.5 VDC alkaline battery included Less than 1 milliwatt (~3.5 years on 1 "D" battery)
Loop-Powered	4-20 mA, two-wire current loop 25 mA maximum consumption
Pulse Output Signal:	One pulse for each increment of the least significant digit of totalizer
Pulse Type	Opto-isolated open collector transistor
Max Voltage	30 VDC
Pulse Width	(ON State) 20 ms/max pulse rate 20 Hz
Current	(ON State) 0.9 V drop @ 5.0 mA or 0.7 V drop @ 0.1 mA
Inputs:	Magnetic pickup
Frequency Range	1 to 3500 Hz
Trigger Sensitivity	30 mV p-p
Over Voltage Protected	30 VDC
Frequency Measurement Accuracy:	±0.1%
Analog Output: (Loop-Powered Version)	4-20 mA
Operating Temperature:	-22 °F (-30 °C) to 158 °F (70 °C)
Humidity:	0-90% non-condensing
Enclosure Rating:	Meter, Remote and Swivel mount: NEMA/UL/CSA Type 4X (IP-66) Panel mount: NEMA 4 (front only) Hand-Held: General Purpose Explosion-proof: NEMA 4X (IP-66)



Certifications:	
CSA Intrinsically Safe: (Meter, Remote & Swivel Mount)	Class I, Division 1, Groups C & D Class II, Division 1, Groups E, F & G
CE: (Meter, Remote & Swivel Mount)	IEC 61326-1
CSA: (Panel Mount Only)	Ordinary Area
CSA Hazardous Locations: (Explosion-Proof Model Only)	Class I, Division 1, Groups B, C & D Class II, Groups E, F & G Class III, Type 4, T6 @ 70 C
Units of Measure (Rate/total): (Simplified Version - user selectable)	GPM/gallons, LPM/liters, M3PD/cubic meters, BPD/barrels, M3PH/cubic meters
Units of Measure (Total): (Advanced Version - user selectable)	Gallons, Oil Barrels, Liters, Cubic Meters, MGal, Cubic Ft, MLiters, MCF, MMCF, Acre Ft, Liquid Barrels, Lbs, Kgs
Time Intervals (Rate): (Advanced Version - user selectable)	Day, Hour, Minute, Second

Flow Monitor Part Numbering Information

B 2 8 X X X - XX

Program Level
A = Advanced
S = Simplified

Power Option
B = Battery
L = Loop

Mounting Style
M = Meter Mount
R = Remote Mount
S = Swivel Mount
H = Hand-Held
P = Panel Mount
X = Explosion-Proof

Units of Measure
AB = Gallons
ED = Barrels
HB = Liters
ID = Cubic Meters
CS = Customer Selectable*

*Note: ***Advanced*** B2800 monitors only.
The default is gallons per minute.

B2800 Mounting Configurations

Meter Mount

- Monitor is assembled to the flow meter, creating a compact flow measurement system
- NEMA 4X (IP-66) enclosure
- 8 digit 0.7 inches (18 mm) numeric rate/total display
- 8 digit 0.35 inches (9 mm) alphanumeric display
- Fixed or toggle modes of operation for flow rate and total display

Remote Mount

- Ideal for installations where flow sensor is located in a challenging environment such as high temperature, excessive noise or inaccessible area
- NEMA 4X (IP-66) enclosure
- 8 digit 0.7 inches (18 mm) numeric (rate/total display; programming choices)
- 8 digit 0.35 inches (9 mm) alphanumeric display (run/programming mode)
- Mounting hardware included
- Fixed or toggle modes of operation for flow rate and total display
- Cable lengths from 10' (3 meters) up to 100' (30.5 meters) sold separately

Swivel Mount

- Capable of adjusting orientation up to 180 degrees
- Offers additional protection from the sun/elements
- Increased visibility in difficult viewing installations
- Remote swivel mount also available, consult factory for details
- NEMA 4X (IP-66) enclosure
- 8 digit 0.7 inches (18 mm) numeric display (rate/total display; programming choices)
- 8 digit 0.35 inches (9 mm) alphanumeric display (run/programming mode)
- Fixed or toggle modes of operation for flow rate and total display

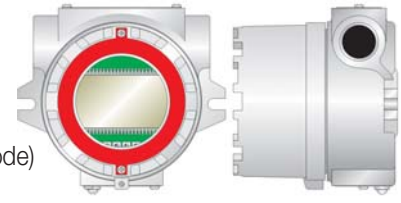
Hand-Held

- Battery-powered
- Portable, includes handle, extendable cable and sensor dock
- On/Off switch for power conservation
- Magnetic pickup included with monitor
- 8 digit 0.7 inches (18 mm) numeric display (rate/total display; programming choices)
- 8 digit 0.35 inches (9 mm) alphanumeric display (run/programming mode)
- Fixed or toggle modes of operation for flow rate and total display
- General Purpose enclosure

Panel Mount

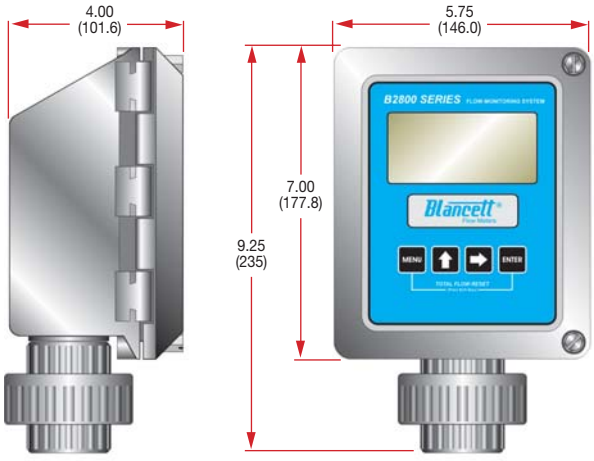
- NEMA 4 (front only)
- Designed to be mounted in 3.6" x 3.6" (91 x 91 mm) opening
- Fixed or toggle modes of operation for flow rate and total display
- 8 digit 0.5 inches (12.7 mm) numeric display (rate/total display; programming choices)
- 8 digit 0.25 inches (6.4 mm) alphanumeric display (run/programming mode)

Explosion-Proof

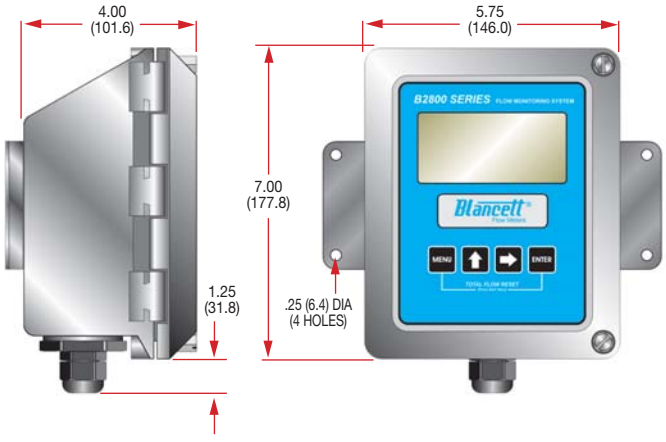


- Ideal for hazardous locations
- Rugged compact design
- 8 digit 0.5 inches (12.7 mm) numeric display (rate/total display; programming choices)
- 8 digit 0.25 inches (6.4 mm) alphanumeric display (run/programming mode)
- Fixed or toggle modes of operation for flow rate and total display
- NEMA 4X (IP-66) enclosure

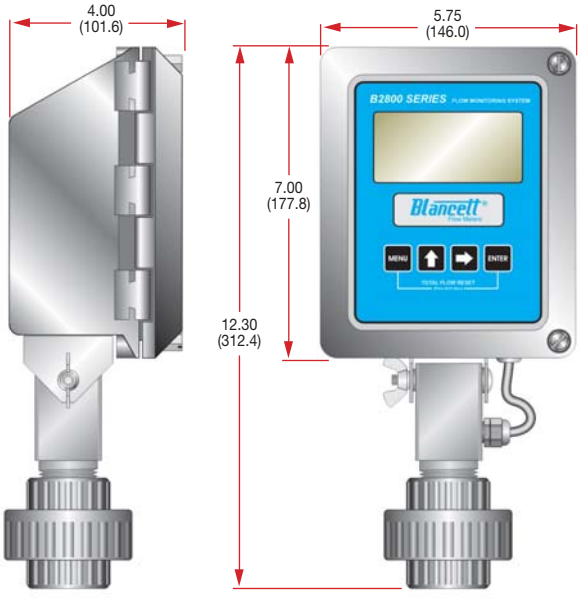
Dimensions - Inches (mm)



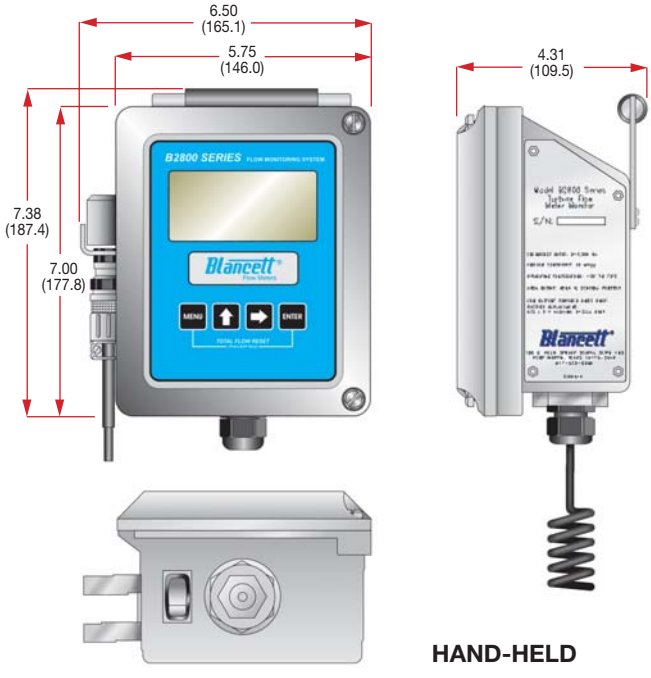
METER MOUNT



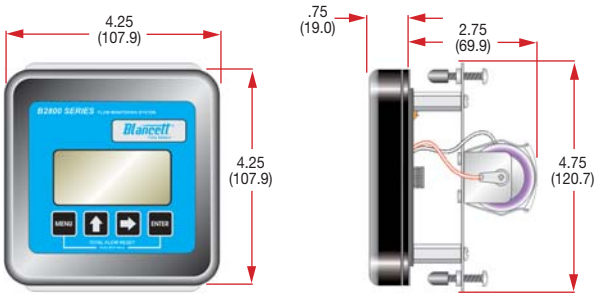
REMOTE MOUNT



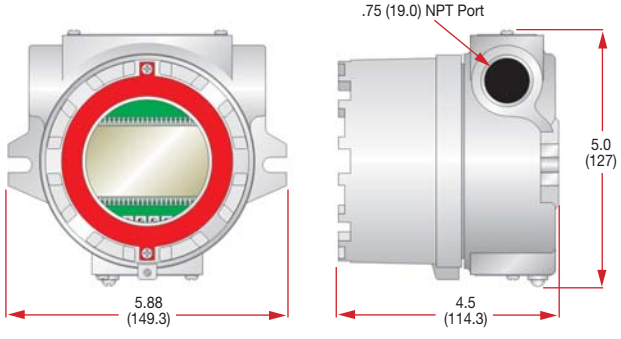
SWIVEL MOUNT



HAND-HELD



PANEL MOUNT



EXPLOSION-PROOF

Related Blancett Products

Model 1100 In-Line Turbine Flow Meter

- Accuracy : ±1% of reading
- Repeatability: ±0.1%
- Flow ranges from 0.6 - 3 GPM to 500 - 5,000 GPM in line sizes from 1/2 to 10 inches (12.7 to 254 mm)
- Rugged 316 stainless steel construction
- NIST traceable calibration certificates available
- Manufactured in the USA

QuikSert™ In-Line Turbine Flow Meter

- Modified flow straighteners for enhanced fluid dynamics
- Body dimensions allow for installation in confined areas
- "Between the flange" design eliminates the need for mating flanges
- Flow ranges from 0.6 - 3 GPM to 500 - 5,000 GPM in line sizes from 1/2 to 10 inches (12.7 to 254 mm)
- NIST traceable calibration certificates available
- Optional installation kit available

3A Sanitary In-Line Turbine Flow Meter

- Meets 3A sanitary standard number 28-03 requirements
- Available in CIP/SIP and COP/SOP environments
- Accuracy: ±1% of reading
- Repeatability: ±0.1%
- Flow ranges from 0.6 - 3 GPM to 40 - 400 GPM
- Meter sizes 3/8 to 2 inches (9.5 to 50 mm)
- Connection sizes: 3/4, 1-1/2, and 2-1/2 inches

Blancett®
Flow Meters
Division of Racine Federated Inc.

8635 Washington Avenue, Racine, WI 53406-3738 U.S.A.

Toll Free: 800-235-1638 Tel: 262-639-6770 Fax: 262-639-2267

E-mail: info@blancett.com

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CSA is a registered trademark of Canadian Standards Association
QuikSert is a trademark of Racine Federated Inc.

Transfer Pump
TP-300 Information

printed October 1, 2012

GRAINGER
FOR THE ONES WHO GET IT DONE

Pump, Diaphragm, 1 In

Air Operated Diaphragm Pump, Metallic Double Diaphragm, Air Inlet 3/8 In, Flow 35 GPM, Max Flow 30 CFM, Max Flow 49 GPM, Max Operating PSI 100, Inlet 1 In FNPT, Outlet 1 In FNPT, Port Type Single, Max Dia Solids 3/16 In, Max Temp 180 F, Buna N Ball Material, Aluminum Body Material, Stainless Steel Check Seat Material, Buna N Diaphragm Material, Self Priming Dry 18 Ft, Self Priming Wet 28 Ft

Grainger Item #	6PY44
Price (ea.)	**$766.00**
Brand	DAYTON
Mfr. Model #	6PY44
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	30.55
Availability	Ready to Ship
Catalog Page No.	3955

Price shown may not reflect your price. Log in or register.

Additional Info

Metallic Air-Operated Double Diaphragm Pumps

General-Purpose (Dayton®)

Self-priming pumps can run dry and are capable of pumping slurries, solvents, and high-viscosity liquids, such as paints and waste oils. Spring-assisted air valve has proprietary seal rings and never requires lubrication.

Tech Specs

Item: Air Operated Double Diaphragm Pump
Inlet/Outlet: 1"
Flow: 35 gpm
Max. Flow GPM: 49
Max. Flow: 30 cfm
Max. Operating PSI: 100
Body Material: Aluminum
Diaphragm Material: Buna N
Ball Material: Buna N
Check Seat Material: Stainless Steel
Air Inlet (F)NPT: 3/8"
Manifold Connection: Single
Max. Dia. Solids: 3/16"
Max. Temp.: 180 Degrees F
Self-Priming Dry: 18 ft.
Self-Priming Wet: 28 ft.
Manufacturers Warranty Length: 1 Year

Notes & Restrictions

There are currently no notes or restrictions for

Optional Accessories

Pump Repair Kit, Fluid

Item #: 6PY67
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $218.75

Pump Repair Kit, Air

Item #: 6PY79
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $146.15

Hose, Push On, 3/8 In ID x 250 Ft, Green

Item #: 4KT71
Brand: GOODYEAR ENGINEERED PRODUCTS
Usually Ships: Ready to Ship
Price (ea): $450.00

this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Filter/Regulator

Item #: 4ZK84
Brand: SPEEDAIRE
Usually Ships: Ready to Ship
Price (ea): $65.00

Push On Hose Barb, 3/8 In ID x 3/8 MNPT

Item #: 5A254
Brand: GRAINGER APPROVED VENDOR
Usually Ships: Ready to Ship
Price (ea): $2.77

Pressure Gauge, 2 In, 0 to 160 Psi

Item #: 5WZ41
Brand: GRAINGER APPROVED VENDOR
Usually Ships: Clearance - limited quantity available
Price (ea): $10.86

Pressure Gauge, 2 In, 160 Psi, Back

Item #: 4FMC7
Brand: GRAINGER APPROVED VENDOR
Usually Ships: Ready to Ship
Price (ea): $11.95

Alternate Products

Pump, Diaphragm, 3/4 In

Item #: 6PY43
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $669.50

Repair Parts

Repair Parts Information is available for this item.

APPENDIX Q

Vapor Phase
Carbon Units Information

1,000lbs Vapor Media Vessels

Environmental Treatment Specialists

General Specifications:	Flow max 750 CFM
Main Equipment:	2 – 1,000 lb Vapor media vessels 3’ diameter x 7’ high
Equipment Features:	Stainless Steel slotted screen for water collection & backwash distribution Standard Absorption System Piping including: Air Eliminators to remove air from headspace Schedule 40 carbon steel process piping w/cast iron fittings Cast Iron butterfly valves for process piping 4” ball valves for GAC discharge
Pressure rating:	75 psig & 14 psig vacuum
Water Hose Connection:	Male camlocks 4” inlet fitting
Air Hose Connection:	¾” Chicago hose connection
Carbon Hose Connection:	5” camlock
Process Pipe Connection:	6” 150# ANSI flange
Maintenance Access:	20” round flanged man-way one side 2- 14” x 18” manway on top
Weight:	1200 lbs. empty /2200 lbs. Operating weight
Options:	Manifold for between vessels
Power Requirements:	None

ProAct Services Corporation

Corp Office: 231-843-2711
Gulf Coast: 210-862-6467
or 713-202-6351
Midwest Office: 231-342-1115
East Coast Office: 203-262-1200

www.proact-usa.com

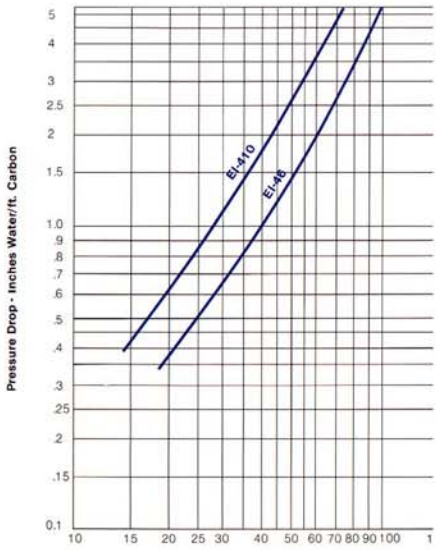
Texas ● Colorado ● Michigan ● New Jersey ● Connecticut

Product Description

EI-46 and EI-410 grade virgin activated carbons are manufactured from select grades of bituminous coal, which are activated at high temperatures under rigidly controlled conditions. The resulting product is characterized by high internal surface area, offering superior gas phase adsorption properties for a broad spectrum of organic compounds.

EI-46 and EI-410 grade activated carbons are very hard and attrition resistant resulting in low dust and high durability during operation and reactivation. Typical applications for EI-46 and EI-410 include: solvent recovery, odor control, tank vent adsorbers, HVAC, VOC control, Soil Vapor Extraction, Air Stripper Off-Gas, and Sub Part CC Compliance.

Grades are available in 200 lb net weight fiber drums or in bulk sacks containing 1000 lbs. net each. They are produced by steam activated process and are therefore excluded from IATA#395, IMCO CLass 4.2 or UN1362, Freight Classification: NMFC #40560; UFC - #20460



WET ACTIVATED CARBON DEPLETES OXYGEN FROM AIR.

All precautions must be taken since dangerously low levels of oxygen may be encountered.

Product Specifications

	EI-46	EI-410
Carbon Tetrachloride Activity (base):	60%	60%
Hardness Number (min.):	95	95
Mean Particle Diameter (mm):	3.7	3.0
Moisture (as packed, weight %):	2.0%	2.0%
U.S. Standard Sieve Size:	4x6	4x10
Greater than 4 mesh (max.):	5%	5%
Less than 7 mesh (max.):	10%	NA
Less than 10 mesh (max):	NA	4%
Apparent Density (dense packing, g/ml)	.44-.50	.44-.50
Total Surface Area (N2 BET, m2/g):	1050-1150 m_2/g	1050-1150 m_2/g
Ignition Temperature (Deg. C):	450	450

The information and recommendations in this publication are, to the best of our knowledge, reliable. Suggestions made concerning uses or applications are only the opinion of Envirotrol Inc., and users should make their own tests to determine the suitability of these products for their own particular purposes. However, because of numerous factors affecting results, Envirotrol Inc., makes no warranty of any kind, expresses or implied, including those of merchantability and fitness for purpose, other than that the material conforms to its applicable current Standard Specifications. Statements herein, therefore, should not be construed as representations or warranties. The responsibility of Envirotrol for claims arising out of breach of warranty, negligence, strict liability, or otherwise is limited to the purchase price of the materials.

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Shipping Infortmation: F.O.B. Points: Rochester, PA

Electrical Power Wiring Drawings

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO

ABBREVIATIONS

ANLG	ANALOG
AUX	AUXILIARY
CHEM	CHEMICAL
CIR	CIRCUIT
CMD	COMMAND
E–STOP	EMERGENCY STOP
EA	EACH
ELEC	ELECTRICAL
FCV	FLOW CONTROL VALVE
FLA	FULL LOAD AMPERAGE
FM	FLOW METER
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
HMI	HUMAN MACHINE INTERFACE
HP	HORSE POWER
INST	INSTANTANEOUS
KVA	KILOVOLT–AMP
KW	KILOWATT
LG	LEVEL GAUGE
mA	MILLIAMP
MLNC	MECHANICALLY LIMIT NORMALLY CLOSED
MLNO	MECHANICALLY LIMIT NORMALLY OPEN
MLO	MAIN LUG ONLY
N	NEUTRAL
N/C	NORMALLY CLOSED
N/O	NORMALLY OPEN
PLC	PROGRAMMABLE LOGIC CONTROLLER
PR	PROCESSING ROOM
PROG	PROGRAM
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TRANSMITTER
PWR	POWER
RECPT	RECEPTACLE
SW	SWITCH
TDDO	TIME DELAY DROP RELAY
TDPU	TIME DELAY ON PICKUP
THERMO	THERMOCOUPLE
TT	TEMPERATURE TRANSMITTER
V	VOLTAGE
VA	VOLT–AMP
VAC	VOLTAGE ALTERNATE CURRENT
VCOM	VOLTAGE COMMON (–)
VDC	VOLTAGE DIRECT CURRENT (+)
UPS	UNINTERRUPTIBLE POWER SUPPLY
WHT	WHITE
XMITER	TRANSMITTER

LEGENDS

DESCRIPTION	SYMBOL
N/O RELAY CONTACT	
N/C RELAY CONTACT	
N/O DELAYED CLOSE, TDPU	
N/C INST. OPEN, DELAYED RECLOSE, TDDO	
N/O INST. CLOSE, DELAYED REOPEN, TDDO	
N/C DELAYED OPEN, TDPU	
RELAY COIL	
SOLENOID COIL	
LAMP – INCANDESCENT, OR INDICATING	
N/O LEVEL SWITCH	
N/C LEVEL SWITCH	
ELECTRIC MOTOR	M
N/O PRESSURE SWITCH	
N/C PRESSURE SWITCH	
N/O TEMPERATURE SWITCH	
N/C TEMPERATURE SWITCH	
N/O LIMIT SWITCH, MLNO	
N/C LIMIT SWITCH, MLNC	
N/C LIMIT SWITCH, HELD OPEN	
N/O LIMIT SWITCH, HELD CLOSED	
TOGGLE SWITCH	
N/O PUSH–BUTTION CONTACT	
N/C PUSH–BUTTON CONTACT	
N/O SELECTOR SWITCH CONTACT	
N/C SELECTOR SWITCH CONTACT	
THERMAL OVERLOAD	
FUSE	
SLUG	

DESCRIPTION	SYMBOL
THERMAL OVERLOAD RELAY	OL
CONNECTOR–SEPARABLE, SHOWN ENGAGED	
GROUND, GRD	
DIODE–RECTIFIER	
VIBRATION SWITCH	
DIODE–ZENER	
CIRCUIT BREAKER	
CHASSIS GROUND	
SURGE SUPPRESSOR	
N/O DIFFERENTIAL PRESSURE SWITCH	
N/C DIFFERENTIAL PRESSURE SWITCH	
GROUNDED TERMINAL POINT	
TERMINAL POINT	
WIRING INSIDE CONTROL PANEL	
WIRING EXTERNAL TO CONTROL PANEL	

ProAct Services Corporation

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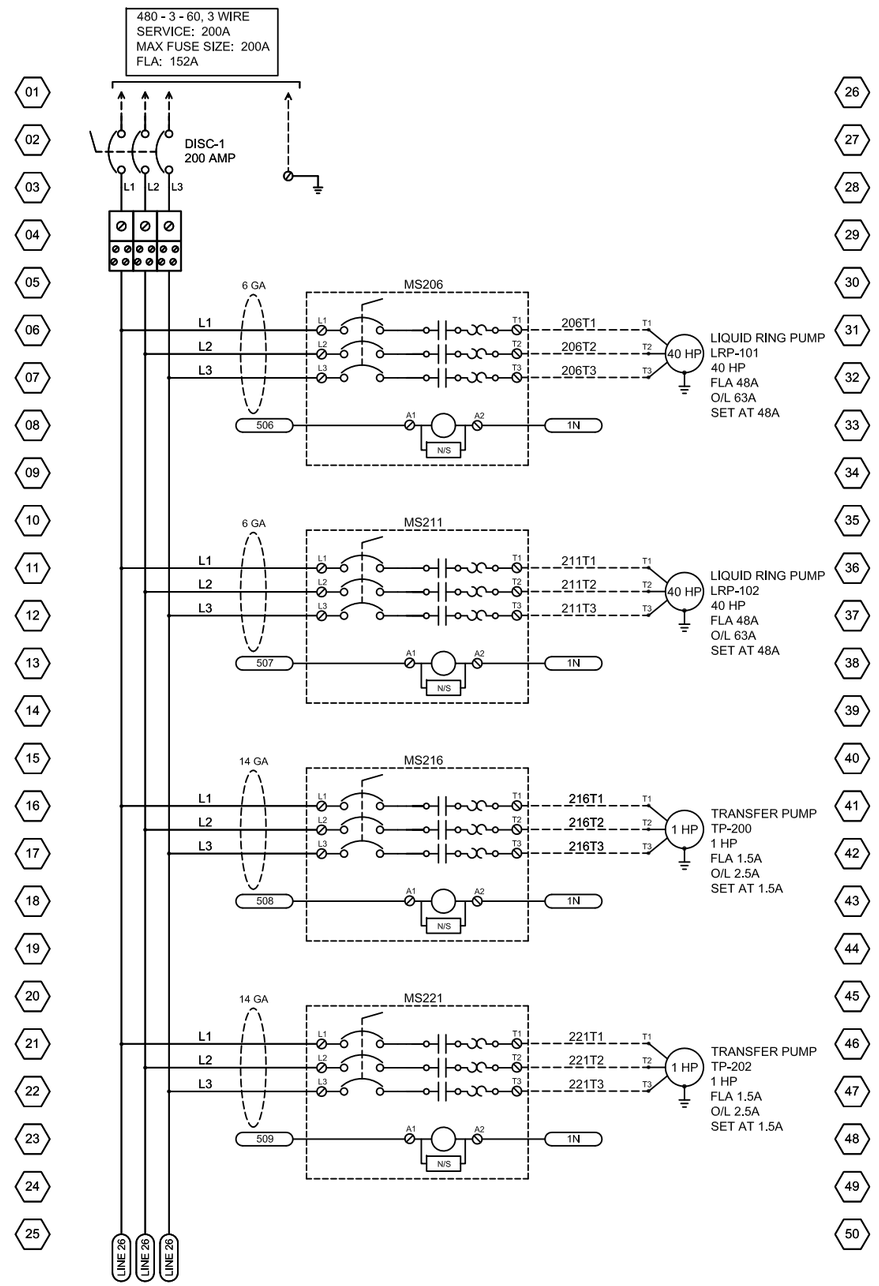
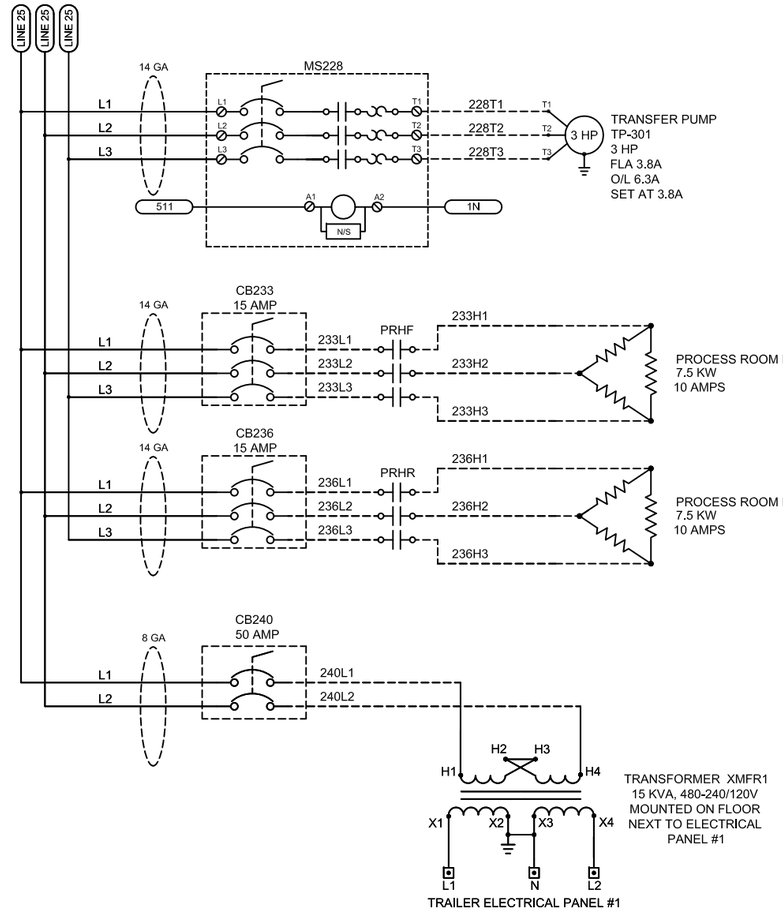
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
ABBREVIATIONS & SYMBOLS – ELECTRICAL

DRAWING NO. E–001	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 1
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

REV	DATE	DESCRIPTION	DRW	APPR

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO





REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	UPDATE FLA CB240 TO 50AMP	SMT	
2	1/17/13	UPDATE FLA, O/L SETTINGS TXFM UPSIZE TO 15KVA	SMT	

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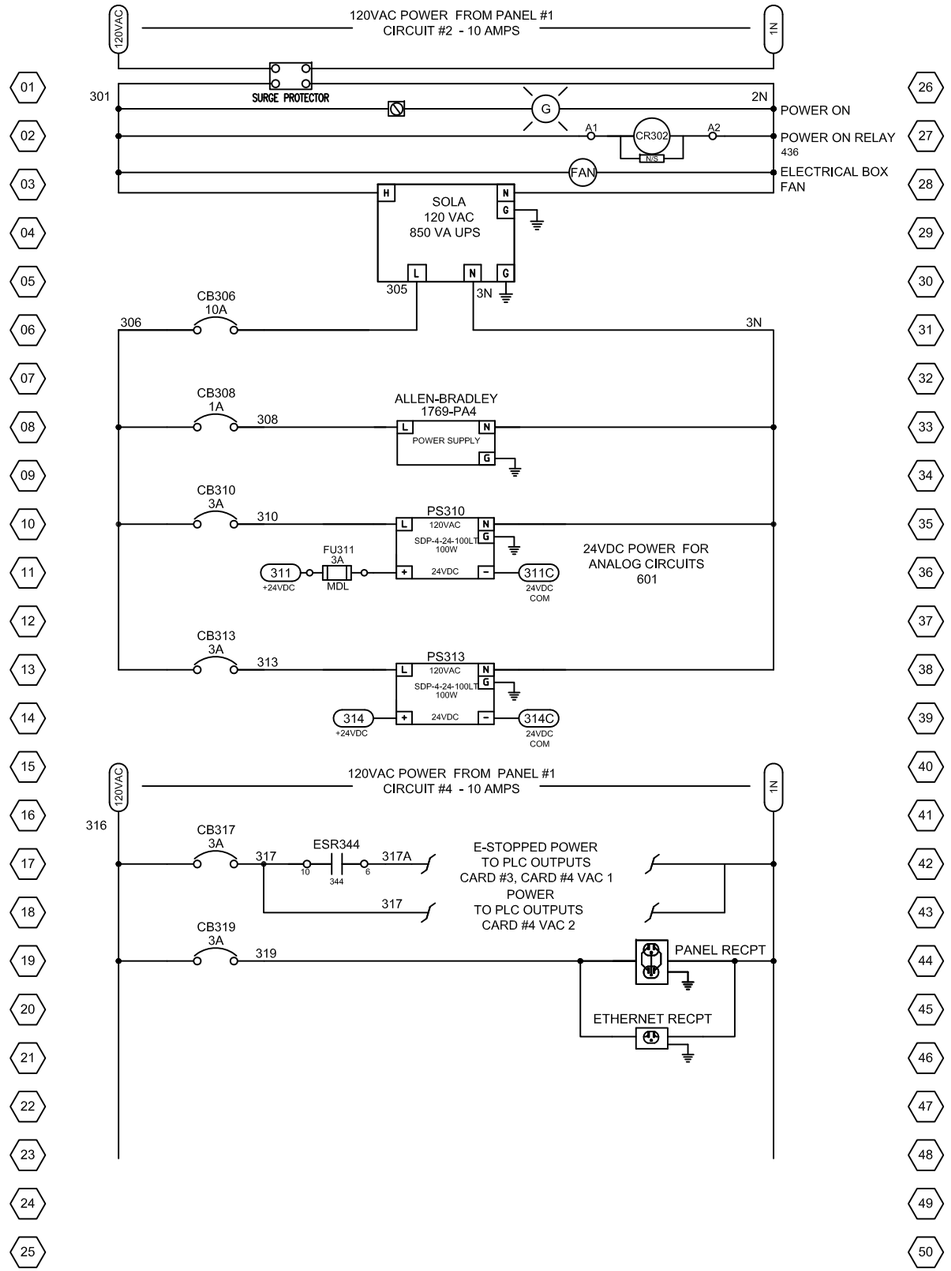
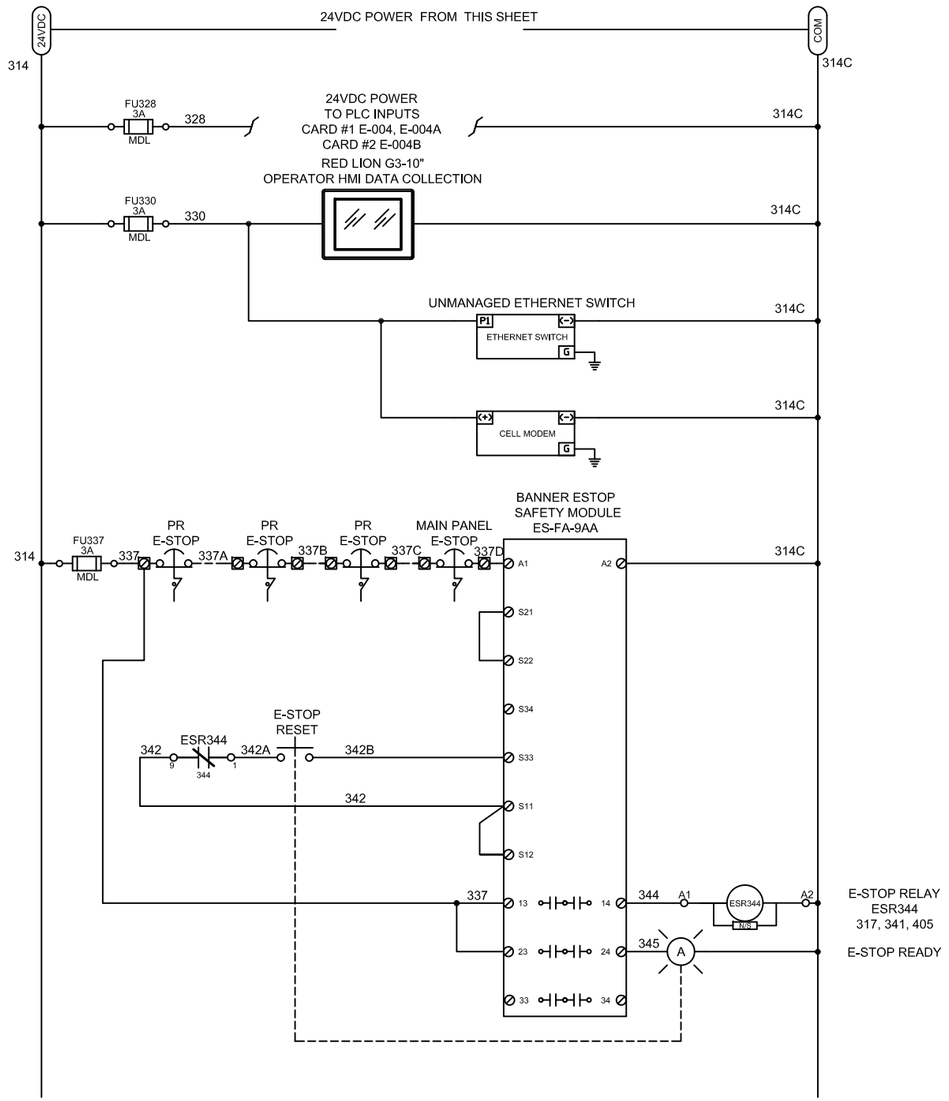
DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
480VAC POWER WIRING

DRAWING NO. E-002	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO





REV	DATE	DESCRIPTION	DRW	APPR
3	2/27/13	ADD CONTROL PANEL FAN CR344 TO ESR344	SMT	
2	1/17/13	ADD 2 E-STOPS, ADD SURGE SUPPRESSOR	SMT	

ProAct Services Corporation

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DUAL PHASE EXTRACTION SYSTEM
SUNNYSIDE YARD QUEENS, NEW YORK
120VAC POWER WIRING

DRAWING NO. E-003	SIZE B	SCALE	JOB NO. 1630	UNIT NO.	REV 3
CUSTOMER AMTRAK	MATERIAL		DRAWN BY STEVE TURNER	DATE 9/24/12	SHEET

NYCDEP Discharge Permit Limits

NYC Environmental Protection

Carter H. Strickland, Jr.
Commissioner

Vincent Sapienza
Deputy Commissioner
Bureau of Wastewater Treatment
vsapienza@dep.nyc.gov

96-05 Horace Harding Expressway
Corona, NY 11368
T: (718) 595-4906
F: (718) 595-6950

September 13, 2012

National Railroad Passenger
Corporation
400 West 31st Street, 4th Floor
New York, NY 10001
Attn: Richard Mohlenhoff

Re: Groundwater Discharge, Sunnyside Yard – OU-3 Remediation, File # C-5201

Dear Mr. Mohlenhoff:

This is in response to the July 30 and August 20, 2012 submissions, requesting for permission to discharge up to **28,800 gallons per day** (gpd) of groundwater generated during the remediation located at 39-29 Honeywell Street, Queens, NY 11101 (New York State Department of Environmental Conservation State Superfund Site #2-41-006). The groundwater will be treated through two 120 gallon knock-out tanks, one 200 gpm oil/water separator, 10 micron bag filters, two 1,000 lb organoclay units, two 1,000 lb carbon units, and one 4,000 gallon settling tank, per provided schematic and information, before discharging to an existing on-site manhole. The manhole leads to the existing 48" combined sewer that runs parallel and South of Northern Boulevard between Honeywell and 39th Streets in Queens, NY.

Based upon the information, schematic and analytical data submitted, you are hereby conditionally authorized, to discharge up to 28,800 gpd of groundwater, treated through the above system, per provided schematic and information, as specified in your submissions, **for a period of one year**, to the combined sewer at the above mentioned location. **This Letter of Approval shall expire at midnight on September 12, 2013.**

This conditional approval, however, is subject to your obtaining a groundwater discharge Approval, specifying allowable flow rates, from the Chief of Permitting and Compliance, Bureau of Water and Sewer Operations. You are also required to follow manufacturer specifications for the operation and maintenance of the selected equipment. **This Letter of Approval is contingent upon the permittee's compliance with any other Federal, State or Local laws applicable to the permitted activity.**

Payment shall be made to and permit obtained from the Bureau of Customer Service for groundwater discharge into the New York City Wastewater System in accordance with the Water and Wastewater Rate Schedule established by the New York City Water Board.

You must notify this section in writing prior to the commencement of discharge. In addition, you are required to hold the groundwater to the maximum extent practicable during heavy wet weather events. Refer to File # C-5201 in any correspondence to this office.

The permittee must collect samples of the groundwater after the pretreatment system in each month of the calendar year. The samples must be analyzed for the parameter(s) included in the attached chart by a New York State Department of Health certified laboratory. The results must be submitted to this office within 14 days after each sampling date. If the sampling results, or any other sampling results, exceed the DEP limits, the discharge must cease and the Bureau of Wastewater Treatment must be notified immediately by phone at (718) 595-4715 and by fax at (718) 595-4771.

You are prohibited from discharging any groundwater that exceeds the attached discharge limit(s), as well as those contained in Title 15 Rules of the City of New York Chapter 19.

This Letter of Approval is an Order of the Commissioner of the Department of Environmental Protection. Please be advised that failure to comply with this Letter of Approval may result in the issuance of Notices of Violation (returnable to the New York City Environmental Control Board) and/or revocation of the Letter of Approval. Notices of Violation carry penalties of up to $10,000 a day, per violation.

If you have any questions concerning this matter, please contact Sean Hulbert, Assistant Chemical Engineer, at (718) 595-4715.

Sincerely,

Frances Leung, P.E., Chief,
Industrial Inspections and
Permitting Section

enc: Sampling Requirements and Limitations

SAMPLING REQUIREMENTS AND LIMITATIONS

Parameter[1]	Daily Limit	Units	Sample Type	Monthly Limit
Non-polar material[2]	50	mg/l	Instantaneous	---
pH	5-12	SUs	Instantaneous	---
Temperature	< 150	Degree F	Instantaneous	---
Flash Point	> 140	Degree F	Instantaneous	---
Cadmium	2 0.69	mg/l mg/l	Instantaneous Composite	--- ---
Chromium (VI)	5	mg/l	Instantaneous	---
Copper	5	mg/l	Instantaneous	---
Lead	2	mg/l	Instantaneous	---
Mercury	0.05	mg/l	Instantaneous	---
Nickel	3	mg/l	Instantaneous	---
Zinc	5	mg/l	Instantaneous	---
Benzene	134	ppb	Instantaneous	57
Carbontetrachloride	---	---	Composite	---
Chloroform	---	---	Composite	---
1,4 Dichlorobenzene	---	---	Composite	---
Ethylbenzene	380	ppb	Instantaneous	142
MTBE (Methyl-Tert-Butyl-Ether)	50	ppb	Instantaneous	---
Naphthalene	47	ppb	Composite	19
Phenol	---	---	Composite	---
Tetrachloroethylene (Perc)	20	ppb	Instantaneous	---
Toluene	74	ppb	Instantaneous	28
1,2,4 Trichlorobenzene	---	---	Composite	---
1,1,1 Trichloroethane	---	---	Composite	---
Xylenes (Total)	74	ppb	Instantaneous	28
PCBs (Total)[3]	1	ppb	Composite	---
Total Suspended Solids (TSS)	350	mg/l	Instantaneous	---
CBOD[4]	---	---	Composite	---
Chloride[4]	---	---	Instantaneous	---
Total Nitrogen[4]	---	---	Composite	---
Total Solids[4]	---	---	Instantaneous	---
Other				

1 All handling and preservation of collected samples and laboratory analyses of samples shall be performed in accordance with 40 C.F.R. pt. 136. If 40 C.F.R. pt. 136 does not cover the pollutant in question, the handling, preservation, and analysis must be performed in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater." All analyses shall be performed using a detection level less than the lowest applicable regulatory discharge limit. If a parameter does not have a limit, then the detection level is defined as the least of the Practical Quantitation Limits identified in NYSDEC's Analytical Detectability and Quantitation Guidelines for Selected Environmental Parameters, December 1988.

2 Non-Polar Material shall mean that portion of the oil and grease that is not eliminated from a solution containing N–Hexane, or any other extraction solvent the EPA shall prescribe, by silica gel absorption.

3 Analysis for PCBs is required if ***both*** conditions listed below are met:
1) if proposed discharge ≥ 10,000 gpd;
2) if duration of a discharge > 10 days.
Analysis for PCBs must be done by EPA method 608 with MDL=<65 ppt. PCBs (total) is the sum of PCB-1242 (Arochlor 1242), PCB-1254 (Arochlor 1254), PCB-1221 (Arochlor 1221), PCB-1232 (Arochlor 1232), PCB-1248 (Arochlor 1248), PCB-1260 (Arochlor 1260) and PCB-1016 (Arochlor 1016).

4 Analysis for Carbonaceous Biochemical Oxygen Demand (CBOD), Chloride, Total Solids and Total Nitrogen are required if proposed discharge ≥ 10,000 gpd. Total Nitrogen = Total Kjeldahl Nitrogen (TKN) + Nitrite (NO_2) + Nitrate (NO_3).

ATTACHMENT

Miscellaneous Treatment System Components

(Provided on CD in Bound Copy)

ATTACHMENT

Miscellaneous Treatment System Components

(Provided on CD in Bound Copy)

PROACT SERVICES CORPORATION

Operation and Maintenance Manual

Job Number: 1630
Dual Phase Extraction Treatment System

Prepared For: Mr. Richard Mohlenhoff, PE
Director of Field Operations
EHS Department
Amtrak
400 West 31st Street
4th Floor
New York, NY 10001

Site: Amtrak Sunnyside Yard
Queeens, NY

© PROACT SERVICES CORPORATION
1140 Conrad Industrial Drive
Ludington, MI 49431
Phone 231.843.2711 • Fax 231.843.4081
www.proact-usa.com
3/22/2013 4:43 PM

Table of Contents

Introduction

Thank you for choosing ProAct Services for your Dual Phase Extraction treatment system. We know there are a lot of choices on the market today…and want to congratulate you for making the right choice! We at ProAct Services Corporation are confident in our products since they are designed and built to exceed customer expectations. We strive to be a "proactive" company that delivers the highest quality products and customer service.

This manual has been prepared to acquaint you with the operation and maintenance of your ProAct Environmental Treatment System, and to provide you with important safety information. It is important that you study the entire Manual. It will answer most of your questions about the system. If you require additional information or assistance, please contact ProAct Services Corporation

PROACT SERVICES CORPORATION
Phone 231.843.2711
www.proact-usa.com

This manual should be considered a permanent part of this system. It should stay with the system at all times

IMPORTANT NOTICE!

Safety Definitions

Statements in this manual preceded by the following words and graphics are of special significance:

WARNING indicates a potentially hazardous situation which if not avoided, could result in death or serious injury.

CAUTION indicates a potential situation which if not avoided, could result in equipment or property damage.

Note:
All information, illustrations, and specifications in this manual are based upon the latest product information available at the time of printing. We reserve the right to make changes at any time without notice.

1.0 Before Operating Your System

This system is designed to treat soil vapor contaminated with organic constituents. This section summarizes the hazards associated with using this remedial system, the basic operation and layout of the system, cold weather operation, and emergency shutdown procedures. ***It is very important to read this section first!***

1.1 Potential Hazards

Due to the nature of the soil vapors and groundwater contaminants, a variety of conditions may exist that could cause serious health and safety hazards.

⚠ WARNING

Please be careful and ask knowledgeable personnel if there are any doubts about what is or is not a hazard.

Vapors

This remediation system is treating organic compounds such as BTEX (BENZENE, TOLUENE, ETHYL BENZENE, AND XLENES) and chlorinated compounds which may be highly volatile organics. Vapors may become concentrated in the trailer and within system components.

⚠ WARNING

If vapors (gasoline type odor) are observed within the control room, the system should be shut down immediately.

Explosions

The presence BTEX or other organic constituents in high concentrations or free product form will increase the potential for explosions.

⚠ WARNING

No Smoking or open flame is allowed within or near the complete treatment system skid trailer.

High Pressure

There is always potential for high pressure leaks or breaks in the plumbing. It is common to observe system vacuum and pressure readings at 25Hg and 135 PSI during normal system operation.

⚠ WARNING

Do not adjust any valves or fittings without taking proper precautions.

Electricity

This treatment system contains high and low voltage components. All unqualified personnel should remain outside of the NFPA 70E Limited Approach Boundary of 42"

Limited Approach Boundary: 3'-6"
Restricted Approach Boundary: 1'
Prohibited Approach Boundary: 1"

CAUTION

The electrical system for this unit is configured for a specific power supply. Failure to connect the correct power will result in system damage

⚠ WARNING

Do not disassemble any electrical parts without properly securing the power. When in doubt…consult a professional.

Granular Activated Carbon

Activated carbon is capable of depleting oxygen supply.

⚠ WARNING

Proper ventilation precautions should be taken when servicing the carbon vessels or when any carbon is directly exposed to the atmosphere.

⚠ WARNING

Chemical-Impervious gloves, safety glasses, and protective clothing should be worn to avoid contact with contaminated liquids.

1.2 System Power

This system requires power from an external source to operate; it is not equipped with a generator. In addition, the treatment system can be configured to accept more than one type of power supply with slight modification. *See Section 3.1 for connecting the remediation system power.*

CAUTION

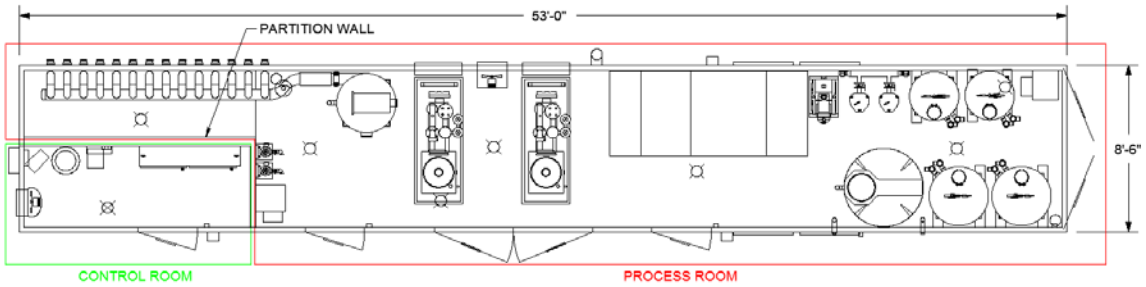
The electrical system for this unit is configured for a specific power supply. Failure to connect the correct power to the remediation system will result in substantial damage

1.3 System Layout

ProAct Services Corporation installed the Dual Phase Extraction System in a 53' x 8'- 6" trailer which allows the system to be readily mobile.

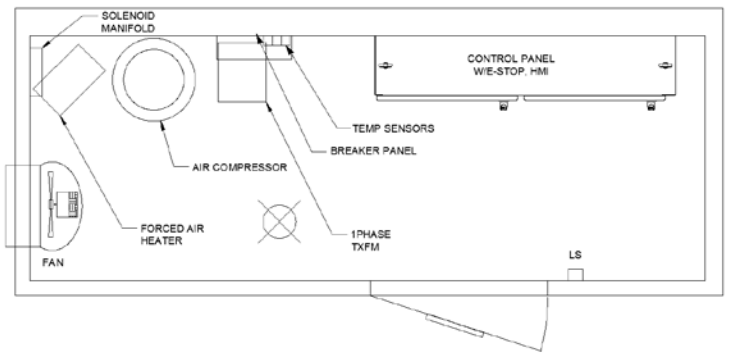
Layout

The inside of the treatment system is divided into two sections called the "process room" and the "control room" (the two rooms are separated by a partition wall). The process room is where the DPE system components have been placed, and all equipment in this room meets explosion proof standards (Class 1 Div. 2). The small room in the front of the trailer houses the electrical circuit panels, system control panel (including the Program Logic Controller). This room is referred to as the "control" room. This room is unclassified and any electrical signal from the control room entering the process room is intrinsically safe.



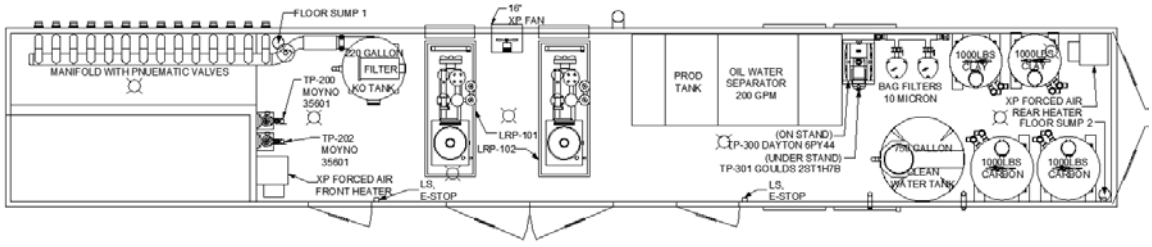
The following is a list of major components located in the control room:

- 15 KVA Transformer
- Control Panel
- Emergency Shut Down (ESD) Pushbutton
- Touch Screen HMI Interface
- Breaker Panel
- Program Logic Controller (PLC)
- 3.0 KW Forced Air Heater and Exhaust Fan
- Air Compressor and Solenoid Manifold
- Pressure Transducer and Gauge
- Lights
- Ventilation Shutters



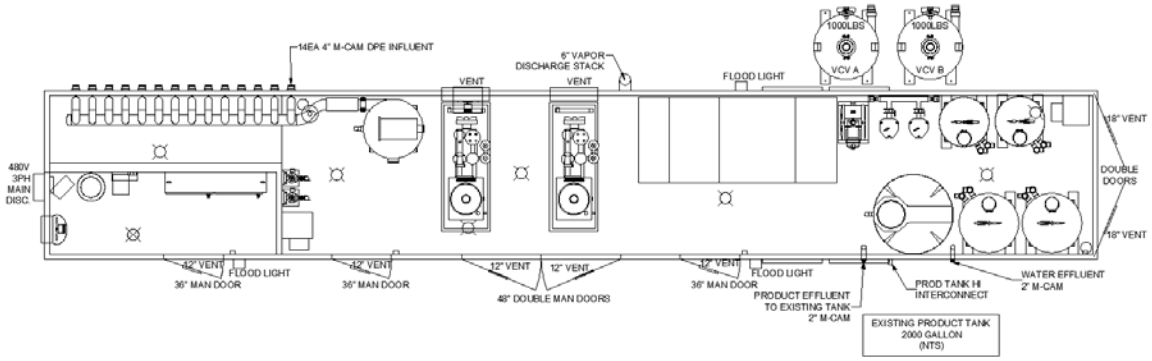
The following is a list of major components located in the process room:

- Liquid Ring Pumps (LRP-101, LRP-102) 40 HP
- Progressive Cavity Transfer Pumps (TP-200, TP-202)
- Diaphragm Pump (TP-300)
- Centrifugal Transfer Pump (TP-301)
- 6 Inch manifold Header with Fourteen-Four Inch Manifold Strings
- Knock Out Tank
- Oil Water Separator
- Bag Filters
- 1000 lb. Liquid Clay Media Vessels
- 1000 lb. Liquid Carbon Media Vessels
- 750 Gallon Clean Water Poly Tank
- Emergency Shut Down Pushbuttons
- Forced Air Heaters 7.5KW (Front and Rear)
- Exhaust Fan
- Floor Sumps
- Level and Temperature Switches,
- Gauges, Flow Meters, and Automated Valves
- Vacuum, Pressure, and Differential Pressure Transducers
- Light Switch and Lights



This system was also designed to be externally functional. In order to meet the requirement, the following components have been installed on the outside of the trailer:

- 480 Volt 3 Phase Main Disconnect
- Exterior Flood Lights
- LRP Ventilation Shutters
- Doors and Door Ventilation Shutters
- Fourteen DPE Influent Well Connections (4" male cam-lock)
- Vapor Discharge Connection (6" flange)
- Water Discharge Connection (2" male cam-lock)
- Product Discharge Connection (2" male cam-lock)
- Product Tank Float Switch Interconnect Box
- 1000 lb. Vapor Carbon Vessels



1.4 System Operation

The following section is a basic description of the control interface and system operation from the standpoint of how water and vapor enters, progresses, and exits the remediation system.

Basic System Control

The control panel is the main control interface "or driver's seat" for the operation and control of the treatment system. The following items are located on the control panel:

- PLC (Program Logic Controller)
- Touch Screen PLC HMI Interface
- Process Room Fan (HAND - OFF - AUTO) Selector Switch
- Control Room Fan (HAND - OFF - AUTO) Selector Switch
- Emergency Shut Down (ESD) Button
- Emergency Stop Reset Button
- Emergency Stop Ready 'Amber' Indicator LED
- Power 'Green' Indicator LED
- System Alarm 'Red' Indicator LED
- System Alarm Clear 'Green' Indicator LED

The PLC works in combination with the Touch Screen Interface. Each of the Liquid Ring Pumps, Transfer Pumps, or Actuator Valves can be independently set to (HAND-OFF-AUTO) 3 position modes for system control on the Touch Screen Interface *(See section 2.1 for detailed interface controls).* Also, inputs from various vacuum, pressure, and differential pressure transducers, float and temperature switches, and flow meters are used to actively monitor and control the treatment system. The control panel switches include (2) H-O-A (HAND-OFF-AUTO) 3 position switches for the control room and process room fans. The PLC will trip an alarm (fault) and shutdown any malfunctioning component(s) or the entire treatment system if necessary. In an emergency, pushing the ESD on the control panel box will shut down the entire system. A reset pushbutton is used to reset the Emergency stop.

Basic System Operation

DPE (Dual Phase Extraction)

Contaminated soil vapors "wet gases" are extracted from wells through a manifold string that consists of fourteen 4" DPE well intakes into a 220 gallon Knock-Out Tank. The contaminated water and vapor that enter the Knock-Out Tank follow separate paths as they pass through the treatment system.

The contaminated vapor that enters the Knock-Out Tank passes through a particulate filter and into a manifold that enters two Travaini TRO600V-1A-XP Liquid Ring Pumps (LRP-101 & LRP-102) each rated at 40 HP. Each LRP string contains a totalizing vapor flow meter. After each LRP, the vapor flow is directed through another manifold and the vapor exits the trailer through a 6" flanged connection. Outside of the treatment trailer the vapors enter two Vapor Carbon Vessels in series for additional treatment. The remaining vapor is discharged to atmosphere through a plumbing stack on top of the last Vapor Carbon Vessels.

The water that collects inside Knock-Out Tank will gravity feed through a Y-Strainer and into the Moyno 35601 progressive cavity Transfer Pumps (TP-200 & TP-202). Each progressive cavity Transfer Pump displaces the Knock-Out Tank water into the Oil Water Separator.

The contaminated water/oil mixture is separated within the Oil Water Separator. The Grainger 6PY44 Transfer Diaphragm Pump (TP-300) removes the oil product from the Oil Water Separator. The product is pushed and passes through a totalizing liquid flow meter and then is discharged effluent of the trailer before it enters the Product Storage Tank. Centrifugal Transfer Pump (TP-301) Goulds 2ST1H7B, transfers water out of the Oil Water Separator. TP-301 pushes water through the Bag Filters, Liquid Clay Vessels, Liquid Carbon Vessels, through a totalizing liquid flow meter, and into a 750 gallon Treated Water Poly Tank. The water that collects inside of the 750 gallon Treated Water Poly Tank is manually gravity drained effluent of the trailer.

1.5 Cold Weather Operation

Warning for cold weather operation…

Water can accumulate within the storage tanks, transfer pumps, and system plumbing. If this water freezes then damage to the system will most likely occur.

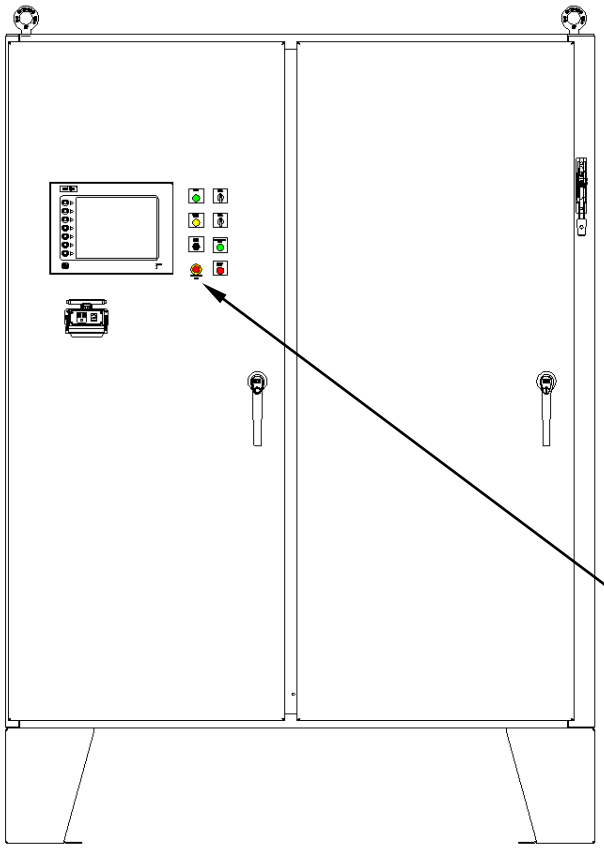
CAUTION

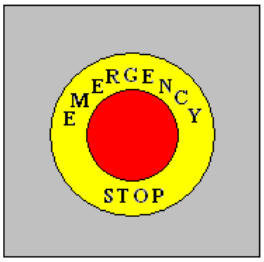
When operating the system in outside air temperatures (OAT) less than 32ºF (0ºC), the system must be protected from freezing if a power failure or extended shutdown occurs. Failure to do so will result in equipment damage

1.6 Emergency Shut-Down Procedure

If an emergency or unsafe condition exists (i.e., Fire, Flooding, etc) the water treatment system may be shut down by pushing "IN" the RED Emergency Shut Down (ESD) button located on the system control panel, or any of three inside the trailer process room.

It is important to become familiar with the location of the Emergency Shut Down buttons before operating your system





Emergency Stop Button
(SWITCH MUST BE "ON"
BEFORE SYSTEM WILL RUN)

Emergency Shut Down (ESD)
"PUSH IN TO SHUT SYSTEM DOWN"

Procedures for Emergency Shutdown

Control Panel

1. **Push "IN" Emergency Shut Down button**
2. **If possible, turn "OFF" the main power disconnect switch**
3. **Contact the appropriate emergency response personnel**

Trailer Process Room

1. **Push "IN" Emergency Shut Down button**
2. **If possible, turn "OFF" the main power disconnect switch**
3. **Contact the appropriate emergency response personnel**

1.7 Towing

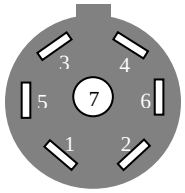
The tow vehicle and trailer must be correctly matched for safe towing. It's essential that the tow vehicle can handle the trailer Gross Vehicle Weight Rating (GVWR). It is also very important that the tongue weight of the trailer does not exceed the hitch weight carrying capacity of the tow vehicle.

Trailer Hitch Requirements

Item	Minimum Recommended
Tow Vehicle Hitch	Class V (weight carrying type)
Ball Mount	Class V
Hitch Ball	Class V – 2 5/16„
Vehicle Wiring	7- way connector type
Trailer Brake Control	Electric

Electric Brake Requirements

Since the trailer is equipped with electric brakes, the tow vehicle must have the proper electronic trailer brake control installed. In addition, the tow unit must accept a 7 way wire connector. The diagram below shows the wiring schematic for the trailer's 7-way connector.



1. Ground
2. Brakes
3. Running Lights
4. Hot Line
5. Left Turn
6. Right Turn
7. Auxiliary

Synchronize Trailer Brakes

Synchronize the trailer brakes with the tow vehicle brakes prior to towing. The trailer brakes are designed to stop only the trailer. Improper synchronization between the trailer and tow vehicle brakes can overload the brakes and generate excessive heat and subsequent brake fade or failure. Brake synchronization is accomplished by adjusting the brake controller in the tow vehicle (see manufacturer's specifications).

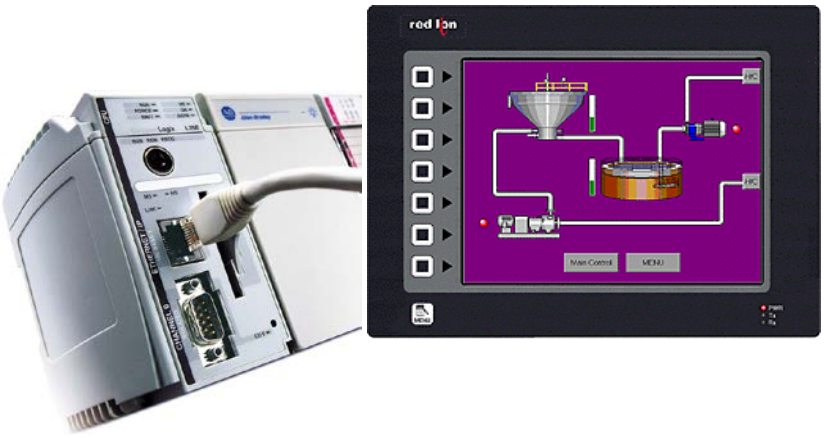
⚠ WARNING

Before towing, reconfirm that the trailer is properly connected to the tow vehicle, and be sure to properly secure the trailer safety chains to the tow vehicle hitch. Always perform a road test before exceeding 25 MPH.

2.0 System Components Description

This section describes the operating characteristics of each major component in the system in greater detail. A user that has a better understanding of the overall operation will be more effective in troubleshooting if the need arises. It is important for the user to understand that this "system" is a collection of smaller systems working simultaneously, and a failure of one system (or component) may shut down additional systems.

2.1 Allen Bradley CompactLogix & Red Lion Touchscreen



Description

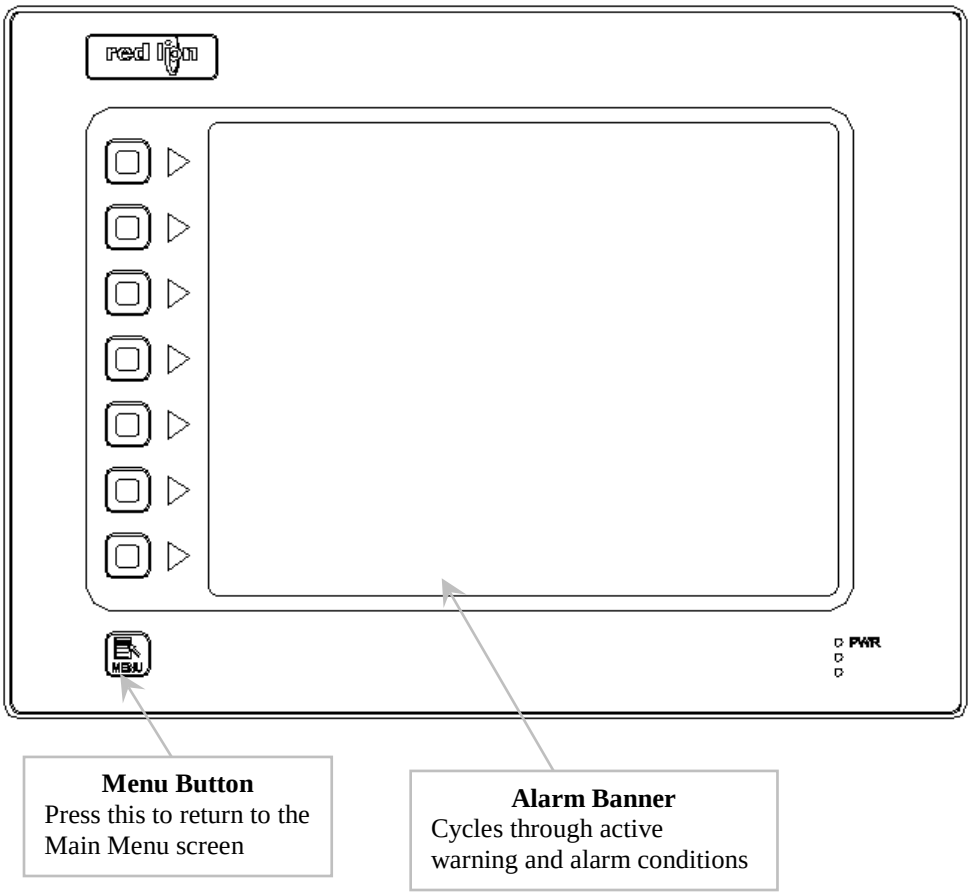
This system is equipped with a PLC (Program Logic Controller) manufactured by Allen Bradley and combined with a Red Lion 10" touchscreen. This combination can perform many simultaneous tasks that include system operations, remote access, email alarming, and data logging. These components communicate over Ethernet.

Touchscreen

The touchscreen is the HMI (Human – Machine Interface) for the treatment system. The touchscreen communicates with the PLC through Ethernet. This allows the user to control system components, view analog and discrete feedback, adjust setpoints, and view a simplified system layout. The HMI also has a webserver feature that allows for remote access.

Main Menu Screen

The main/startup screen for the system displays all of the other pages included in the HMI. Pressing the MENU button in the lower left corner at any time will return the touchscreen to the Main Menu screen. The green buttons will display system flow and conditions for different sections of the system. There is an alarm banner at the bottom of each screen and it cycles through active warnings and alarms.



HMI Touch screen Pages/Buttons

1. **Main Menu**
2. **DPE Valves 1-5**
3. **DPE Valves 6-9**
4. **DPE Valves 10-14**
5. **KO Tank-TP-200-TP-202**
6. **OWS/TP-300**
7. **TP-301/Bag Filters/Clay Vessels**
8. **Carbon Vessel/Treated Water**
9. **LRP-101/102**
10. **Current Runtimes and Flow Totals**
11. **ACC Runtimes and Flow Totals**
12. **Mode Select**
13. **Trend Select**
14. **System Setup** (**See Section 3.2**)
15. **Alarms**

DPE Valve Screens

These three screens display the influent manifold strings 1 through 14. Each Automated Valve can be set to operate by time of day or open/closed by touching any AV on the touchscreen. The vacuum pressure is monitored on each well string.

Displayed Data (Realtime)	Description
DPE Valves 1-5	
AV1 Status	Automated Valve 1 Open/Closed Status
AV2 Status	Automated Valve 2 Open/Closed Status
AV3 Status	Automated Valve 3 Open/Closed Status
AV4 Status	Automated Valve 4 Open/Closed Status
AV5 Status	Automated Valve 5 Open/Closed Status
VT1 Measurement	Vacuum Transducer 1 IHG Reading
VT2 Measurement	Vacuum Transducer 2 IHG Reading
VT3 Measurement	Vacuum Transducer 3 IHG Reading
VT4 Measurement	Vacuum Transducer 4 IHG Reading
VT5 Measurement	Vacuum Transducer 5 IHG Reading
DPE Valves 6-9	
AV6 Status	Automated Valve 6 Open/Closed Status
AV7 Status	Automated Valve 7 Open/Closed Status
AV8 Status	Automated Valve 8 Open/Closed Status
AV9 Status	Automated Valve 9 Open/Closed Status
VT6 Measurement	Vacuum Transducer 6 IHG Reading
VT7 Measurement	Vacuum Transducer 7 IHG Reading
VT8 Measurement	Vacuum Transducer 8 IHG Reading
VT9 Measurement	Vacuum Transducer 9 IHG Reading
DPE Valves 10-14	
AV10 Status	Automated Valve 10 Open/Closed Status
AV11 Status	Automated Valve 11 Open/Closed Status
AV12 Status	Automated Valve 12 Open/Closed Status
AV13 Status	Automated Valve 13 Open/Closed Status
AV14 Status	Automated Valve 14 Open/Closed Status
VT10 Measurement	Vacuum Transducer 10 IHG Reading
VT11 Measurement	Vacuum Transducer 11 IHG Reading
VT12 Measurement	Vacuum Transducer 12 IHG Reading
VT13 Measurement	Vacuum Transducer 13 IHG Reading
VT14 Measurement	Vacuum Transducer 14 IHG Reading

KO Tank-TP-200-TP-202 Screen

This screen displays the soil vapor influent to the system provided by vacuum from both of the Liquid Ring Pumps. The soil vapors enter the Knock Out Tank where the vapors and liquids are separated. The vapors flow toward the Liquid Ring Pumps 101 & 102, while the liquids are pumped by Transfer Pumps 200 & 202 toward the Oil Water Separator.

Displayed Data (Realtime)	Description
TP-200 Operation Mode	Transfer Pump 200 HAND-OFF-AUTO Operation Mode
TP-202 Operation Mode	Transfer Pump 202 HAND-OFF-AUTO Operation Mode
DPT1 Measurement	Differential Pressure Transducer 1 IWC Reading
VT15 Measurement	Vacuum Transducer 15 IHG Reading
LSL1	Knock Out Tank Level Float Switch 1 Low Activated
LSH2	Knock Out Tank Level Float Switch 2 High Activated
LSHH3	Knock Out Tank Level Float Switch 3 High High Activated
LSHHH4	Knock Out Tank Level Float Switch 4 High High High Activated
LSH17	Floor Sump 1 Level Float Switch 17 High Activated

OWS/TP-300 Screen

Liquids effluent of the Transfer Pumps 200 & 202 is displayed on this screen entering the Oil water Separator. Product collects in the product chamber and the water passes through the weir inside of the Oil Water Separator. Transfer Pump 300 pumps product out of the Oil Water Separator chamber and into an external Product Tank.

Displayed Data (Realtime)	Description
TP-300 Operation Mode	Transfer Pump 300 HAND-OFF-AUTO Operation Mode
PT4 Measurement	Pressure Transducer 4 PSI Reading
PT5 Measurement	Pressure Transducer 5 PSI Reading
FT3 Measurement	Flow Transducer 3 GPM Reading
LSL9	Oil Water Separator Level Float Switch 9 Low Activated
LSH10	Oil Water Separator Level Float Switch 10 High Activated
LSHH11	Oil Water Separator Level Float Switch 11 High High Activated
LSL12	Oil Water Separator Product Level Float Switch 12 Low Activated
LSH13	Oil Water Separator Product Level Float Switch 13 High Activated
LSHH14	Oil Water Separator Product Level Float Switch 14 High High Activated
LSHH15	External Product Tank Level Float Switch 15 High High Activated

TP-301/Bag Filters/Clay Vessels

This screen displays effluent water from the Oil water Separator. Transfer Pump 301 pushes water through the Bag Filters and Liquid Clay Vessels.

Displayed Data (Realtime)	Description
TP-301 Operation Mode	Transfer Pump 301 HAND-OFF-AUTO Operation Mode
DPT2 Measurement	Differential Pressure Transducer 2 PSID Reading
PT6 Measurement	Pressure Transducer 6 PSI Reading
PT7 Measurement	Pressure Transducer 7 PSI Reading
PT8 Measurement	Pressure Transducer 8 PSI Reading

Carbon Vessel/Treated Water

This screen is a continuation of the TP-301/Bag Filters/Clay Vessels screen displaying effluent water from the Oil water Separator. Pressurized water from Transfer Pump 301 displaces water through the Liquid Carbon Vessels before entering the Treated Water Tank. The control room Air Compressor is also displayed on this screen.

Displayed Data (Realtime)	Description
PT9 Measurement	Pressure Transducer 9 PSI Reading
PT10 Measurement	Pressure Transducer 10 PSI Reading
PT11 Measurement	Pressure Transducer 11 PSI Reading
PT12 Measurement	Pressure Transducer 12 PSI Reading
FT4 Measurement	Flow Transducer 4 GPM Reading
LSHH16	Treated Water Tank Level Float Switch 16 High High Activated
LSH18	Floor Sump 2 Level Float Switch 18 High Activated

LRP-101/102

This screen displays the vapors after passing through the Knock-Out Tank and entering both Liquid Ring Pumps. The vapors are discharged effluent of the trailer for further treatment by the Vapor Carbon Vessels.

Displayed Data (Realtime)	Description
LRP-101 Operation Mode	Liquid Ring Pump 101 HAND-OFF-AUTO Operation Mode
LRP-102 Operation Mode	Liquid Ring Pump 102 HAND-OFF-AUTO Operation Mode
FT1 Measurement	Flow Transducer 1 SCFM Reading
FT2 Measurement	Flow Transducer 2 SCFM Reading
VT16 Measurement	Vacuum Transducer 16 IHG Reading
VT17 Measurement	Vacuum Transducer 17 IHG Reading
PT1 Measurement	Pressure Transducer 1 IWC Reading
PT2 Measurement	Pressure Transducer 2 IWC Reading
PT3 Measurement	Pressure Transducer 3 IWC Reading

Current & Previous Run Times Screen

The run times of all of the major components are displayed on this screen. Motor run hours and flow meter totals are monitored by the HMI daily and monthly.

ACC Run Times and Flow Totals Screen

The accumulated and trip run time hours of all of the major components are displayed on this screen. Motor run hours and flow meter totals are monitored by the HMI. The blue reset buttons will reset the totalized hours of operation.

Mode Select Screen

This screen is where you change the operational mode of the major motor operated components to HAND-OFF-AUTO. Components in HAND mode will run with an alarm condition present. Components in AUTO mode will operate until an alarm exists and this will shut down the motor. The individual screens that display each motor can be operated in HAND-OFF-AUTO on each specific screen by touching the component.

Trend Menu Screen

These ten screens display a Graphical User Interface (GUI) of the transducers in the system controls. The readings of pressure, differential pressure, vacuum, and flow are continuously monitored and updated. All transducer data can be observed over a period of time.

Alarm Screen

This screen shows all active warnings and alarms. Warnings will clear on their own and do not require anything more than the removal of the abnormal condition. Alarms shutdown a portion or the entire system and require the ALARM RESET button to be pressed before they will clear. A list of the warnings and alarms can be found in **Section 4.1**

2.2 Liquid Ring Pumps (LRP-101, LRP-102)

The Liquid Ring Pumps (LRP) are the core of the Dual Phase Extraction system. They are rotating "positive displacement" vacuum pumps that generates suction at the DPE well points. Each LRP is capable of extracting particle filled soil vapors and water reliably and continuously with very little maintenance.

In this system, the LRP pulls contaminated soil vapors through the well into a manifold that connects directly to a Knock-Out Tank. Water pulled into the Knock-Out Tank flows into the progressive cavity Transfer Pumps, while the vapors pass through a particulate filter and into both of the LRPs. After the LRPs, the vapor passes effluent of the treatment trailer and through two Vapor Carbon Vessels.

The operation of the LRP-101 is monitored by the system PLC. The LRP-101 has 3 modes that can be selected using the touchscreen on the control panel. Descriptions of the 3 modes are as follows:

Liquid Ring Pump 101 Operations

Mode	RUN	STOPS WHEN
HAND	CONTINUOUS	• AFTER 10 MINUTES
OFF	NEVER	
AUTO	CONTINUOUS	• LRP-101 mode is turned to the "OFF" position • LRP-101 discharge pressure transducer (PT-1) is high • LRP combined discharge pressure transducer (PT-3) is high • Knock-Out Tank level switch high high high (LSHHH-4) is activated • Knock-Out Tank filter differential pressure (DPT-1) is high • Knock-Out Tank vacuum (VT-15) is high or low • LRP-101 vacuum (VT-16) is high or low • LRP-101 oil level switch low (LSL-5) is activated • LRP-101 oil level switch high (LSH-6) is activated • LRP-101 oil temperature switch high (TSH-1) is activated • Floor Sump 1 level switch high (LSH-17) is activated • Floor Sump 2 level switch high (LSH-18) is activated • LRP-101 motor electrical overload is tripped • System power has been interrupted • Emergency shut-down button was pushed IN

The operation of the LRP-102 is monitored by the system PLC. The LRP-102 has 3 modes that can be selected using the touchscreen on the control panel. Descriptions of the 3 modes are as follows:

Liquid Ring Pump 102 Operations

Mode	RUN	STOPS WHEN
HAND	CONTINUOUS	• AFTER 10 MINUTES
OFF	NEVER	
AUTO	CONTINUOUS	• LRP-102 mode is turned to the "OFF" position • LRP-102 discharge pressure transducer (PT-2) is high • LRP combined discharge pressure transducer (PT-3) is high • Knock-Out Tank level switch high high high (LSHHH-4) is activated • Knock-Out Tank filter differential pressure (DPT-1) is high • Knock-Out Tank vacuum (VT-15) is high or low • LRP-102 vacuum (VT-17) is high or low • LRP-102 oil level switch low (LSL-7) is activated • LRP-102 oil level switch high (LSH-8) is activated • LRP-102 oil temperature switch high (TSH-2) is activated • Floor Sump 1 level switch high (LSH-17) is activated • Floor Sump 2 level switch high (LSH-18) is activated • LRP-102 motor electrical overload is tripped • System power has been interrupted • Emergency shut-down button was pushed IN

2.3 Knock-Out Tank

This DPE system is equipped with one 220 gallon Knock-Out Tank.

Knock-Out Tank

Soil vapor and water that initially enter this remediation system begin their processing in the Knock-Out Tank. The water and vapor is separated since they follow separate paths through the system (It is important to protect the LRP from ingesting water). The water collected in the Knock-Out Tank gravity feeds into TP-200 and TP-202. The vapors are directed out of the top of the Knock-Out Tank to the LRPs. See the table below for a description of the Knock-Out Tank float level logic.

Knock-Out Tank Level Float Switch Logic

Float Position	System Response
Water Level = LO (LSL-1)	PLC shuts down TP-200 and TP-202
Water Level = HI (LSH-2)	PLC turns TP-200 or TP-202 ON in Cycles
Water Level = HI HI (LSHH-3)	PLC turns TP-200 and TP-202 ON
Water Level = HI HI HI (LSHHH-4)	PLC shuts down LRP-101, LRP-102

Knock-Out Tank Filter

The L-style inlet vacuum filter is mounted on the top of the Knock-Out Tank. The vapors that exit the Knockout Tank flow into the filter. This filter is used to remove contaminants from the vapors before entering the LRPs. The filter is equipped with a differential pressure transmitter to monitor the clean pressure drop. See the table below for a description of the differential pressure transmitter logic.

Differential Pressure Transmitter 1

SETPOINTS	OPERATIONS
High Alarm Setpoint	Shuts down LRP-101 and LRP-102

2.4 Vapor Carbon Vessels

This system is equipped with dual 1000lb Vapor Carbon Adsorption (GAC) tanks used to remove additional contaminants from the soil vapor.

Vapor Carbon Adsorber Tanks

The Liquid Ring Pumps push the soil vapor outside of the treatment trailer and into the bottom of the first carbon vessel. The vapor is then forced up through the carbon and ejected out the top of the first tank and into the bottom of the second. Next, the vapor is forced up through the carbon in the second tank and discharged out the stack (mounted on the top of the second tank).

The dual carbon tank system allows for lower pressure drops, and provides continuous operation since one side can be serviced while the other is still functioning.

⚠ WARNING

Proper ventilation precautions should be taken when servicing the carbon vessels or when any carbon is directly exposed to the atmosphere.

2.5 Transfer Pumps

There are 4 transfer pumps that are utilized to transfer water and product through and to exit the remediation system. The operation of each transfer pump is monitored and controlled by the system PLC, and have 3 modes of operation that can be selected on the system control panel.

Transfer Pump 200 (TP-200)

TP-200 is a progressive cavity pump that is gravity fed by the water that collects in the Knock-Out Tank. The operation of TP-200 is monitored by the system PLC. TP-200 has 3 modes that can be selected using the touchscreen on the control panel. Descriptions of the 3 modes are as follows:

Transfer Pump 200 Operations

Mode	RUNS WHEN	STOPS WHEN
HAND	CONTINUOUS	• AFTER 10 MINUTES
OFF	NEVER	
AUTO	Knock out tank HI float switch is activated (LSH-2) (TP-200 and TP-202 alternate operation based on the Knock-Out Tank HI float activation) or Knock out tank HI HI float switch is activated (LSHH-3) (TP-200 and TP-202 both operate based on the Knock-Out Tank HI HI float activation)	• TP-200 mode is turned to the "OFF" position • Knock-Out Tank Lo float switch is deactivated (LSL-1) • TP-200 effluent pressure (PT-4) is low or high • Oil Water Separator level switch high high (LSHH-11) is activated • Oil Water Separator product level switch high high (LSHH-14) is activated • Floor Sump 1 level switch high (LSH-17) is activated • Floor Sump 2 level switch high (LSH-18) is activated • TP-200 motor electrical overload is tripped • System power has been interrupted • Emergency shut-down button was pushed IN

Transfer Pump 202 (TP-202)

TP-202 is a progressive cavity pump that is gravity fed by the water that collects in the Knock-Out Tank. The operation of TP-202 is monitored by the system PLC. TP-202 has 3 modes that can be selected using the touchscreen on the control panel. Descriptions of the 3 modes are as follows:

Transfer Pump 202 Operations

Mode	RUNS WHEN	STOPS WHEN
HAND	CONTINUOUS	• AFTER 10 MINUTES
OFF	NEVER	
AUTO	Knock out tank HI float switch is activated (LSH-2) (TP-202 and TP-200 alternate operation based on the Knock-Out Tank HI float activation) or Knock out tank HI HI float switch is activated (LSHH-3) (TP-202 and TP-200 both operate based on the Knock-Out Tank HI HI float activation)	• TP-202 mode is turned to the "OFF" position • Knock-Out Tank Lo float switch is deactivated (LSL-1) • TP-202 effluent pressure (PT-5) is low or high • Oil Water Separator level switch high high (LSHH-11) is activated • Oil Water Separator product level switch high high (LSHH-14) is activated • Floor Sump 1 level switch high (LSH-17) is activated • Floor Sump 2 level switch high (LSH-18) is activated • TP-202 motor electrical overload is tripped • System power has been interrupted • Emergency shut-down button was pushed IN

Transfer Pumps 300 (TP-300)

TP-300 is a pneumatic operated diaphragm pump used to remove product that collects within the Oil Water Separator. TP-300 pumps the product through a totalizing flow meter, effluent of the treatment trailer, and into an existing 2000 gallon Product Tank. The operation of TP-300 is monitored by the system PLC. TP-300 has 3 modes that can be selected using the touchscreen on the control panel. Descriptions of the 3 modes are as follows:

Transfer Pump 300 Operations

Mode	RUN	STOPS WHEN
HAND	CONTINUOUS	• AFTER 10 MINUTES
OFF	NEVER	
AUTO	Oil Water Separator HI product float switch is activated (LSH-13)	• TP-300 mode is turned to the "OFF" position • Oil Water Separator LO product float switch is deactivated (LSL-12) • Product Tank level switch high high (LSHH-15) is activated • System power has been interrupted • Emergency shut-down button was pushed IN

Transfer Pump 301 (TP-301)

TP-301 is a centrifugal pump used to deliver water out of the Oil Water Separator and through the remaining filtration components. TP-301 pushes water through the Bag Filters, Liquid Clay Vessels, Liquid Carbon Vessels, through a totalizing liquid flow meter, and into a 750 gallon Treated Water Poly Tank. The water that collects inside of the 750 gallon Treated Water Poly Tank is manually gravity drained effluent of the trailer. The operation of TP-301 is monitored by the system PLC. TP-301 has 3 modes that can be selected using the touchscreen on the control panel. Descriptions of the 3 modes are as follows:

Transfer Pump 301 Operations

Mode	RUNS WHEN	STOPS WHEN
HAND	CONTINUOUS	• AFTER 10 MINUTES
OFF	NEVER	
AUTO	Oil Water Separator HI float switch is activated (LSH-10)	• TP-301 mode is turned to the "OFF" position • Oil Water Separator LO float switch is deactivated (LSL-9) • TP-301 effluent pressure (PT-6) is low or high • Pre-Clay Vessel pressure (PT-7) is high • Mid-Clay Vessel pressure (PT-8) is high • Pre-Carbon Vessel pressure (PT-9) is high • Mid-Carbon Vessel pressure (PT-10) is high • Discharge pressure (PT-11) is high • Bag Filter differential pressure (DPT-2) is high • Clean Water Tank level switch high (LSH-16) is activated • TP-301 motor electrical overload is tripped • System power has been interrupted • Emergency shut-down button was pushed IN

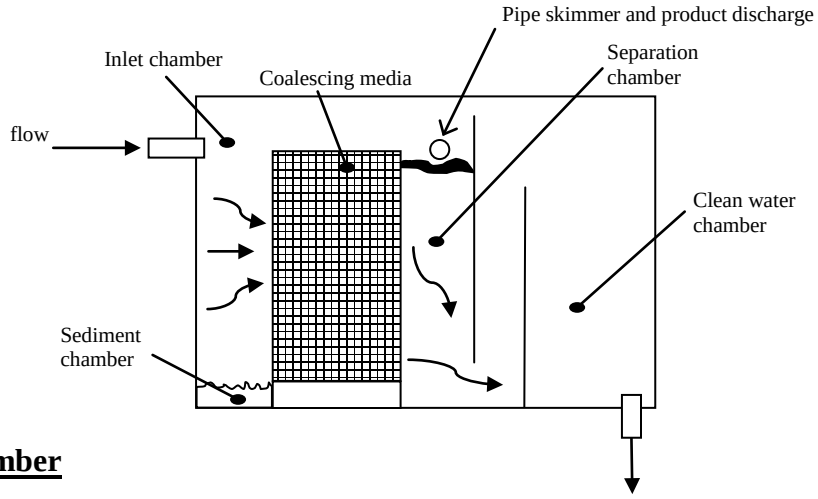
2.6 Oil Water Separator

The oil-water separator is designed to remove all free and dispersed non-emulsified oil and various settled solids from the water. The oil water separator is a gravity displacement type unit comprised of an inlet chamber, sludge chamber, separation chamber, and clean water output chamber.

Oil –Water Separator

Water from the wells are pumped by TP-200 and TP-202 into the oil water separator inlet chamber where the turbulence water is calmed and the solid particles begin to settle. Then the oily water flows through coalescing media where two things happen. First, additional solids are trapped in the media and settle into the sludge baffle, and secondly, the media (plates) intercept tiny oil droplets and combine (coalesce) them with additional tiny droplets to create a large droplet that readily rises to the surface of the separation chamber. The larger oil droplets are then trapped behind the oil retention weir. The remaining water then passes the underflow and overflow weir into the clean water chamber and discharges into the holding tank.

Gravity Displacement Oil Water Separator



Water Chamber

The main function of the water chamber is to serve as a liquid level indication for the oil-water separator.
The water chamber has a 3 level float system (LO, HI, HI HI), and each position is continuously monitored by the system PLC for overall system management. See the table below for a description of the oil water separator level logic.

Oil Water Separator Float Level Logic

Float Position	System Response
Water Level = LO (LSL-9)	PLC shuts down TP-301
Water Level = HI (LSH-10)	PLC turns TP-301 ON
Water Level = HI HI (LSHH-11)	PLC shuts down TP-200 and TP-202

Product Chamber

The main function of the product chamber is to serve as a liquid level indication for the oil-water separator product that collects.
The product chamber has a 3 level float system (LO, HI, HI HI), and each position is continuously monitored by the system PLC for overall system management. See the table below for a description of the oil water separator level logic.

Product Float Level Logic

Float Position	System Response
Product Level = LO (LSL-12)	PLC shuts down TP-300
Product Level = HI (LSH-13)	PLC turns TP-300 ON
Product Level = HI HI (LSHH-14)	PLC shuts down TP-200 and TP-202

2.7 Bag Filters

This system is equipped with one set of dual high-capacity particulate filters utilized to carry out gross particulate removal.

The dual system allows for lower pressure drops, and provides continuous operation since one side can be serviced while the other is still functioning. The filter housings are equipped with pressure gauges and a differential pressure transmitter to monitor the clean pressure drop (when the clean pressure drop exceeds a 15 psig, the bag filters require replacement -See *Section 6, Servicing*). The filter housings are equipped with a quick clamp cover to expedite filter replacement.

Differential Pressure Transmitter 2

SETPOINTS	OPERATIONS
High Alarm Setpoint	Shuts down TP301

2.8 Liquid Clay Vessels

This system is equipped with two 1000lbs Liquid Clay Adsorption tanks used to remove additional contaminants from the water after it passes through the bag filters.

There are two parallel sets of Liquid Clay Vessels set up in lead lag. After passing through the Bag Filters, TP-301 pushes the water into the top of the first clay vessel. The liquid is then forced down through the clay and ejected out of the bottom of the first vessel and into the top of the second vessel. Next, the liquid is forced down through the second vessel and discharged out of the bottom.

2.9 Liquid Carbon Vessels

This system is equipped with two 1000lbs Liquid Carbon Adsorption (GAC) tanks used to remove additional contaminants from the water after it passes through the clay vessels.

Like the Clay Vessels, there are two parallel sets of Liquid Carbon Vessels set up in lead lag. Pressurized water from TP-301 pushes the water into the top of the first carbon vessel. The liquid is then forced down through the carbon and ejected out of the bottom of the first tanks and into the top of the second tank. Next, the liquid is forced down through the second carbon vessel and discharged out of the bottom. The water then flows through a totalizing flow meter before entering the 750 gallon Poly Tank.

⚠ WARNING

Proper ventilation precautions should be taken when servicing the carbon vessels or when any carbon is directly exposed to the atmosphere.

2.10 Water Storage Tank

This DPE system is equipped with one 750 gallon PolyTank. This is where treated water is stored until it is manually drained.

The water collected in the water holding tank is stored until it is manually drained. The holding tank has a 1 position (HI HI) float switch installed, and is continuously monitored by the PLC for overall system management. See the table below for a description of the holding tank float switch logic for your system.

Treated Water Poly Tank Float Switch Logic

Float Position	System Response
Water Level = HI HI (LSHH-16)	PLC shuts down TP-301

2.11 Product Tank

This DPE system pumps product external of the treatment trailer to an existing Product Storage Tank.

The product from the Oil Water Separator exits the trailer and enters the 2000 gallon Product Tank. The Product Tank has a 1 position (HI HI) float switch installed, and is continuously monitored by the PLC for overall system management. See the table below for a description of the holding tank float switch logic for your system.

Product Tank Float Switch Logic

Float Position	System Response
Water Level = HI HI (LSHH-15)	PLC shuts down TP-300

2.12 Floor Sump

This remediation system has two Floor Sump level float switches in the process room that are used to alarm the system when water has flooded the system trailer floor.

See the table below for a description of the Floor Sump float switch logic for your system.

Front Floor Sump Float Logic

Level Position	System Response
Level Switch NC opened = HI (LSH-17)	Alarm - Shuts down LRP-101, LRP-102, TP-200, TP-202, TP-300, TP-301

Rear Floor Sump Float Logic

Level Position	System Response
Level Switch NC opened = HI (LSH-18)	Alarm - Shuts down LRP-101, LRP-102, TP-200, TP-202, TP-300, TP-301

2.13 Air Compressor

The 2 HP air compressor is used to operate the pneumatic valves and provide air to operate TP-300 in the DPE system. This system does monitor and regulate the pressure of the incoming compressed air. The Air Compressor is also available for the Bag Filter blow down replacement procedure.

2.14 Automated Valves and Solenoid Manifold

The Automated Valves are located on each manifold string.

Automated Valve 1 (AV1 – AV14)

AV1 – AV14 can be set to operate on/off or based on time of day cycle on the HMI. They are pneumatic operated valves that are driven by the solenoid manifold.

2.15 Miscellaneous Transducers and Meters

This system is equipped with transducers and flow meters that provide pressure, vacuum, and flow measurements. Outputs from transducers are monitored by the system PLC and are either used for system control or just recorded for statistics.

Pressure Transmitters

The table below is a list of pressure transducers that send inputs to the program logic controller.

Tag Name	Measures	Units	Location Description	Range
PT 1	Pressure	PSI	Liquid Ring Pump 101 Discharge Pressure	0-5
PT 2	Pressure	PSI	Liquid Ring Pump 102 Discharge Pressure	0-5
PT 3	Pressure	PSI	Combined Liquid Ring Pump Discharge Pressure	0-5
PT 4	Pressure	PSI	Transfer Pump 200 Discharge Pressure	0-50
PT 5	Pressure	PSI	Transfer Pump 202 Discharge Pressure	0-50
PT 6	Pressure	PSI	Transfer Pump 301 Discharge Pressure	0-50
PT 7	Pressure	PSI	Before Clay Vessel Pressure	0-50
PT 8	Pressure	PSI	Mid Clay Vessel Pressure	0-50
PT 9	Pressure	PSI	Before Carbon Vessel Pressure	0-50
PT 10	Pressure	PSI	Mid Carbon Vessel Pressure	0-50
PT 11	Pressure	PSI	Trailer Discharge Pressure	0-50
PT 12	Pressure	PSI	Compressed Air Pressure	0-200
DP 1	Differential Pressure	IWC	KO Tank Filter Differential Pressure	0-50
DP 2	Differential Pressure	PSID	Bag Filter Differential Pressure	0-50

Flow Meters

The table below is a list of flow meters that send inputs to the program logic controller.

Tag Name	Measures	Units	Location Description	Range
FT 1	Flow	SCFM	Liquid Ring Pump 101 Inlet Vapor Flow	0-740
FT 2	Flow	SCFM	Liquid Ring Pump 102 Inlet Vapor Flow	0-740
FT 3	Flow	GPM	Product Discharge Flow	0-50
FT 4	Flow	GPM	Water Discharge Flow	0-180

Vacuum Transmitters

The table below is a list of vacuum transducers that send inputs to the program logic controller.

Tag Name	Measures	Units	Location Description	Range
VT 1	Vacuum	PSIG	Manifold String 1 Vacuum	-14.7 – 30
VT 2	Vacuum	PSIG	Manifold String 2 Vacuum	-14.7 – 30
VT 3	Vacuum	PSIG	Manifold String 3 Vacuum	-14.7 – 30
VT 4	Vacuum	PSIG	Manifold String 4 Vacuum	-14.7 – 30
VT 5	Vacuum	PSIG	Manifold String 5 Vacuum	-14.7 – 30
VT 6	Vacuum	PSIG	Manifold String 6 Vacuum	-14.7 – 30
VT 7	Vacuum	PSIG	Manifold String 7 Vacuum	-14.7 – 30
VT 8	Vacuum	PSIG	Manifold String 8 Vacuum	-14.7 – 30
VT 9	Vacuum	PSIG	Manifold String 9 Vacuum	-14.7 – 30
VT 10	Vacuum	PSIG	Manifold String 10 Vacuum	-14.7 – 30
VT 11	Vacuum	PSIG	Manifold String 11 Vacuum	-14.7 – 30
VT 12	Vacuum	PSIG	Manifold String 12 Vacuum	-14.7 – 30
VT 13	Vacuum	PSIG	Manifold String 13 Vacuum	-14.7 – 30
VT 14	Vacuum	PSIG	Manifold String 14 Vacuum	-14.7 – 30
VT 15	Vacuum	PSIG	Knock-Out Tank Vacuum	-14.7 – 30
VT 16	Vacuum	PSIG	Liquid Ring Pump 101 Vacuum	-14.7 – 30
VT 17	Vacuum	PSIG	Liquid Ring Pump 102 Vacuum	-14.7 - 30

2.16 Vent Fan and Heaters

Both the control room and process room are equipped with heaters and exhaust fans. The control room heater, process room heaters, process room vent fan, and control room vent fan all have separate thermostats.

Note - The vent fans are single phase and only turn in one direction.

Vent Fans

The mode for each vent fan is controlled by a 3 position (H-O-A) switch located on the control panel. The switch for the control room vent fan is labeled "C-FAN", and the process room vent fan switch is labeled "P-FAN". The thermostats (and temperature probes) that control the fans are located in the control room near the control panel. It is recommended to set the fan thermostats to 80° F.

Control Room Fan and Process Room Fan

There are three modes of operation for the vent fans are as follows:

Hand Operations

- The vent fan will run continuously. The only conditions that shut down the vent fan are thermal or electrical overload.

Off Operations

- The vent fan will not operate.

Auto Operations

- The vent fan will run according to the vent fan thermostat located near control panel

Heaters

Control Room Heat

The control room heater is controlled by a thermostat (dial) located on the heater. It is recommended to have this set at 45ºF minimum during winter operations.

Process Room Heat

The process room heater is controlled by a thermostat located in the control room near the control panel. It is recommended to have this set at 45ºF minimum during winter operations.

3.0 Standard Operating Procedures

Standard procedure is to connect the system to the main power supply and start the system.

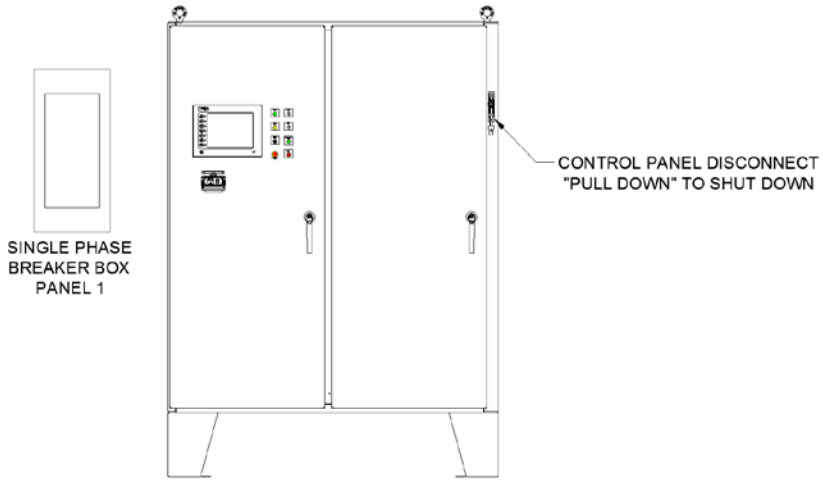
3.1 Connecting the System to the Main Power Supply

It is recommended to use a professional electrical contractor or a certified ProAct technician to connect the main power supply to your remediation system.

CAUTION
Never power up the system unless there is absolutely no doubt the correct power supply has been connected. Considerable damage to the electrical components will most likely occur if the wrong power supply is connected and the system is powered up.

1) Turn "OFF" the main power disconnect switch on the front of the trailer.
2) Shut OFF all **circuit breakers** in the control panel and in the single phase breaker box (to the left of the control panel). Make sure that the disconnect on the front of the main control panel door is in the OFF position before attempting to open the door

   For the initial startup it may be easier to use a wrench or pliers to turn the disconnect to the ON position with the door open. Only qualified, knowledgeable personnel should do this.



3) Connect the ***correct*** electrical power to the trailer main disconnect

> ***The correct power supply for your system is as follows:***
> Power Supply
> 480-3-60
> Recommended Minimum Service: 200 AMPS
> Max Fuse: 200 AMPS

4) Have a qualified person use a multimeter and verify the voltage is correct. It can often be useful to record these voltages.

5) Turn ON the main disconnect on the outside of the trailer

6) Open the Main Control Panel Door. Power is live inside the panel. **ALWAYS** exercise extreme caution when working near electricity

7) Turn "ON" CB240 in the Main Control Panel. This supplies power to the single phase transformer

8) In the panel 1 single phase breaker box turn ON the 15 amp circuit breaker 1 "INT LIGHTS" for the interior lights

9) Turn on the overhead light and verify that it looks normal.

10) If the overhead light seems unusually dim or unusually bright then go to Step 11, if the light appears normal proceed to Step 12.

CAUTION
Abnormally bright: system voltage too high Abnormally dim: system voltage too low

11) Execute the following steps:
   a) Turn OFF the "LIGHTS" circuit breaker in the breaker box
   b) Turn OFF the main power disconnect switch on the front of the trailer.
   c) Find a professional electrician to confirm the main power supply voltage
   d) Return Step 1 in this section

12) In the panel 1 single phase breaker box turn ON the 15 amp circuit breaker 3 "EXT LIGHTS" for exterior lights

13) Bump test the Liquid Ring Pump 101 (3 phase) to ensure proper motor rotation
   a) Have a qualified person open the Main Control Panel. Exercise caution the panel is live
   b) Turn ON the Motor Starter breaker MS206 inside of the control panel
   c) Momentarily energize LRP-101contactor
   d) Have an assistant verify that the motor is rotating in the proper direction indicated by the rotation label on the motor housing
   e) If rotation is correct, proceed to step 15, otherwise go to step 14.

14) Have an electrician swap any 2 of the 3 main power (hot) lines that feed the main disconnect on the outside of the trailer All motors in the system have been wired to turn the same direction. If one 3 phase motor is turning the wrong direction, then all others will follow in suit. Return to Step 13.

15) The system is properly connected to the main power supply. Continue to Section 3.2

3.2 System Start-up

System Setup

These pages are password protected and should only be changed by knowledgeable personnel. The pages hold the settings for system warnings, alarms, and delays. A brief description of each is given below.

System Setup Pages

System Setup Configuration Fields	Type	Description
Screen 1 - ADJUST SHUTDOWN SETPOINTS		
VT15 High Alarm Setpoint	Alarm Setpoint	Knock Out Tank Vacuum High Alarm Setpoint (IHG)
VT15 Low Alarm Setpoint	Alarm Setpoint	Knock Out Tank Vacuum Low Alarm Setpoint (IHG)
VT15 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Knock Out Vacuum Alarm
VT16 High Alarm Setpoint	Alarm Setpoint	LRP-101 Vacuum High Alarm Setpoint (IHG)
VT16 Low Alarm Setpoint	Alarm Setpoint	LRP-101 Vacuum Low Alarm Setpoint (IHG)
VT16 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for LRP-101 Vacuum Alarm
VT17 High Alarm Setpoint	Alarm Setpoint	LRP-102 Vacuum High Alarm Setpoint (IHG)
VT17 Low Alarm Setpoint	Alarm Setpoint	LRP-102 Vacuum Low Alarm Setpoint (IHG)
VT17 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for LRP-102 Vacuum Alarm
PT1 High Alarm Timer	Alarm Setpoint	LRP-101 Pressure High Alarm Setpoint (IWC)

System Setup Configuration Fields	Type	Description
PT1 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for LRP-101 Pressure Alarm
Screen 2 - ADJUST SHUTDOWN SETPOINTS		
PT2 High Alarm Timer	Alarm Setpoint	LRP-102 Pressure High Alarm Setpoint (IWC)
PT2 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for LRP-102 Pressure Alarm
PT3 High Alarm Timer	Alarm Setpoint	LRP-101, LRP-102 Combined Pressure High Alarm Setpoint (IWC)
PT3 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for LRP-101, LRP-102 Combined Pressure Alarm
PT4 High Alarm Setpoint	Alarm Setpoint	TP-200 Pressure High Alarm Setpoint (PSI)
PT4 Low Alarm Setpoint	Alarm Setpoint	TP-200 Pressure Low Alarm Setpoint (PSI)
PT4 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for TP-200 Pressure Alarm
PT5 High Alarm Setpoint	Alarm Setpoint	TP-202 Pressure High Alarm Setpoint (PSI)
PT5 Low Alarm Setpoint	Alarm Setpoint	TP-202 Pressure Low Alarm Setpoint (PSI)
PT5 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for TP-202 Pressure Alarm
Screen 3 - ADJUST SHUTDOWN SETPOINTS		
PT6 High Alarm Setpoint	Alarm Setpoint	TP-301 Pressure High Alarm Setpoint (PSI)
PT6 Low Alarm Setpoint	Alarm Setpoint	TP-301 Pressure Low Alarm Setpoint (PSI)
PT6 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for TP-301 Pressure Alarm

System Setup Configuration Fields	Type	Description
PT7 High Alarm Setpoint	Alarm Setpoint	Pre-Clay Pressure High Alarm Setpoint (PSI)
PT7 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Pre-Clay Pressure Alarm
PT8 High Alarm Setpoint	Alarm Setpoint	Mid-Clay Pressure High Alarm Setpoint (PSI)
PT8 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Mid-Clay Pressure Alarm
PT9 High Alarm Setpoint	Alarm Setpoint	Pre-Carbon Pressure High Alarm Setpoint (PSI)
PT9 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Pre-Carbon Pressure Alarm
PT10 High Alarm Setpoint	Alarm Setpoint	Mid-Carbon Pressure High Alarm Setpoint (PSI)
PT10 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Mid-Carbon Pressure Alarm
Screen 4 - ADJUST ALARM/SHUTDOWN SETPOINTS		
PT11 High Alarm Setpoint	Alarm Setpoint	Post-Carbon Pressure High Alarm Setpoint (PSI)
PT11 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Post-Carbon Pressure Alarm
PT12 Low Alarm Setpoint	Alarm Setpoint	Air Compressor Low Alarm Setpoint (PSI)
PT12 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Air Compressor Pressure Alarm
DPT1 High Alarm Setpoint	Alarm Setpoint	KO Tank Differential Pressure High Alarm Setpoint (IWC)
DPT1 High High Alarm Setpoint	Alarm Setpoint	KO Tank Differential Pressure High High Alarm Setpoint (IWC)

System Setup Configuration Fields	Type	Description
DPT1 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for KO Tank Differential Pressure Alarm
DPT2 High High Alarm Setpoint	Alarm Setpoint	Bag Filter Differential Pressure High High Alarm Setpoint (PSID)
DPT2 Alarm Timer	Time Delay Setpoint	Alarm Delay Time (Seconds) for Bag Filter Differential Pressure Alarm
Screen 5 - MAINTENANCE OPTIONS		
CHANGE TIME / DATE	System Setting	Allows The Time and Date to be Manually Changed
SECURITY	System Setting	Allows User to Enter or Edit Password to have Access to the System Controls
CHANGE TIME / DATE PLC	System Setting	Allows The Time and Date to be Manually Changed on the Program Logic Controller

3.3 Sampling and Monitoring

Sampling

Sampling ports should be sampled per discharge permit requirements, or as required.

Please use the following sample collection instructions

1) Allow the water or vapor from the sample port(s) to run for 10 seconds to ensure a representative sample is collected

2) Follow proper sampling instructions.

3) Make sure you are wearing the proper safety clothing and equipment.

Note - It is essential that samples reach the appropriate laboratory as soon as possible after sampling collection. If you are mailing sample(s) to the laboratory, check your local postal schedule beforehand, and plan the sample collection accordingly.

Monitoring

The treatment equipment should be monitored weekly during continuous operation to record operating flow rates, pressure measurements, and the volume of material treated.

The weekly monitoring allows the operator to evaluate the system operations. It is important to visually inspect the treatment equipment on a monthly basis. Any variation from normal operations may require additional maintenance or repair.

3.4 Normal Shut-down

The system may require shut down (deactivation) for repairs, maintenance, or general servicing. It is recommended to use the following procedures:

1) Prior to deactivation of the system, record all flow rates, pressures, and other applicable information if required

2) On the Red Lion mode select screen, press the "OFF" button on all components

3) If applicable, turn OFF all disconnects and breakers in the Control Panel and in Breaker Panel 1.

Note – If treatment is complete and the system is being removed, then all valves should be opened and all vessels and pumps drained and decontaminated

4.0 System Faults and Troubleshooting

4.1 Touch Screen Warning and Alarm Messages

The control panel for your system has fault condition lights that illuminate on the Red Lion touchscreen interface as necessary to warn the user of certain fault conditions, and they also aid in troubleshooting. A description of faults that activate the lights and the associated system response is detailed on the next pages.

ALARM ON TOUCH SCREEN	DESCRIPTION	TEXT BACKGROUND
SYSTEM ESTOPPED	The Emergency Stop has been triggered	RED
POWER FAIL ALARM	There has been an interruption of Main Line Power to the control system	RED
ANALOG OUTPUT SIGNAL IS OUT OF RANGE	An analog Output signal is out of range (3.8mA>AS>20mA)	YELLOW
KNOCK OUT TANK VACUUM HIGH ALARM SETPOINT	Knock Out Tank Vacuum is High (VT15)	RED
KNOCK OUT TANK VACUUM LOW ALARM	Knock Out Tank Vacuum is Low (VT15)	RED
LRP-101 VACUUM HIGH ALARM	Liquid Ring Pump 101 Vacuum is High (VT16)	RED
LRP-101 VACUUM LOW ALARM	Liquid Ring Pump 101 Vacuum is Low (VT16)	RED
LRP-102 VACUUM HIGH ALARM	Liquid Ring Pump 102 Vacuum is High (VT17)	RED
LRP-102 VACUUM LOW ALARM	Liquid Ring Pump 102 Vacuum is Low (VT17)	RED
LRP-101 PRESSURE HIGH ALARM	Liquid Ring Pump 101 Pressure is High (PT1)	RED
LRP-102 PRESSURE HIGH ALARM	Liquid Ring Pump 102 Pressure is High (PT2)	RED
LRP-101, LRP-102 COMBINED PRESSURE HIGH ALARM	Liquid Ring Pump 101 and Liquid Ring Pump 102 Combined Pressure is High (PT3)	RED
TP-200 PRESSURE HIGH ALARM	Transfer Pump 200 Pressure Is High (PT4)	RED
TP-200 PRESSURE LOW ALARM	Transfer Pump 200 Pressure Is Low (PT4)	RED
TP-202 PRESSURE HIGH ALARM	Transfer Pump 202 Pressure Is High (PT5)	RED
TP-202 PRESSURE LOW ALARM	Transfer Pump 202 Pressure Is Low (PT5)	RED
TP-301 PRESSURE HIGH ALARM	Transfer Pump 301 Pressure Is High (PT6)	RED

ALARM ON TOUCH SCREEN	DESCRIPTION	TEXT BACKGROUND
TP-301 PRESSURE LOW ALARM	Transfer Pump 301 Pressure Is Low (PT6)	RED
PRE-CLAY PRESSURE HIGH ALARM	Before Clay Vessel Pressure Is High (PT7)	RED
MID-CLAY PRESSURE HIGH ALARM	Mid-Stage Clay Vessel Pressure Is High (PT8)	RED
PRE-CARBON PRESSURE HIGH ALARM	Before Carbon Vessel Pressure Is High (PT9)	RED
MID-CARBON PRESSURE HIGH ALARM	Mid-Stage Carbon Vessel Pressure Is High (PT10)	RED
POST-CARBON PRESSURE HIGH ALARM	Discharge Pressure Is High (PT11)	RED
AIR COMPRESSOR LOW PRESSURE ALARM	Air Compressor Pressure is Low (PT12)	YELLOW
KO TANK DIFFERENTIAL PRESSURE HIGH ALARM	Knock-Out Tank Filter Differential Pressure is High (DPT1)	RED
KO TANK DIFFERENTIAL PRESSURE HIGH HIGH ALARM	Knock-Out Tank Filter Differential Pressure is High High (DPT1)	RED
BAG FILTER DIFFERENTIAL PRESSURE HIGH HIGH ALARM	Bag Filter Differential Pressure is High High (DPT2)	RED

4.2 Troubleshooting

The following chart should be used to troubleshoot system malfunctions. Each component OMM also has a troubleshooting guide which should be used to address component specific troubleshooting.

ALARM ON TOUCH SCREEN	POSSIBLE CAUSES
SYSTEM ESTOPPED	An emergency stop has been activated by pushing in one of the E-Stop switches Sometimes this is triggered by turning off the disconnect on the main control panel door
POWER FAIL ALARM	Power failure that has exhausted other power backups Disconnect on front of main control panel was left off
ANALOG OUTPUT SIGNAL IS OUT OF RANGE	The mA value is out of spec A wiring short or break could cause this
KNOCK OUT TANK VACUUM HIGH ALARM SETPOINT	Liquid Ring Pump not running in AUTO mode Process Gate Valves on manifold strings too far closed Faulty vacuum transducer
KNOCK OUT TANK VACUUM LOW ALARM	Air Dilution Valve on manifold header too far open Process Gate Valves on manifold strings too far open Faulty vacuum transducer
LRP-101 VACUUM HIGH ALARM	Liquid Ring Pump 101 not running in AUTO mode Faulty vacuum transducer
LRP-101 VACUUM LOW ALARM	Knock Out Tank Filter needs replacement Faulty vacuum transducer
LRP-102 VACUUM HIGH ALARM	Liquid Ring Pump 102 not running in AUTO mode Faulty vacuum transducer
LRP-102 VACUUM LOW ALARM	Knock Out Tank Filter needs replacement Faulty vacuum transducer
LRP-101 PRESSURE HIGH ALARM	A downstream obstruction in plumbing Process Ball Valve after Pressure Transducer too far closed LRP-101 worn or not running in AUTO mode Faulty Pressure Transducer
LRP-102 PRESSURE HIGH ALARM	A downstream obstruction in plumbing Process Ball Valve after Pressure Transducer too far closed LRP-102 worn or not running in AUTO mode Faulty Pressure Transducer
LRP-101, LRP-102 COMBINED PRESSURE HIGH ALARM	A downstream obstruction in plumbing Vapor Carbon has depleted Faulty Pressure Transducer
TP-200 PRESSURE HIGH ALARM	A downstream obstruction in plumbing Check valve malfunction Oil Water Separator backed up Faulty Pressure Transducer
TP-200 PRESSURE LOW ALARM	Influent plumbing to Transfer Pump 200 is obstructed or not primed Knock-Out Tank is full of sediment Y-Strainer or influent pipe is clogged or broken Faulty Pressure Transducer

ALARM ON TOUCH SCREEN	POSSIBLE CAUSES
TP-202 PRESSURE HIGH ALARM	A downstream obstruction in plumbing Check valve malfunction Oil Water Separator backed up Faulty Pressure Transducer
TP-202 PRESSURE LOW ALARM	Influent plumbing to Transfer Pump 200 is obstructed or not primed Knock-Out Tank is full of sediment Y-Strainer or influent pipe is clogged or broken Faulty Pressure Transducer
TP-301 PRESSURE HIGH ALARM	A downstream obstruction in plumbing Check valve malfunction Carbon or Clay Vessels need media change out Faulty Pressure Transducer
TP-301 PRESSURE LOW ALARM	Influent plumbing to Transfer Pump 301 is obstructed or not primed Oil Water Separator effluent valve too far closed Faulty Pressure Transducer
PRE-CLAY PRESSURE HIGH ALARM	Particulate filters need replacement Influent valve to particulate filters too far closed Plumbing between Bag Filters and Clay Vessels is clogged Faulty Pressure Transducer
MID-CLAY PRESSURE HIGH ALARM	Plumbing between Clay Vessels is obstructed Faulty Pressure Transducer
PRE-CARBON PRESSURE HIGH ALARM	Plumbing between Clay Vessels and Carbon Vessels is obstructed Faulty Pressure Transducer
MID-CARBON PRESSURE HIGH ALARM	Plumbing between Carbon Vessels is obstructed Faulty Pressure Transducer
POST-CARBON PRESSURE HIGH ALARM	Plumbing between Carbon Vessels and Treated Water Tank is obstructed Faulty Pressure Transducer
AIR COMPRESSOR LOW PRESSURE ALARM	Air line Ball Valve on Air Compressor too far closed Faulty Pressure Transducer
KO TANK DIFFERENTIAL PRESSURE HIGH ALARM	Knock-Out Tank Filter needs replacement Faulty Pressure Transducer
KO TANK DIFFERENTIAL PRESSURE HIGH HIGH ALARM	Bag Filter needs replacement Faulty Pressure Transducer
BAG FILTER DIFFERENTIAL PRESSURE HIGH HIGH ALARM	Bag Filter needs replacement Faulty Pressure Transducer

All other technical or unknown problems should be directed to a ProAct technician. Please call (231) 843-2711.

5.0 Preventative Maintenance

Maintenance of the environmental treatment system should be scheduled on a monthly and quarterly basis.

5.1 Weekly

Record operational information
Inspect all plumbing for integrity
Inspect DPE dilution air filter
Inspect LRP oil levels
Inspect knock out tank filter

In harsh environments, it will be necessary to exercise all ball valves to ensure good working order. Ball valves left in the same position for long periods of time may seize.

5.2 Monthly

Inspect Liquid Ring Pump
Inspect Transfer Pumps
Inspect all tanks
Inspect Air Compressor
Inspect all electrical connections
Grease Liquid Ring Pump bearings
Test motor conditions (Amps and Volts)
Inspect flow meters
Inspect/clean vent screens
Verify shutters open and close freely
Test Emergency Stops

5.3 Quarterly

Inspect and test pressure, and vacuum transducers
Inspect tank O-rings
Inspect air bleeds, pressure gauges, sample ports
Inspect cam locks & fittings
Test alarm conditions to verify shutdown sequences

6.0 Servicing

6.1 Particulate Filter Bag Change

It is recommended to change particulate filter elements (bags) when the pressure drops across the filters reach 15 psig. (Clean pressure drop ≈ 2psig). The following procedure should be used to change the particulate filter bags. Please note that the system does not need to be shut down.

Blow out the Filter Housing with Compressed air

1. Close the influent and effluent valve on the bag filter housing that requires a bag change.

2. Connect one end of a drain hose to the filter housing drain valve (1" cam-lock) and place the other end in your drain vessel.

3. Observe the pressure gage on the filter housing. Open the drain valve and be prepared for a high pressure discharge out the drain hose. If necessary, have an assistant or other setup secure the drain hose.

4. Connect an air hose to the air chuck located on the respective filter housing.

5. Refer to Appendix B and read the "Operating" manual for the Ingersoll Rand air compressor.

6. Turn on the air compressor and supply 5-10 PSI air pressure to the respective filter housing.

7. Open the ball valve just past the air chuck and allow the compressed air to blow out the filter housing. It may be necessary to cycle this ball valve open and closed a few times to allow sufficient pressure to repeatedly build and remove as much water as possible from the filter.

8. Close the air chuck ball valve on the filter housing. Allow any residual air pressure in the filter housing to bleed off and **verify that the pressure gage reads "0" PSI**

Remove and Replace the Filter Element

9. Unclamp the retaining ring for the housing lid

10. Open lid and remove bag filter

11. Place new bag filter in bag filter housing

12. Replace and fasten the lid.

13. Reopen the influent and effluent valves on the bag filter housing (Always open influent valve first)

14. Proceed Steps 1-13 for the remaining particulate filters

6.2 Carbon Servicing and Disposal

This servicing of the spent carbon is recommended to be done by trained individuals. Spent carbon typically will need to be classified to determine if the carbon is hazardous or non-hazardous. Spent carbon is typically brought to a regeneration facility and reactivated. In special cases, the spent carbon may be sent to a land fill.

⚠ WARNING

Extreme care must be exercised when handling spent activated carbon. If the adsorbed materials are carcinogenic and their toxic exposure routes are adsorption, inhalation, or ingestion; personnel who handle this material should be equipped with respirator, safety glasses, neoprene or buna-n Gloves, as well as an impervious laboratory apron or clothing.

6.3 Swapping Lead and Lag Vapor Carbon

When the carbon's adsorbtion capacity is nearing depletion it is possible to swap lead and lag vessels to allow time to schedule a carbon replacement.

1. Turn off the LRP-101, LRP-102
2. Change hose connections to correspond to the desired setup
3. Restart system

Appendix A

DRAWINGS

Drawing	Description	Sheet
Plan	PLAN VIEW LAYOUT	1
P & ID	PROCESS & INSTRUMENTATION DIAGRAM	2
P & ID Legend	PROCESS & INSTRUMENTATION LEGEND	3
E-001	ABBREVIATIONS & SYMBOLS - ELECTRICAL	1
E-002	480VAC POWER WIRING	2
E-003	120VAC POWER WIRING	3
E-004	PLC INPUT CARD WIRING	4
E-004A	PLC INPUT CARD WIRING	5
E-004B	PLC INPUT CARD WIRING	6
E-005	PLC OUTPUT CARD WIRING	7
E-006	PLC ANALOG INPUT CARD WIRING	8
E-007	PLC ANALOG INPUT CARD WIRING	9
E-008	PLC ANALOG INPUT CARD WIRING	10
E-009	PANEL 1 ELECTRICAL SCHEMATIC	11
E-010	CONTROL PANEL PARTS LAYOUT INT	12
E-011	CONTROL PANEL PARTS LAYOUT EXT	13

Appendix B

CONTROL ROOM COMPONENTS

Component	PID	Description	Manufacturer	Part Number
Transformer		15kVA Transformer – Single Phase	Dongan	85-1070SH
Controller	PLC	Programmable Automation Controller	Allen Bradley CompactLogix	1769-L32E
Discrete Input Module		Discrete Input Module 32 Inputs, DC	Allen Bradley	1769-IQ32
Discrete Input Module		Discrete Input Module 16 Inputs, DC	Allen Bradley	1769-IQ16
Discrete Output Module		Discrete Output Module 16 Outputs	Allen Bradley	1769-OW16
Analog Input Module		Analog Input Module 8 Inputs, 4-20mA	Allen Bradley	1769-IF8
Touchscreen		10” Color Touchscreen Interface (HMI)	Red Lion	G310C210
Cellular Modem		Cellular Communications for system	MultiTech	MTCBA-EV2-EN2-N3
UPS		Uninterrupted Power Supply 120 VAC, 60HZ, SDU series	Sola	SDU850
Air Compressor		Air Compressor - 2HP, 20 Gallon Capacity, 4.6CFM, 135PSI, 120V, 60HZ	Ingersoll Rand	P1.5IU-A9

Component	PID	Description	Manufacturer	Part Number
Manifold for Solenoids		Solenoid Valve Manifold - 4 Station Dual	SMC	VV5Q21-04
Solenoid for Automated Valves		Solenoid Valve - 4 Position Dual 3 Port Valve	SMC	VQ2000
Air Filter		Air Filter for Air Compressor - 3/8" NPT Inlet and Outlet, NO Float	SMC	AF30-N03D-Z Filter Element: AF30P-060S
Mist Separator		Mist Separator for Air Compressor - 3/8" NPT Inlet and Outlet, NO Float	SMC	AFM30-N03D-Z Filter Element: AFM30P-060AS
Heater		Control Room Convection Heater 3kW, 240/208V, 1 PH, 12.5/11A	Dayton	2YU58
C-Fan		12” Control Room Ventilation Fan	Dayton	1HKL4
P-Fan Thermostat		Thermostat - Process Room Fan	Honeywell	T6031A
P-Heat Thermostat		Thermostat - Process Room Heat	Honeywell	T6031A
C-Fan Thermostat		Thermostat - Control Room Fan	Honeywell	T6031A
Shutter		12” x 12” Shutter for Control Room Man Door	Dayton	4C556
Shutter		12” x 12” Shutter for Vent Fan	Dayton	4C556
Pressure Transducer	PT12	Pressure Transducer - Air Compressor (0 - 200 PSI)	Dwyer	628-12

Component	PID	Description	Manufacturer	Part Number
Pressure Gauge	PI21	Pressure Indicator - Air Compressor (0 - 200 PSI)	Precision Instrument Co	201L 202L
Light (Flood)		Flood Light Outside - Near Control Room door	RAB	WPTS70

DONGAN ELECTRIC MANUFACTURING CO. • 2987 FRANKLIN • DETROIT, MI 48207
800.428.2626 • 313.567.8500 • FAX 313.567.8828 • www.dongan.com

Primary Volts 240 X 480, Secondary Volts 120 / 240

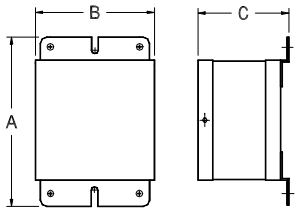
General Information				Winding Specifications				Dimensions			
kVA Cap.	Catalog Number	Hz.	Wgt. Lbs	Taps	Maximum Amps		Conn Dia. Pg. 15	Height A	Width B	Depth C	Outline Dwg.
					Pri.	Sec.					
.050	35-1005	50/60	3.3	0	.2 / .1	.4 / .2	1	6.37	3.75	3.37	1
.100	35-1010	50/60	5	0	.4 / .2	.8 / .4	1	6.37	3.75	3.37	1
.150	35-1015	50/60	7	0	.6 / .3	1.2 / .6	1	7.00	4.00	3.63	2
.250	85-1020SH	50/60	14	0	1.0 / .52	2.0 / 1.0	4	12.00	4.87	5.25	3
.500	85-1025SH	50/60	18	0	2.0 / 1.0	4.1 / 2.0	4	12.00	4.87	5.25	3
.750	85-1030SH	50/60	22	0	3.1 / 1.6	6.2 / 3.1	4	12.00	4.87	5.25	3
1.0	85-1035SH	60	29	0	4.1 / 2.0	8.3 / 4.1	4	15.25	5.75	5.87	3
1.5	85-1040SH	60	37	0	6.2 / 3.1	12.5 / 6.2	4	15.25	5.75	5.87	3
2.0	85-1045SH	60	42	0	8.3 / 4.1	16.6 / 8.3	4	15.25	5.75	5.87	3
3.0	85-1050SH	60	62	0	12.5 / 6.2	25.0 / 12.5	4	15.25	8.25	7.87	3
3.0	85-1450SH	60	62	4	12.5 / 6.2	25.0 / 12.5	2	15.25	8.25	7.87	3
5.0	85-1055SH	60	102	0	20.8 / 10.4	41.6 / 20.8	4	15.25	8.25	7.87	3
5.0	85-1455SH	60	102	4	20.8 / 10.4	41.6 / 20.8	2	15.25	8.25	7.87	3
7.5	85-1060SH	60	131	0	31 / 15.6	62 / 31	4	15.75	14.25	8.75	4
7.5	85-1460SH	60	131	4	31 / 15.6	62 / 31	2	15.75	14.25	8.75	4
10	85-1065SH	60	152	0	41 / 20	83 / 41	4	15.75	14.25	8.75	4
10	85-1465SH	60	152	4	41 / 20	83 / 41	2	15.75	14.25	8.75	4
15	85-1070SH	60	270	0	62 / 31	125 / 62	4	19.38	17.56	11.50	4
15	85-1470SH	60	270	4	62 / 31	125 / 62	2	19.38	17.56	11.50	4
25	85-1075SH	60	300	0	104 / 52	208 / 104	4	19.38	17.56	11.50	4
25	85-1475SH	60	300	4	104 / 52	208 / 104	2	19.38	17.56	11.50	4

Floor Mount, Cabinet Style Enclosure

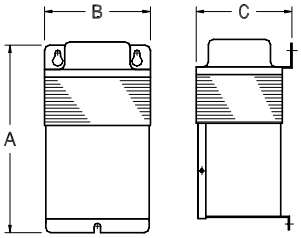
7.5	61-1460SH	60	125	4	31 / 15.6	62 / 31	2	22.00	16.00	14.00	5
10	61-1465SH	60	133	4	41 / 20	83 / 41	2	22.00	16.00	14.00	5
15	61-1470SH	60	185	4	62 / 31	125 / 62	2	23.50	18.62	16.00	5
25	61-1475SH	60	281	4	104 / 52	208 / 104	2	23.50	18.62	16.00	5
37.5	61-1680SH	60	384	6	156 / 78	312 / 156	3	32.00	27.00	26.25	5
50	61-1685SH	60	445	6	208 / 104	416 / 208	3	32.00	27.00	26.25	5
75	61-1690SH	60	663	6	312 / 156	625 / 312	3	41.00	34.00	26.75	5
100	61-1695SH	60	732	6	416 / 208	833 / 416	3	41.00	34.00	26.75	5

Primary Volts 240 X 480, Secondary Volts 120 - Fused

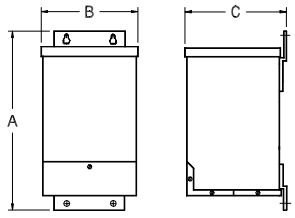
General Information				Winding Specifications				Dimensions			
kVA Cap.	Catalog Number	Hz.	Wgt. Lbs	Taps	Maximum Amps		Conn Dia. Pg. 16	Height A	Width B	Depth C	Outline Dwg. Pg. 24
					Pri.	Sec.					
.100	35-2010	50/60	5	0	.4 / .2	.8	11	6.37	3.75	3.38	6
.150	35-2015	50/60	7	0	.6 / .3	1.2	11	7.00	4.00	3.63	7
.250	35-2020	50/60	11	0	1.0 / .52	2.0	11	7.50	4.50	4.00	7
.500	35-2025	50/60	20	0	2.0 / 1.0	4.1	11	9.16	5.38	4.56	7
.750	35-2030	50/60	29	0	3.1 / 1.6	6.2	11	10.75	5.50	4.75	7
1.0	80-2035	50/60	29	0	4.1 / 2.0	8.3	11	10.88	5.50	4.75	7
1.5	80-2040	50/60	37	0	6.2 / 3.1	12.5	11	10.19	6.50	5.66	7



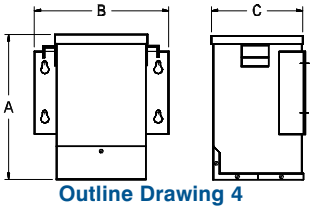
Outline Drawing 1
Wall Mount - Ventilated - NEMA 1



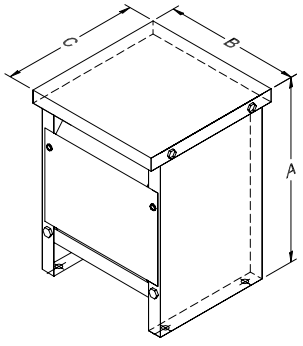
Outline Drawing 2
Wall Mount - Ventilated - NEMA 3R



Outline Drawing 3
Wall Mount - Encapsulated - NEMA 3R
Note: 3 kVA & 5kVA 85 Series are also available in Outline Drawing 4 Configuration



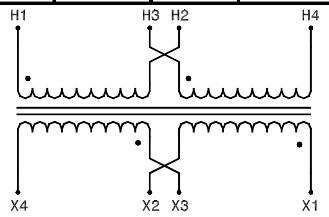
Outline Drawing 4
Wall Mount - Encapsulated - NEMA 3R



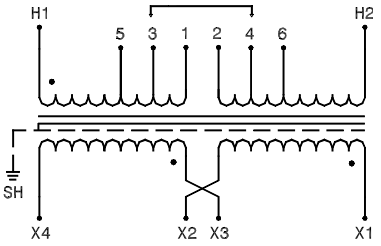
Outline Drawing 5
Floor Mount - Ventilated - NEMA 3R

Single Phase Connection Diagrams

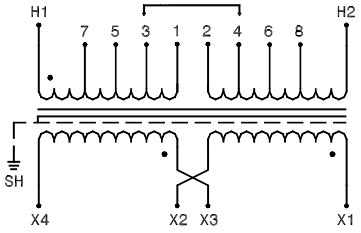
Dia. 1	Catalog Series 35-10XX & 80-10XX		
Tap Arrangement	None		
% High Voltage	High Voltage 240 X 480	Inter-Connect	Connect High Voltage Lines To
100	240	H1 To H3 H2 To H4	H1H3 & H2H4
100	480	H2 To H3	H1 & H4
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



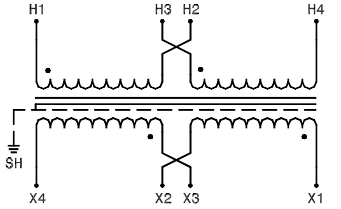
Dia. 2	Catalog Series 85-14XXSH & 61-14XXSH		
Tap Arrangement	2 - 2½ FCAN (Full Capacity Above Normal) 2 - 2½ FCBN (Full Capacity Below Normal)		
% High Voltage	High Voltage 240 X 480	Inter-Connect	Connect High Voltage Lines To
105	252	H1 To 2 H2 To 1	H1 & H2
100	240	H1 To 4 H2 To 3	
95	228	H1 To 6 H2 To 5	
105	504	1 To 2	
102.5	492	2 To 3	
100	480	3 To 4	
97.5	468	4 To 5	
95	456	5 To 6	
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



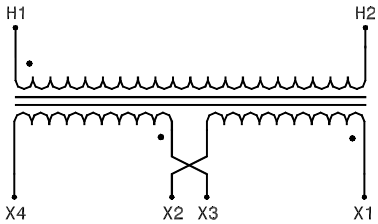
Dia. 3	Catalog Series 61-16XXSH		
Tap Arrangement	2 - 2½ FCAN (Full Capacity Above Normal) 4 - 2½ FCBN (Full Capacity Below Normal)		
% High Voltage	High Voltage 240 X 480	Inter-Connect	Connect High Voltage Lines To
105	252	H1 To 2 H2 To 1	H1 & H2
100	240	H1 To 4 H2 To 3	
95	228	H1 To 6 H2 To 5	
90	216	H1 To 8 H2 To 7	
105	504	1 To 2	
102.5	492	2 To 3	
100	480	3 To 4	
97.5	468	4 To 5	
95	456	5 To 6	
92.5	444	6 To 7	
90	432	7 To 8	
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



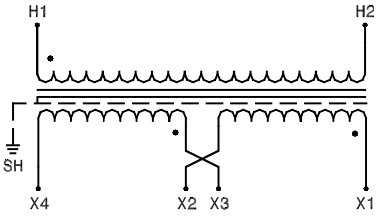
Dia. 4	Catalog Series 85-10XXSH		
Tap Arrangement	None		
% High Voltage	High Voltage 240 X 480	Inter-Connect	Connect High Voltage Lines To
100	240	H1 To H3 H2 To H4	H1H3 & H2H4
100	480	H2 To H3	H1 & H4
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



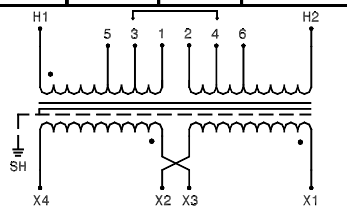
Dia. 5	Catalog Series 35-30XX & 80-30XX		
Tap Arrangement	None		
% High Voltage	High Voltage 208	Inter-Connect	Connect High Voltage Lines To
100	208	--	H1 & H2
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



Dia. 6	Catalog Series 85-30XXSH		
Tap Arrangement	None		
% High Voltage	High Voltage 208	Inter-Connect	Connect High Voltage Lines To
100	208	--	H1 & H2
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



Dia. 7	Catalog Series 61-34XXSH		
Tap Arrangement	2-2½ % FCAN (Full Capacity Above Normal) 2-2½ % FCBN (Full Capacity Below Normal)		
% High Voltage	High Voltage 208	Inter-Connect	Connect High Voltage Lines To
105	218	1 To 2	H1 & H2
102.5	213	2 To 3	
100	208	3 To 4	
97.5	203	4 To 5	
95	198	5 To 6	
% Low Voltage	Low Voltage 120 / 240	Inter-Connect	Connect Low Voltage Lines To
100	120	X1 To X3 X2 To X4	X1X3 & X2X4
100	120 / 240	X2 To X3	X1 & X2X3 & X4
100	240	X2 To X3	X1 & X4



DONGAN ELECTRIC MANUFACTURING CO. • 2987 FRANKLIN • DETROIT, MI 48207
800.428.2626 • 313.567.8500 • FAX 313.567.8828 • www.dongan.com

User Manual

Allen-Bradley

1769 CompactLogix Controllers User Manual

Catalog Numbers 1769-L31, 1769-L32C, 1769-L32E, 1769-L35CR, 1769-L35E

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Allen-Bradley, Rockwell Automation, Rockwell Software, CompactLogix, ControlFLASH, Logix5000, RSLinx, RSLogix, PanelView, PhaseManager, ControlLogix, PanelView, Ultra, PowerFlex, FlexLogix, PLC-5, DriveLogix, SLC, MicroLogix, and TechConnect are trademarks of Rockwell Automation, Inc.

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This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
Updated the Verify Compatibility section	18

Notes:

Chapter 7

Develop Applications

Chapter 8

Configure PhaseManager Application

Chapter 9

Use a CompactFlash Card

Chapter 10

Maintain the Battery

Appendix A

Status Indicators

Use this manual to become familiar with the CompactLogix™ controller and its features.

This manual describes the necessary tasks to install, configure, program, and operate a CompactLogix system. In some cases, this manual includes references to additional documentation that provides the more comprehensive details.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1769 CompactLogix Controllers Specifications Technical Data, publication 1769-TD005	Contains technical specifications and certifications for all CompactLogix controllers.
1769-L3*x* CompactLogix System Quick Start, publication IASIMP-QS001	Provides examples of using a 1769-L3*x* CompactLogix controller to connect to multiple devices over various networks.
Logix5000 Controller Design Considerations Reference Manual, publication 1756-RM094	Provides guidelines you can follow to optimize your system. This manual also provides system information you need to make system design choices.
Logix5000 Controllers Common Procedures Manual, publication 1756-PM001	Guides the development of projects for Logix5000™ controllers. It provides links to individual guides.
Logix5000 Controllers General Instruction Set Reference Manual, publication 1756-RM003	Provides a programmer with details about each available instruction for a Logix5000 controller. You should already be familiar with how the Logix5000 controller stores and processes data.
Logix5000 Controllers Process Control/Drives Instruction Set Reference Manual, publication 1756-RM006	Provides a programmer with details about each function block instruction available for a Logix5000 controller. You should already be familiar with how the Logix5000 controller stores and processes data.
EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication ENET-UM001	Describes how to install and configure EtherNet/IP modules in Logix5000 control systems.
ControlNet Communication Modules in Logix5000 Control Systems User Manual, publication CNET-UM001	Describes how to install and configure ControlNet modules in a Logix5000 control system.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

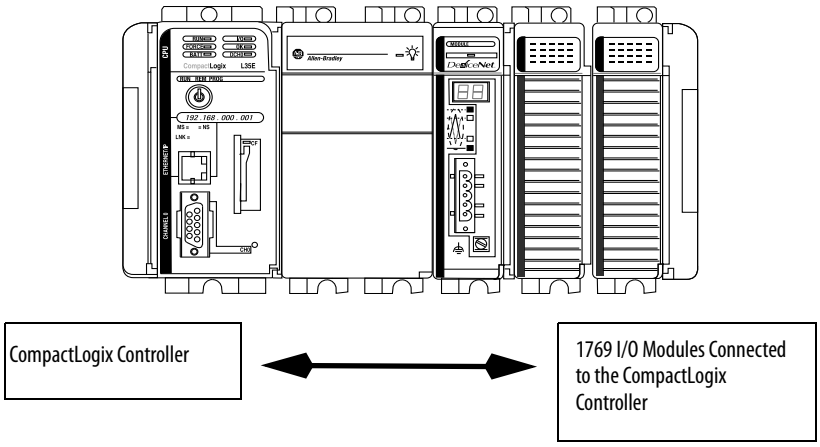
1769 CompactLogix Controllers Overview

This chapter introduces the 1769 CompactLogix controllers. These controllers offer state-of-the-art control, communication, and I/O elements in a distributed control package.

About the 1769 CompactLogix Controller

The 1769 CompactLogix controller offers state-of-the-art control, communication, and I/O elements in a distributed control package.

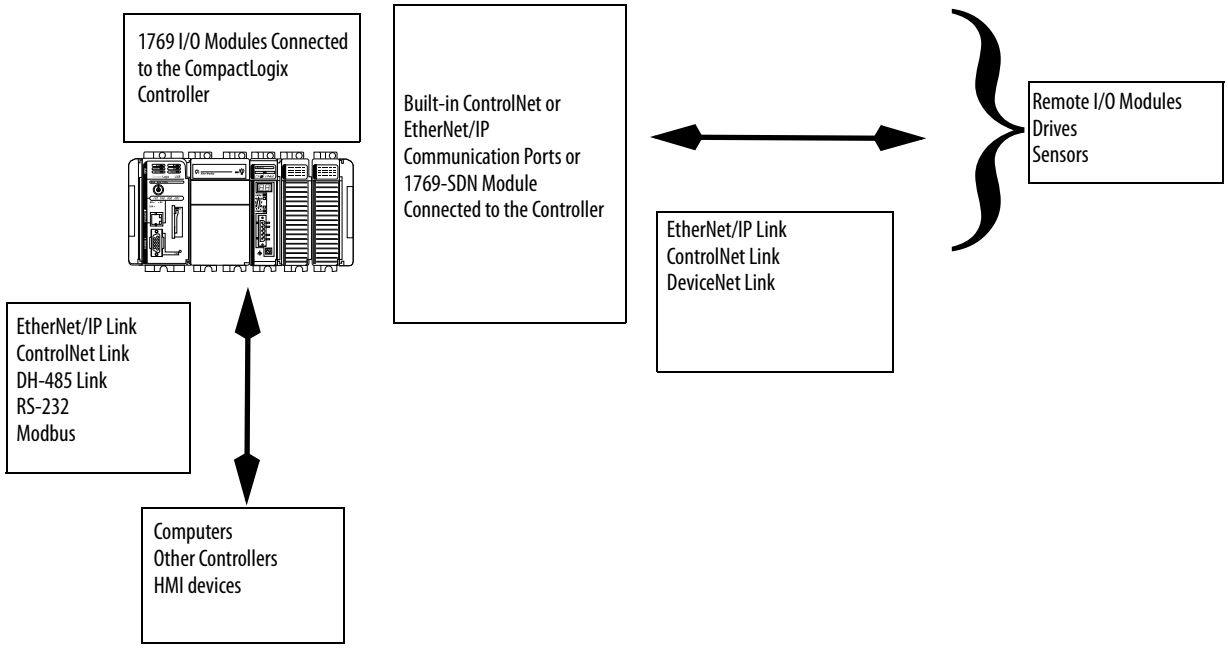
Figure 1 - CompactLogix Controller and 1769 I/O Modules



For a more flexible system, use:

- multiple controllers in a single chassis.
- multiple controllers joined across networks.
- I/O in multiple platforms that is distributed in many locations and connected over multiple I/O links.

Figure 2 - CompactLogix System Overview



The CompactLogix controller, part of the Logix family of controllers, provides a small, powerful, cost-effective system consisting of the following:

- RSLogix™ 5000 programming software
- Built-in communication ports for EtherNet/IP (1769-L32E and 1769-L35E only) and ControlNet (1769-L32C and 1769-L35CR only) networks
- A 1769-SDN communication interface module providing I/O control and remote device configuration over DeviceNet
- A built-in serial port on every CompactLogix controller
- Compact I/O modules providing a compact, DIN-rail or panel-mounted I/O system

Table 1 - CompactLogix Controller Combinations

Controller	Available Memory	Communication Options	Number of Tasks Supported	Number of Local I/O Modules Supported
1769-L35CR	1.5 MB	1 port ControlNet - supports redundant media 1 port RS-232 serial (system or user protocols)	8	30
1769-L35E		1 port EtherNet/IP 1 port RS-232 serial (system or user protocols)		
1769-L32C	750 KB	1 port ControlNet 1 port RS-232 serial (system or user protocols)	6	16
1769-L32E		1 port EtherNet/IP 1 port RS-232 serial (system or user protocols)		
1769-L31	512 KB	1 port RS-232 serial (system or user protocols) 1 port RS-232 serial (system protocol only)	4	

Design a CompactLogix System

When designing a CompactLogix system, determine the network configuration and the placement of components in each location. To design your CompactLogix system, you must select the following:

- I/O devices
- A communication network
- Controllers
- Power supplies
- Software

Notes:

Install the 1769-L3*x* Controllers

Use this chapter to install the CompactLogix™ controller, which must be the leftmost module in the first bank of the system.

WARNING: This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- • Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley® publication 1770-4.1, for additional installation requirements
- • NEMA 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure

WARNING: This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

Table 2 - North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	**Informations sur l'utilisation de cet équipement en environnements dangereux.**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
 **WARNING: Explosion Hazard -** • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	 **AVERTISSEMENT: Risque d'Explosion –** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Table 3 - European Hazardous Location Approval

European Zone 2 Certification (The following applies when the product bears the Ex or EEx Marking)
This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC and has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in potentially explosive atmospheres, given in Annex II to this Directive. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-15 and EN 60079-0.

WARNING:

- This equipment must be installed in an enclosure providing at least IP54 protection when applied in Zone 2 environments.
- This equipment shall be used within its specified ratings defined by Allen-Bradley.
- Provisions shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40% when applied in Zone 2 environments.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

ATTENTION: This equipment is not resistant to sunlight or other sources of UV radiation.

Verify Compatibility

IMPORTANT The series B controllers are compatible only with the controller firmware and the RSLogix 5000 software versions as indicated in the table below.

Attempting to use controllers with incompatible software and firmware revisions can result in the following:

- An inability to connect to the series B controller in RSLogix 5000 software
- Unsuccessful firmware upgrades in ControlFLASH™ or AutoFlash utilities

This table shows the compatible pairs of RSLogix 5000 software versions and controller firmware revisions.

Controller	RSLogix 5000 Software Version or Later	Controller Firmware Revision or Later
1769-L31, 1769-L32C, 1769-L32E, 1769-L35CR, 1769-L35E	16.00.00	16.023
	17.01.02	17.012
	19.01.00	19.015
	20.01.00	20.013

Before You Begin

Consider the following when planning your CompactLogix system:

- The CompactLogix controller is always the leftmost module in the system.
- The controller must be within four modules of the system power supply. Some I/O modules may be up to eight modules away from the power supply. See the documentation for your 1769 I/O modules for details.
- The 1769-L32E controller supports as many as 16 I/O modules and the 1769-L35E controller supports as many as 30 I/O modules. Both controllers can use a maximum of 3 I/O banks with 2 expansion cables.
- Each I/O bank requires its own power supply.
- Only one controller can be used in a CompactLogix system.
- A 1769-ECR right end cap or 1769-ECL left end cap is required to terminate the end of the communication bus.

Parts List

These components are shipped with the controller.

Component	Description
	1769-BA battery
	1747-KY controller key

You may also use these components with the controller.

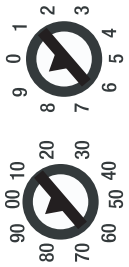
If you want to	Then use this component
Connect a device to the RS-232 port	1756-CP3 or 1747-CP3 serial cable
Add nonvolatile memory	1784-CF128 Industrial CompactFlash card
Connect a device to the EtherNet/IP port	Standard Ethernet cable with RJ-45 connector
Connect a device to the ControlNet port	• ControlNet taps for connections from controller channels A or B to the ControlNet network • 1786-CP cable for connections from a programming terminal to the ControlNet network via the controller's network access port (NAP)

Set the Node Address (ControlNet only)

Every ControlNet network requires at least one module that can store parameters and configure the network with those parameters upon startup. The CompactLogix controller is called a keeper because it keeps the network configuration.

The CompactLogix controller can keep the network parameters at any legal node address (01...99). Multiple devices on any one network can act as the network keepers. Each device capable of being the network keeper acts to back up the current keeper. This back-up function is automatic and requires no action on your part.

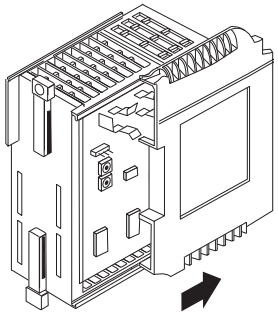
Node address switches are set to the 99 position at shipment, as shown in the figure.



43868

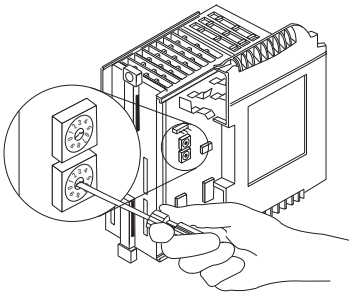
Use these steps to set the node address.

1. Slide the side cover forward.



43860

2. Use a small screwdriver to set the node address via the controller switches.



31504-M

3. Write the node address on the front panel overlay after setting the node address switches.

Connect the 1769-BA Battery

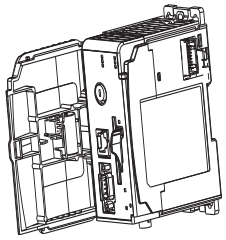
The controller is shipped with the 1769-BA battery that is packed separately. To connect the battery, follow this procedure.

ATTENTION: The 1769-BA battery is the only battery you can use with the 1769-L32E and 1769-L35E controllers. The 1747-BA battery is not compatible with the 1769-L32E and 1769-L35E controllers and may cause problems.

WARNING: When you connect or disconnect the battery, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

For safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, see Guidelines for Handling Lithium Batteries Technical Data, publication AG-5.4NOV04.

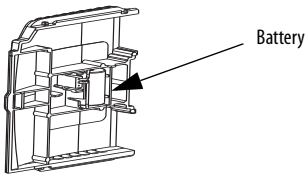
1. Remove the battery door by sliding it forward.



IMPORTANT Do not remove the plastic insulation covering the battery. The insulation is necessary to protect the battery contacts.

1. Insert the battery connector into the connector port.

   The connector is keyed to be installed with the correct polarity.
2. Insert the battery into the battery port in the battery door.



3. Slide the battery door back until it clicks into position.

TIP At the end of its life, the used battery should be collected separately from any unsorted municipal waste and recycled.

Install a CompactFlash Card (optional)

ATTENTION: Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF status indicator. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

The optional industrial CompactFlash card provides nonvolatile memory for a CompactLogix controller. The card is not required for controller operation.

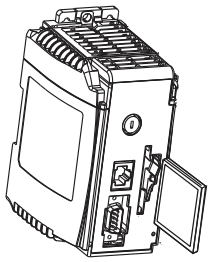
WARNING: When you insert or remove the CompactFlash card while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

To install a CompactFlash card, push the locking tab to the right and insert the industrial CompactFlash card into the socket on the front of the controller.

The label of the CompactFlash card faces toward the left. Match the orientation arrow on the card with the arrow on the front of the controller.

To remove the CompactFlash card, push the locking tab away from the CompactFlash card and pull the CompactFlash card from the socket.



44732

Assemble the System

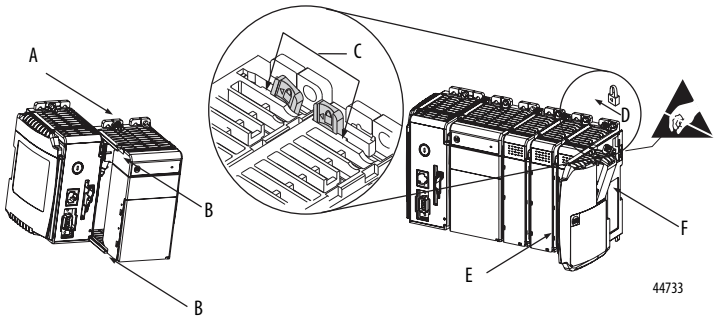
The controller can be attached to an adjacent I/O module or power supply before or after mounting.

WARNING: The CompactLogix controller is not designed for removal and insertion under power.

If you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

Refer to the illustration when installing a controller.



44733

1. Disconnect line power.
2. Check that the lever of the adjacent module (A) is in the unlocked (fully right) position.

3. Use the upper and lower tongue-and-groove slots (B) to secure the modules together.
4. Move the module back along the tongue-and-groove slots until the bus connectors line up with each other.
5. Use your fingers or a small screwdriver to push the module's bus lever back slightly to clear the positioning tab (C).
6. Move the module's bus lever fully to the left (D) until it clicks, being sure it is locked firmly in place.

ATTENTION: When attaching the controller, power supply, and I/O modules, make sure the bus connectors are securely locked together to be sure of proper electrical connection.

This equipment is not resistant to sunlight or other sources of UV radiation.

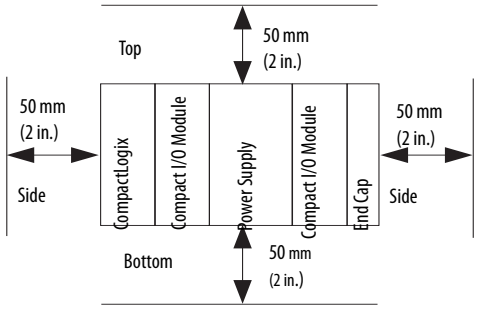
7. Attach an end-cap terminator (E) to the last module in the system by using the tongue-and-groove slots as before.
8. Lock the end-cap bus terminator (F).

Mount the System

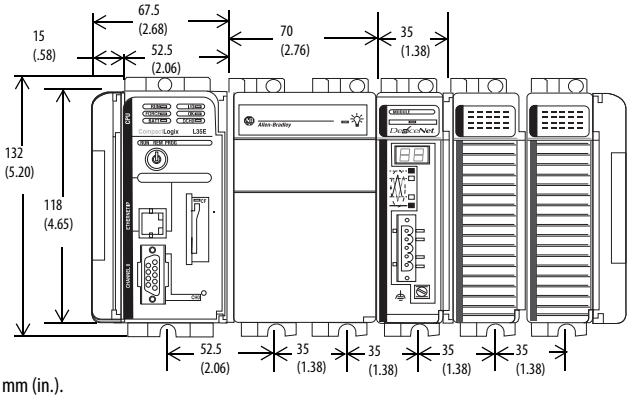
ATTENTION: During panel or DIN-rail mounting of all devices, be sure that all debris (such as metal chips or wire strands) is kept from falling into the controller. Debris that falls into the controller could cause damage while the controller is energized.

Minimum Spacing

Maintain spacing from enclosure walls, wireways, and adjacent equipment. Allow 50 mm (2 in.) of space on all sides, as shown. This provides ventilation and electrical isolation.



Dimensions



All dimensions are in mm (in.).

IMPORTANT Compact I/O expansion cables have the same dimensions as the end caps. Expansion cables can be used on either the right or left end. A 1769-ECR right-end cap or 1769-ECL left-end cap terminates the end of the communication bus.

Ground the Wiring

ATTENTION: This product is grounded through the DIN rail to chassis ground. Use zinc-plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (such as aluminum or plastic) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding. Secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the controller's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded.

Refer to Allen-Bradley Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional information.

Mount the Panel

Mount the controller to a panel by using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module. This procedure lets you use the assembled modules as a template for drilling holes in the panel.

IMPORTANT Due to module-mounting hole tolerance, it is important to follow these procedures.

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel and check for proper hole alignment.

   TIP The grounding plate, that is, where you install the mounting screws, enables the module to be grounded when it is panel-mounted.

6. Attach the modules to the panel by using the mounting screws.

   TIP If you are mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time when you are drilling and tapping the next group of modules.

7. Repeat steps 1...6 for any remaining modules.

Mount the Controller on the DIN Rail

The controller can be mounted on the following DIN rails:

- EN 50 022 - 35 x 7.5 mm (1.38 x 0.30 in.)
- EN 50 022 - 35 x 15 mm (1.38 x 0.59 in.)

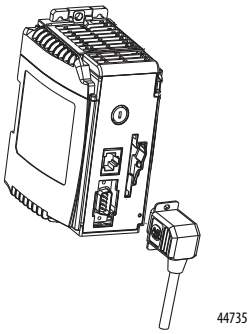
ATTENTION: This product is grounded through the DIN rail to chassis ground. Use zinc-plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (for example, aluminum or plastic) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding. Secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.

1. Before mounting the controller on a DIN rail, close the DIN rail latches.
2. Press the DIN-rail mounting area of the controller against the DIN rail.

   The latches will momentarily open and lock into place.

Make RS-232 Connections to the Controller

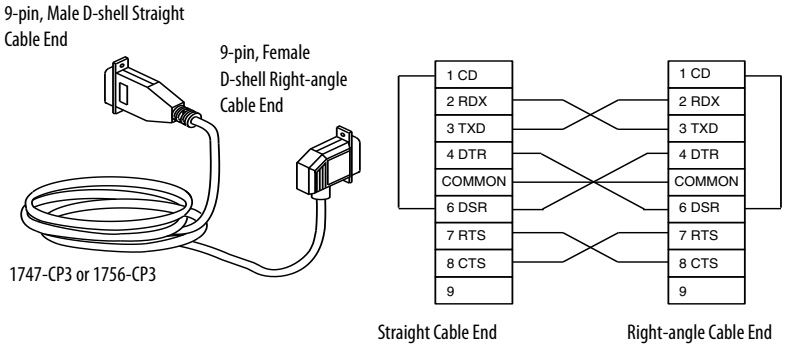
Connect the 9-pin female end of the serial cable to the serial port of the controller.



WARNING: If you connect or disconnect the serial cable with power applied to this module or the serial device on the other end of the cable, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

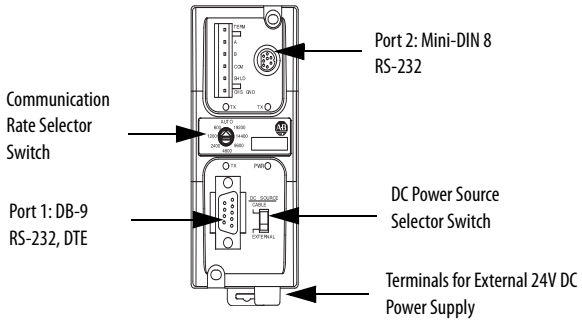
RS-232 Cable



TIP This cable must be shielded and tied to the connector housing.

Optical Isolator (1769-L31 only)

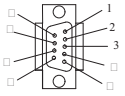
Channel 0 is fully isolated and does not need a separate isolation device. Channel 1 is nonisolated. If you connect channel 1 to a device outside of the system's enclosure, consider installing an isolator (such as the 1761-NET-AIC interface converter) between the controller and device.



Select the appropriate cable.

Isolator Use	Cable
No	The 1756-CP3 cable attaches the controller directly to the controller. If you make your own cable, it must be shielded and the shields must be tied to the metal shell surrounding the pins on the ends of the cable. You can also use a 1747-CP3 cable. This cable has a taller right-angle connector housing than the 1756-CP3 cable.
Yes	The 1761-CBL-AP00 cable (right-angle connector to controller) or the 1761-CBL-PM02 cable (straight connector to the controller) attaches the controller to port 2 on the 1761-NET-AIC isolator. The mini-DIN connector is not commercially available, so you cannot make this cable.

Pin	DB-9 End	Mini-DIN End
1	DCD	DCD
2	RxD	RxD
3	TxD	TxD
4	DTR	DTR
5	Ground	Ground
6	DSR	DSR
7	RTS	RTS
8	CTS	CTS
9	N/A	N/A



DB-9 Right-angle or Straight Cable End

8-pin, Mini-DIN Cable End

Default Serial Configuration

Channel 0 and Channel 1 (both serial ports) have the following default communication configuration.

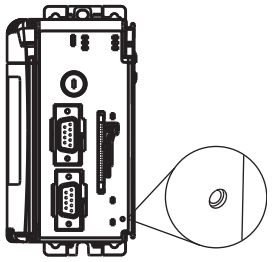
Parameter	Default
Protocol	DF1 Full-duplex
Communication Rate	19.2 Kbps
Parity	None
Station Address	0
Control Lines	No Handshaking

Parameter	Default
Error Detection	BCC
Embedded Responses	Auto Detect
Duplicate Packet (Message) Detect	Enabled
ACK Timeout	50 (x 20 ms)
NAK Receive Limit	3 Retries
ENQ Transmit Limit	3 Retries
Data Bits	8
Stop Bits	1

TIP Only Channel 0 has a default communication push button.

Using the Channel 0 Default Communication Push Button

The Channel 0 default communication push button is located on the front of the controller in the lower right corner as shown in the illustration. Use the Channel 0 default communication push button to change from the user-defined communication configuration to the default Communication mode. The Channel 0 default communication (DCH0) status indicator turns on (green, steady) to indicate that the default communication configuration is active.



IMPORTANT The default communication push button is recessed.

Before pressing the default communication push button, be sure to note the present communication configuration for Channel 0. Pushing the default communication push button resets all configured parameters back to their default settings.

To return the channel to its user-configured parameters, you must enter them manually while online with the controller or download them as part of an RSLogix 5000 software project file. To do this online with RSLogix 5000 software, access the Controller Properties dialog box and enter parameters on the Serial Port, System Protocol, and User Protocol tabs.

Make Ethernet Connections to the Controller

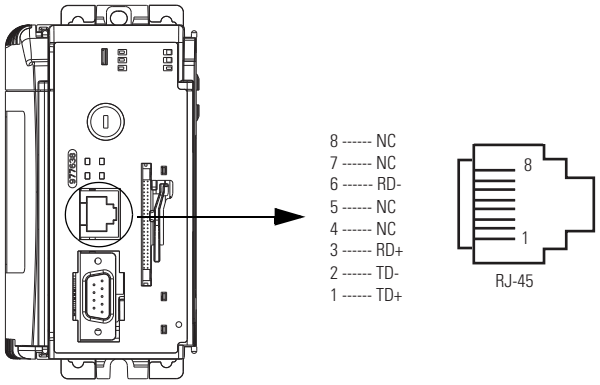
The 1769-L32E and 1769-L35E controller are shipped with the BOOTP utility enabled. You must assign an IP address to the Ethernet port for the controller to communicate over an EtherNet/IP network.

WARNING: If you connect or disconnect the communication cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding

Connect the RJ-45 connector of the Ethernet cable to the Ethernet port (top port) on the controller.

ATTENTION: Do not plug a DH-485 network cable or a NAP cable into the Ethernet port. Undesirable behavior or damage to the port may result.



Assign an IP Address

You can set the IP address by using any of these utilities:

- Rockwell BOOTP Utility (available with RSLinx® and RSLogix 5000 software)
- RSLinx software
- RSLogix 5000 software

Use BOOTP to Set the IP Address

The BOOTP utility is a standalone program in one of the following directories:

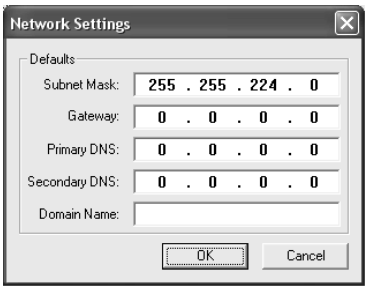
- RSLinx Tools directory in the Rockwell Software® program folder on the Start menu

  The utility is automatically installed when you install RSLinx software.
- Utils directory on the RSLogix 5000 software installation CD

Follow this procedure to use the BOOTP utility.

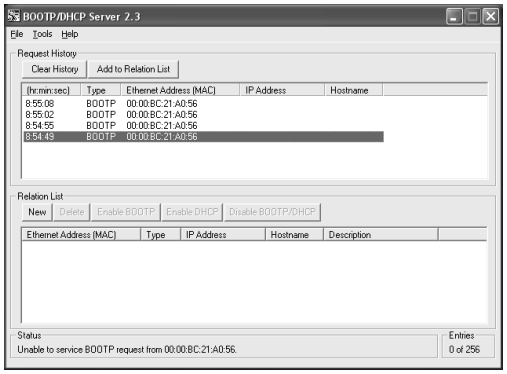
1. Start the BOOTP software.
2. Select Tools>Network Settings.
3. Enter the Ethernet mask and gateway.

4. Click OK.



In the BOOTP Request History dialog box, you see the hardware addresses of devices issuing BOOTP requests.

5. Double-click the hardware address of the device you want to configure.

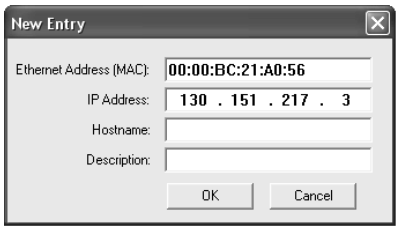


TIP The hardware address is on the sticker on the left-side circuit board of the controller next to the battery.

The hardware address will be in this format: 00-0b-db-14-55-35.

The New Entry dialog box displays the device's Ethernet Address (MAC).

6. Enter the IP address.
7. Click OK.



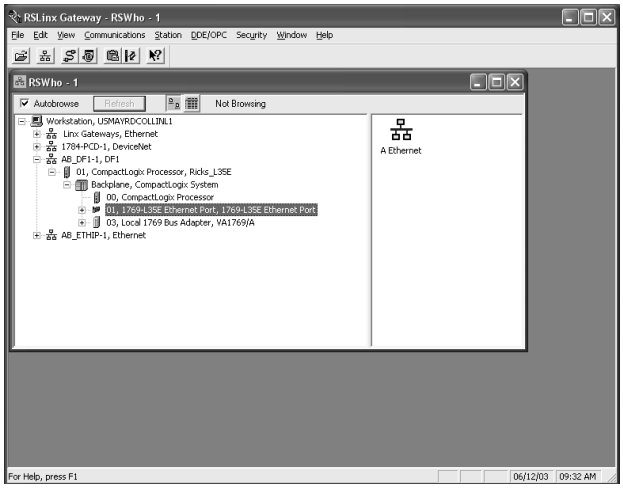
8. To permanently assign this configuration to the device, highlight the device and click Disable BOOTP/DHCP.

When you cycle power, the device uses the configuration you assigned and does not issue a BOOTP request.

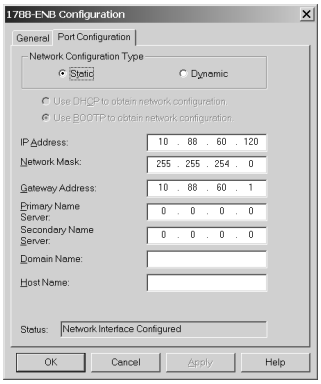
Use RSLinx Software to Set the IP Address

1. You can use RSLinx software, version 2.41 or later, to set the IP address.
2. Make sure the controller that uses the IP address is installed and running.
3. Connect to the controller via the serial connection (see page 26).
4. Start RSLinx software.

   The RSWho dialog box opens.
5. Navigate to the Ethernet network via the serial network.



6. Right-click the Ethernet port (not the controller) and select Module Configuration.
7. Select the Port Configuration tab.
8. Click the appropriate radio button to choose the Network Configuration type.

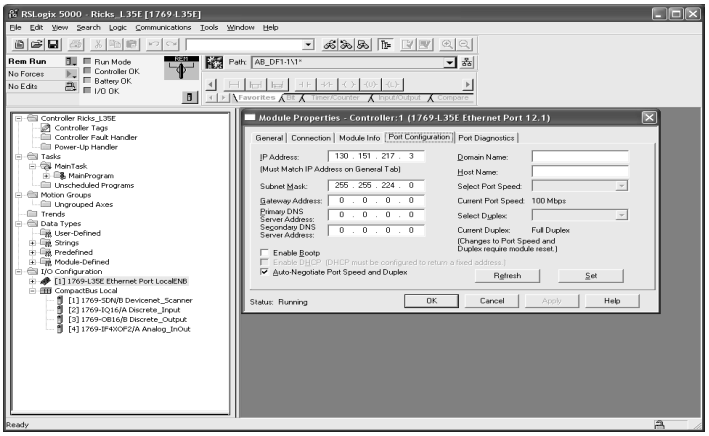


9. Enter the IP address, network (subnet) mask, and gateway address (if needed).

Use RSLogix 5000 Software to Set the IP Address

You can use RSLogix software to set the IP address.

1. Make sure the controller that uses the IP address is installed and running.
2. Connect to the controller via the serial connection (see page 26).
3. Start RSLogix 5000 software.
4. In the Controller Organizer, select properties for the Ethernet port.



5. Choose the Port Configuration tab.
6. Specify the IP address.
7. Click Apply.
8. Click OK.

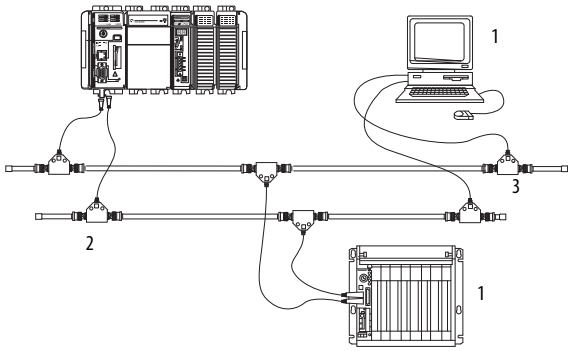
   This sets the IP address in the hardware. This IP address should be the same IP address you assigned under the General tab.

Make ControlNet Connections to the Controller

The CompactLogix 1769-L32C and 1769-L35CR controllers connect to the ControlNet network. The CompactLogix 1769-L32C controller supports channel A connections only. The CompactLogix 1769-L35CR controller supports channels A and B (redundant media) connections.

For permanent connections to the network, you connect the module to the ControlNet network by using a ControlNet tap (for example, 1786-TPR, 1786-TPS, 1786-TPYR, 1786-TPYS).

The figure shows an example ControlNet network using redundant media.



Item	Description
1	ControlNet node
2	Redundant media available on 1769-L35CR only
3	ControlNet link

When connecting the CompactLogix controller to a ControlNet network, also refer to the following documentation:

- ControlNet Coax Tap Installation Instructions, publication 1786-IN007
- ControlNet Coax Media Planning and Installation Guide, publication CNET-IN002
- ControlNet Fiber Media Planning and Installation Guide, publication CNET-IN001

IMPORTANT For network connections we recommend taps with a straight connector (catalog number 1786-TPS or 1786-TPYS) because of the location of the BNC connectors on the bottom of the module.

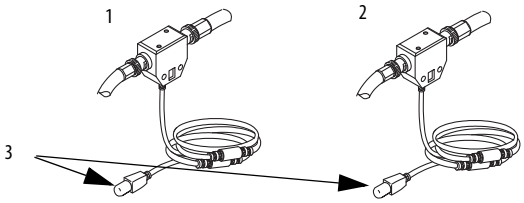
Connect the Controller to the Network via a ControlNet Tap

Typically, ControlNet taps are used to make permanent connections from the CompactLogix controller to the network. Perform the following steps to connect the module to the network by using a ControlNet tap.

ATTENTION: Do not allow any metal portions of the tap to contact any conductive material.

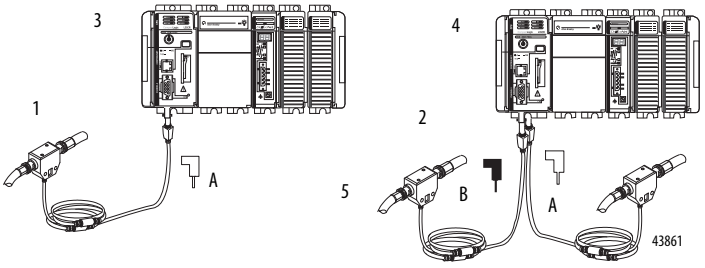
If you disconnect the tap from the module, place the dust cap back on the straight or right angle connector to prevent the connector from accidentally contacting a metallic grounded surface.

1. Remove and save the dust caps from the ControlNet taps.



Item	Description
1	Segment 1
2	Segment 2
3	Dust caps

2. Connect the tap's straight or right-angle connector to the module's BNC connector as shown in the figure.



Item	Description
1	Segment 1
2	Segment 2
3	Tap connected to a CompactLogix controller not using redundant media
4	Tap connected to a CompactLogix controller using redundant media (1769-L35CR unit only)
5	Tap

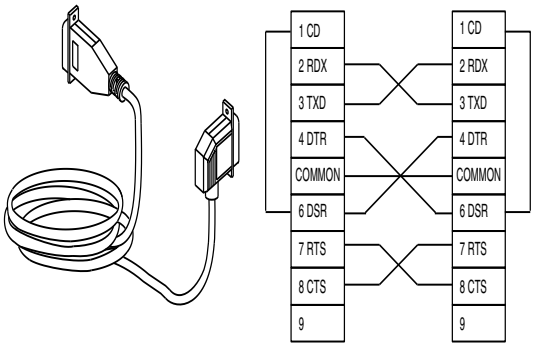
IMPORTANT To prevent inadvertent reversal of the tap connections (resulting in incorrect status displays requiring troubleshooting), check the tap drop cable for the label indicating the attached segment before making your connection.

WARNING: If you connect or disconnect the communication cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding

Connect a Programming Terminal to the Network via a 1786-CP Cable

You can use the CompactLogix controller's network access port (NAP) to connect a programming terminal to the ControlNet network. The figure shows the 1786-CP cable connections.



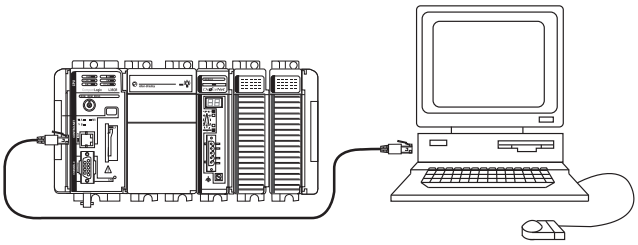
WARNING: The NAP port is intended for temporary local-programming purposes only and not intended for permanent connection. If you connect or disconnect the NAP cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

ATTENTION: Use the 1786-CP cable when you connect a programming terminal to the network through the NAP.

Using another cable could result in possible network failures or product damage.

Connect one end of the 1786-CP cable to the CompactLogix controller and the other end to the NAP of the programming terminal.



ATTENTION: Do not plug a DH-485 network cable or an RJ45 connector for the EtherNet/IP network to the NAP. Undesirable behavior and/or damage to the port may result.

Install the Appropriate EDS Files

If you have RSLinx software, version 2.42 or later, the most current EDS files were installed with the software. If you are using an earlier version of RSLinx software, you might need to install EDS files.

You need EDS files for these devices:

- 1769-L32E and 1769-L35E controllers
- 1769 CompactBus
- 1769 local adapter

All of these EDS files, except for the 1769 CompactBus file, are updated for each firmware revision. There is also a version 1 of the controller EDS file that you need for new controllers. Each controller is shipped with revision 1 firmware. To update the firmware, you must have the revision 1 EDS file (0001000E00410100.eds) installed for the controller.

The EDS files are available on the RSLogix 5000 Enterprise Series software CD. The files are also available at http://www.ab.com/networks/eds.

Load the Controller Firmware

You must download the current firmware before you can use the controller.

To load firmware, you can use any of the following:

- ControlFLASH utility that is shipped with RSLogix 5000 programming software
- AutoFlash that launches through RSLogix 5000 software when you download a project and the controller does not have the matching firmware revision
- CompactFlash card (catalog number 1784-CF128) with valid memory already loaded

If you use the ControlFLASH or AutoFlash utilities, you need a network connection to the controller.

The firmware is available with RSLogix 5000 software or you can download it from the support website. Go to http://www.rockwellautomation.com/support/.

Follow these steps to download firmware from the support website.

1. On the Rockwell Automation Support Page, click Software Updates, Firmware and Other Downloads under the Other Tools heading.
2. Click Firmware Updates.
3. Select the appropriate firmware update.
4. Select the firmware revision.
5. Click a revision file to unzip the data.

Use the ControlFLASH Utility to Load Firmware

You can use the ControlFLASH utility to load firmware through a serial connection.

1. Make sure the appropriate network connection is made before starting.
2. Start the ControlFLASH utility.
3. When the Welcome dialog box appears, click Next.
4. Choose the catalog number of the controller and click Next.
5. Expand the network until you see the controller.
6. If the required network is not shown, first configure a driver for the network in RSLinx software.
7. Choose the controller and click OK.
8. Choose the revision level to which you want to update the controller and click Next.
9. To start the update of the controller, click Finish and then click Yes.
10. After the controller is updated, the status dialog box displays Update complete.
11. Click OK.
12. To close the ControlFLASH utility, click Cancel and then click Yes.

Use AutoFlash to Load Firmware

You can use AutoFlash to load firmware through a network connection.

IMPORTANT When upgrading your controller firmware, it is extremely important to allow the upgrade to complete without interruption.

If you interrupt the firmware upgrade either in the software or by disturbing the physical media, you may render the controller inoperable.

For more information about upgrading your CompactLogix controller firmware, see information posted at http://www.rockwellautomation.com/knowledgebase/.

1. Make sure the appropriate network connection is made and your network driver is configured in RSLinx software.
2. Use RSLogix 5000 programming software to create a controller project.
3. Click RSWho to specify the controller path.

4. Select your controller and click Download.

   You may also choose to click Update Firmware to complete this process. If you do so, skip to step 8.

   A dialog box displays indicating that the project revision and controller firmware revision are different.

5. Click Update Firmware.
6. Use the checkbox and pull-down menu to select your controller and firmware revision.
7. Click Update.
8. Click Yes.

   The firmware upgrade begins.

IMPORTANT	**DO NOT INTERRUPT THE FIRMWARE UPGRADE ONCE IT HAS BEGUN.** Interrupting the firmware upgrade may result in an inoperable controller.

When the firmware upgrade is complete, the Download dialog box appears and you may continue by downloading your project to the controller.

Use a CompactFlash Card to Load Firmware

If you have an existing controller that is already configured and has firmware loaded, you can store the current controller user program and firmware on the CompactFlash card and use that card to update other controllers.

1. Use RSLogix 5000 software to store the controller user program and firmware of a currently configured controller to the CompactFlash card.
2. Access the Nonvolatile Memory tab of the Controller Properties dialog box.

   Be sure to select Load Image On Powerup when you save to the card.

3. Remove the card and insert it into a controller that will use the same firmware and controller user program.

   When you apply power to the second controller, the image stored on the CompactFlash card is loaded into the controller.

Select the Controller's Operating Mode

Use the keyswitch on the front panel of the controller to determine the controller's operating mode.

Keyswitch Position	Description	
Run	• Upload projects. • Run the program and enable outputs. • You cannot create or delete tasks, programs, or routines. You cannot create or delete tags or edit online while the keyswitch is in the Run position. • You cannot change the mode by using the programming software while the keyswitch is in the Run position.	
Prog	• Disable outputs. • Upload/download projects. • Create, modify, and delete tasks, programs, or routines. • The controller does not execute (scan) tasks while the keyswitch is in the Prog position. • You cannot change the mode through the programming software while the keyswitch is in the Prog position.	
Rem	• Upload/download projects. • Change between Remote Program, Remote Test, and Remote Run modes through the programming software.	
	Remote Run	• The controller executes (scans) tasks. • Enable outputs. • Edit online.
	Remote Program	• Disable outputs. • Create, modify, and delete tasks, programs, or routines. • Download projects. • Edit online. • The controller does not execute (scan) tasks.
	Remote Test	• Execute tasks with outputs disabled. • Edit online.

Notes:

Connect to the Controller via the Serial Port

This chapter describes how to connect to the controller via the serial port so that you can configure the controller and upload or download a project to the controller.

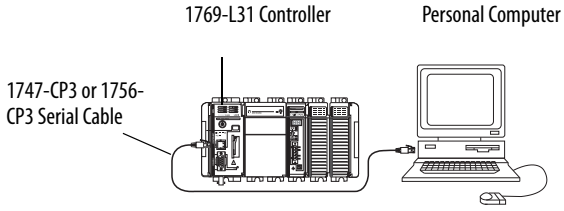
For the CompactLogix controller to operate on a serial network, you need:

- a workstation with a serial port.
- RSLinx software to configure the serial communication driver.
- RSLogix5000 programming software to configure the serial port of the controller.

Connect to the Controller via the Serial Port

Channel 0 on the CompactLogix controllers is fully isolated and does not need a separate isolation device. Channel 1 on the 1769-L31 is not an isolated serial port.

Figure 3 - Serial Connection to Controller

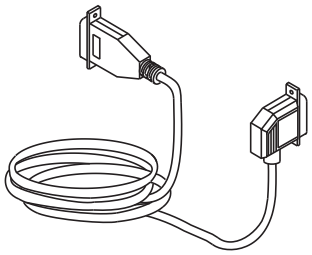


If you connect channel 1 of the 1769-L31 controller to a modem or an ASCII device, consider installing an isolator between the controller and modem or ASCII device. An isolator is also recommended when connecting the controller directly to a programming workstation. One possible isolator is the 1761-NET-AIC interface converter.

For more information on installing an isolator, see Configure an Isolator on page 57.

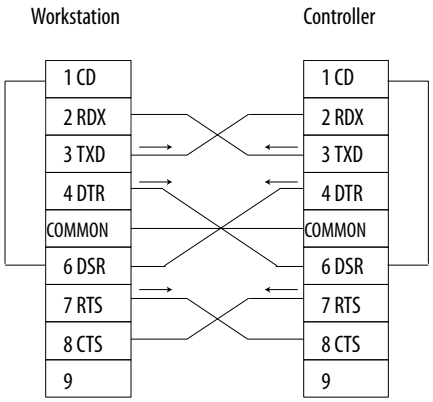
To connect a serial cable, perform this procedure.

1. Obtain a 1747-CP3 or 1756-CP3 serial cable.

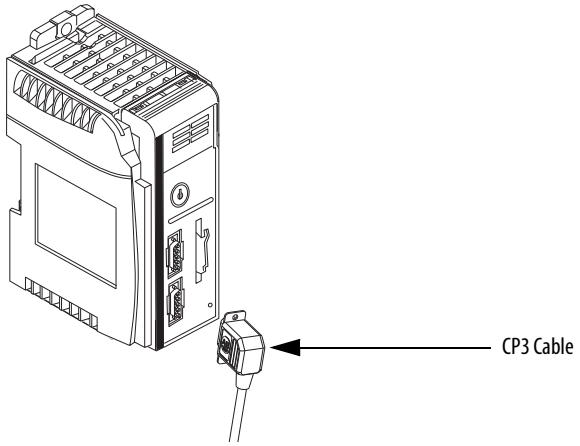


TIP If you make your own serial cable, complete this procedure.

- Limit the length to 15.2 m (50 ft).
- Wire the connectors.



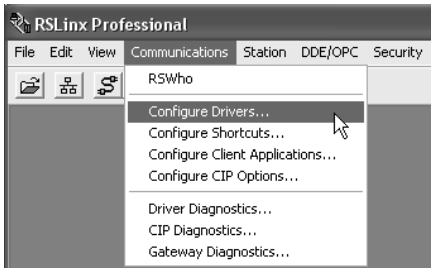
2. Connect the cable to your controller and workstation.



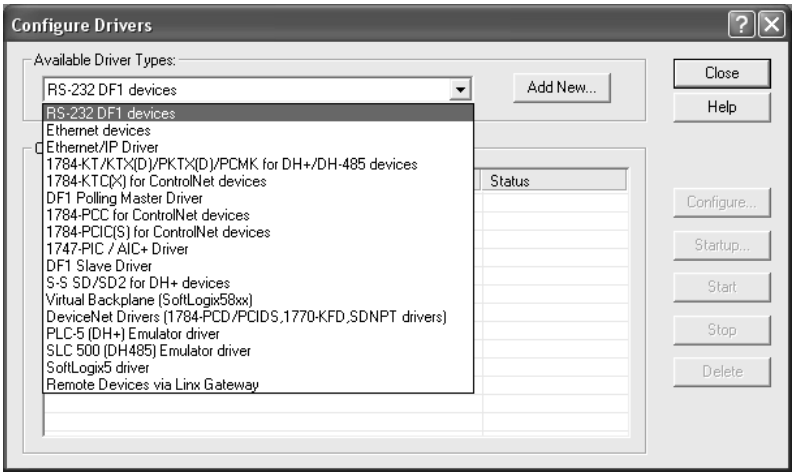
Configure the Serial Driver

Use RSLinx software to configure the RS-232 DF1 Device driver for serial communication. To configure the driver, perform this procedure.

1. From the communication pull-down menu, choose Configure Drivers.

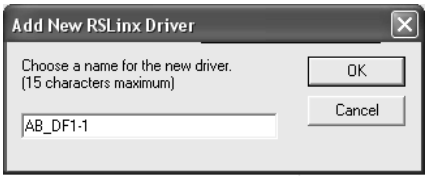


   The Configure Drivers dialog box appears.



2. From the Available Driver Types pull-down menu, choose the RS-232 DF1 Device driver.
3. Click Add New to add the driver.

   The Add New RSLinx Driver dialog box appears.



4. Specify the driver name and click OK.

The Configure RS-232 DF1 Devices dialog box appears.

5. Specify the serial port settings.
   a. From the Comm Port pull-down menu, choose the serial port on the workstation to which the cable is connected.
   b. From the Device pull-down menu, choose Logix 5550-Serial Port.
   c. Click Auto-Configure.
6. Verify that the Auto-Configuration was successful.

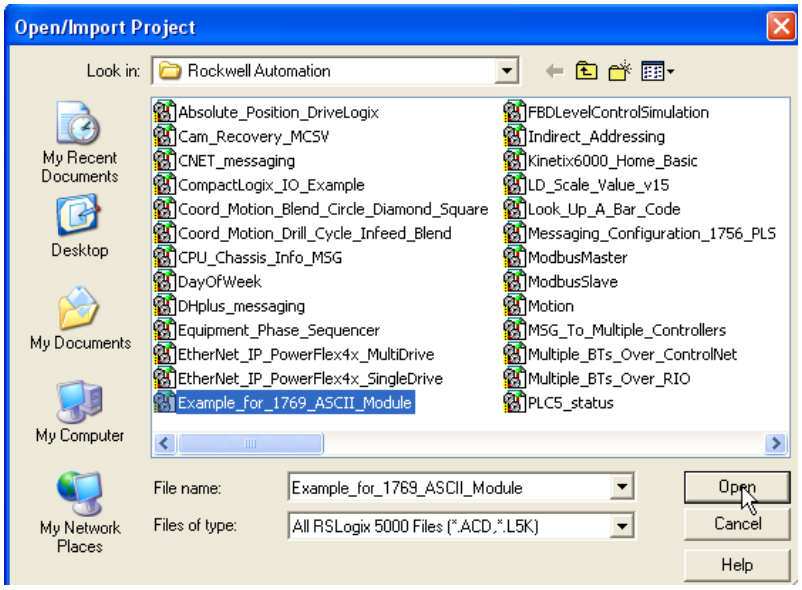
If	Then
Yes	Click OK.
No	Go to step 5 and verify that you selected the correct communication port.

7. Click Close.

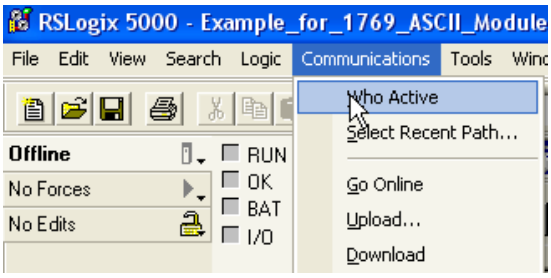
Select the Controller Path

To select the controller path, perform this procedure.

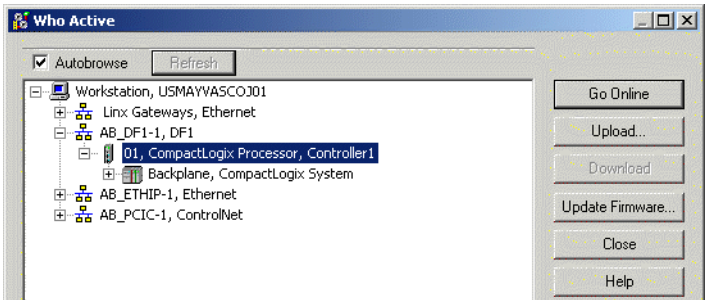
1. In RSLogix 5000 programming software, open a project for the controller.



2. From the Communications pull-down menu, choose Who Active.



The Who Active dialog box appears.



3. Expand the communication driver to the level of the controller.
4. Select the controller.

Controller Options

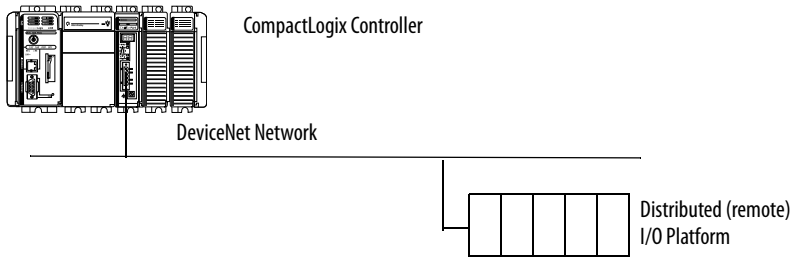
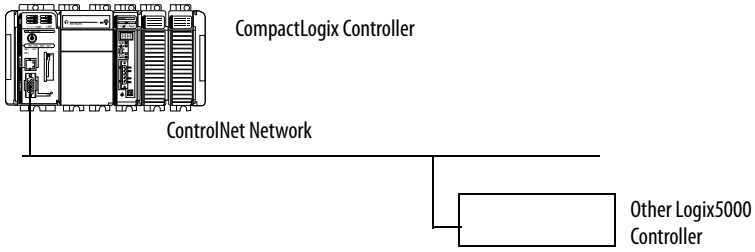
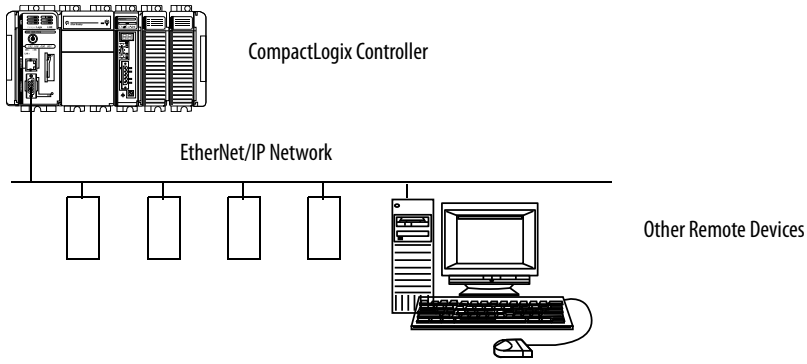
Once you have selected a controller, you have several options.

To	Choose
Monitor the project in the controller	Go Online
Transfer a copy of the project from the controller to RSLogix 5000 software	Upload
Transfer the open project to the controller	Download

Communicate over Networks

This chapter explains how CompactLogix controllers support additional networks to enable various functions.

Table 4 - CompactLogix Controller Network Support

Function	Example
Control distributed (remote) I/O. • EtherNet/IP • ControlNet • DeviceNet	
Produce/consume (interlock) data between controllers. • EtherNet/IP • ControlNet	
Send and receive messages to and from other devices. This includes access to the controller via RSLogix 5000 programming software. • EtherNet/IP • ControlNet • DeviceNet (to devices only) • serial • DH-485	

EtherNet/IP Network Communication

The EtherNet/IP network offers a full suite of control, configuration and data collection services by layering the Common Industrial Protocol (CIP) over the standard Internet protocols, such as TCP/IP and UDP. This combination of well-accepted standards provides the capability required to both support information data exchange and control applications.

The EtherNet/IP network also uses commercial, off-the-shelf Ethernet components and physical media, providing you with a cost-effective plant-floor solution.

For EtherNet/IP communication, you can use these CompactLogix controllers with a built-in EtherNet/IP communication port:

- 1769-L32E CompactLogix controller
- 1769-L35E CompactLogix controller

You can use several software products with a 1769 CompactLogix controller on an EtherNet/IP network.

Table 5 - EtherNet/IP Network Software Combinations

Software	Functions	Requirement
RSLogix 5000 programming software	• Configure the CompactLogix project • Define EtherNet/IP communication	Yes
BOOTP/DHCP utility with RSLogix 5000 programming software	Assign IP addresses to devices on an EtherNet/IP network	No
RSNetWorx software for an EtherNet/IP network	Configure EtherNet/IP devices by IP addresses and/or host names	No

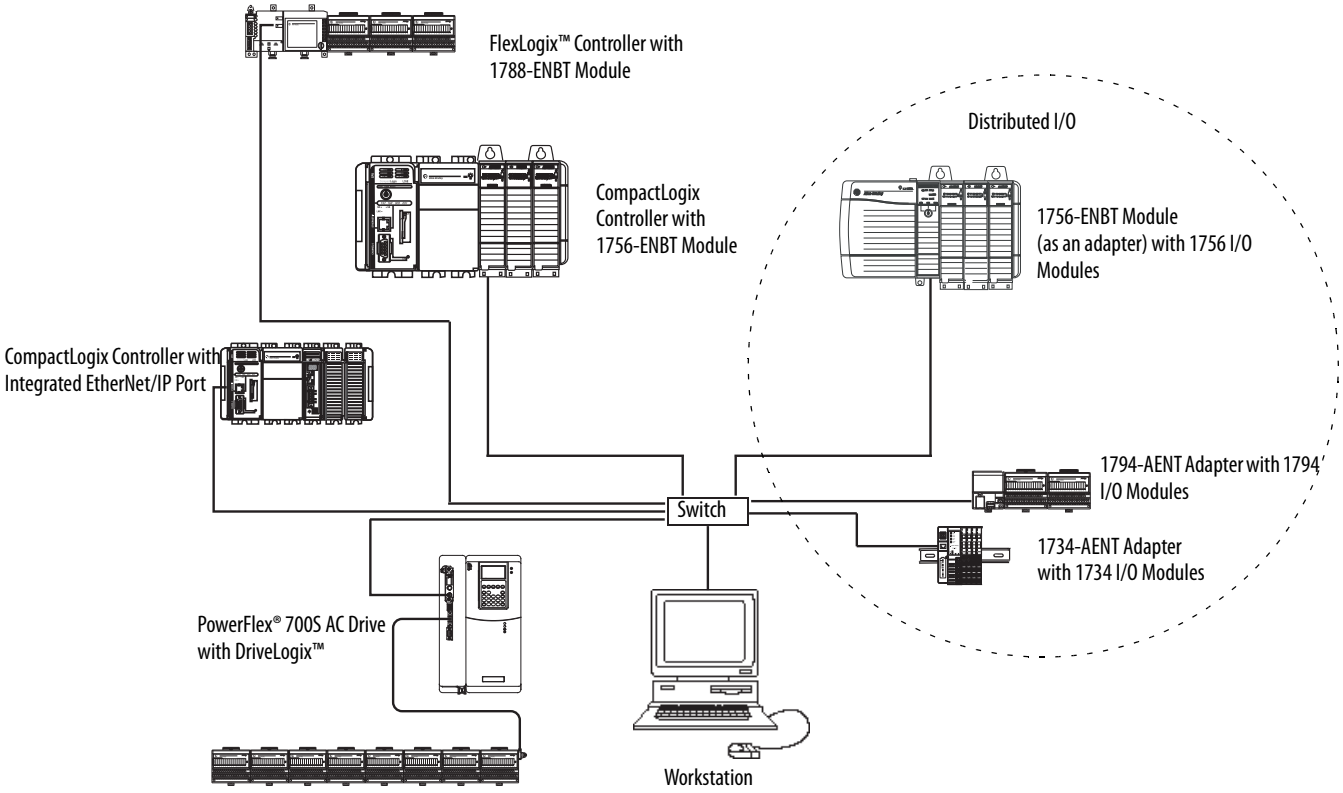
The EtherNet/IP communication modules:

- support messaging, produced/consumed tags, HMI, and distributed I/O.
- encapsulate messages within standard TCP/UDP/IP protocol.
- share a common application layer with ControlNet and DeviceNet.
- interface via RJ45, category 5, unshielded, twisted-pair cable.
- support half/full-duplex 10 Mbps or 100 Mbps operation.
- support standard switches.
- require no network scheduling.
- require no routing tables.

In this example:

- the controllers produce and consume tags amongst themselves.
- the controllers initiate MSG instructions that send and receive data or configure devices.
- the personal computer uploads or downloads projects to the controllers.
- the personal computer configures devices on an EtherNet/IP network.

Figure 4 - CompactLogix EtherNet/IP Overview



Connections over an EtherNet/IP Network

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communication between devices than unconnected messages.

All EtherNet/IP connections are unscheduled. An unscheduled connection is a message transfer between controllers that is triggered by the requested packet interval (RPI) or the program, such as a MSG instruction. Unscheduled messaging lets you send and receive data when needed.

The 1769-L32E and 1769-L35E controllers support 100 connections. However, the built-in EtherNet/IP port supports only 32 CIP connections over an EtherNet/IP network. With these controllers, the number of end-node connections they effectively support depends on a connection's RPI.

Requested Packet Interval	Max EtherNet/IP Port Communication Connections
2 ms	2
4 ms	5
8 ms	10
16 ms	18
32 ms+	25+

You can use all 32 communication connections on the built-in EtherNet/IP port. However, we recommend that you leave some connections available for tasks such as going online and non-I/O purposes.

ControlNet Network Communication

ControlNet is a real-time control network that provides high-speed transport of both time-critical I/O and interlocking data and messaging data, including uploading and downloading of programming and configuration data on a single physical-media link. The ControlNet network's highly-efficient data transfer capability significantly enhances I/O performance and peer-to-peer communication in any system or application.

The ControlNet network is highly deterministic and repeatable and remains unaffected as devices are connected or disconnected from the network. This robust quality results in dependable, synchronized, and coordinated real-time performance.

The ControlNet network often functions as:

- the default network for the CompactLogix platform.
- a substitute/replacement for the remote I/O (RIO) network because the ControlNet network adeptly handles large numbers of I/O points.
- a backbone to multiple distributed DeviceNet networks.
- a peer interlocking network.

For ControlNet communication, you can use these CompactLogix controllers with a built-in ControlNet communication port:

- 1769-L32C CompactLogix controller
- 1769-L35CR CompactLogix controller

You can use these software products with a 1769 CompactLogix controller on a ControlNet network.

Table 6 - ControlNet Network Software Combinations

Software	Functions	Requirement
RSLogix 5000 programming software	• Configure the CompactLogix project • Define EtherNet/IP communication	Yes
RSNetWorx for ControlNet software	• Configure the ControlNet network • Define the NUT (network update time) • Schedule the ControlNet network	

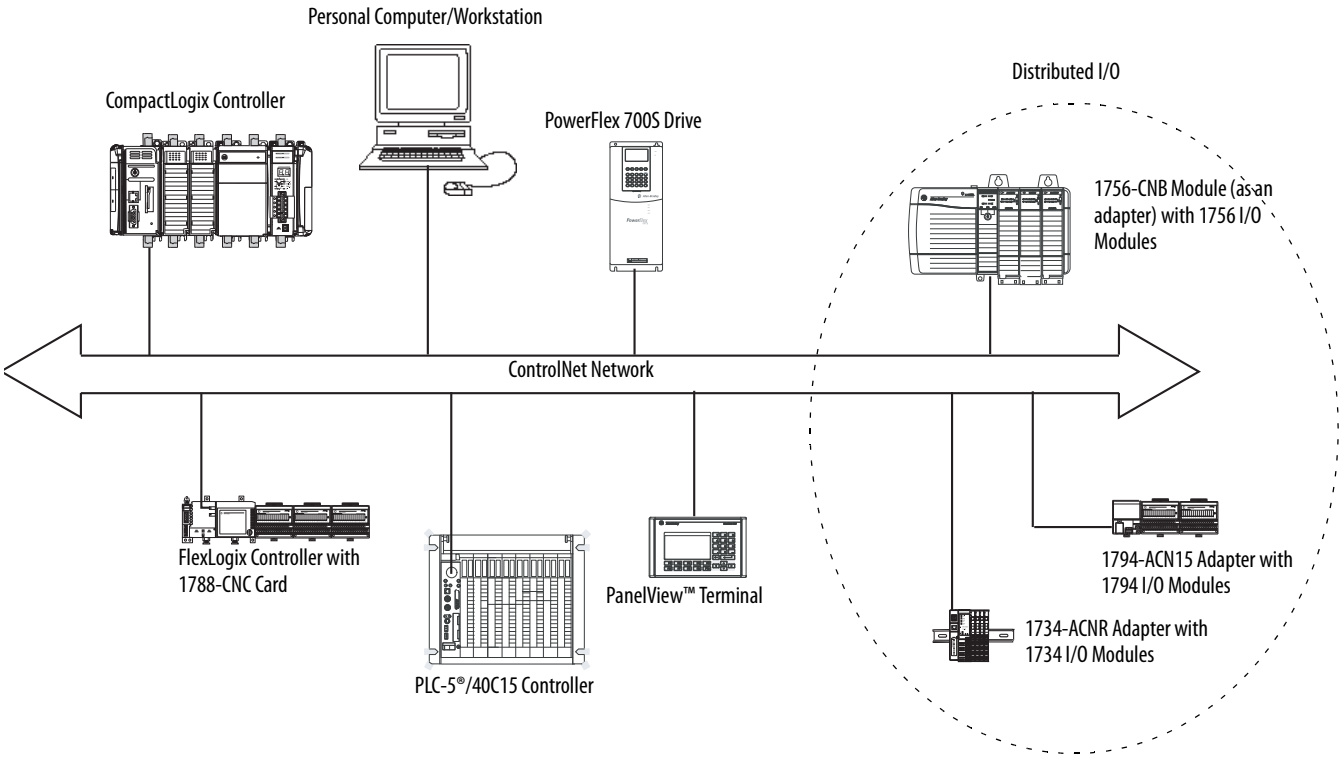
The ControlNet communication modules:

- support messaging, produced/consumed tags and distributed I/O.
- share a common application layer with DeviceNet and EtherNet/IP networks.
- require no routing tables.
- support the use of coax and fiber repeaters for isolation and increased distance.

In this example:

- the controllers produce and consume tags amongst themselves.
- the controllers initiate MSG instructions that send and receive data or configure devices.
- the personal computer uploads or downloads projects to the controllers.
- the personal computer configures devices on ControlNet, and configures the network itself.

Figure 5 - CompactLogix ControlNet Overview



Connections over ControlNet Network

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communication between devices compared to unconnected messages.

Table 7 - ControlNet Connection Methods

Connection Method	Description
Scheduled	A scheduled connection is unique to ControlNet communication. A scheduled connection lets you send and receive data repeatedly at a set interval, which is the requested packet interval (RPI). For example, a connection to an I/O module is a scheduled connection because you repeatedly receive data from the module at a specified interval. Other scheduled connections include connections to: • communication devices. • produced/consumed tags. On a ControlNet network, you must use RSNetWorx for ControlNet to enable all scheduled connections and establish a network update time (NUT). Scheduling a connection reserves network bandwidth to specifically handle the connection.
Unscheduled	An unscheduled connection is a message transfer between nodes that is triggered by ladder logic or the program (such as a MSG instruction). Unscheduled messaging lets you send and receive data when needed. Unscheduled messages use the remainder of network bandwidth after scheduled connections are allocated.

The 1769-L32C and 1769-L35CR controllers support 100 connections. However, the built-in ControlNet port only supports 32 communication connections. With these controllers, the number of end-node connections they effectively support depends on the connection's NUT and RPI.

NUT	RPI	Supported ControlNet Communication Connections[1]
2 ms	2 ms	0…1
3 ms	3 ms	1…2
5 ms	5 ms	3…4
10 ms	10 ms	6…9
14 ms	14 ms	10…12
5 ms	20 ms	12…16
4 ms	64 ms	31

(1) For each NUT/RPI combination, the number of connections supported is listed in a range. The lower number is the number of connections we recommend you make to maintain reasonable ControlNet port CPU utilization rates. The higher number is the maximum number of connections possible for that NUT/RPI combination.

You can use all 32 communication connections on the built-in ControlNet port. However, we recommend that you leave some connections available for tasks such as going online and unscheduled network traffic.

DeviceNet Communication

The DeviceNet network uses the Common Industrial Protocol (CIP) to provide the control, configuration, and data collection capabilities for industrial devices. The DeviceNet network uses the proven Controller Area Network (CAN) technology, which lowers installation costs and decreases installation time and costly downtime.

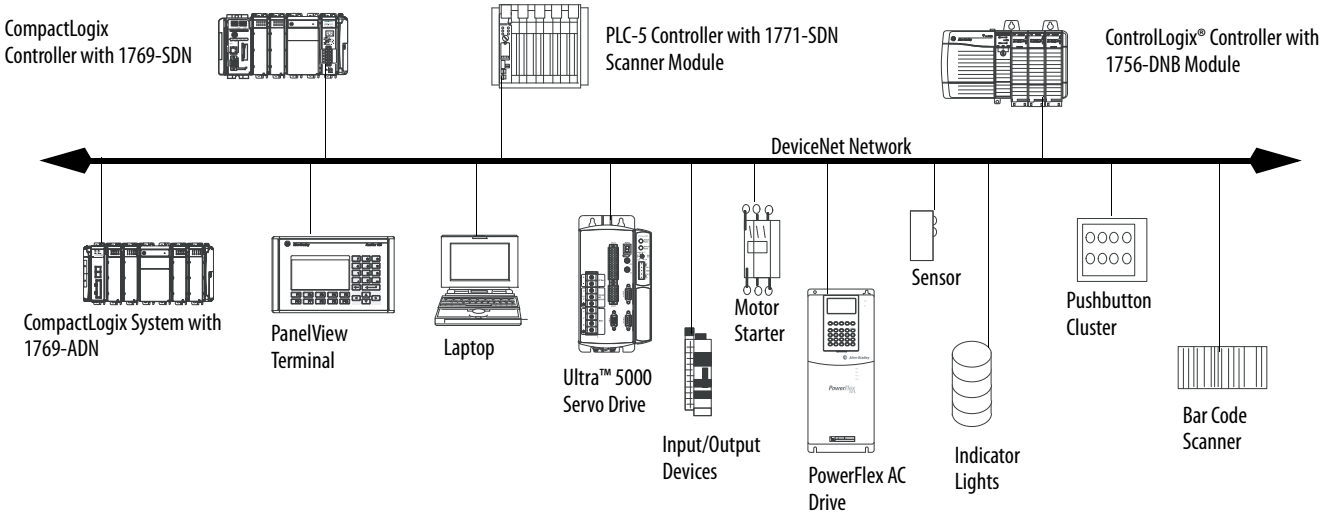
A DeviceNet network provides access to the intelligence present in your devices by letting you connect devices directly to plant-floor controllers without having to hard wire each device into an I/O module.

Table 8 - CompactLogix DeviceNet Communication Interfaces

If your application	Select
• Communicates with other DeviceNet devices • Uses the controller as a master or slave on DeviceNet • Uses a controller ControlNet, Ethernet or serial port for other communication	1769-SDN DeviceNet scanner module
• Accesses remote Compact I/O over a DeviceNet network • Sends remote I/O data for as many as 30 modules back to scanner or controller	1769-ADN DeviceNet adapter module[1]

(1) This table specifically describes using the 1769-ADN module to access remote Compact I/O over DeviceNet. However, CompactLogix controllers can access other Allen-Bradley remote I/O over DeviceNet. In those cases, you must select the appropriate interface. For example, if accessing remote POINT I/O modules, you must select the 1734-ADN.

Figure 6 - CompactLogix DeviceNet Overview



You can use these software products with a 1769 CompactLogix controller on a DeviceNet network.

Table 9 - CompactLogix DeviceNet Software Combinations

Software	Functions	Requirement
RSLogix 5000 programming software	• Configure the CompactLogix project • Define EtherNet/IP communication	Yes
RSNetWorx software for DeviceNet	• Configure DeviceNet devices • Define the scan list for DeviceNet devices	

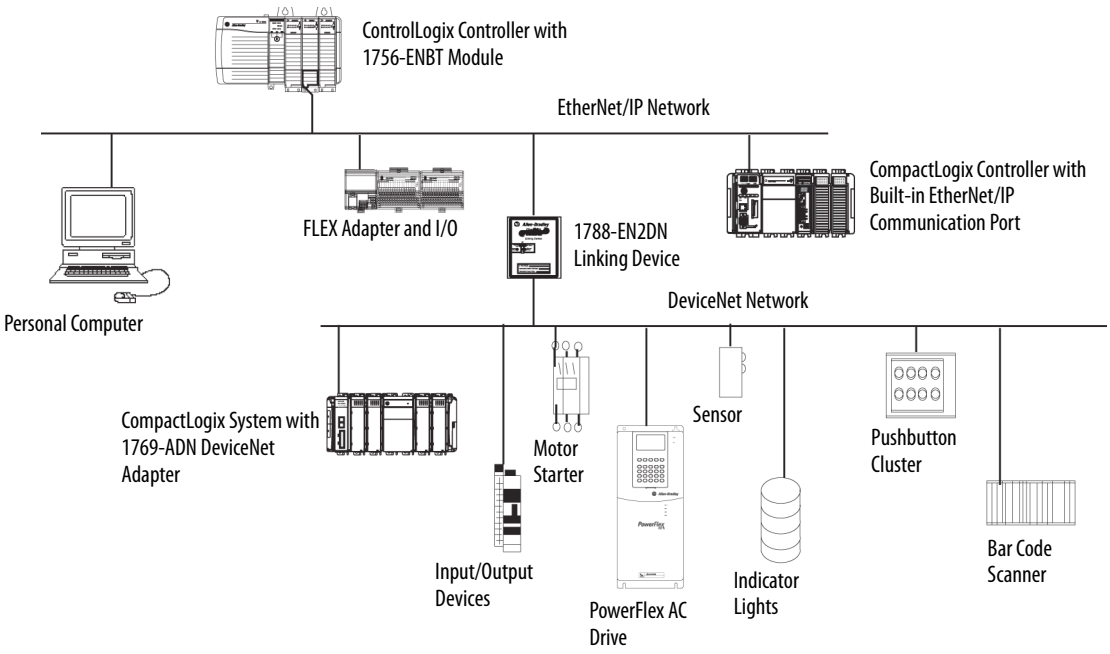
The DeviceNet communication module:

- supports messaging to devices, not controller to controller.
- shares a common application layer with ControlNet and EtherNet/IP.
- offers diagnostics for improved data collection and fault detection.
- requires less wiring than traditional, hardwired systems.

You can use a linking device as a:

- gateway to connect information.
- control-level network to device-level network for programming, configuration, control or data collection.
- router/bridge to connect the EtherNet/IP or ControlNet network to the DeviceNet network.

Figure 7 - CompactLogix Linking Device Overview



Serial Communication

CompactLogix controllers have a built-in RS-232 port.

- 1769-L32C, -L32E, -L35CR, and -L35E CompactLogix controllers have one built-in RS-232 port. By default, that port is channel 0 on these controllers.
- The 1769-L31 CompactLogix controller has two RS-232 ports. One port only allows DF1 protocol only. The second port accepts DF1 and ASCII protocol.

IMPORTANT Limit the length of serial (RS-232) cables to 15.2 m (50 ft).

You can configure the serial port of the controller for several modes.

Table 10 - CompactLogix Serial Port Configuration

Mode	Functions
DF1 Point-to-Point	Communicate between the controller and one other DF1-protocol-compatible device. This is the default system mode. Default parameters are: • Baud Rate: 19,200 • Data Bits: 8 • Parity: None • Stop Bits: 1 • Control Line: No Handshake • RTS send Delay: 0 • RTS Off Delay: 0 This mode is typically used to program the controller through its serial port.
DF1 Master	Control polling and message transmission between the master and slave nodes. • The master/slave network includes one controller configured as the master node and as many as 254 slave nodes. Link slave nodes using modems or line drivers. • A master/slave network can have node numbers from 0…254. Each node must have a unique node address. Also, at least 2 nodes must exist to define your link as a network (1 master and 1 slave station are the two nodes).
DF1 Slave	Use a controller as a slave station in a master/slave serial communication network. • When there are multiple slave stations on the network, link slave stations using modems or line drivers to the master. When you have a single slave station on the network, you do not need a modem to connect the slave station to the master. You can configure the control parameters for no handshaking. You can connect 2…255 nodes to a single link. In DF1 slave mode, a controller uses DF1 half-duplex protocol. • One node is designated as the master and it controls who has access to the link. All the other nodes are slave stations and must wait for permission from the master before transmitting.
DF1 Radio Modem	• Compatible with SLC™ 500 and MicroLogix™ 1500 controllers. • This mode supports master and slave, and store and forward modes.
User (channel 0 only)	Communicate with ASCII devices. This requires your program to use ASCII instructions to transmit data to and from ASCII device.
DH-485	• Communicate with other DH-485 devices. • This multi-master, token-passing network allows programming and peer-to-peer messaging.

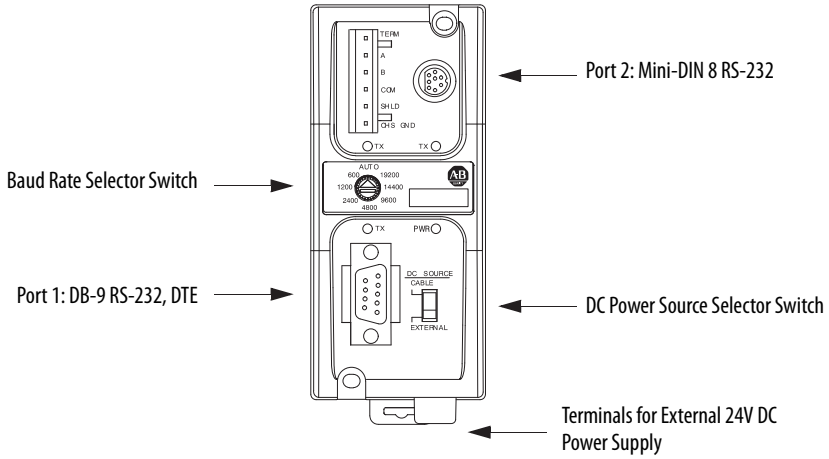
Configure an Isolator

Channel 0 on the CompactLogix controllers is fully isolated and does not need a separate isolation device. Channel 1 on the 1769-L31 controller is not an isolated serial port. To configure an isolator, perform this procedure.

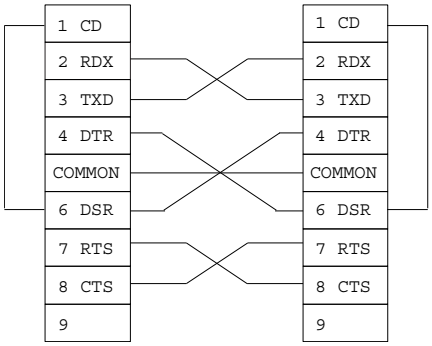
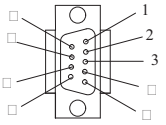
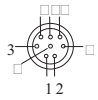
1. Determine whether you need an isolator.

   If you connect channel 1 of the 1769-L31 controller to a modem or an ASCII device, consider installing an isolator between the controller and modem or ASCII device. An isolator is also recommended when connecting the controller directly to a programming workstation.

   One possible isolator is the 1761-NET-AIC interface converter.



2. Select the appropriate cable.

Are you using an isolator?	Then use this cable
No	The 1756-CP3 cable attaches the controller directly to the controller.  If you make your own cable, it must be shielded, and the shields must be tied to the metal shell (that surrounds the pins) on both ends of the cable. You can also use a 1747-CP3 cable from the SLC product family. This cable has a taller right-angle connector housing than that of the 1756-CP3 cable.
Yes	The 1761-CBL-AP00 cable (right-angle connector to controller) or the 1761-CBL-PM02 cable (straight connector to the controller) attaches the controller to port 2 on the 1761-NET-AIC isolator. The mini-DIN connector is not commercially available, so you cannot make this cable.  DB-9 Right-angle or Straight Cable End  8-pin, Mini-DIN Cable End **Pin** / **DB-9 End** / **Mini-DIN End** 1 / DCD / DCD 2 / RxD / RxD 3 / TxD / TxD 4 / DTR / DTR 5 / Ground / Ground 6 / DSR / DSR 7 / RTS / RTS 8 / CTS / CTS 9 / NA / NA

3. Connect the appropriate cable to the serial port.

Communicate with DF1 Devices

You can configure the controller as a master or slave on a serial communication network. Use serial communication when:

- the system contains three or more stations.
- communication occur regularly and require leased-line, radio, or power-line modem.

ATTENTION: Only the 1769-L31 controller has more than one RS-232 port. All other 1769 controllers are limited to one RS-232 port.

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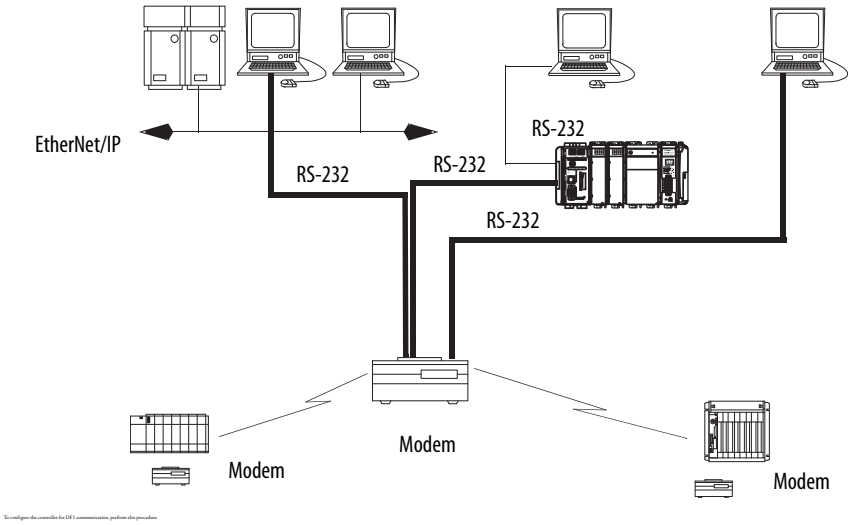
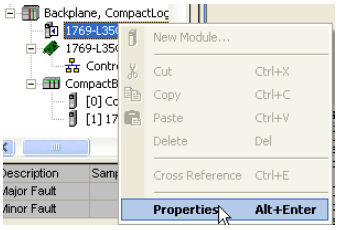
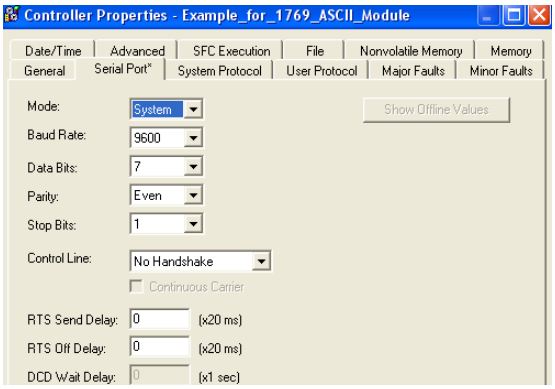


To configure the controller for DF1 communications, perform this procedure.

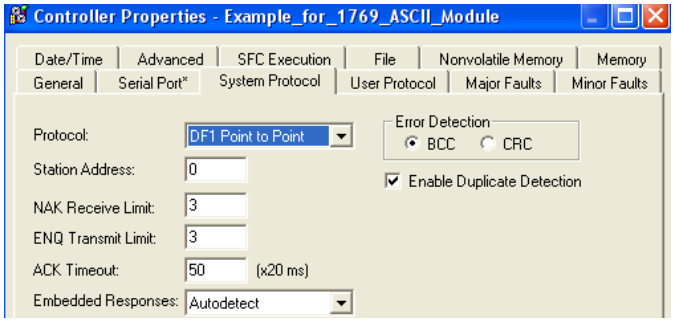
1. In RSLogix 5000 programming software, right-click your controller and select Properties.



The Controller Properties dialog box appears.



2. Click the Serial Port tab.
3. From the Mode pull-down menu, choose System.
4. Specify communication settings.
5. Click the System Protocol tab.

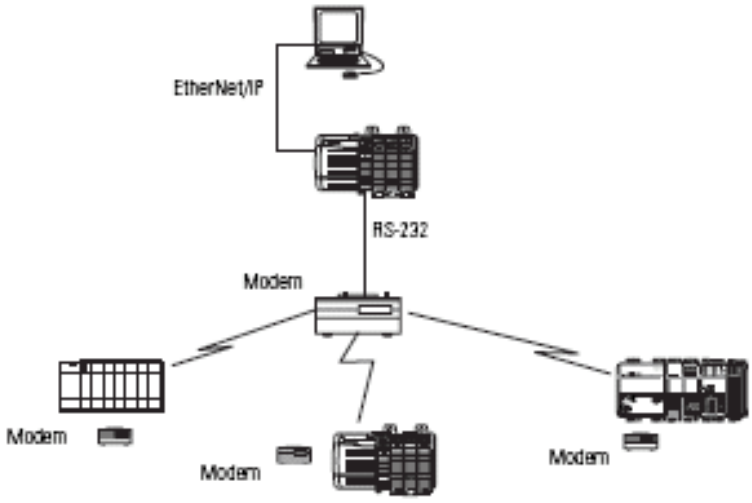


6. From the Protocol pull-down menu, choose a DF1 protocol.
7. Specify DF1 settings.

DF1 Radio Modem Support

Your ControlLogix controller includes a driver that lets it to communicate over the DF1 Radio Modem protocol. This driver implements a protocol, optimized for use with radio modem networks, that is a hybrid between DF1 full-duplex protocol and DF1 half-duplex protocol, and therefore is not compatible with either of these protocols.

IMPORTANT	The DF1 radio modem driver should be used only among devices that support and are configured for the DF1 radio modem protocol. Additionally, there are some radio modem network configurations that will not work with the DF1 radio modem driver. In these configurations, continue to use DF1 half-duplex protocol.



Like DF1 full-duplex protocol, DF1 radio modem lets any node to connect to any other node at any time (if the radio modem network supports full-duplex data port buffering and radio transmission collision avoidance). Like DF1 half-duplex protocol, a node ignores any packets received that have a destination address other than its own, with the exception of broadcast packets and pass-through packets.

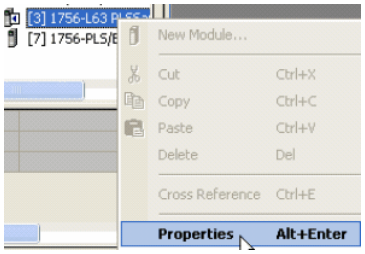
Unlike either DF1 full-duplex or DF1 half-duplex protocols, DF1 radio modem protocol does not include ACKs, NAKs, ENQs, or poll packets. Data integrity is assured by the CRC checksum.

Using the DF1 Radio Modem Driver

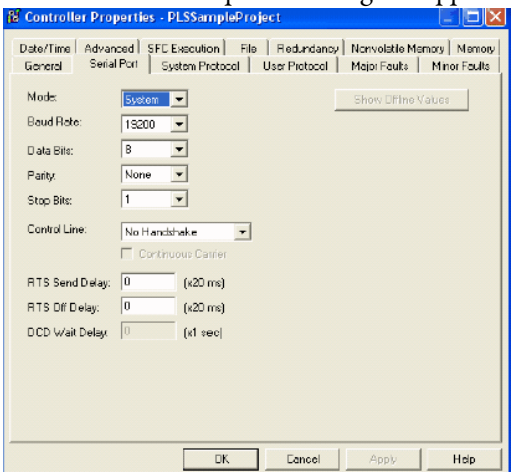
The DF1 radio modem driver can be configured as the system mode driver by using RSLogix 5000 programming software, version 17 or later.

To configure the controller for DF1 Radio Modem communication, perform this procedure.

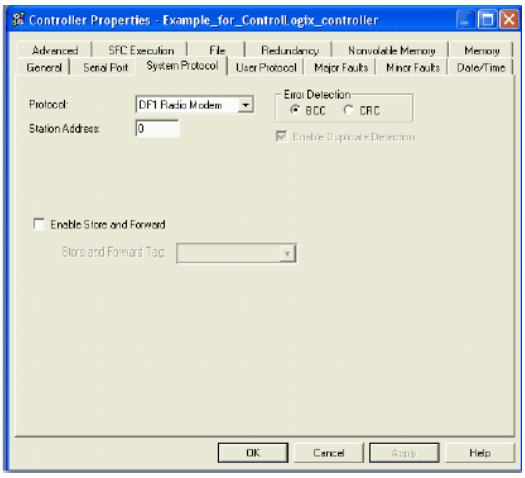
1. In the Controller Organizer of RSLogix 5000 programming software, right-click your controller and select Properties.



The Controller Properties dialog box appears.



2. Click the System Protocol tab.



3. From the Protocol pull-down menu, choose DF1 Radio Modem.

4. Specify DF1 Radio Modem system protocol settings.

Setting	Description
Station Address	Specifies the node address of the controller on the serial network. Select a number 1… 254 decimal, inclusive. To optimize network performance, assign node addresses in sequential order. Initiators, such as personal computers, should be assigned the lowest address numbers to minimize the time required to initialize the network.
Error Detection	Click one of the radio buttons to specify the error detection scheme used for all messages. • BCC - the processor sends and accepts messages that end with a BCC byte. • CRC - the processor sends and accepts messages with a 2-byte CRC.
Enable Store and Forward	Check the Enable Store and Forward checkbox if you want to enable the store and forward functionality. When enabled, the destination address of any received message is compared to the Store and Forward tag table. If there is a match, the message is then forwarded (re-broadcasted) from the port. From the Store and Forward Tag pull-down menu, choose an integer (INT[16]) tag. Each bit represents a station address. If this controller reads a message destined for a station that has its bit set in this table, it forwards the message. Also note, the Enable Store and Forward function is usable only if the controller is connected to the master radio modem.

5. Click OK.

Advantage of Using DF1 Radio Modem Protocol

The primary advantage of using DF1 radio modem protocol for radio modem networks is in transmission efficiency. Each read/write transaction (command and reply) requires only one transmission by the initiator (to send the command) and one transmission by the responder (to return the reply). This minimizes the number of times the radios need to key-up to transmit, which maximizes radio life and minimizes radio power consumption. In contrast, DF1 half-duplex protocol requires five transmissions for the DF1 master to complete a read/write transaction with a DF1 slave - three by the master and two by the slave.

The DF1 radio modem driver can be used in a pseudo master/slave mode with any radio modems, as long as the designated master node is the only node initiating MSG instructions, and as long as only one MSG instruction is triggered at a time.

For modern serial radio modems that support full-duplex data port buffering and radio transmission collision avoidance, the DF1 radio modem driver can be used to set up a masterless peer-to-peer radio network. In a peer-to-peer radio network, any node can initiate communication to any other node at any time, as long as all of the nodes are within radio range so that they receive each other's transmissions.

DF1 Radio Modem System Limitations

The following questions need to be answered to determine if you can implement the new DF1 radio modem driver in your radio modem network.

- If all of the devices on the network are ControlLogix controllers, you must configure them with the DF1 radio modem driver by using RSLogix 5000 programming software, version 17 or later. If not, then make sure that all of the nodes can support the DF1 radio modem protocol.
- If each node receives the radio transmissions of every other node, being both within radio transmission/reception range and on a common receiving frequency (either via a Simplex radio mode or via a single, common, full-duplex repeater) the radio modems must handle full-duplex data port buffering and radio transmission collision avoidance.

  If this is the case, you can take full advantage of the peer-to-peer message initiation capability in every node (for example, the ladder logic in any node can trigger a MSG instruction to any other node at any time).

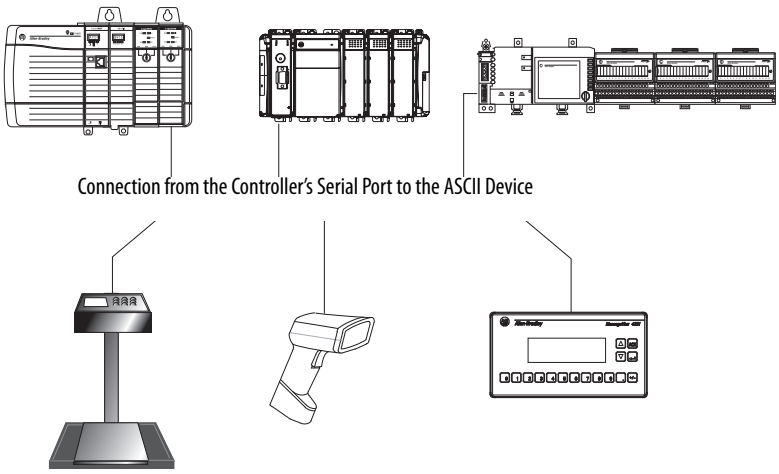
  If not all modems can handle full-duplex data port buffering and radio transmission collision avoidance, you may still be able to use the DF1 radio modem driver, but only if you limit MSG instruction initiation to a single master node whose transmission can be received by every other node.
- If not all nodes receive the radio transmission of every other node, you may still be able to use the DF1 radio modem driver, but only if you limit MSG instruction initiation to the node connected to the master radio modem whose transmissions can be received by every other radio modem in the network.
- You can take advantage of the ControlLogix controller channel-to-channel pass-through to remotely program the other nodes using RSLinx and RSLogix 5000 programming software running on a personal computer connected to a local ControlLogix controller via DH-485, DH+, or Ethernet.

Communicate with ASCII Devices

You can use the serial port to interface with ASCII devices when the controller is configured for user mode. For example, you can use the serial port to:

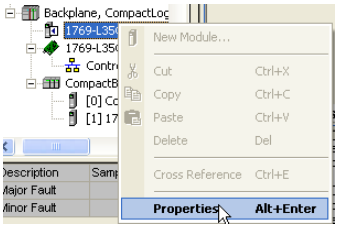
- read ASCII characters from a weigh scale module or bar code reader.
- send and receive messages from an ASCII triggered device, such as a MessageView terminal.

Figure 8 - ASCII Device Serial Communication

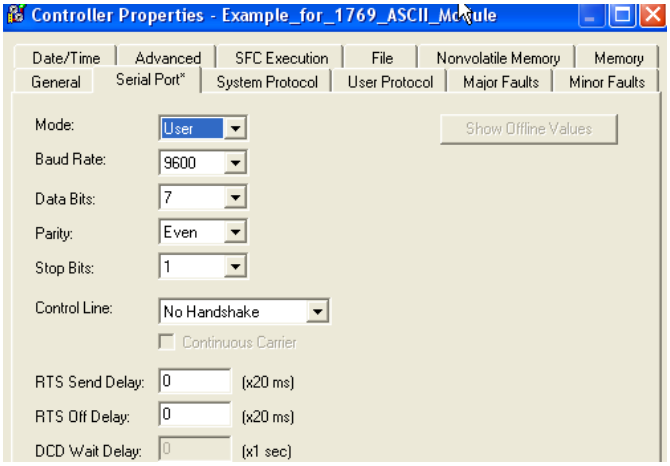


To configure the controller for ASCII communication, perform this procedure.

1. In RSLogix 5000 programming software, right-click your controller and select Properties.

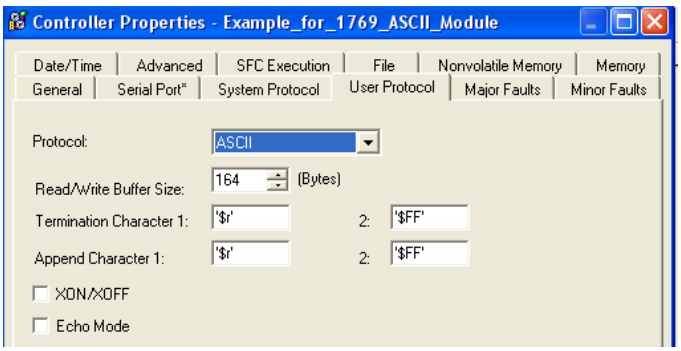


The Controller Properties dialog box appears.



2. Click the Serial Port tab.
3. From the Mode pull-down menu, choose User.
4. Specify communication settings.

5. Click the User Protocol tab.



6. From the Protocol pull-down menu, choose ASCII.
7. Specify ASCII settings.

The controller supports several instructions to manipulate ASCII characters. The instructions are available in ladder diagram (LD) and structured text (ST).

Read and Write ASCII Characters

Instruction Code	Description
ABL	Determine when the buffer contains termination characters
ACB	Count the characters in the buffer
ACL	Clear the buffer
	Clear out ASCII Serial Port instructions that are currently executing or are in the queue
AHL	Obtain the status of the serial port control lines
	Turn on or off the DTR signal
	Turn on or off the RTS signal
ARD	Read a fixed number of characters
ARL	Read a varying number of characters, up to and including the first set of termination characters
AWA	Send characters and automatically append one or two additional characters to mark the end of the data
AWT	Send characters

Create and Modify Strings of ASCII Characters

Instruction Code	Description
CONCAT	Add characters to the end of a string
DELETE	Delete characters from a string
FIND	Determine the starting character of a substring
INSERT	Insert characters into a string
MID	Extract characters from a string

Convert Data to or from ASCII Characters

Instruction Code	Description
STOD	Convert the ASCII representation of an integer value to a SINT, INT, DINT, or REAL value
STOR	Convert the ASCII representation of a floating-point value to a REAL value
DTOS	Convert a SINT, INT, DINT, or REAL value to a string of ASCII characters
RTOS	Convert a REAL value to a string of ASCII characters
UPPER	Convert the letters in a string of ASCII characters to upper case
LOWER	Convert the letters in a string of ASCII characters to lower case

Modbus Support

To use Logix5000 controllers on Modbus, connect the controllers through the serial port and execute specific ladder logic routines.

A sample controller project is available with RSLogix 5000 Enterprise programming software.

Broadcast Messages over a Serial Port

You can broadcast messages over a serial port connection from a master controller to all of its slave controllers by using several communication protocols. Those protocols are the following:

- DF1 Master
- DF1 Radio Modem
- DF1 Slave

Broadcasting over a serial port is achieved using the ‘message’ tag. Because messages are sent to receiving controllers, only the ‘write’ type messages can be used for broadcasting.

The broadcast feature can be set up by using ladder logic programming software or Structured Text programming software.

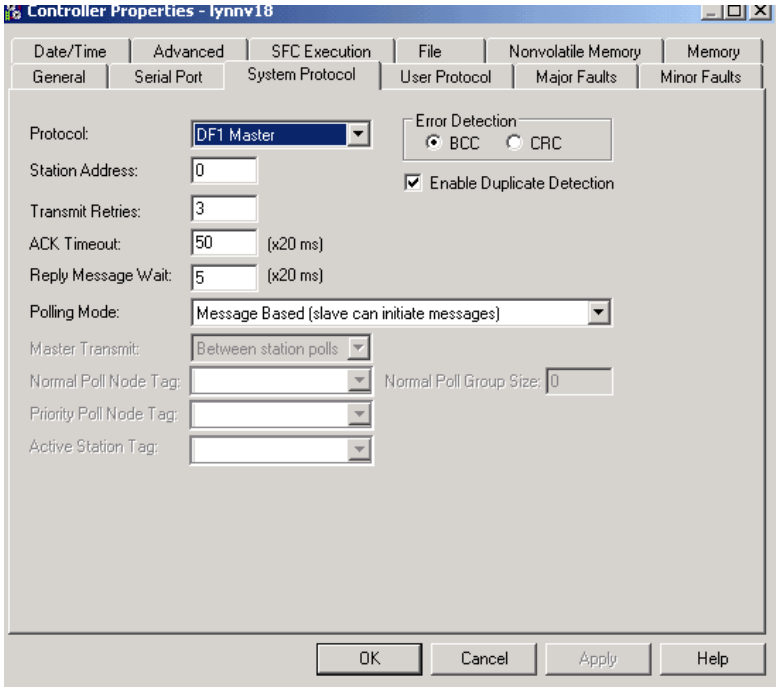
The broadcast feature can also be set by modifying the path value of a message tag in the tag editor.

For this example, Ladder Logic programming software will be used.

Step 1: Set Broadcast-Controller Properties

First, set the System Protocol by following these steps.

1. In the Controller Organizer, right-click on the controller and choose Properties.
2. In the Controller Properties dialog box, from the System Protocol tab, choose the settings for the controller, then choose OK.



Field	DF-1 Master Protocol	DF-1 Slave Protocol	DF-1 Radio Modem Protocol
Station Address	Controller station address number	Controller station address number	Controller station address number
Transmit Retries	3	3	N/A
ACK Timeout	50	N/A	N/A
Slave Poll Timeout	N/A	3000	N/A
Reply Message Wait	5	N/A	N/A
Polling Mode	Message: polls the slave by using the Message instruction Slave: initiates messages for slave-to-slave broadcast. Standard: schedules polling for the slave.	N/A	N/A
EOT Suppression	N/A	Disable	N/A
Error Detection	BCC	BCC	BCC
Duplicate Detection	Enabled	Enabled	N/A
Enable Store and Forward	N/A	N/A	Choose enable if you want to use the store and forward tag. The last bit of the INT[16] Enable Store and Forward array must be 'enabled.' For example, say you create an INT[16] tag named EnableSandF. Then EnableSandF[15].15 must be set to 1 for broadcast to work on radio modem.

Step 2: Set Broadcast - Create Controller Scope Message Tag

Next, create a Message tag by following these steps.

1. In the Controller Organizer, right-click on the Controller Tags folder and choose New Tag.

   The new tag must be a 'message' tag.

2. Name the tag and select the Data Type 'Message', then choose OK.

   The Message tag in the Controller Scope's Controller Tags folder will look similar to the following.

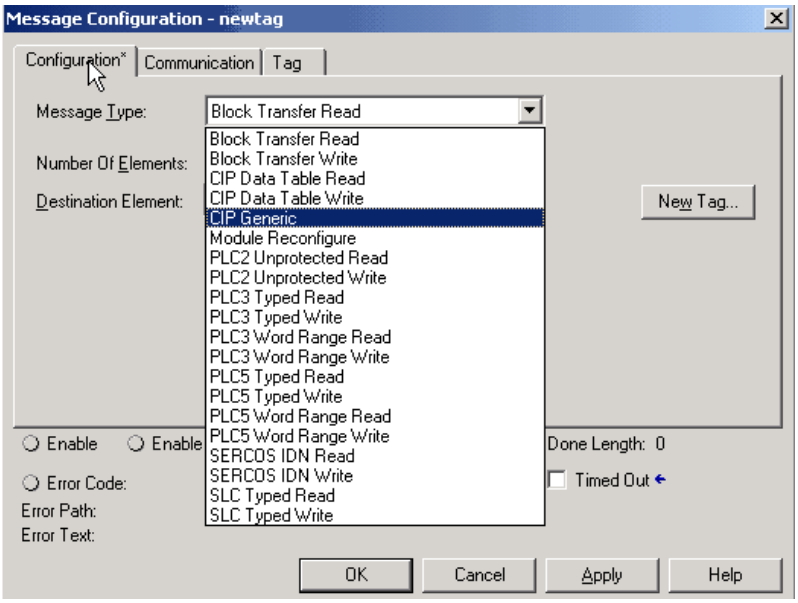
Name	Value	Force Mask	Style	Data Type
newtag	{...}	{...}		MESSAGE
newtag.Flags	16#0200		Hex	INT
newtag.EW	0		Decimal	BOOL
newtag.ER	0		Decimal	BOOL
newtag.DN	0		Decimal	BOOL
newtag.ST	0		Decimal	BOOL
newtag.EN	0		Decimal	BOOL
newtag.TO	0		Decimal	BOOL
newtag.EN...	1		Decimal	BOOL
newtag.ERR	16#0000		Hex	INT
newtag.EX	16#0000_0000		Hex	DINT

Step 3: Ladder Logic Programming Software

Then, to set broadcasting over a serial port, follow these steps.

1. In the Controller Organizer, from the Tasks folder, choose Main Routine to display the ladder logic programming software interface.
2. Open a MSG instruction from the Input/Output tab.
3. Double-click in the Message Control field to enable the pull-down menu and select the tag you created.
4. Launch the View Configuration dialog box.

5. In the Message Configuration dialog box, from the Configuration tab, select the message type from the Message Type field.

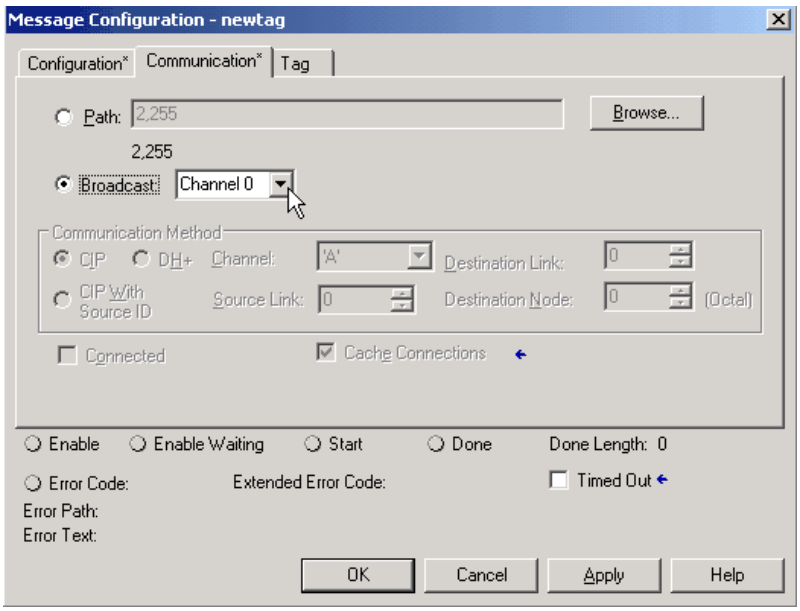


Valid 'Write' Message Types include the following:

- CIP Generic
- CIP Data Table Write
- PLC2 Unprotected Write
- PLC3 Typed Write
- PLC3 Word Range Write
- PLC5 Typed Write
- PLC5 Word Range Write
- SLC Typed Write

6. Fill in any other fields needed.

7. From the Communication tab, select the Broadcast Radio button and the Channel from the pull-down, then choose OK.



ATTENTION: When using structured text programming software, broadcast over serial is set by typing MSG(aMsg) and right-clicking on aMSG to display the Message Configuration dialog box.

DH-485 Network Communication

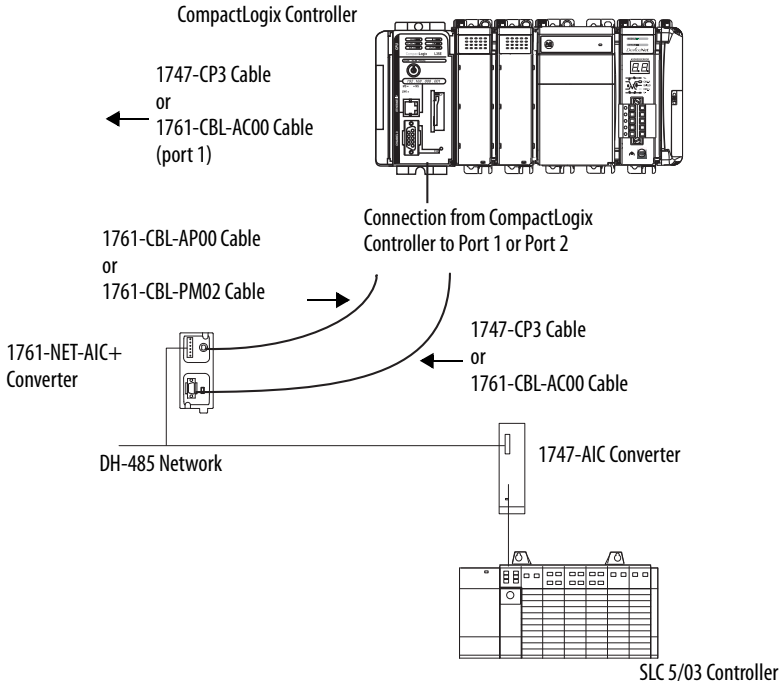
For DH-485 communication, use the controller's serial port.

However, with a CompactLogix controller, we recommend that you use NetLinx networks, such as EtherNet/IP, ControlNet, or DeviceNet, because excessive traffic on a DH-485 network may make it impractical to connect to a controller with RSLogix 5000 programming software.

IMPORTANT If your application uses connections to DH-485 networks, select built-in serial ports.

The DH-485 protocol uses RS-485 half-duplex as its physical interface. RS-485 is a definition of electrical characteristics, not a protocol. You can configure the CompactLogix controller's RS-232 port to act as a DH-485 interface. By using a 1761-NET-AIC converter and the appropriate RS-232 cable (1756-CP3 or 1747-CP3), a CompactLogix controller can send and receive data on a DH-485 network.

Figure 9 - CompactLogix DH-485 Communication Overview



On the DH-485 network, the CompactLogix controller can send and receive messages to and from other controllers.

IMPORTANT A DH-485 network consists of multiple cable segments. Limit the total length of all the segments to 1219 m (4000 ft).

For the controller to operate on a DH-485 network, you need a 1761-NET-AIC interface converter for each controller you want to put on the DH-485 network.

You can have two controllers for each 1761-NET-AIC converter, but you need a different cable for each controller.

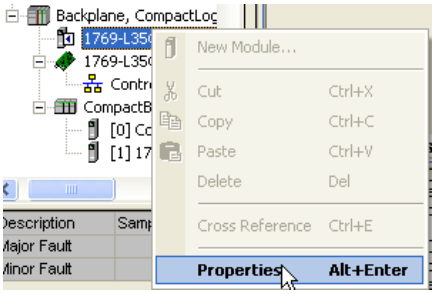
To establish DH-485 communication, perform this procedure.

1. Connect the serial port of the controller to either port 1 or port 2 of the 1761-NET-AIC converter.
2. Use the RS-485 port to connect the converter to the DH-485 network.

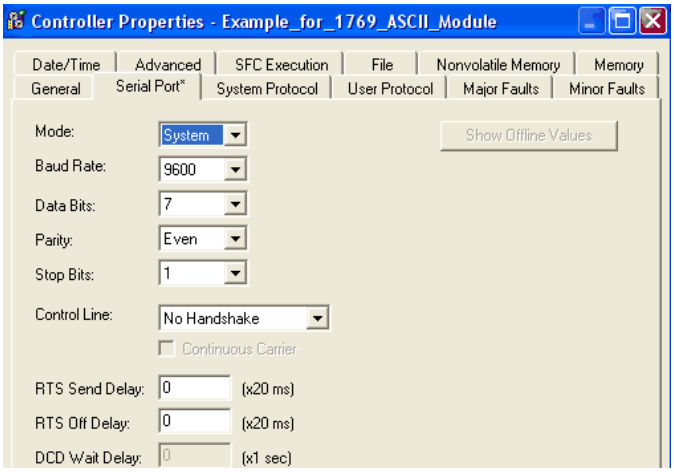
   The cable you use to connect the controller depends on the port you use on the 1761-NET-AIC converter.

Connection	Required Cable
Port 1 DB-9 RS-232, DTE connection	1747-CP3 or 1761-CBL-AC00
Port 2 mini-DIN 8 RS-232 connection	1761-CBL-AP00 or 1761-CBL-PM02

3. In RSLogix 5000 programming software, right-click on your controller and choose Properties.



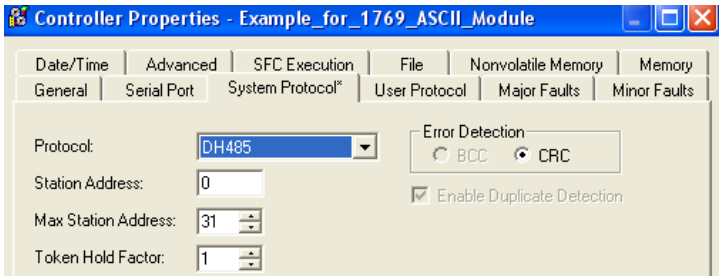
   The Controller Properties dialog appears.



4. Click the Serial Port tab.
5. From the Mode pull-down menu, choose System.
6. Specify communication settings.

IMPORTANT The baud rate specifies the communication rate for the DH-485 port. All devices on the same DH-485 network must be configured for the same baud rate. Select 9600 or 19200 KB.

7. Click the System Protocol tab.



8. From the Protocol pull-down menu, choose DH485.
9. Specify DH-485 settings.
10. From the Protocol pull-down menu, choose DF1 Radio.

Table 11 - System Protocol Specifications

Characteristic	Description
Station Address	Specifies the node address of the controller on the DH-485 network. Select a number 1…31 decimal, inclusive. To optimize network performance, assign node addresses in sequential order. Initiators, such as personal computers, should be assigned the lowest address numbers to minimize the time required to initialize the network.
Token Hold Factor	Number of transmissions plus retries that a node holding a token can send onto the data link each time it receives the token. Enter a value between 1…4. The default is 1.
Maximum Station Address	Specifies the maximum node address of all the devices on the DH-485 network. Select a number 1…31 decimal, inclusive. To optimize network performance, make sure: • the maximum node address is the highest node number being used on the network. • that all the devices on the same DH-485 network have the same maximum node address.

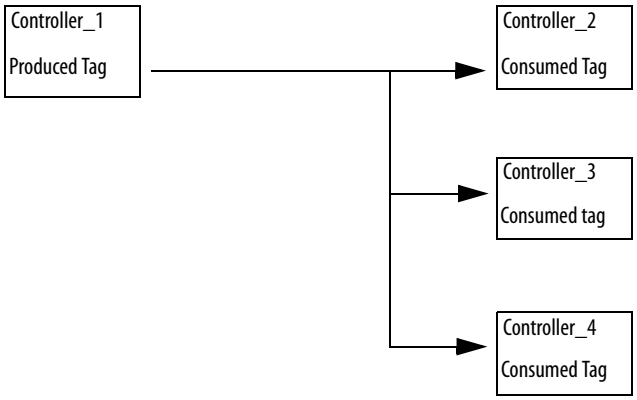
Manage Controller Communication

This chapter explains how to manage controller communication.

Produce and Consume Data

The controller supports the ability to produce (broadcast) and consume (receive) system-shared tags over ControlNet or EtherNet/IP networks. Produced and consumed tags each require connections. Over ControlNet, produced and consumed tags are scheduled connections.

Table 12 - Controller Communication Overview



Tag Type	Description
Produced	A produced tag allows other controllers to consume the tag, which means that a controller can receive the tag data from another controller. The producing controller uses one connection for the produced tag and another for each consumer. The controller's communication device uses one connection for each consumer. As you increase the number of controllers that can consume a produced tag, you also reduce the number of connections the controller and communication device have available for other operations, like communication and I/O.
Consumed	Each consumed tag requires one connection for the controller that is consuming the tag. The controller's communication device uses one connection for each consumer.

For two controllers to share produced or consumed tags, both controllers must be attached to the same control network, such as a ControlNet or Ethernet/IP network. You cannot bridge produced and consumed tags over two networks.

The number of available connections limits the total number of tags that can be produced or consumed. If the controller uses all of its connections for I/O and communication devices, no connections are left for produced and consumed tags.

Send and Receive Messages

Messages transfer data to other devices, such as controllers or operator interfaces. Messages use unscheduled connections to send or receive data. Connected messages can leave the connection open (cache) or close the connection when the message is done transmitting.

Table 13 - Message Transmission

Message Type	Communication Method	Connected Message	Can the message be cached?
CIP data table read or write	NA	Yes	Yes
PLC-2, PLC-3, PLC-5, or SLC (all types)	CIP	No	No
	CIP with Source ID	No	No
	DH+	Yes	Yes
CIP generic	NA	Optional (1)	Yes(2)
Block-transfer read or write	NA	NA	Yes

(1) You can connect CIP generic messages. However, for most applications we recommend you leave CIP generic messages unconnected.

(2) Consider caching only if the target module requires a connection.

Connected messages are unscheduled connections on both ControlNet and EtherNet/IP networks.

Each message uses one connection, regardless of how many devices are in the message path. You can program the target of a MSG instruction to optimize message transfer time.

Determine Whether to Cache Message Connections

When you configure a MSG instruction, you can cache or not cache the connection.

Table 14 - Caching Messages

Message Execution	Function
Repeatedly	Cache the connection. This keeps the connection open and optimizes execution time. Opening a connection each time the message executes increases execution time.
Infrequently	Do not cache the connection. This closes the connection upon completion of the message, freeing up that connection for other uses.

Connections

A Logix5000 system uses a connection to establish a communication link between two devices. Connections can be:

- a controller to local I/O modules or local communication modules.
- a controller to remote I/O or remote communication modules.
- a controller to remote I/O (rack-optimized) modules.
- produced and consumed tags.
- messages.
- controller access by RSLogix 5000 programming software.
- controller access by RSLinx software for HMI or other applications.

The limit of connections may ultimately reside in the communication module you use for the connection. If a message path routes through a communication module, the connection related to the message also counts towards the connection limit of that communication module.

Table 15 - Connections Overview

Device	Supported Connections
CompactLogix controller (1769-L31)	100
Built-in ControlNet communication port (1769-L32C and 1769-L35CR controllers only)	
Built-in EtherNet/IP communication port (1769-L32E and 1769-L35E controllers only)	

Calculate Total Connections

You can calculate the total number of local and remote connections the controller uses.

Table 16 - Local Connections Calculation

Local Connection Type	Device Quantity	Connections per Device	Total Connections
Local I/O module (always a direct connection)		1	
Built-in ControlNet communication port (1769-L32C and 1769-L35CR controllers only)		0	
Built-in EtherNet/IP communication port (1769-L32E and 1769-L35E controllers only)		0	
1769-SDN DeviceNet scanner module		2	
		Total	

The number of remote connections a communication module supports determines how many connections the controller can access through that module.

Table 17 - Remote Connections Calculation

Remote Connection Type	Device Quantity	Connections per Device	Total Connections
Remote ControlNet communication module • I/O configured as direct connection (none) • I/O configured as rack-optimized connection		0 or 1	
Remote I/O module over ControlNet (direct connection)		1	
Remote EtherNet/IP communication module • I/O configured as direct connection (none) • I/O configured as rack-optimized connection		0 or 1	
Remote I/O module over a EtherNet/IP network (direct connection)		1	
Remote device over a DeviceNet network (accounted for in rack-optimized connection for local 1769-SDN module)		0	
Other remote communication adapter (POINT and FLEX adapters, for example)		1	
Produced tag Each consumer		1 1	
Consumed tag		1	
Message (depending on type)		1	
Block-transfer message		1	
		Total	

Connections Example

In this example system the 1769-L35E CompactLogix controller:

- controls local digital I/O modules in the same chassis.
- controls remote I/O devices on a DeviceNet network.
- sends and receives messages to/from a ControlLogix controller on an EtherNet/IP network.
- produces one tag that the 1794 FlexLogix controller consumes.
- is programmed via RSLogix 5000 programming software.

Figure 10 - Example - CompactLogix System Connections

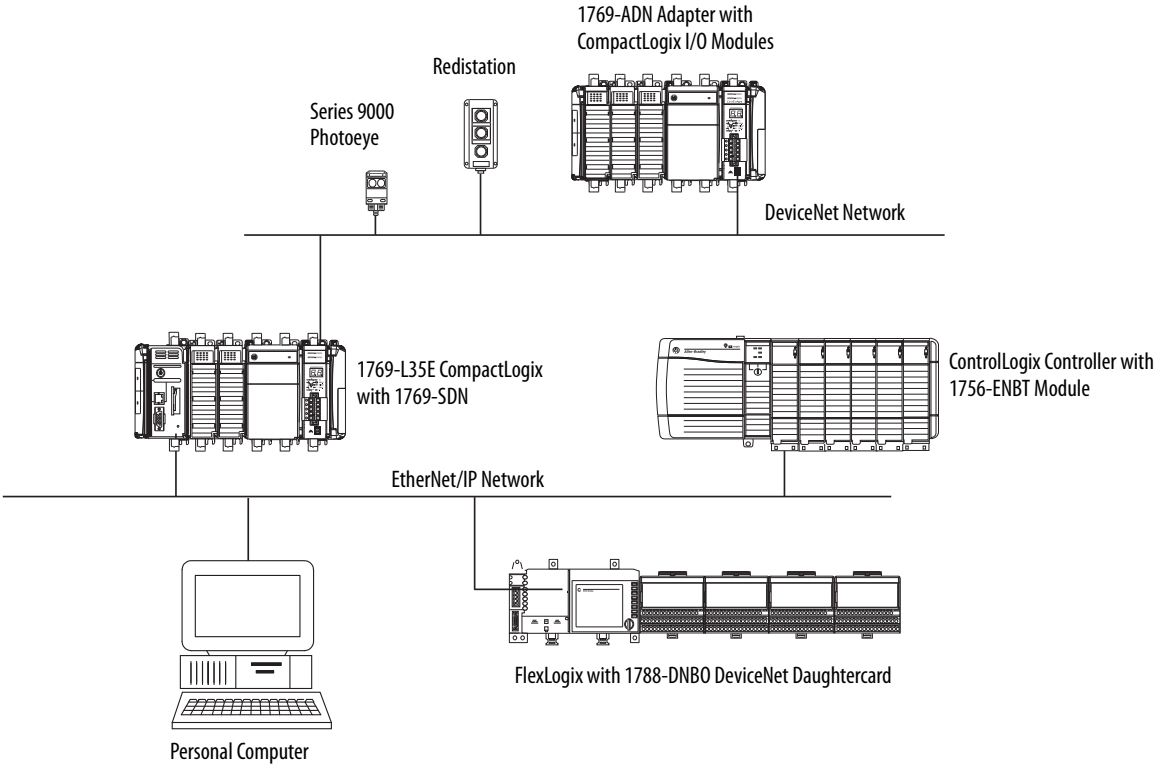


Table 18 - Example - CompactLogix Connection Types

Connection Type	Device Quantity	Connections per Device	Total Connections
Controller to local I/O modules (rack-optimized)	2	1	2
Controller to 1769-SDN scanner module	1	2	2
Controller to built-in EtherNet/IP communication port (rack-optimized)	1	0	0
Controller to RSLogix 5000 programming software	1	1	1
Message to ControlLogix controller	2	1	2
Produced tag consumed by FlexLogix controller	2	1	2
		Total	9

Notes:

Place, Configure, and Monitor I/O

This chapter explains how to place, configure, and monitor CompactLogix I/O modules.

Select I/O Modules

When choosing 1769 I/O modules, select:

- specialty I/O modules when appropriate.

  Some modules have field-side diagnostics, electronic fusing, or individually-isolated inputs and outputs.

- a 1492 wiring system for each I/O module as an alternative to the terminal block that comes with the module.

- 1492 PanelConnect modules and cables if you are connecting input modules to sensors.

Validate I/O Layout

After you have selected your I/O modules, you need to validate the system you want to design. Before you begin to place your I/O modules, consider that the minimum backplane RPI increases as you add modules. Also, the I/O modules must be distributed so that the current consumed from the left or right side of the power supply never exceeds 2.0 A at 5V DC or 1.0 A at 24V DC.

Estimate Requested Packet Interval

The requested packet interval (RPI) defines the frequency at which the controller sends and receives all I/O data on the backplane. Each module on the backplane can have its own individual RPI setting.

The effective scan frequency for any individual module is still impacted by the other modules in the system and those modules' RPI settings. The following table provides relative scanning durations for various types of modules. This information should be taken into account when setting an individual module's RPI in order to achieve the desired effective scan frequency for any module in the system.

Type of Module	Request Packet Interval
Digital and analog (any mix)	• 1…4 modules can be scanned in 1 ms. • 5…30 modules can be scanned in 2 ms. • Some input modules have a fixed 8 ms filter, so selecting a greater RPI has no effect.
Specialty	• Full-sized 1769-SDN modules add 2 ms per module. • 1769-HSC modules add 1 ms per module. • Full-sized 1769-ASCII modules add 1 ms per module.

You can always select an RPI that is slower than these. The RPI shows how quickly modules can be scanned, not how quickly an application can use the data. The RPI is asynchronous to the program scan. Other factors, such as program execution duration, affect I/O throughput.

Calculate System Power Consumption

To validate your proposed system, calculate the total 5V DC current and 24V DC to be consumed.

Table 19 - I/O Module Power Consumption Calculation Table

Catalog Number	Number of Modules	Module Current Requirements		Calculated Current = (Number of Modules) x (Module Current Requirements)	
		at 5V DC (in mA)	at 24V DC (in mA)	at 5V DC (in mA)	at 24V DC (in mA)
1769-L31		330	40		
1769-L32C		650	40		
1769-L32E		660	90		
1769-L35CR		680	40		
1769-L35E		660	90		
			Total Current Required(1):		

(1) This number must not exceed the power supply current capacity.

Table 20 - Power Supply Current Capacity

Specification	Power Supply and Capacity			
	1769-PA2	1769-PB2	1769-PA4	1769-PB4
Output Bus Current Capacity 0…55 °C (32…131 °F)	2 A at 5V DC and 0.8 A at 24V DC		4 A at 5V DC and 2 A at 24V DC	
24V DC User Power Capacity 0…55 °C (32…131 °F)	250 mA (maximum)	NA		

Validate Placement of I/O Modules

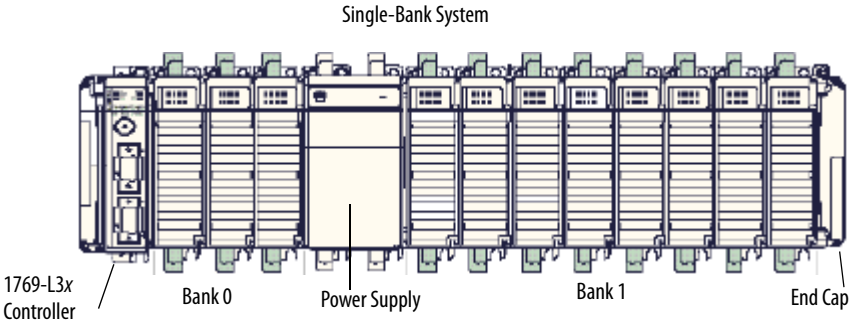
The controller you use determines how many local I/O modules you can configure.

Table 21 - Controller I/O Support

Controller	Supported Local I/O Modules	I/O Banks
1769-L35CR	30	3
1769-L35E	30	3
1769-L32C, 1769-L32E and 1769-L31	16	3

To validate the proposed placement of I/O modules in your CompactLogix system, perform this procedure.

1. Verify that your 1769-L3*x* controller resides on the leftmost side of the bank.



2. Verify that you have placed no more than three I/O modules between your controller and power supply (bank 0).

   Placing more than three I/O modules in bank 0 would exceed the distance rating of four and invalidate your system.

3. Validate the number of I/O modules your power supply can support.

   In a single-bank system, make sure you have not placed more than eight I/O modules between the power supply and end cap (bank 1).

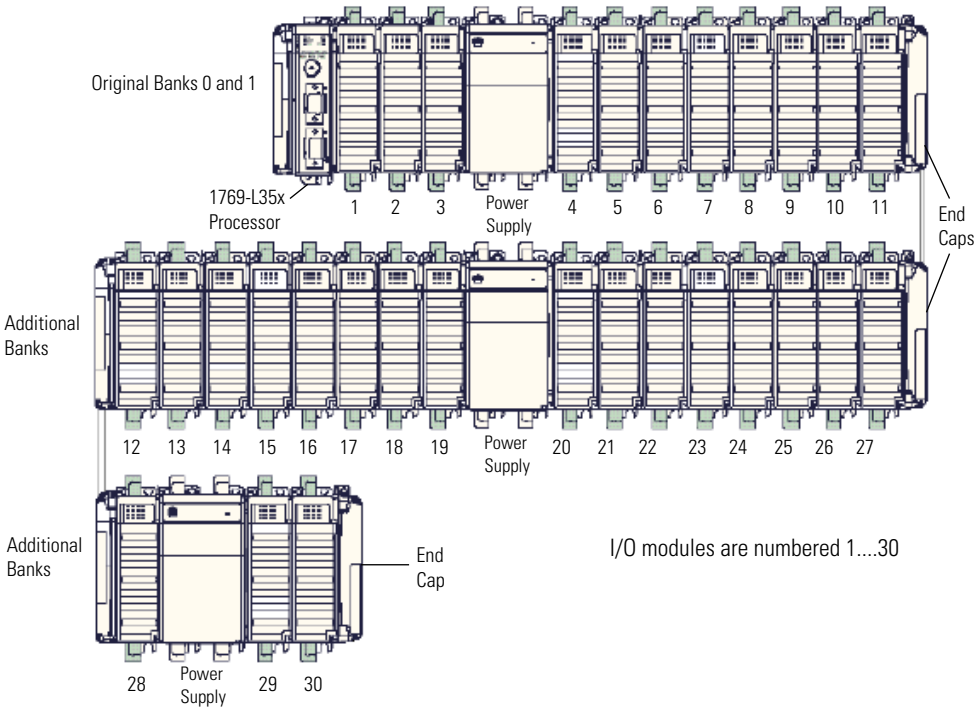
IMPORTANT	In a single-bank system, the power supply can support up to eight I/O modules as long as the modules' power consumption does not exceed the power supply's capacity. So, in a single-bank system, you may not have more than eleven total I/O modules, three to the left of your power supply and eight to the right. If your system requires additional I/O modules, you must add an additional bank.

In a multi-bank system, make sure that your additional bank(s) do not have more than eight I/O modules on either side of the additional power supply.

IMPORTANT	In a multi-bank system, you may place up to eight I/O modules on either side of the additional power supply so long as the power consumed by these modules does not exceed the power supply's capacity.

In this example, the I/O modules 12...30 could be arranged in any way as long as the power supplies' capacity was not exceeded. In other words, the first additional bank could contain fewer than 16 I/O modules This is just 1 possible arrangement.

Example of Multi-Bank System



4. Verify that all banks have end caps.

IMPORTANT If you place and configure more I/O modules and I/O banks than your controller can support, your system may run well for a period of time. Nothing alerts you to the fact that you have exceeded your controller's capacity.

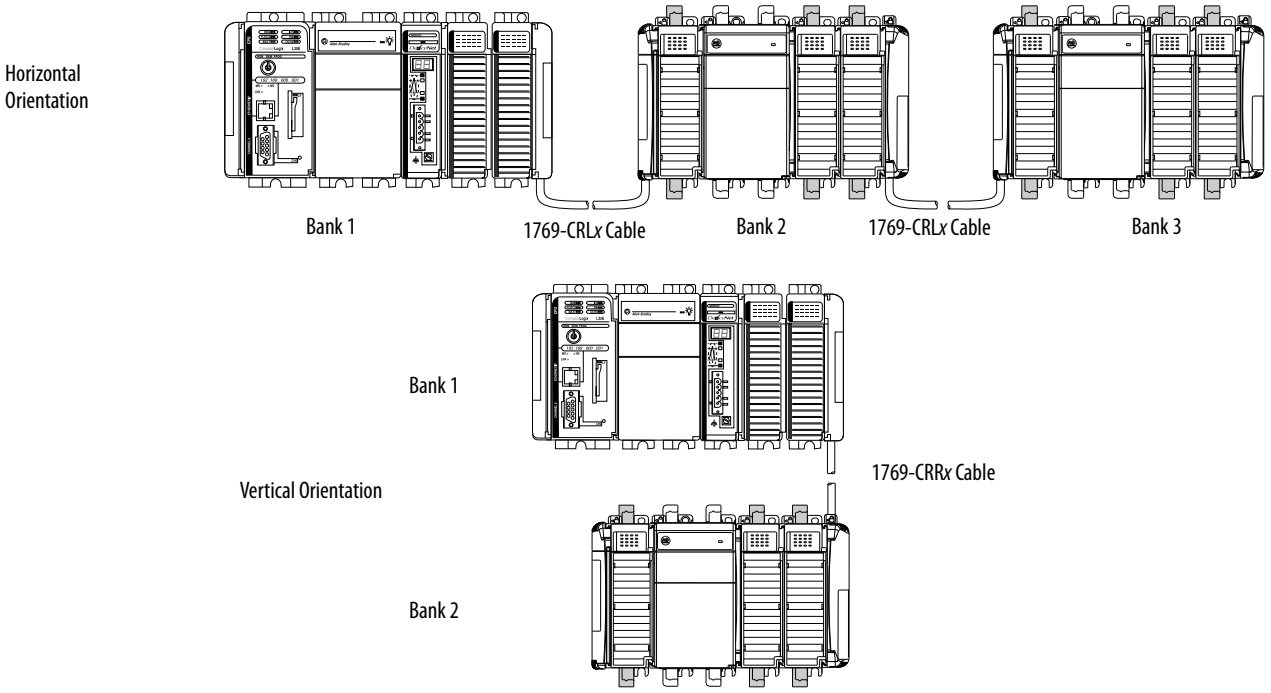
However, by exceeding your controller's I/O capacity, you put your system at risk of intermittent faults, the most common being Major Fault Type 03 (I/O Fault) Code 23.

Place Local I/O Modules

Use the 1769-CRR1/-CRR3 or 1769-CRL1/-CRL3 expansion cable to connect banks of I/O modules.

Each I/O module also has a power supply distance rating, the number of modules from the power supply. The distance rating is printed on each module's label. Each module must be located within its distance rating.

Figure 11 - Controller I/O Placement



ATTENTION: The CompactLogix system does not support Removal and Insertion Under Power (RIUP). While the CompactLogix system is under power:

- any break in the connection between the power supply and the controller (for example, removing the power supply, controller, or an I/O module) may subject the logic circuitry to transient conditions above the normal design thresholds and may result in damage to system components or unexpected behavior.
- removing an end cap or an I/O module faults the controller and may also result in damage to system components.

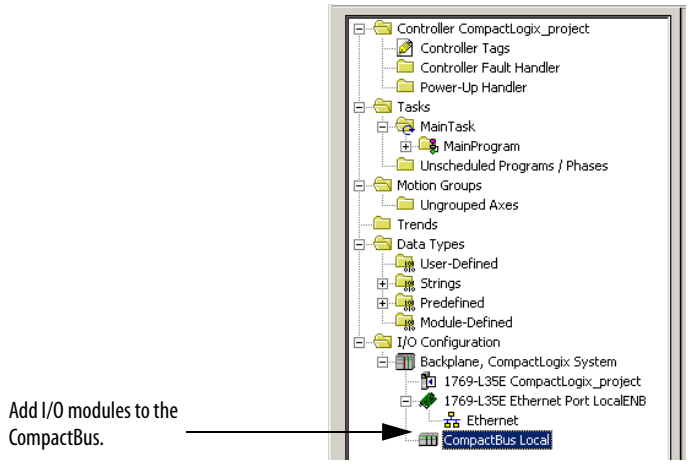
The CompactLogix controller also supports distributed (remote) I/O via these networks:

- EtherNet/IP
- ControlNet
- DeviceNet

Configure I/O

To communicate with an I/O module in your system, add the module to the I/O Configuration folder of the controller.

Figure 12 - I/O Module Configuration



When you add a module, you also define a specific configuration for the module. While the configuration options vary from module to module, there are some common options that you typically configure

Table 22 - I/O Configuration Options

Configuration Option	Description
Requested packet interval (RPI)	The RPI specifies the interval at which data updates over a connection. For example, an input module sends data to a controller at the RPI that you assign to the module. • Typically, you configure an RPI in milliseconds (ms). The range is 0.1…750 ms. • If a ControlNet network connects the devices, the RPI reserves a slot in the stream of data flowing across the ControlNet network. The timing of this slot may not coincide with the exact value of the RPI, but the control system guarantees that the data transfers at least as often as the RPI.
Change of state (COS)	Digital I/O modules use COS to determine when to send data to the controller. If a COS does not occur within the RPI timeframe, the module multicasts data at the RPI. Because the RPI and COS functions are asynchronous to the logic scan, it is possible for an input to change state during program scan execution. If this is a concern, buffer input data so your logic has a stable copy of data during its scan. Use the Synchronous Copy (CPS) instruction to copy the input data from your input tags to another structure and use the data from that structure.
Communication format	Many I/O modules support different formats. The communication format that you choose also determines: • data structure of tags. • connections. • network usage. • ownership. • returning of diagnostic information.
Electronic keying	When you configure a module, you specify the slot number for the module. However, it is possible to purposely or accidentally place a different module in that slot. Electronic keying lets you protect your system against the accidental placement of the wrong module in a slot. The chosen keying option determines how closely any module in a slot must match the configuration for that slot before the controller opens a connection to the module. There are different keying options depending on your application needs.

I/O Connections

A Logix5000 system uses connections to transmit I/O data.

Table 23 - Logix5000 I/O Connections

Connection	Description
Direct	A direct connection is a real-time, data-transfer link between the controller and an I/O module. The controller maintains and monitors the connection between the controller and the I/O module. Any break in the connection, such as a module fault or the removal of a module while under power, causes the controller to set fault status bits in the data area associated with the module. Typically, analog I/O modules, diagnostic I/O modules, and specialty modules require direct connections.
Rack-optimized	For digital I/O modules, you can select rack-optimized communication. A rack-optimized connection consolidates connection usage between the controller and all the digital I/O modules on a rack (or DIN rail). Rather than having individual, direct connections for each I/O module, there is one connection for the entire rack (or DIN rail).

Configure Distributed I/O on an EtherNet/IP Network

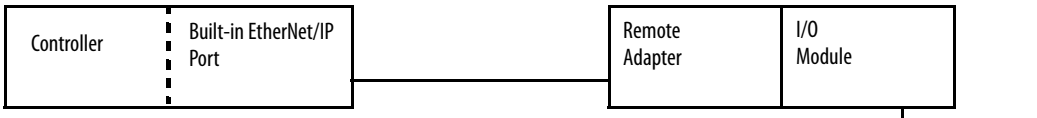
To communicate with distributed I/O modules over an EtherNet/IP network:

- choose a 1769-L32E or 1769-L35E CompactLogix controller with a built-in EtherNet/IP communication port.
- add an EtherNet/IP adapter, and I/O modules to the I/O Configuration folder of the controller.

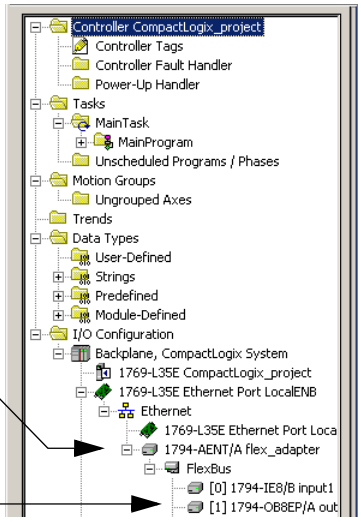
  Within the I/O Configuration folder, organize the modules into a hierarchy of tree/branch and parent/child.

Figure 13 - EtherNet/IP Distributed I/O Configuration

For a typical distributed I/O network…



…you build the I/O configuration in this order.



1. Add the remote adapter for the distributed I/O chassis or DIN rail.
2. Add the distributed I/O modules.

Configure Distributed I/O on a ControlNet Network

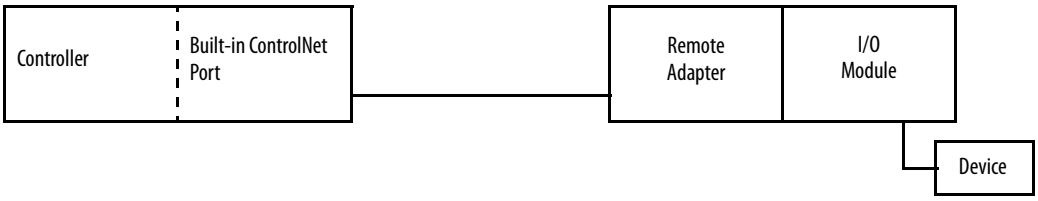
To communicate with distributed I/O modules over a ControlNet network:

- choose a 1769-L32C or 1769-L35CR CompactLogix controller with a built-in ControlNet communication port.
- add a ControlNet adapter, and I/O modules to the I/O Configuration folder of the controller.

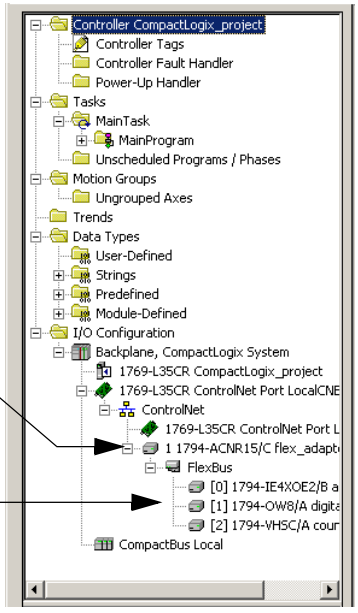
  Within the I/O Configuration folder, organize the modules into a hierarchy of tree/branch and parent/child.

Figure 14 - ControlNet Distributed I/O Configuration

For a typical distributed I/O network…



…you build the I/O configuration in this order.



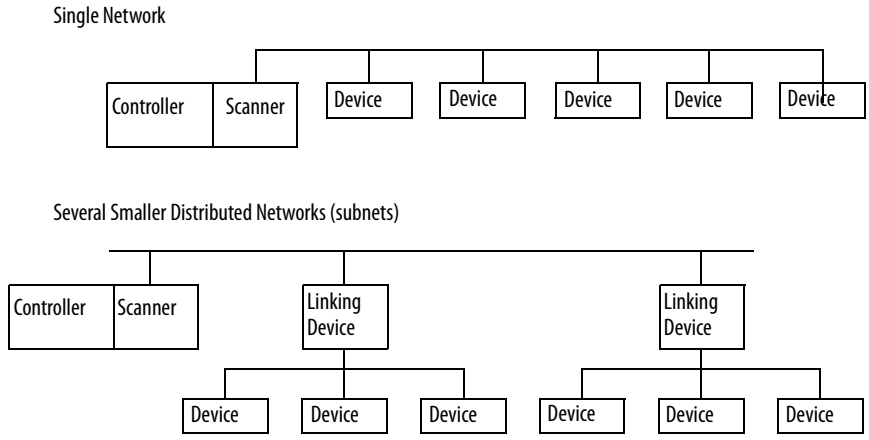
1. Add the remote adapter for the distributed I/O chassis or DIN rail.
2. Add the distributed I/O modules.

Configure Distributed I/O on a DeviceNet Network

To communicate with the I/O modules over a DeviceNet network, add the DeviceNet bridge to the I/O Configuration folder of the controller. RSNetWorx for DeviceNet software is used to define the scanlist within the DeviceNet scanner to communicate data between the devices and the controller through the scanner.

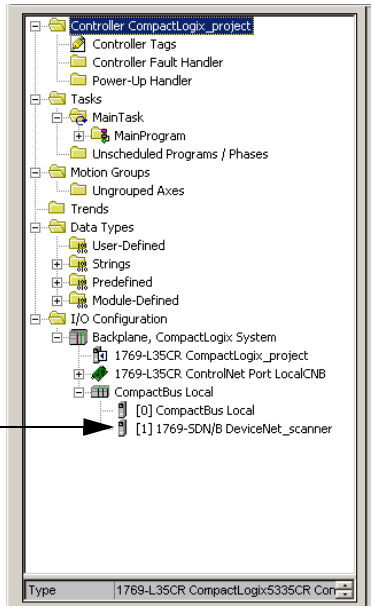
Figure 15 - DeviceNet Distributed I/O Configuration

For a typical distributed I/O network…



…you build the I/O configuration in this order

Add the local scanner module.

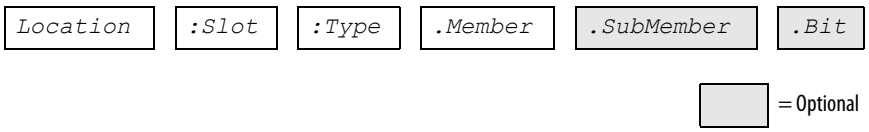


Address I/O Data

I/O information is presented as a set of tags.

- Each tag uses a structure of data, depending on the specific features of the I/O module.
- The name of the tags is based on the location of the I/O module in the system.

Figure 16 - I/O Address Format

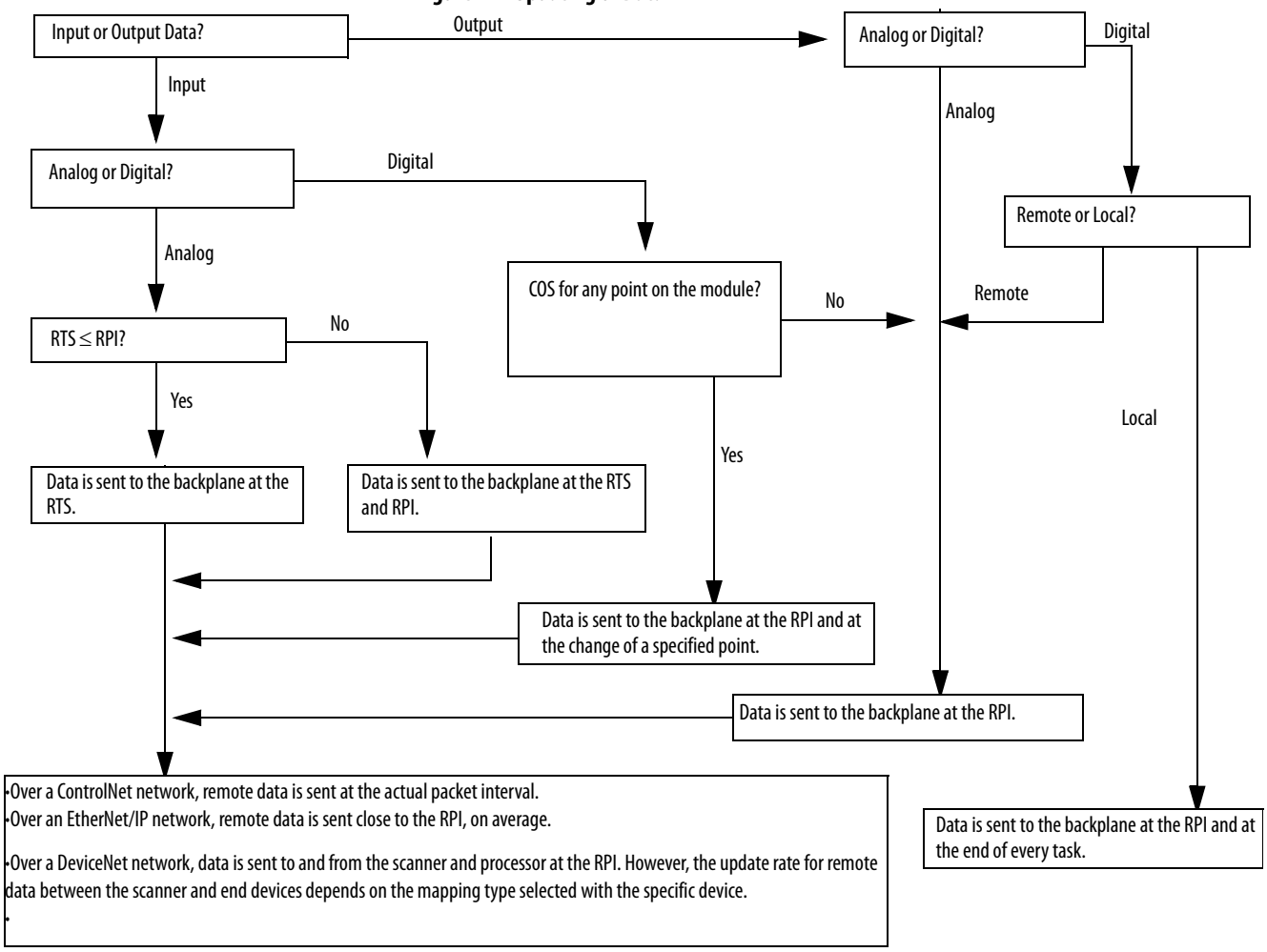


Where	Is
Location	Network location.
	Local = same chassis or DIN rail as the controller.
	Adapter_Name = identifies remote communication adapter or bridge module.
Slot	Slot number of I/O module in its chassis or DIN rail.
Type	Type of data.
	I = input.
	O = output.
	C = configuration.
	S = status.
Member	Specific data from the I/O module, depending on what type of data the module can store. • For a digital module, a data member usually stores the input or output bit values. • For an analog module, a channel member (CH#) usually stores the data for a channel.
SubMember	Specific data related to a member.
Bit	Specific point on a digital I/O module, depending on the size of the I/O module (0…31 for a 32-point module).

Determine When Data Is Updated

CompactLogix controllers update data asynchronously with the execution of logic. This flowchart illustrates when producers send data. Controllers, input modules and bridge modules are producers.

Figure 17 - Updating of Data



TIP If you need to ensure that the I/O values being used during logic execution are from one moment in time, such as at the beginning of a ladder program, use the Synchronous Copy instruction (CPS) to buffer I/O data.

Monitor I/O Modules

With the CompactLogix controller, you can monitor I/O modules at different levels by:

- using the programming software to display fault data.

  Refer to Display Fault Data on page 93.

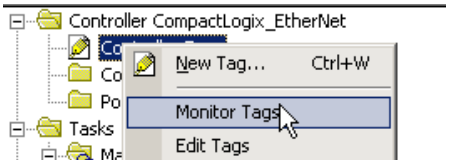
- programming logic to monitor fault data so you can take appropriate action

Display Fault Data

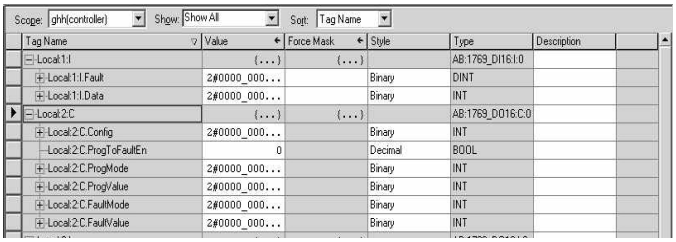
Fault data for certain types of module faults can be viewed through the programming software.

To display fault data, perform this procedure.

1. In RSLogix 5000 programming software, select Controller Tags in the Controller Organizer and right-click to select Monitor Tags.



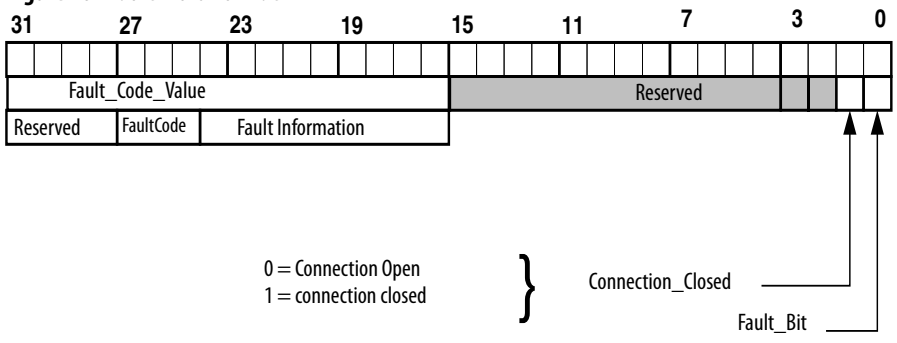
The display style for the fault data defaults to decimal.



2. Change the display style to Hex to read the fault code.

If the module faults, but the connection to the controller remains open, the controller tags database displays the fault value 16#0E01_0001. The fault word uses this format.

Figure 18 - Fault Word Format



Bit	Description
Fault_Bit	This bit indicates that at least one bit in the fault word is set (1). If all the bits in the fault word are cleared (0), this bit is cleared (0).
Connection_Closed	This bit indicates whether the connection to the module is open (0) or closed (1). If the connection is closed (1), the Fault_Bit is set (1).

End-cap Detection and Module Faults

If a module not adjacent to an end cap experiences a fault and the connection to the controller is not broken, only the module enters the fault state. If a module adjacent to an end cap experiences a fault, both the module and the controller transition to the fault state.

Reconfigure an I/O Module

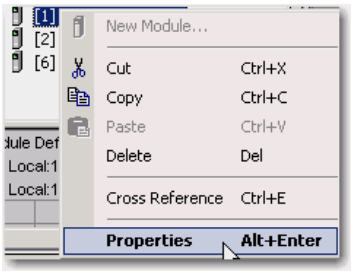
If an I/O module supports reconfiguration, you can reconfigure the module via:

- the Module Properties dialog box in RSLogix 5000 programming software.
- a MSG instruction in program logic.

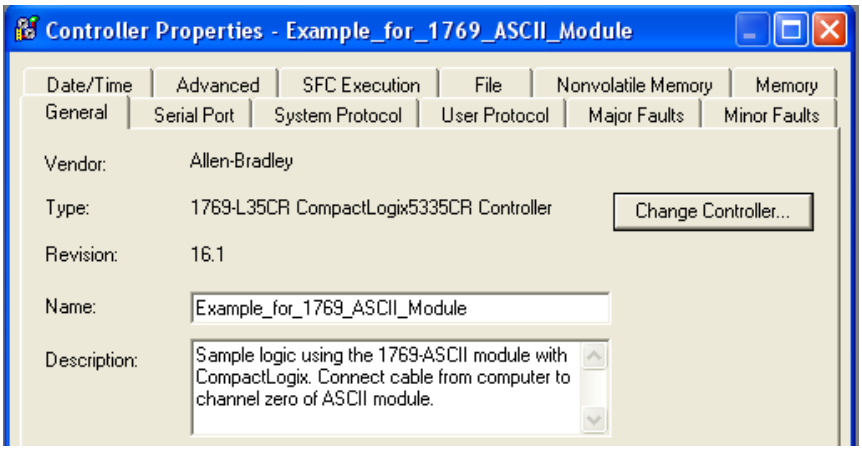
Reconfigure a Module via RSLogix 5000 Programming Software

To reconfigure an I/O module via RSLogix 5000 programming software, perform this procedure.

1. Highlight the module in the I/O Configuration tree and right-click to choose Properties.



The Controller Properties dialog box appears.



2. Reconfigure the module.

Reconfigure a Module via a MSG Instruction

To reconfigure an I/O module, use a Module Reconfigure MSG instruction. During the reconfiguration:

- input modules continue to send input data to the controller.
- output modules continue to control their output devices.

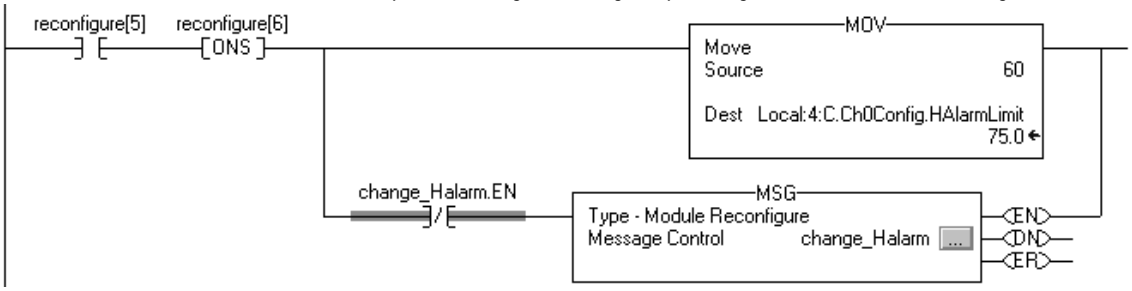
A Module Reconfigure message requires the property Message Type and a selection of Module Reconfigure.

To reconfigure an I/O module, perform this procedure.

1. Set the required member of the configuration tag of the module to the new value.
2. Send a Module Reconfigure message to the module.

EXAMPLE

When reconfigure[5] is on, the MOV instruction sets the high alarm to 60 for the local module in slot 4. The Module Reconfigure message then sends the new alarm value to the module. The ONS instruction prevents the rung from sending multiple messages to the module while the reconfigure[5] is on.



Notes:

Develop Applications

This chapter explains how to develop applications.

Manage Tasks

With a Logix5000 controller, you can use multiple tasks to schedule and prioritize the execution of your programs based on specific criteria. This divides your controller's processing time among the different operations in your application. Remember that:

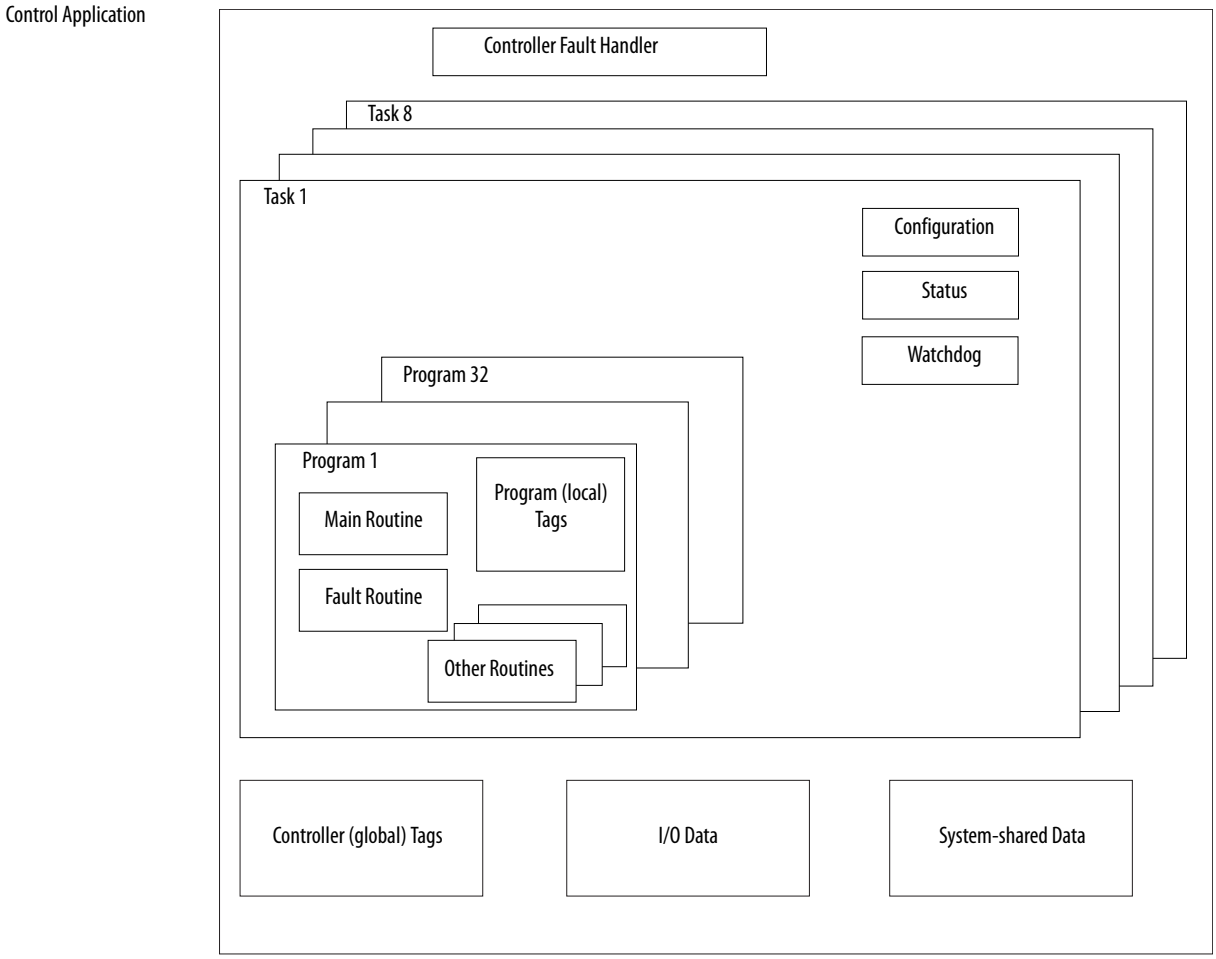
- the controller executes only one task at one time.
- one exception task can interrupt another and take control.
- in any given task, only one program executes at one time.

Develop Programs

The controller's operating system is a preemptive multitasking system that is IEC 1131-3 compliant. This environment provides:

- tasks to configure controller execution.
- programs to group data and logic.
- routines to encapsulate executable code written in a single programming language.

Figure 19 - Program Development



Define Tasks

Tasks provide scheduling and priority information for programs. You can configure tasks as continuous, periodic, or event tasks. Only one task can be continuous.

Table 24 - Task Support

Controller	Tasks Supported
1769-L35*x*	8
1769-L32*x*	6
1769-L31	4

A task can have as many as 32 separate programs, each with its own executable routines and program-scoped tags. Once a task is triggered (activated), all the programs assigned to the task execute in the order in which they are grouped. Programs can only appear once in the Controller Organizer and cannot be shared by multiple tasks.

Specify Task Priorities

Each task in the controller has a priority level. The operating system uses the priority level to determine which task to execute when multiple tasks are triggered. You can configure periodic tasks to execute from the lowest priority of 15 up to the highest priority of 1. A higher-priority task will interrupt any lower-priority task. The continuous task has the lowest priority and is always interrupted by a periodic task.

The CompactLogix controller uses a dedicated periodic task at priority 6 to process I/O data. This periodic task executes at the RPI you configure for the CompactBus, which can be as fast as once each millisecond. Its total execution time is as long as it takes to scan the configured I/O modules.

How you configure your tasks affects how the controller receives I/O data. Tasks at priorities 1...5 take precedence over the dedicated I/O task. Tasks in this priority range can impact I/O processing time. For example, if you use the following configuration:

- I/O RPI = 1 ms
- a task of priority = 1...5 that requires 500 µs to execute and is scheduled to run every millisecond

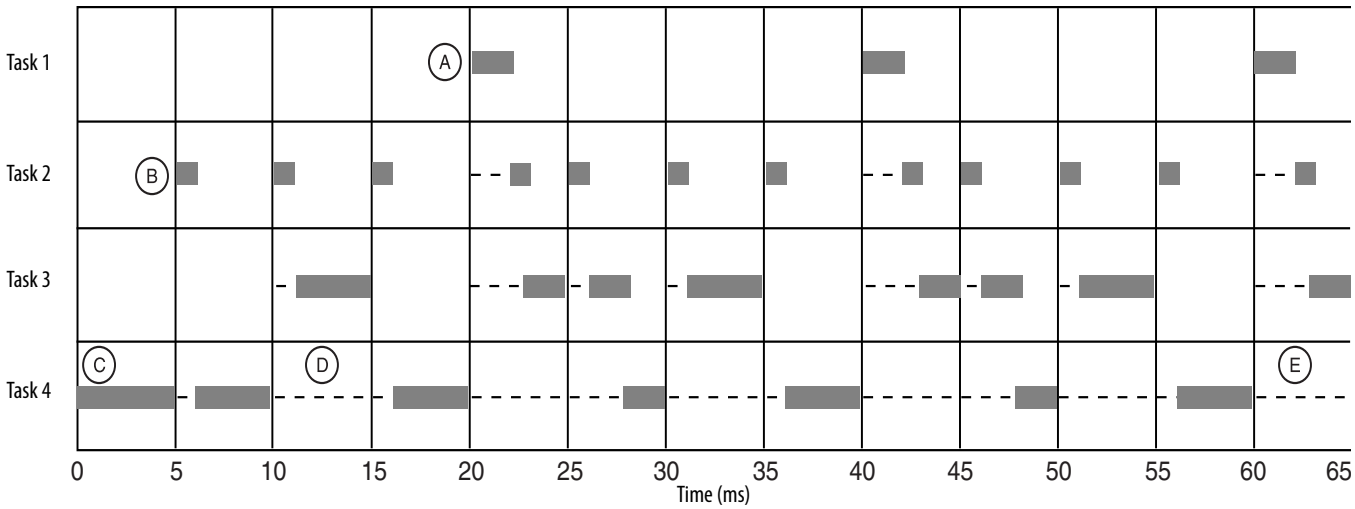
this configuration leaves the dedicated I/O task 500 µs to complete its job of scanning the configured I/O.

However, if you schedule two high priority tasks 1...5 to run every millisecond, and they both require 500 µs or more to execute, no CPU time would be left for the dedicated I/O task. Furthermore, if you have so much configured I/O that the execution time of the dedicated I/O task approaches 2 ms (or the combination of the high priority tasks and the dedicated I/O task approaches 2 ms) no CPU time is left for low priority tasks 7...15.

TIP For example, if your program needs to react to inputs and control outputs at a set rate, configure a periodic task with a priority higher than 6 (1…5). This keeps the dedicated I/O task from affecting the periodic rate of your program. However, if your program contains a lot of math and data manipulation, place this logic in a task with priority lower than 6 (7…15), such as the continuous task, so that the dedicated I/O task is not adversely affected by your program.

Table 25 - Multiple Tasks Example

Task	Priority Level	Task Type	Example Execution Time	Worst-Case Completion Time
1	5	20 ms periodic task	2 ms	2 ms
2	7	Dedicated I/O task 5 ms selected RPI	1 ms	3 ms
3	10	10 ms periodic task	4 ms	8 ms
4	None (lowest)	Continuous task	25 ms	60 ms



Remember that:

- the highest priority task interrupts all lower priority tasks.
- the dedicated I/O task can be interrupted by tasks with priority levels 1...5.

  The dedicated I/O task interrupts tasks with priority levels 7...15. This task runs at the selected RPI rate scheduled for the CompactLogix system (2 ms in this example).
- the continuous task runs at the lowest priority and is interrupted by all other tasks.
- a lower priority task can be interrupted multiple times by a higher priority task.
- when the continuous task completes a full scan it restarts immediately, unless a higher priority task is running.

Define Programs

Each program contains:

- program tags.
- a main executable routine.
- other routines.
- an optional fault routine.

Each task can schedule as many as 32 programs.

The scheduled programs within a task execute to completion from first to last. Programs unattached to any task show up as unscheduled programs. You must specify (schedule) a program within a task before the controller can scan the program.

Define Routines

A routine is a set of logic instructions in a single programming language, such as ladder logic. Routines provide the executable code for the project in a controller. A routine is similar to a program file or subroutine in a PLC or SLC controller.

Each program has a main routine. This is the first routine to execute when the controller triggers the associated task and calls the associated program. Use logic, such as the Jump to Subroutine (JSR) instruction, to call other routines.

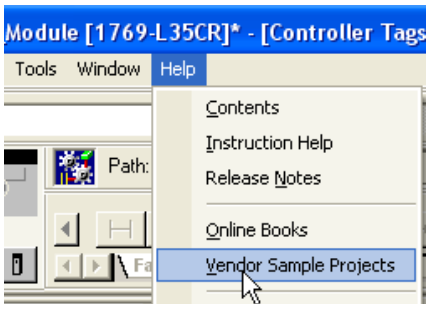
You can also specify an optional program fault routine. The controller executes this routine if it encounters an instruction-execution fault within any of the routines in the associated program.

Sample Controller Projects

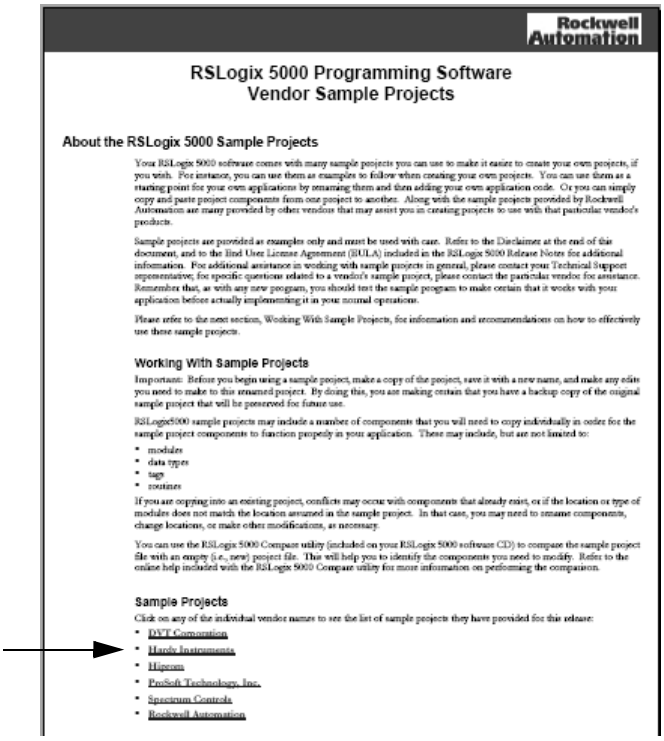
RSLogix 5000 Enterprise programming software includes sample projects that you can copy and then modify to fit your application.

To view a set of sample controller projects, perform this procedure.

1. From the Help pull-down menu, choose Vendor Sample Projects.



2. Scroll down to select a set of sample projects.

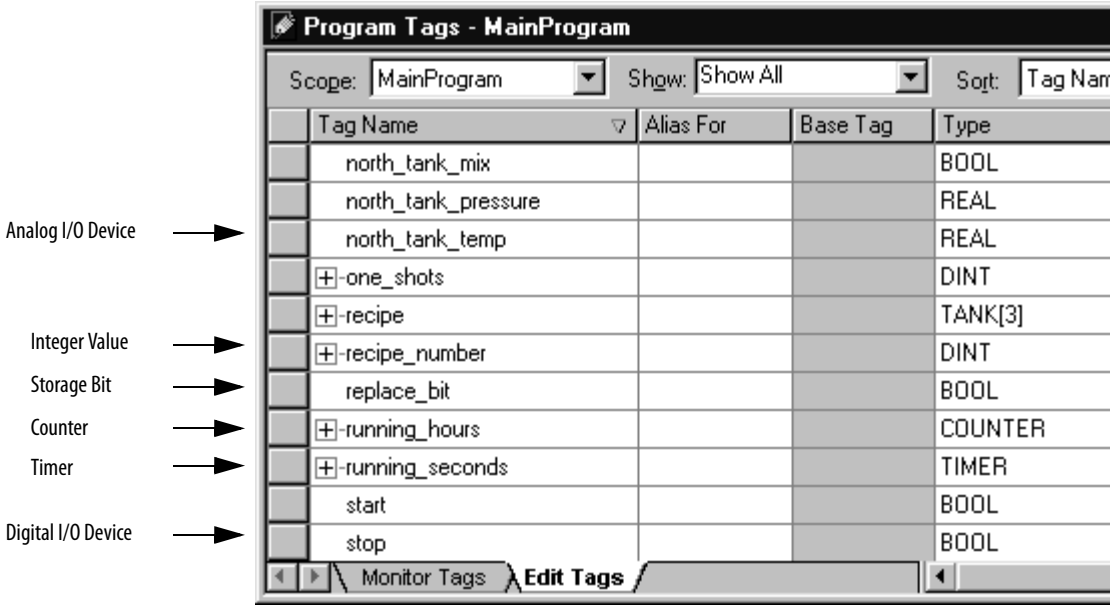


Organize Tags

With a Logix5000 controller, you use a tag (alphanumeric name) to address data (variables). In Logix5000 controllers, there is no fixed, numeric format. The tag name itself identifies the data. This lets you:

- organize your data to mirror your machinery.
- document (through tag names) your application as you develop it.

Figure 20 - Tag Organization



When you create a tag, assign these properties to the tag:

- Tag type
- Data type
- Scope

Select a Programming Language

The CompactLogix controller supports these programming languages, both online and offline.

Table 26 - Programming Language Selection

Required Language	Program
Ladder diagram (LD)	Continuous or parallel execution of multiple operations (not sequenced)
	Boolean or bit-based operations
	Complex logical operations
	Message and communication processing
	Machine interlocking
	Operations that service or maintenance personnel may have to interpret in order to troubleshoot the machine or process
Function block diagram (FBD)	Continuous process and drive control
	Loop control
	Calculations in circuit flow
Sequential function chart (SFC)	High-level management of multiple operations
	Repetitive sequence of operations
	Batch process
	Motion control using structured text
	State machine operations
Structured text (ST)	Complex mathematical operations
	Specialized array or table loop processing
	ASCII string handling or protocol processing

Add-on Instructions

With version 18 of RSLogix 5000 programming software, you can design and configure sets of commonly used instructions to increase project consistency. Similar to the built-in instructions contained in Logix5000 controllers, these instructions you create are called Add-on Instructions. Add-on Instructions reuse common control algorithms. With them, you can:

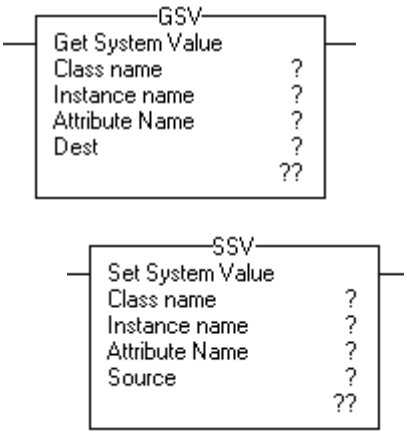
- ease maintenance by animating logic for a single instance.
- protect intellectual property with locking instructions.
- reduce documentation development time.

You can use Add-on Instructions across multiple projects. You can define your instructions, obtain them from somebody else, or copy them from another project.

Once defined in a project, Add-on Instructions behave similarly to the built-in instructions in Logix5000 controllers. They appear on the instruction tool bar for easy access, as do internal RSLogix 5000 software instructions.

Feature	Description
Save Time	With Add-on Instructions, you can combine your most commonly used logic into sets of reusable instructions. You save time when you create instructions for your projects and then share them with others. Add-on Instructions increase project consistency since commonly used algorithms all work in the same manner, regardless of who implements the project.
Use Standard Editors	You create Add-on Instructions by using one of three RSLogix 5000 software programming editors. • Standard Ladder • Function Block Diagram • Structured Text Once you have created instructions, you can use them in any RSLogix 5000 editor.
Export Add-on Instructions	You can export Add-on Instructions to other projects as well as copy and paste them from one project to another. Give each instruction a unique name so that you don't accidentally overwrite another instruction of the same name.
Add-on InstructionsUse Context Views	Context views let you visualize an instruction's logic for a specific instant, simplifying online troubleshooting of your Add-on Instructions. Each instruction contains a revision, a change history, and an auto-generated help page.
Create Custom Help	When you create an instruction, you enter information for the description fields in software dialog boxes, information that becomes what is known as Custom Help. Custom Help makes it easier for users to get the help they need when implementing the instructions.
Apply Source Protection	As the creator of Add-on Instructions, you can limit users of your instruction(s) to read-only access, or you can bar access to the internal logic or local parameters used by the instruction(s). This source protection lets you prevent unwanted changes to your instruction(s) and protects your intellectual property.

Monitor Controller Status



The CompactLogix controller uses Get System Value (GSV) and Set System Value (SSV) instructions to get and set (change) controller data. The controller stores system data in objects. There is no status file, as in the PLC-5 processor.

The GSV instruction retrieves the specified information and places it in the destination. The SSV instruction sets the specified attribute with data from the source.

When you enter a GSV/SSV instruction, the programming software displays the:

- valid object classes.
- object names.
- attribute names.

For the GSV instruction, you can get values for all the available attributes. For the SSV instruction, the software displays only those attributes you are allowed to set.

In some cases, there will be more than one of the same type of object, so you might also have to specify the object name. For example, there can be several tasks in your application. Each task has its own TASK object that you access by the task name.

You can access these object classes:

- AXIS
- CONTROLLER
- CONTROLLERDEVICE
- CST
- DF1
- FAULTLOG
- MESSAGE
- MODULE
- MOTIONGROUP

- PROGRAM
- ROUTINE
- SERIALPORT
- TASK
- WALLCLOCKTIME

Monitor Connections

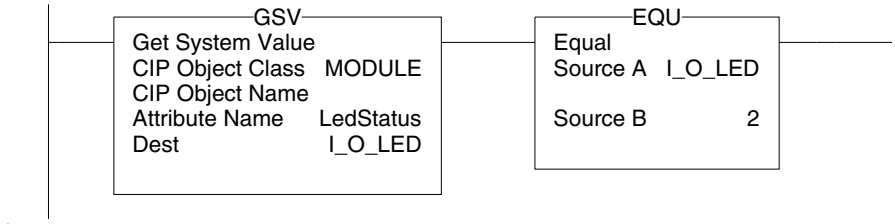
If communication with a device in the I/O configuration of the controller does not occur for 100 ms or 4 times the RPI, whichever is less, the communication times out, and the controller produces these warnings:

- The I/O status indicator on the front of the controller flashes green.
- A ⚠ displays over the I/O configuration folder and the device (s) that has timed out.
- A module fault code is produced, which you can access via:
  - the Module Properties dialog box for the module.
  - a GSV instruction.

Determine if Device Communication Has Timed Out

If communication times out with at least one device (module) in the I/O configuration of the controller, the I/O status indicator on the front of the controller flashes green.

- The GSV instruction gets the status of the I/O status indicator and stores it in the I_O_LED tag.
- If I_O_LED equals 2, the controller has lost communication with at least one device.



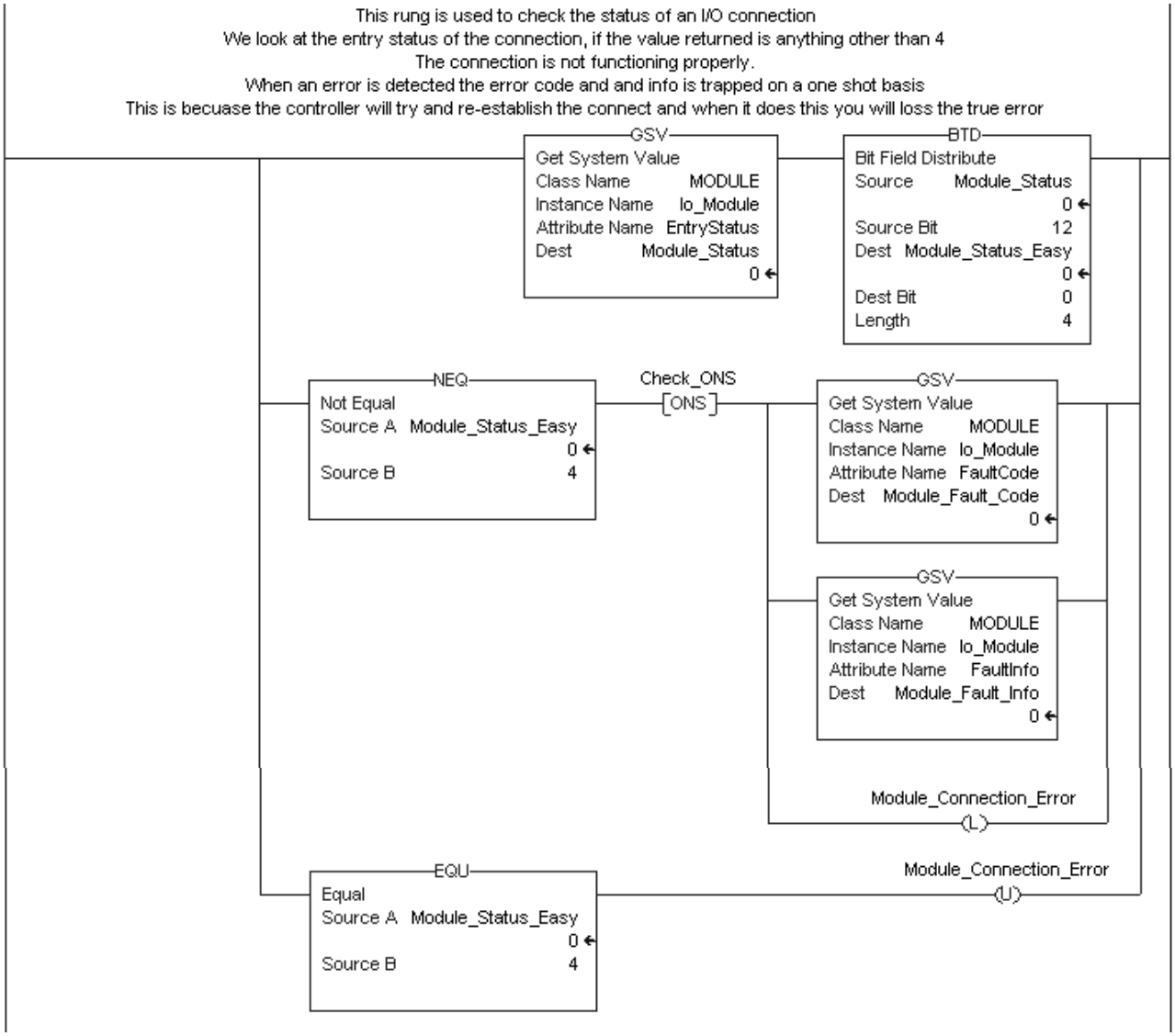
I_O_LED is a DINT tag that stores the status of the I/O status indicator on the front of the controller.

Determine if I/O Module Communication Has Timed Out

If communication times out with a device (module) in the I/O configuration of the controller, the controller produces a fault code for the module.

- The GSV instruction gets the fault code for IO_Module and stores it in the Module_Status tag.
- If Module_Status is any value other than 4, the controller is not communicating with the module.

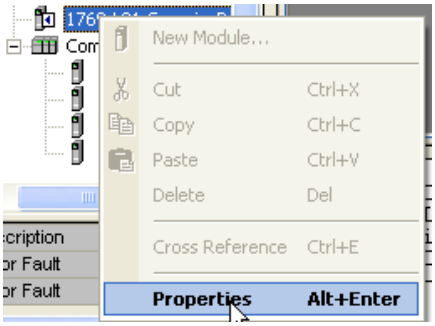
Figure 21 - I/O Module Communication



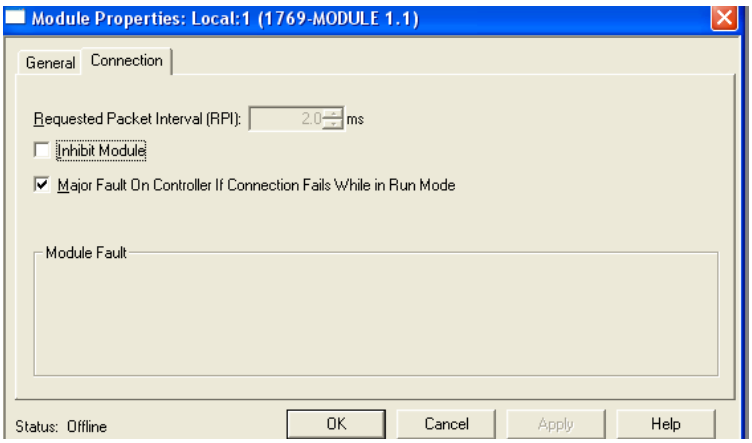
Interrupt the Execution of Logic and Execute the Fault Handler

To interrupt the execution of logic and execute the fault handler, perform this procedure.

1. In the Controller Organizer of RSLogix 5000 programming software, right-click the module and choose Properties.



The Module Properties dialog box appears.



2. Click the Connection and check Major Fault On Controller If Connection Fails While in Run Mode checkbox.
3. Click OK.
4. Develop a routine for the Controller Fault Handler.

Select a System Overhead Time Slice Percentage

With RSLogix 5000 programming software, you can specify a percentage for the system overhead time slice. A Logix5000 controller communicates with other devices (I/O modules, controllers, HMI terminals) at either a specified rate (scheduled) or when there is processing time available to service the communication (unscheduled).

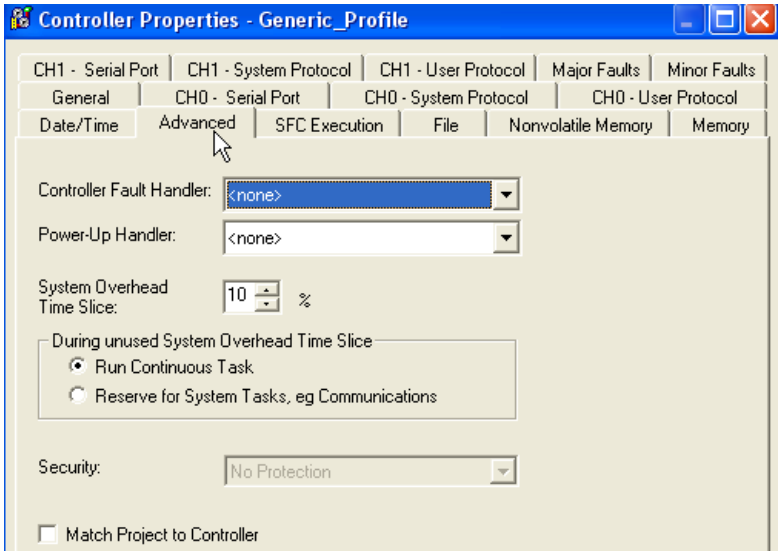
Service communication is any communication that you do not configure through the I/O configuration folder of the project.

- The system overhead time slice specifies the percentage of time (excluding the time for periodic or event tasks) that the controller devotes to service communication.
- The controller performs service communication for up to 1 ms at a time and then resumes the continuous task.

To select a system overhead percentage, perform this procedure.

1. In the Controller Organizer of RSLogix 5000 programming software, right-click on your controller and choose Properties.

   The Controller Properties dialog box appears.



2. Click the Advanced tab.
3. From the System Overhead Time Slice menu, choose a percentage.

   System overhead time slice functions include:

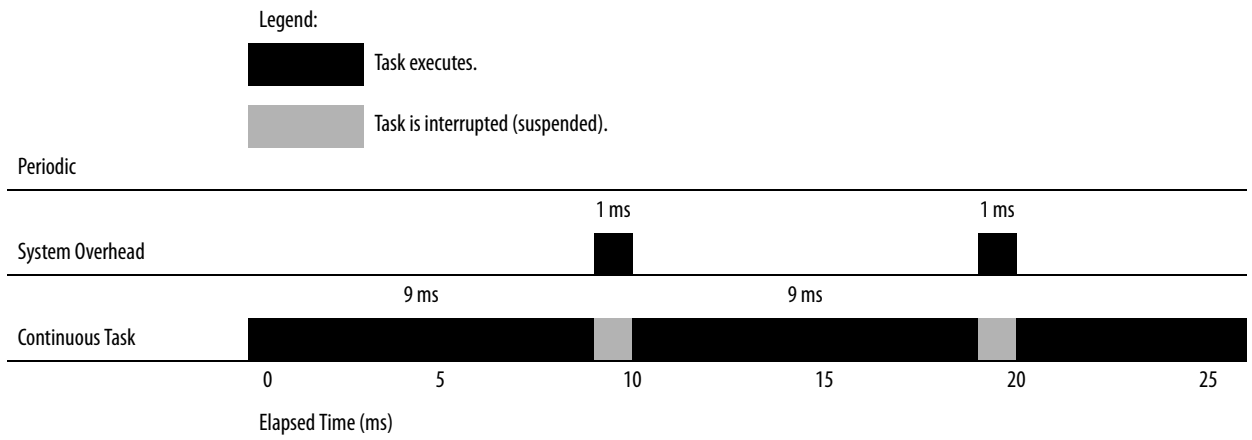
   - communicating with programming and HMI devices, such as RSLogix 5000 software.
   - responding to messages.
   - sending messages.

The controller performs system overhead functions for up to 1 millisecond at a time. If the controller completes the overhead functions in less than one millisecond, it resumes the continuous task.

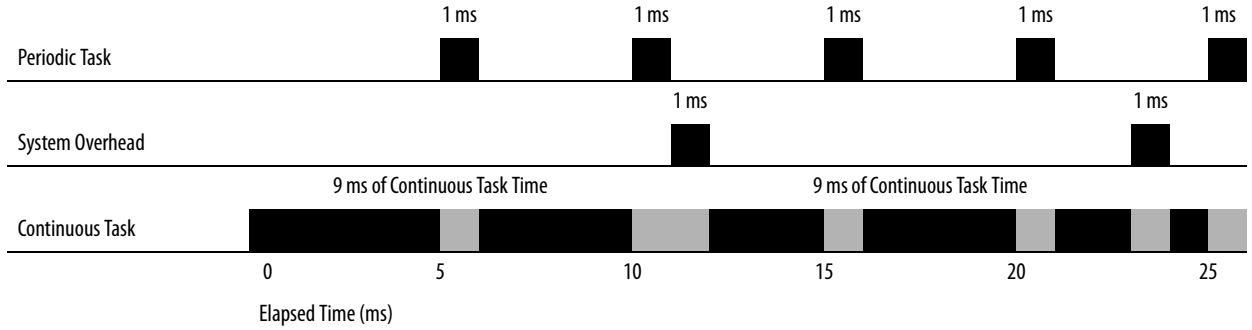
As the system overhead time slice percentage increases, time allocated to executing the continuous task decreases. If there are no communication for the controller to manage, the controller uses the communication time to execute the continuous task. While increasing the system overhead percentage does increase communication performance, it also increases the amount of time it takes to execute a continuous task, increasing overall scan time.

	V15 and Lower		V16 and Higher	
Time Slice (SOTS)	**Comms**	**Continuous Task**	**Comms**	**Continuous Task**
10%	1 msec	9 msec	1 msec	9 msec
20%	1 msec	4 msec	1 msec	4 msec
33%	1 msec	2 msec	1 msec	2 msec
50%	1 msec	1 msec	1 msec	1 msec
66%	1 msec	0.5 msec	2 msec	1 msec
80%	1 msec	0.2 msec	4 msec	1 msec
90%	1 msec	0.1 msec	9 msec	1 msec

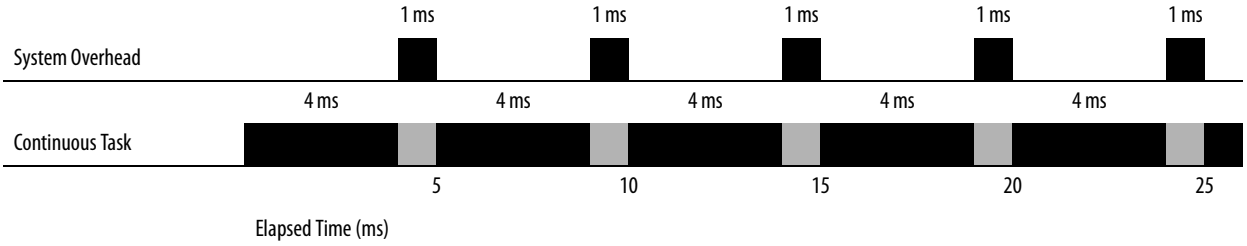
At a time slice of 10%, system overhead interrupts the continuous task every 9 ms of continuous task time.



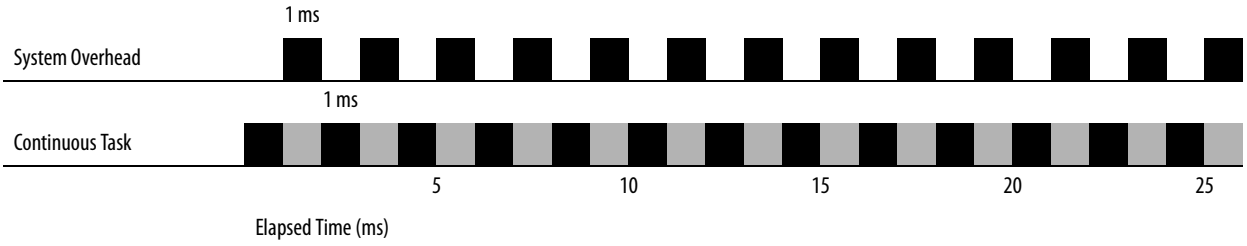
The interruption of a periodic task increases the elapsed time (clock time) between the execution of system overhead functions.



If you use the default time slice of 20%, the system overhead interrupts the continuous task every 4 ms.



If you increase the time slice to 50%, the system overhead interrupts the continuous task every 1 ms.



If the controller contains only a periodic task(s), the system overhead time slice value has no effect. System overhead runs whenever a periodic task is not running.

Configure PhaseManager Application

This chapter explains how to configure a PhaseManager™ application.

The PhaseManager option of RSLogix 5000 programming software gives you a state model for your equipment.

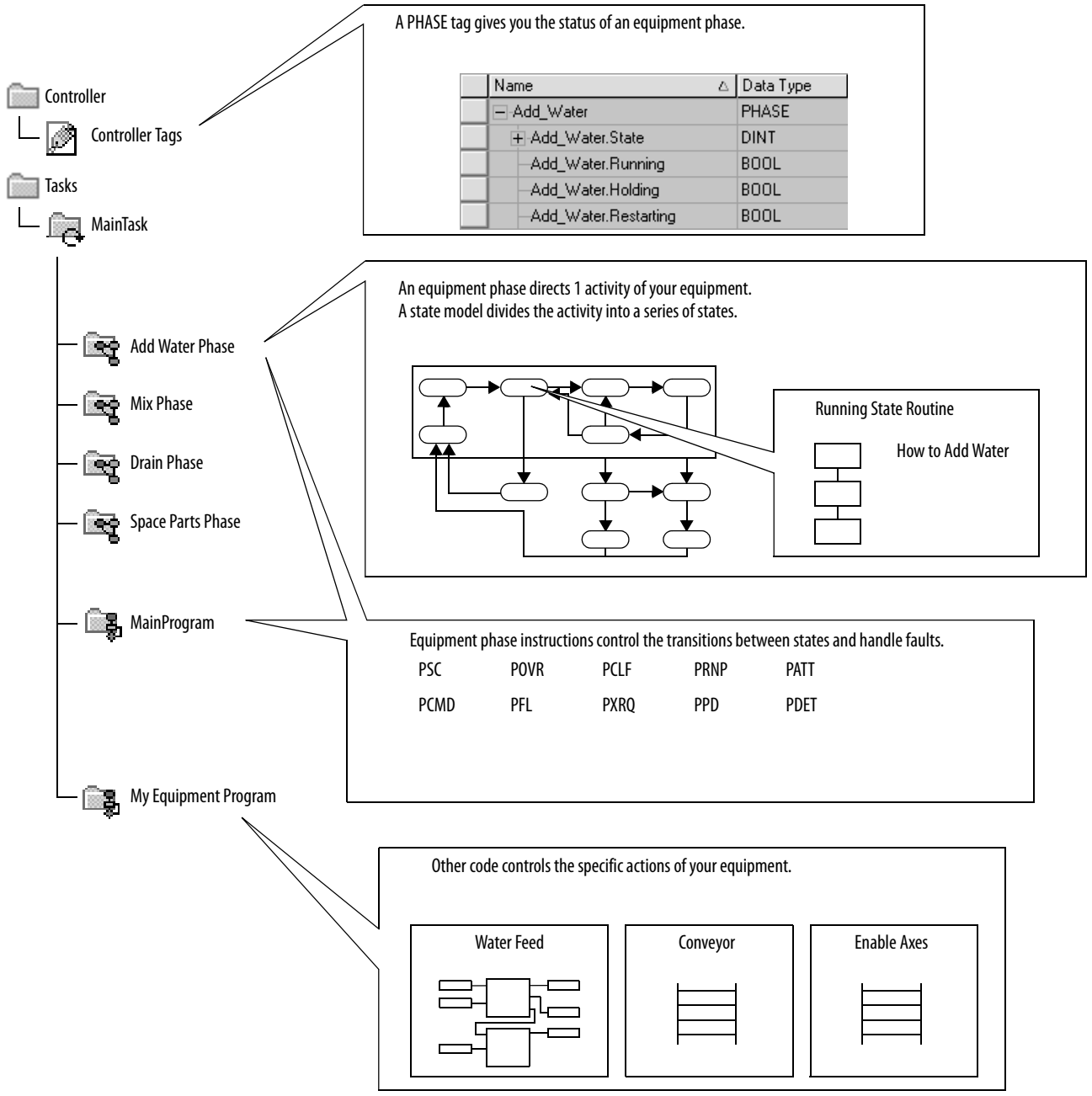
For additional information, consult PhaseManager User Manual, publication LOGIX-UM001

PhaseManager Overview

PhaseManager lets you add equipment phases to your controller. An equipment phase helps you lay out your code in sections that are easier to write, find, follow, and change.

Term	Description
Equipment phase	• As with a program, an equipment phase is run in a task and is given a set of routines and tags. • Unlike a program, an equipment phase runs by a state model and lets you do one activity.
State model	A state model divides the operating cycle of your equipment into a series of states. Each state is an instant in the operation of the equipment. It's the actions or conditions of the equipment at a given time. The state model of an equipment phase is similar to the S88 and Pack*ML* state models.
State machine	• An equipment phase includes an embedded state machine that: • calls the main routine (state routine) for an acting state. • manages the transitions between states with minimal coding. • makes sure that the equipment goes from state to state along an allowable path.
PHASE tag	When you add an equipment phase, RSLogix 5000 programming software makes a tag, using the PHASE data type.

Figure 22 - PhaseManager Overview



State Model Overview

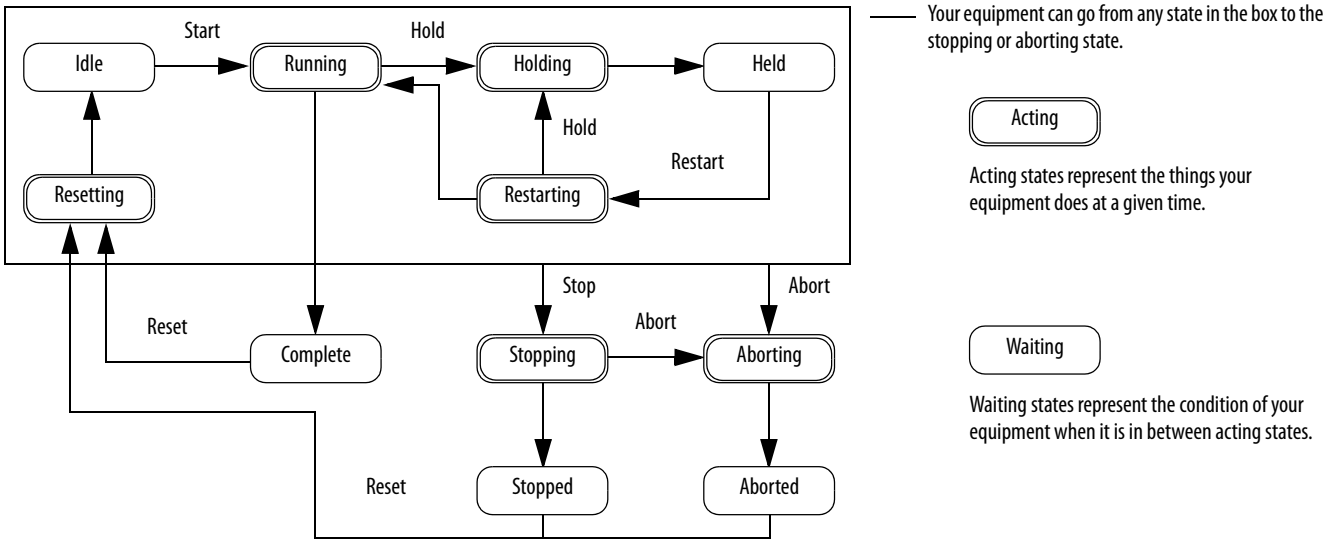
A state model divides the operating cycle of your equipment into a series of states. Each state is an instant in the operation of the equipment, an action or condition at a given time.

In a state model, you define what your equipment does under different conditions, such as run, hold, and stop. You don't need to use all the states for your equipment. Use only needed states.

Table 27 - Types of States

State	Description
Acting	Does something or several things for a certain time or until certain conditions are met. An acting state runs one time or repeatedly.
Waiting	Shows that certain conditions are met and the equipment is waiting for the signal to go to the next state.

Figure 23 - PhaseManager States



With a state model, you define the behavior of your equipment and put it into a brief functional specification. In this way you show what happens and when it happens.

State	Question To Be Asked
Stopped	What happens when you turn on power?
Resetting	How does the equipment get ready to run?
Idle	How do you tell that the equipment is ready to run?
Running	What does the equipment do to make product?
Holding	How does the equipment temporarily stop making product without making scrap?
Held	How do you tell if the equipment is safely holding?
Restarting	How does the equipment resume production after holding?
Complete	How do you tell when the equipment has finished what it had to do?
Stopping	What happens during a normal shutdown?
Aborting	How does the equipment shut down if a fault or failure happens?
Aborted	How do you tell if the equipment is safely shut down?

How Equipment Changes States

The arrows in the state model show how your equipment can transition from one state to another.

- Each arrow is called a transition.
- A state model lets the equipment make only certain transitions. This transition restriction standardizes equipment behavior so that another piece of equipment using the same model will behave the same way.

Table 28 - PhaseManager Transitions Overview

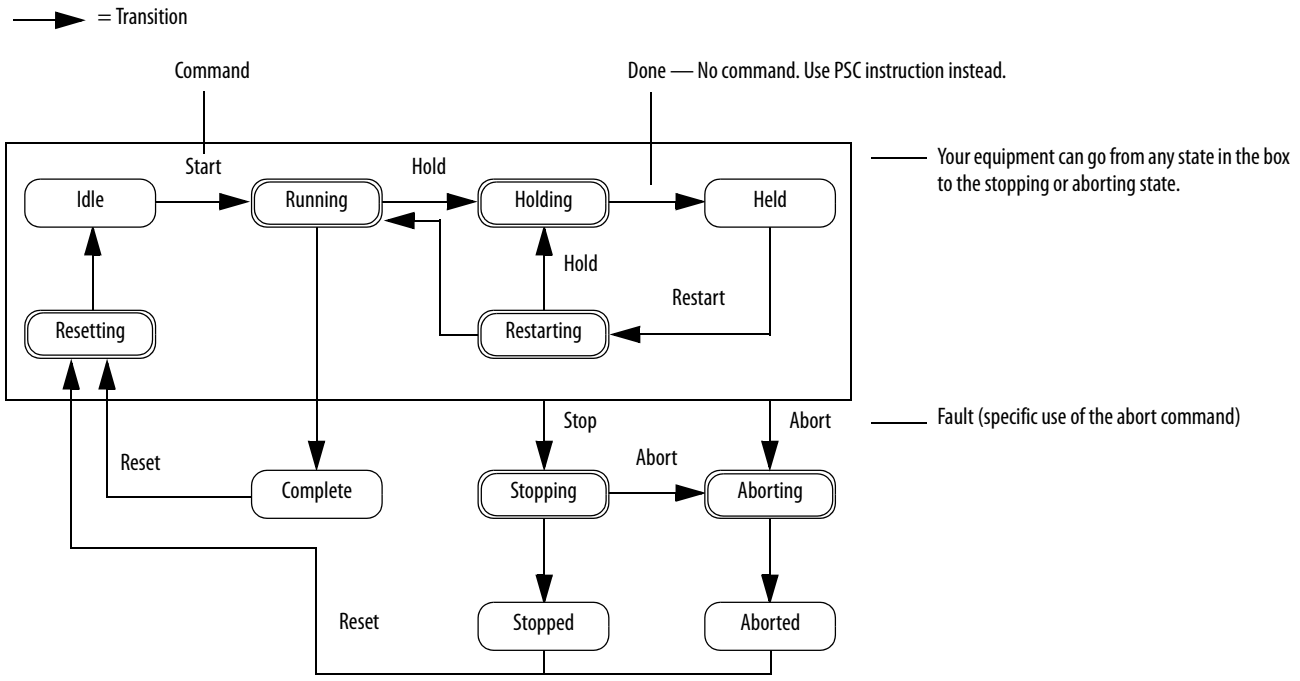
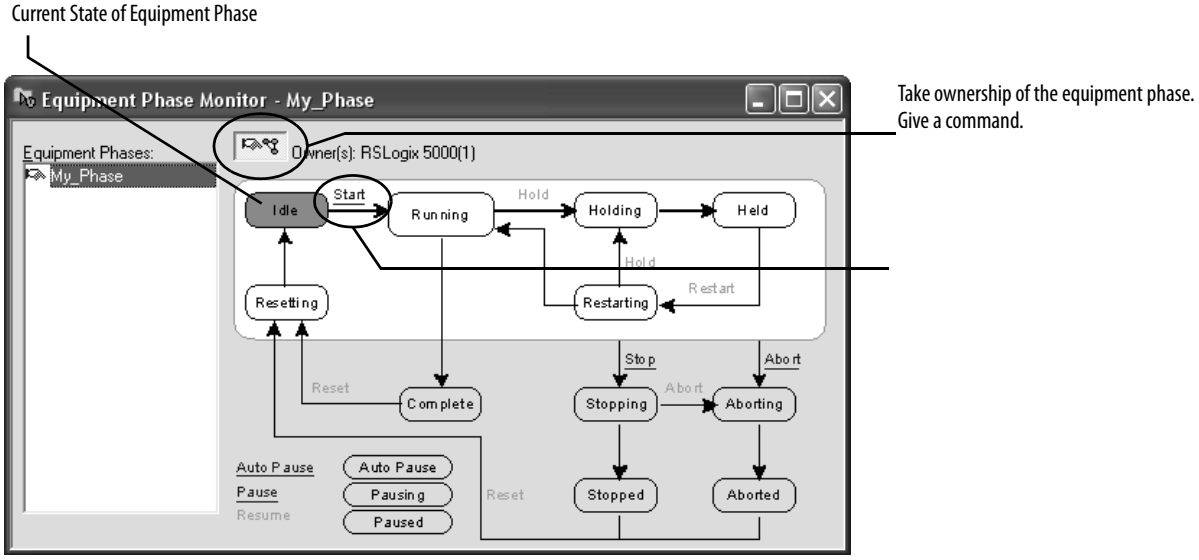


Table 29 - PhaseManager Transition Types

Transition Type	Description
Command	A command tells the equipment to start doing something or do something different. For example the operator pushes the start button to start production and the stop button to halt production. PhaseManager uses these commands: • Reset • Start • Stop • Hold • Restart • Abort
Done	Equipment goes to a waiting state when it has completed a task. You don't have to command equipment to stop. Instead, set up your code to signal when a task is complete.
Fault	A fault tells you that something unusual has occurred. Set up your code to find and take action for faults. Suppose you want your equipment to shut down as fast as possible in case of a certain fault. In that case, set up your code to look for that fault and give the abort command if it finds it.

Manually Change States

With RSLogix 5000 programming software, you can monitor and command an equipment phase. To manually change states, perform this procedure.



Compare PhaseManager to Other State Models

You can compare PhaseManager's state models to other common state models.

Table 30 - State Model Comparisons

S88	Pack*ML*	PhaseManager
Idle	Starting ? Ready	Resetting ? Idle
Running ? Complete	Producing	Running ? Complete
Pausing ? Paused	Standby	Subroutines and/or breakpoints
Holding ? Held	Holding ? Held	Holding ? Held
Restarting	None	Restarting
Stopping ? Stopped	Stopping ? Stopped	Stopping ? Stopped
Aborting ? Aborted	Aborting ? Aborted	Aborting ? Aborted

Minimum System Requirements

To develop PhaseManager programs, you need:

- a CompactLogix controller with firmware revision 16.0 or later.
- a communication path to the controller.
- RSLogix 5000 programming software, version 15.0 or later.

To enable PhaseManager support, you need the full or professional editions of RSLogix 5000 programming software or the optional PhaseManager add-on (9324-RLDPMENE) to your RSLogix 5000 programming software package.

Equipment Phase Instructions

With CompactLogix controllers, you can issue many ladder diagram (LD) and structured text (ST) instructions to begin various equipment phases.

Instruction Code	Instruction
PSC	Signal a phase that the state routine is complete so go to the next state
PCMD	Change the state or substate of a phase
PFL	Signal a failure for a phase
PCLF	Clear the failure code of a phase
PXRQ	Initiate communication with RSBizWare Batch software
PRNP	Clear the NewInputParameters bit of a phase
PPD	Set up breakpoints within the logic of a phase
PATT	Take ownership of a phase to either: • prevent another program or RSBizWare Batch software from commanding a phase or • make sure another program or RSBizWare Batch software does not already own a phase
PDET	Relinquish ownership of a phase
POVR	Override a command

Use a CompactFlash Card

This chapter explains how to use a CompactFlash card for nonvolatile memory or data storage.

CompactLogix controllers only support nonvolatile storage through CompactFlash removable media. CompactLogix controllers support the 1784-CF128 Industrial CompactFlash memory cards for nonvolatile memory.

CompactLogix controllers 1769- L31, 1769-L32E, 1769-L32C, 1769-L35E, and 1769-L35CR can save and restore user applications to CompactFlash memory.

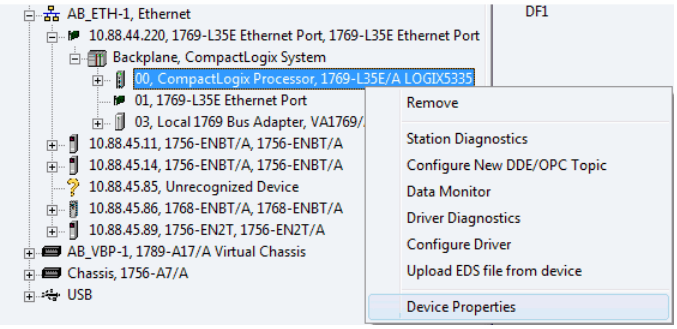
Of the 1769 CompactLogix controllers, only the 1769-L32E and 1769-L35E can store user data (for example, a recipe) to the CompactFlash card during runtime. This feature is supported on 1769-L35E controllers with serial numbers starting with SS0OR9GE, or greater, and 1769-L32E controllers with serial numbers starting with SS0QZ000, or greater. To find the controller's serial number, look on the label on the outside of the controller, or access it electronically in RSLinx software or RSLogix 5000 programming software. You must use firmware version V16, or greater.

Locate the Controller Serial Number in RSLinx Software

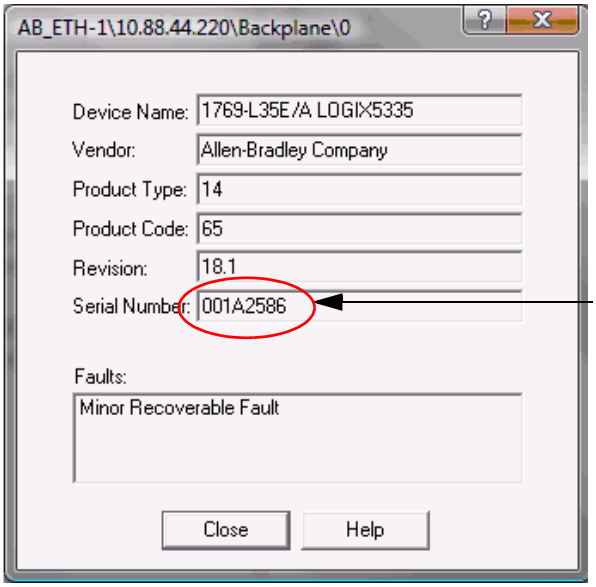
To find the controller's serial number in RSLinx software, follow these steps.

1. Open RSLinx software and from the Communication pull-down menu, choose RSWho.

2. Right-click on the controller in the RSWho browse window and select Device Properties.



The Device Properties dialog box displays, showing the serial number.



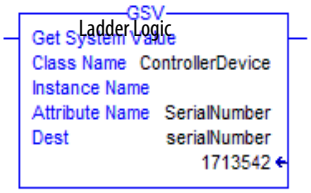
The serial number shown in this example is in hexadecimal format.

Locate the Controller Serial Number

Via the RSLogix 5000 Project

To find the controller's serial number in your RSLogix 5000 project when using ladder logic or structured text, use the Get System Value (GSV) instruction to obtain the value of the Serial Number attribute of the ControllerDevice object.

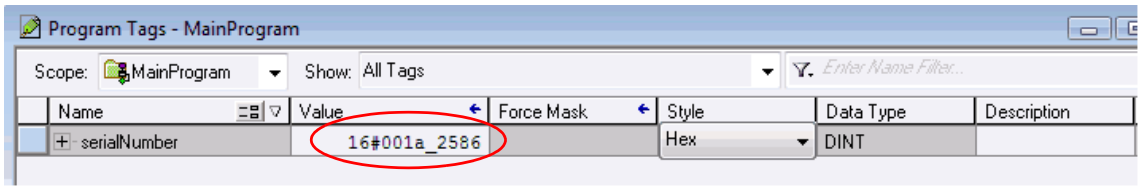
Ladder Logic



Structured Text

```
GSV(ControllerDevice,,SerialNumber,serialNumber);
```

The value can be shown in RSLogix 5000 programming software's data monitor. When the style is set to Hex, the displayed value is the same as shown in RSLinx software.



TIP If the user wants to access the serial number programmatically, additional logic is needed to obtain the serial number's value.

Via RSLogix 5000 Programming Software

To find the controller's serial number in RSLogix programming software, follow these steps.

1. In the controller organizer, right-click on the controller and select Properties from the pull-down menu.

   The Controller Properties dialog box displays.

2. Click the Advanced tab to see the serial number.

Use a CompactFlash Card to Load/Store a User Application

You can load the user application/project from nonvolatile memory/ CompactFlash to the user memory of the controller:

- on every power-up.
- on corrupt memory.
- anytime through RSLogix 5000 programming software.

ATTENTION: Fault conditions can occur if the controller types do not match. For example, if the CompactFlash user program and controller firmware were created for a 1769-L35E controller, and then an attempt was made to load that program and/or firmware into a 1769-L32E controller.

IMPORTANT The user application and firmware version on the CompactFlash card is loaded into the controller. If the contents of the CompactFlash card are a different revision than the revision that is on the controller, then the controller will be updated to the revision on the CompactFlash card.

ATTENTION: Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF status indicator. Doing so could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

IMPORTANT CompactFlash card memory stores the contents of the user memory when you store the project.\

- Changes made after you store the project are not reflected in CompactFlash card memory.
- If you change the project but do not store those changes, you overwrite them when you load the project from the CompactFlash card. If this occurs, you have to upload or download the project to go online.
- If you want to store changes such as online edits, tag values, or a ControlNet network schedule, store the project again after you make the changes.

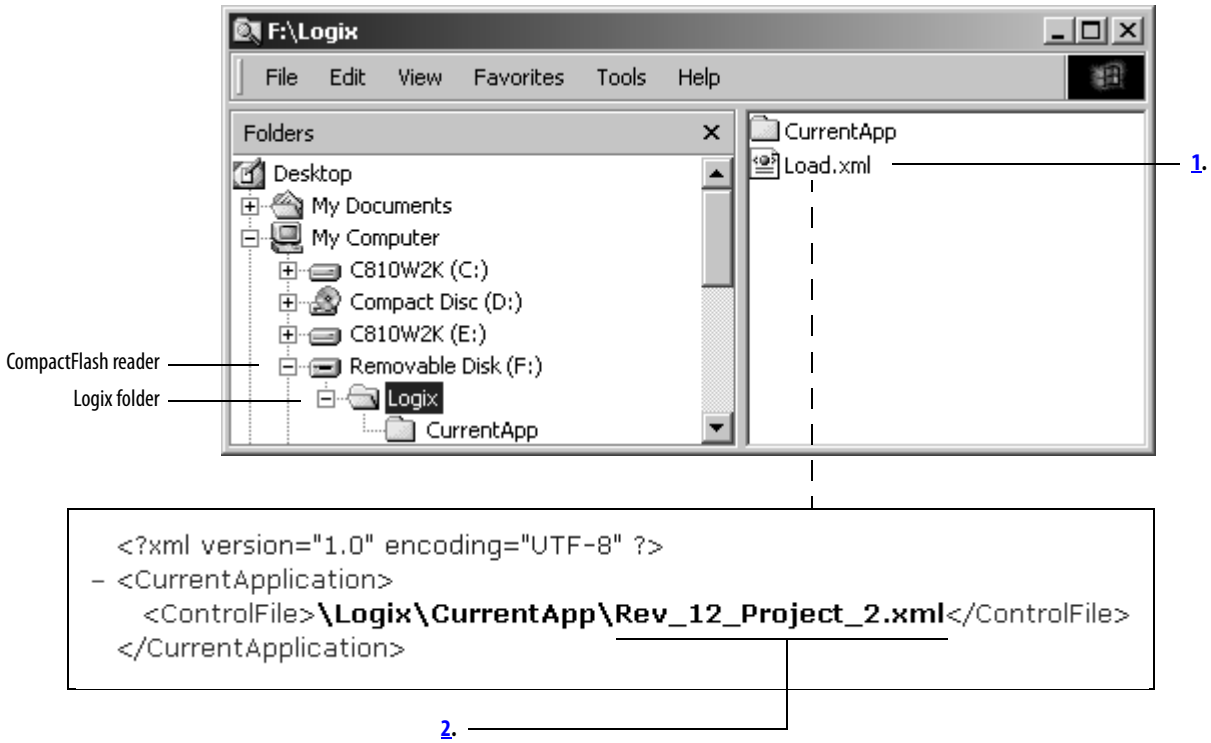
When you store a project to a 1784-CF128 Industrial CompactFlash memory card, the controller formats the card, if required.

Manually Change Which Project Loads

A CompactFlash card stores multiple projects. By default, the controller loads the project that you most recently stored, according to the load options of that project.

IMPORTANT Be aware that when loading a different project, the firmware revisions must be the same.

To assign a different project to load from the CompactFlash card, edit the Load.xml file on the card.



1. To change which project loads from the card, open *Load.xml*. Use a text editor to open the file.
2. Edit the name of the project that you want to load.
   - Use the name of an XML file that is in the CurrentApp folder.
   - In the CurrentApp folder, a project is comprised of an XML file and a P5K file.

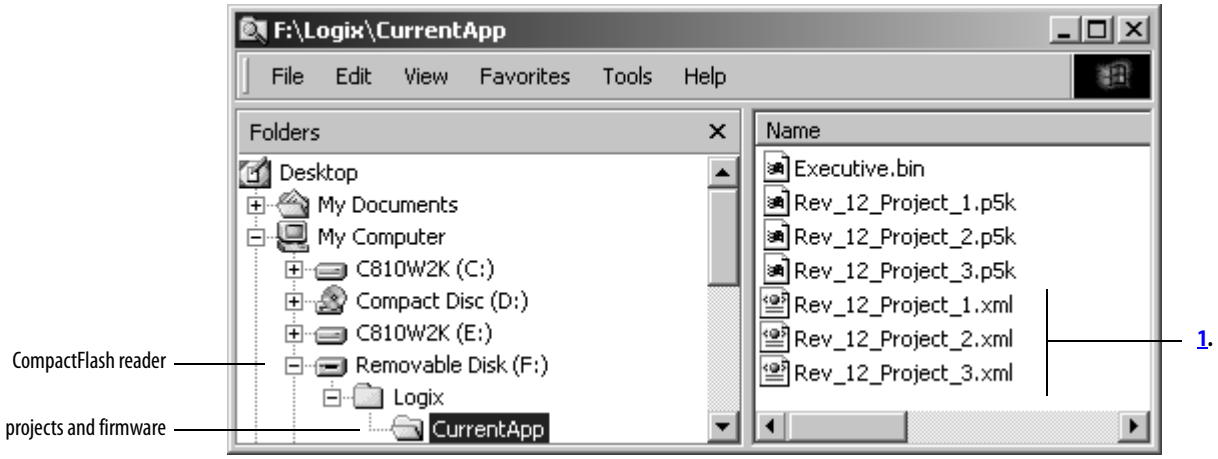
Manually Change the Load Parameters

When you store a project to a CompactFlash card, you define:

- when the project is to load (On Power Up, On Corrupt Memory, User Initiated).
- mode to which to set the controller (if the keyswitch is in REM and the load mode is not User Initiated).

IMPORTANT Be aware that when loading a different project, the firmware revisions must be the same.

To assign a different project to load from the CompactFlash card, edit the Load.xml file on the card.



1. To change the load parameters for a project, open the XML file with the same name as the project. Use a text editor to open the file.

```
<?xml version="1.0" encoding="UTF-8" ?>
- <Controller>
  - <ExecutiveLoadOption>
      <ExecFile>\Logix\CurrentApp\Executive.bin</ExecFile>
    </ExecutiveLoadOption>
  - <ProgramLoadOption>
      <ProgramLoadMode>CORRUPT_RAM</ProgramLoadMode>
      <LoadFile>\Logix\CurrentApp\Rev_12_Project_2.p5k</LoadFile>
    </ProgramLoadOption>
  - <ControllerModeOption>
      <ControllerMode>RUN</ControllerMode>
    </ControllerModeOption>
  </Controller>
```

2.

3.

2. Edit the Load Image option of the project.

If you want to set the Load Image option to	Then enter
On Power Up	ALWAYS
On Corrupt Memory	CORRUPT_RAM
User Initiated	USER_INITIATED

3. Edit the Load Mode option of the project (doesn't apply if the Load Image option is *User Initiated*).

If you want to set the Load Mode option to	Then enter
Program (Remote Only)	PROGRAM
Run (Remote Only)	RUN

Use a CompactFlash Card for Data Storage

You can also store data to the CompactFlash memory card.

For example:

- A PanelView terminal changes tag values in a controller project. If power to the controller is lost (and the controller is not battery backed up), the program running in the controller, along with any values that were changed by the PanelView terminal, will be lost. Use the CompactFlash file system and logic in the project to store tag values as they change. When the project reloads from the CompactFlash card, it can check the CompactFlash card for any saved tag values and reload those into the project.
- Store a collection of recipes on the CompactFlash card. When you need to change a recipe, program the controller to read data for the new recipe from a CompactFlash card.
- Program the controller to write data logs at specific time intervals.

Read and Write User Data to the CompactFlash Card

A sample controller project that reads and writes from a CompactFlash card is available with RSLogix 5000 Enterprise programming software.

Notes:

Maintain the Battery

This chapter explains how to maintain your battery.

CompactLogix controllers support the 1769-BA battery.

ATTENTION: The 1769-BA battery is the only battery you can use with the CompactLogix controllers. The 1747-BA battery is not compatible with the CompactLogix controllers and may cause problems.

Battery Handling

Lithium batteries are primary (not rechargeable) cells that give extended memory support for Rockwell Automation products.

ATTENTION: This product contains a sealed lithium battery that may need to be replaced during the life of the product.

At the end of its life, the battery contained in this product should be collected separately from any unsorted municipal waste.

The collection and recycling of batteries helps protect the environment and contributes to the conservation of natural resources as valuable materials are recovered.

Check If the Battery Is Low

The battery indicator (BAT) warns when the battery is low. Once the controller is powered down, the battery retains controller memory as long as the BAT indicator remains on. Temperature dictates how long the BAT indicator remains on.

Figure 24 - Battery Status Indicator

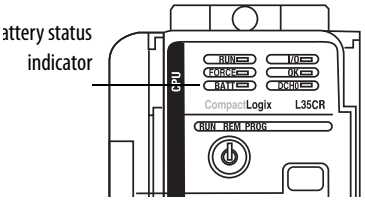


Table 31 - BAT Indicator Duration

Temperature	Duration
60 °C (140 °F)	8 days
25 °C (77 °F)	25 days

Estimate 1769-BA Battery Life

Certain conditions affect typical battery life.

Table 32 - Battery Life Estimations

Time On/Off	At 25 °C (77 °F)	At 40 °C (104 °F)	At 60 °C (140 °F)
Always off	14 months	12 months	9 months
On 8 hours per day 5 days per week	18 months	15 months	12 months
On 16 hours per day 5 days per week	26 months	22 months	16 months
Always On	There is almost no drain on the battery when the controller is always on.		

Store Lithium Batteries

ATTENTION: Follow these general rules to store your batteries.

- Store batteries in a cool, dry environment. We recommend 25 °C (77 °F) with 40…60% relative humidity.
- Regularly monitor the temperature and humidity of the storage area.
- Use a first-in/first-out system for handling stored batteries.
- Store in the original containers away from flammable materials.
- Keep track of storage time. Reference storage time to the date of manufacture.
- Do not store batteries longer than 10 years.
- Do not store used batteries longer than 3 months before disposal.
- Clearly mark the contents of the storage area.
- Place a Lith-X or Class D Powder fire extinguisher in a readily accessible area in or around the storage area.
- Ventilate and protect the storage area against fire. You must have a system that automatically detects and extinguishes fires and automatically activates an alarm signal.
- Do not smoke in the storage area.

Table 33 - Storage Temperatures for 1769-BA Lithium Batteries

Storage Temperature	Capacity Loss
40 °C (104 °F) for 5 years	Loses up to 4% of original capacity
60 °C (140 °F)	Loses 2.5 % of capacity each year

- You may store batteries for up to 30 days between -45...85 °C (-49...185 °F) such as during transportation. Do not store in temperatures above 85° C (185 °F).
- To avoid leakage or other hazards, do not store batteries above 60° C for more than 30 days.
- The rate of capacity loss increases as storage temperature increases.

Battery Removal

WARNING: When you connect or disconnect the battery, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Additional Resources

For additional information, consult this publication.

Resource	Description
Guidelines for Handling Batteries, publication AG 5-4	Detailed information on battery-handling procedures for the 1769-BA lithium battery.

Status Indicators

This appendix explains how to interpret the status indicators on your CompactLogix controllers.

1769-L3*xx* Controllers Status Indicators

These are the 1769-L3*xx* CompactLogix controller status indicators.

Indicator	Condition	Interpretation
RUN	Off	The controller is in program or test mode.
	Steady green	The controller is in run mode.
FORCE	Off	• No tags contain I/O force values. • I/O forces are inactive (disabled).
	Steady amber	• I/O forces are active (enabled). • I/O force values may or may not exist.
	Flashing amber	One or more input or output addresses have been forced to an On or Off condition, but the forces have not been enabled.
BAT	Off	The battery supports memory.
	Steady red	• The battery is: • not installed. • 95% discharged and should be replaced.
I/O	Off	• There are no devices in the I/O configuration of the controller. • The controller does not contain a project.
	Steady green	The controller is communicating with all the devices in its I/O configuration.
	Flashing green	One or more devices in the I/O configuration of the controller are not responding.
	Flashing red	• The controller is not communicating with any devices. • The controller is faulted.

<table>
<tr><th>Indicator</th><th>Condition</th><th>Interpretation</th></tr>
<tr><td rowspan="5">OK</td><td>Off</td><td>No power is applied.</td></tr>
<tr><td>Flashing red</td><td>
• The controller requires a firmware update.
• A major recoverable fault occurred on the controller. To clear the fault, perform this procedure.
a. Turn the controller keyswitch from PROG to RUN to PROG.
b. Go online with RSLogix 5000 programming software.
• A nonrecoverable major fault occurred on the controller. In this case, the controller:
a. initially displays a steady red status indicator.
b. resets itself.
c. clears the project from its memory.
d. sets the status indicator to flashing red.
e. produces a major recoverable fault.
f. generates a fault code in the RSLogix 5000 project.
The fault code displayed in RSLogix 5000 programming software, and the subsequent fault recovery method, depends on whether you have installed a CompactFlash card in the controller.
<table>
<tr><th>Code</th><th>Condition</th><th>Fault recovery method</th></tr>
<tr><td>60</td><td>CompactFlash card is not installed.</td><td>1. Clear the fault.
2. Download the project.
3. Change to Remote Run/Run mode.
If the problem persists:
1. Before you cycle power to the controller, record the state of the OK and RS232 status indicators.
2. Contact Rockwell Automation support. See the back cover.</td></tr>
<tr><td>61</td><td>CompactFlash is installed.</td><td>1. Clear the fault.
2. Download the project.
3. Change to Remote Run/Run mode.
If the problem persists, contact Rockwell Automation support. See the back cover.</td></tr>
</table>
</td></tr>
<tr><td>Steady red</td><td>The controller detected a nonrecoverable major fault, so it cleared the project from memory. To recover from a major fault, perform this procedure.
1. Cycle power to the chassis.
2. Download the project.
3. Change to Run mode.
If the OK status indicator remains steady red, contact your Rockwell Automation representative or local distributor.</td></tr>
<tr><td>Steady green</td><td>Controller is OK.</td></tr>
<tr><td>Flashing green</td><td>The controller is storing or loading a project to or from nonvolatile memory.</td></tr>
</table>

CompactFlash Indicator

This is the CompactFlash card status indicator present on all CompactLogix controllers.

ATTENTION: Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF status indicator. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

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Indicator	Condition	Interpretation
CF	Off	There is no activity.
	Flashing green	The controller is reading from or writing to the CompactFlash card.
	Flashing red	CompactFlash card does not have a valid file system.

RS-232 Serial Port Status Indicators

These are the RS-232 serial port status indicators present on all CompactLogix controllers.

Indicator	Condition	Interpretation
DCH0	Off	Channel 0 configuration differs from the default serial configuration.
	Steady green	Channel 0 has the default serial configuration.
CH0	Off	No RS-232 activity.
	Flashing green	RS-232 activity.
CH1 (1769-L31 only)	Off	No RS-232 activity.
	Flashing green	RS-232 activity.

ControlNet Indicators

The ControlNet indicators are only on the 1769-L32C and 1769-L35CR controllers.

Use these indicators to determine how your CompactLogix 1769-L32C or 1769-L35CR controller is operating on the ControlNet network:

- Module Status
- Network Status

These indicators provide information about the controller and network when the controller is connected to ControlNet via the BNC connectors.

Table 34 - ControlNet Network Status Indicator States

Status Indicator State	Interpretation
Steady	The indicator is on continuously in the defined state.
Alternating	When viewed together, two indicators alternate between two defined states; the two indicators are always in opposite states, out of phase.
Flashing	When viewed independent of another, an indicator alternates between the two defined states; if both indicators are flashing, they flash together, in phase.

IMPORTANT Keep in mind that the Module Status indicator reflects the module state (for example, self-test, firmware update, normal operation but no connection established). The network status indicators, A and B, reflect network status. Remember that the host is able to engage in local messaging with the card although it is detached from the network. Therefore, the Module Status indicator is flashing green if the host has successfully started the card. Note, however, that until the host removes reset, all communication port status indicators.

When you view the indicators, always view the Module Status indicator first to determine the state of the communication port. This information may help you to interpret the network indicators. As a general practice, view all indicators (Module Status and Network Status) together to gain a full understanding of the daughtercard's status.

Module Status (MS) Indicator

These are the ControlNet module indicators.

Indicator	Condition	Recommended Action
Off	The controller has no power.	Apply power.
	The controller is faulted.	Make sure that the controller is firmly seated in the slot.
Steady red	A major fault has occurred on the controller.	1. Cycle power. 2. If the problem persists, replace the controller.
Flashing red	A minor fault has occurred because a firmware update is in progress.	Normal operation - No action is required.
	A node address switch change has occurred. The controller's node address switches may have been changed since power-up.	Change the node address switches back to the original setting. The module will continue to operate properly.
	The controller uses invalid firmware.	Update the controller firmware with the ControlFlash Update utility.
	The controller's node address duplicates that of another device.	1. Remove power. 2. Change the node address to a unique setting. 3. Reapply power.
Steady green	Connections are established.	Normal operation - No action is required.
Flashing green	No connections are established.	Establish connections, if necessary.
Flashing red/green	The controller is diagnosing a problem.	Wait briefly to see if problem corrects itself. If problem persists, check the host. If the daughtercard cannot communicate with the host, the card may remain in self-test mode.

Network Channel Indicators

These are the ControlNet network channel indicators.

Channel B is only labelled on the 1769-L35CR controller. The 1769-L32C controller only has channel A but uses the second indicator in some status indicator patterns as described below.

Indicator	Condition	Recommended Action
Off	A channel is disabled.	Program network for redundant media, if necessary.
Steady green	Normal operation is occurring.	Normal operation - No action is required.
Flashing green/off	Temporary network errors have occurred.	1. Check media for broken cables, loose connectors, and missing terminators. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	The node is not configured to go online.	Make sure the network keeper is present and working and the selected address is less or equal to the UMAX(1).
Flashing red/off	Media fault has occurred.	1. Check media for broken cables, loose connectors, and missing terminators. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	No other nodes are present on the network.	Add other nodes to the network.
Flashing red/green	The network is configured incorrectly.	Reconfigure the ControlNet network so that UMAX is greater than or equal to the card's node address.
Off	You should check the MS indicators.	Check the MS indicators.
Steady red	The controller is faulted.	1. Cycle power. 2. If the fault persists, contact your Rockwell Automation representative or distributor.
Alternating red/green	The controller is performing a self test.	Normal operation - No action is required.
Alternating red/off	The node is configured incorrectly.	Check the card's network address and other ControlNet configuration parameters.

(1) UMAX is the highest node address on a ControlNet network that can transmit data.

EtherNet/IP Indicators

The EtherNet/IP indicators are only on 1769-L32E and 1769-L35E controllers.

Module Status (MS) Indicator

These are the EtherNet/IP module indicators.

Indicator	Condition	Recommended Action
Off	The controller does not have power.	Check the controller power supply.
Flashing green	The port is in standby mode; it does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
Steady green	The port is operating correctly.	Normal operation - No action is required.
Steady red	The controller is holding the port in reset or the controller has faulted.	1. Clear the controller fault. 2. If the fault will not clear, replace the controller.
	The port is performing its power-up self test.	Normal operation - No action is required.
	A nonrecoverable fault has occurred.	1. Cycle power to the controller. 2. If the fault will not clear, replace the controller.
Flashing red	The port firmware is being updated.	Normal operation - No action is required.

Network Status (NS) Indicator

These are the EtherNet/IP network indicators.

Indicator	Condition	Recommended Action
Off	The port is not initialized; it does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
Flashing green	The port has an IP address, but no CIP connections are established.	• If no connections are configured, no action is required. • If connections are configured, check connection originator for connection error code.
Steady green	The port has an IP address and CIP connections (Class 1 or Class 3) are established.	Normal operation - No action is required.
Steady red	The port has detected that the assigned IP address is already in use.	Verify that all IP addresses are unique.
Flashing red/green	The port is performing its power-up self test.	Normal operation - No action is required.

Link Status (LNK) Indicator

Indicator	Condition	Recommended Action
Off	The port is not connected to a powered Ethernet device. Therefore, the port cannot communicate on Ethernet.	1. Verify that all Ethernet cables are connected. 2. Verify that Ethernet switch is powered.
Flashing green	The port is performing its power-up self-test.	Normal operation - No action is required.
	The port is communicating on Ethernet.	
Steady green	The port is connected to a powered Ethernet device. Therefore, the port can communicate on Ethernet.	

Dynamic Memory Allocation in CompactLogix Controllers

This appendix explains the dynamic allocation of memory in CompactLogix controllers.

Certain operations cause the controller to dynamically allocate and remove user-available memory, affecting the space available for program logic. As these functions become active, memory is allocated. Memory is then removed when these functions become inactive.

Operations that dynamically allocate memory are:

- messages.
- connections to processors with RSLogix 5000 programming software.
- RSLinx tag optimization.
- trends.
- DDE/OPC topics.

Messages

Messages come in and go out of the controller via the Ethernet, ControlNet, and serial ports, causing memory allocation. The memory allocations for messages destined to I/O are accounted for in these allocations. To prevent message instructions from using too much memory, do not send messages simultaneously.

Table 35 - Message Types

Message Path		Connection Established?	Memory Allocated
ControlNet Port	Incoming	Yes - The message is connected.	1200 bytes
		No - The message is unconnected.	1200 bytes
	Outgoing	All outgoing messages whether connected or unconnected	1200 bytes
Ethernet Port	Incoming	Yes - The message is connected.	1200 bytes
		No - The message is unconnected.	1200 bytes
	Outgoing	All outgoing messages whether connected or unconnected	1200 bytes
Serial Port	Incoming	All incoming messages whether connected or unconnected	1200 bytes
	Outgoing	All outgoing messages whether connected or unconnected	1200 bytes

RSLinx Tag Optimization

With tag optimization, trend objects, trend drivers, and connections allocate memory.

Table 36 - Tag Functions

Item	Description	Memory Allocated
Trend Object	Object is created in the controller to group the requested tags. One trend object can handle approximately 100 tags.	80 bytes
Trend Driver	Drive is created to communicate with the trend object.	36 bytes
Connection	Connection is created between the controller and RSLinx software.	1200 bytes

EXAMPLE

To monitor 100 points:

100 points x 36 bytes = 3600 bytes (Trend Driver)

3600 (Trend Driver) + 80 (Trend Object) + 1200 (Connection) = approximately 4000 bytes

We estimate that one tag consumes about 40 bytes of memory.

Trends

Each trend created in a controller creates a trend object and allocates a buffer for logging.

Table 37 - Controller Trends

Item	Memory Allocated
Trend Object	80 bytes
Log Buffer	4000 bytes

DDE/OPC Topics

A DDE/OPC topic uses connections based on these variables:

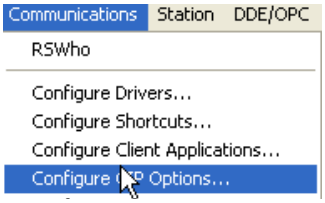
- Maximum number of messaging connections per PLC controller configured in RSLinx software
- Number of connections needed to optimize throughput
- Configuration of RSLinx software to use connections for writing to a ControlLogix processor

IMPORTANT These variables are per path. For example, if you set up two different DDE/OPC topics, with different paths to the same controller, the variables limit the connections for each path. Therefore, if you have a limit of 5 connections, it is possible to have 10 connections, with 5 over each path.

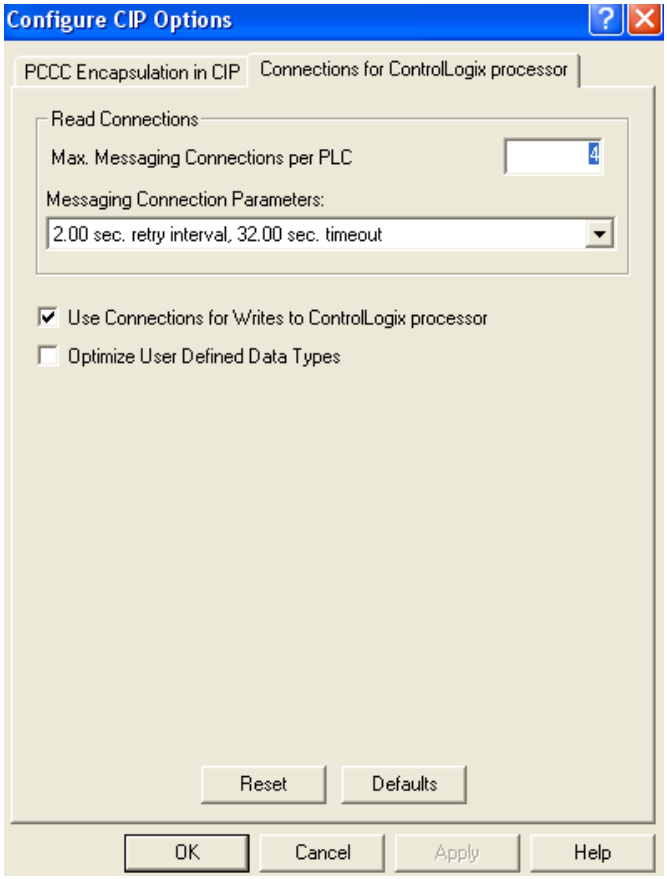
Specify Connections per PLC Controller

To specify the maximum messaging connections per PLC controller, perform this procedure.

1. In RSLinx programming software, from the Communication pull-down menu, choose Configure CIP Options.



The Configure CIP Options dialog box appears.



2. In the Max. Messaging Connections per PLC field, enter the maximum number of read connections you want a particular workstation to make to a ControlLogix controller.
3. Click OK.

Specify Number of Connections Needed to Optimize Throughput

To specify the number of connections needed to optimize throughput, perform this procedure.

1. Repeat step 1 from the previous procedure.
2. In the Configure CIP Options dialog box, click the Use Connections for Writes to ControlLogix processor checkbox.

IMPORTANT	Once you have selected this feature, you cannot limit the number of connections established.

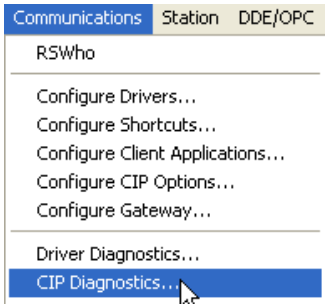
Number of Connections Needed to Optimize Throughput

RSLinx software only opens the number of connections required to optimize throughput. For example, if you have one tag on scan, but have configured RSLinx software to allow five connections as the maximum number of connections, RSLinx software only opens one connection for the tag. Conversely, if you have thousands of tags on scan and limit the maximum number of CIP connections to five, RSLinx software cannot establish more than five connections to the CompactLogix controller. RSLinx software then funnels all of the tags through those five available connections.

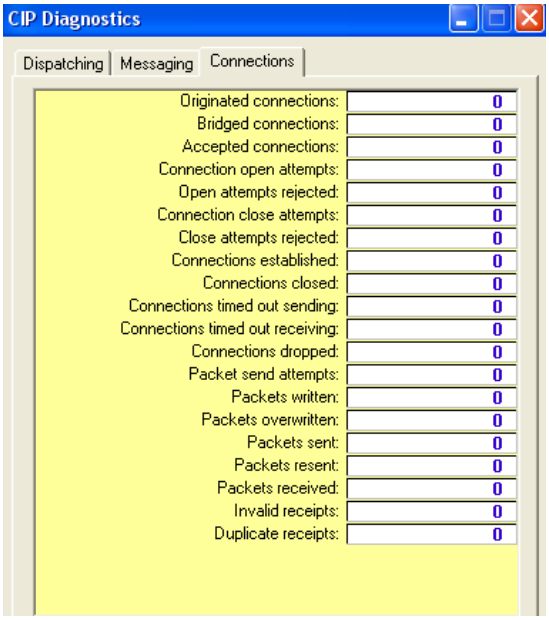
View the Number of Open Connections

To view the number of open connections made from your workstation to the CompactLogix controller, perform this procedure.

1. In RSLinx programming software, from the Communication pull-down menu, choose CIP Diagnostics.



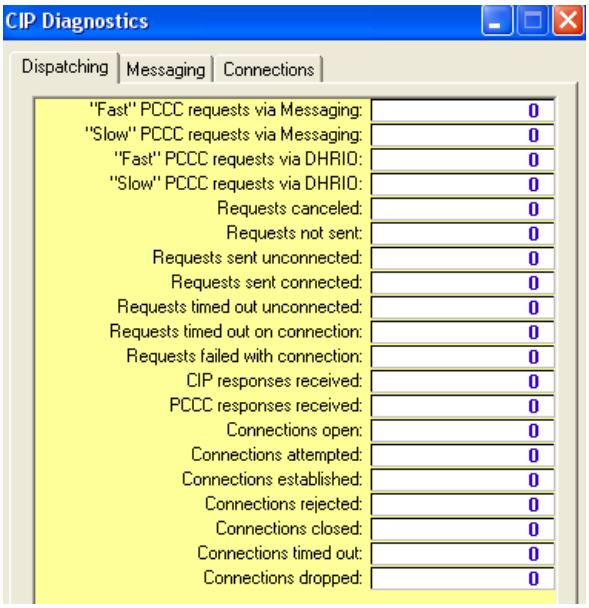
The CIP Diagnostics dialog box appears.



2. Click the Connections tab.

   Here you see an itemized list of open connections.

3. Click the Dispatching tab.



In the Connections Established box you see the total number of connections open to the CompactLogix controller.

Numerics

A

B

C

D

E

F

G

I

L

M

N

O

P

R

S

T

U

V

W

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support, you can find technical manuals, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools. You can also visit our Knowledgebase at http://www.rockwellautomation.com/knowledgebase for FAQs, technical information, support chat and forums, software updates, and to sign up for product notification updates.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect^{SM} support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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Installation Instructions

Compact 32-point 24V dc Sink/Source Input Module

Catalog Number 1769-IQ32

Use this document as a guide when installing a Compact™ 32-point 24V dc sink/source input module.

Publication 1769-IN032A-EN-P - April 2003

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Rockwell Automation be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

Any illustrations, charts, sample programs, and layout examples shown in this publication are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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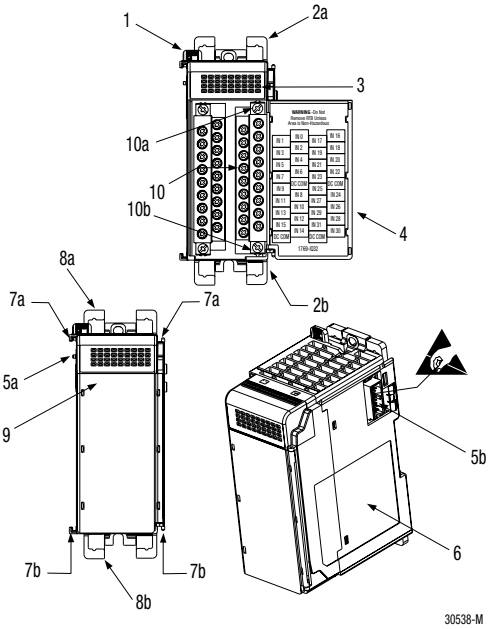
Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Module Description



Item	Description
1	bus lever (with locking function)
2a	upper panel mounting tab
2b	lower panel mounting tab
3	I/O diagnostic LEDs
4	module door with terminal identification label
5a	movable bus connector with female pins
5b	stationary bus connector with male pins
6	nameplate label
7a	upper tongue-and-groove slots
7b	lower tongue-and-groove slots
8a	upper DIN rail latch
8b	lower DIN rail latch
9	write-on label (user ID tag)
10	removable terminal block (RTB) with finger-safe cover
10a	RTB upper retaining screw
10b	RTB lower retaining screw

Module Installation

Compact I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2[1]) and to circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

Prevent Electrostatic Discharge

ATTENTION

Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the bus connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION

Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

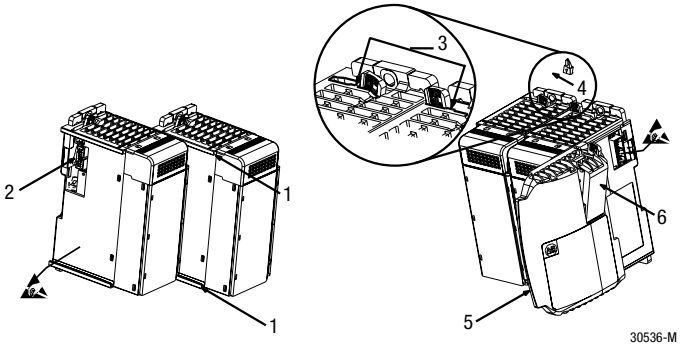
(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

System Assembly

The module can be attached to the controller or an adjacent I/O module *before* or *after* mounting. For mounting instructions, see Panel Mounting on page 6, or DIN Rail Mounting on page 8. To work with a system that is already mounted, see Replacing a Single Module within a System on page 8.

The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.
2. Check that the bus lever of the module to be installed is in the unlocked (fully right) position.
3. Use the upper and lower tongue-and-groove slots (1) to secure the modules together (or to a controller).
4. Move the module back along the tongue-and-groove slots until the bus connectors (2) line up with each other.
5. Push the bus lever back slightly to clear the positioning tab (3). Use your fingers or a small screw driver.
6. To allow communication between the controller and module, move the bus lever fully to the left (4) until it clicks. Ensure it is locked firmly in place.

ATTENTION

When attaching I/O modules, it is very important that the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (5) to the last module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (6).

IMPORTANT A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the serial communication bus.

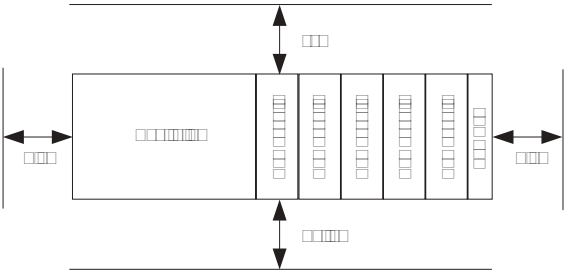
Mounting Expansion I/O

ATTENTION

During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage on power up.

Minimum Spacing

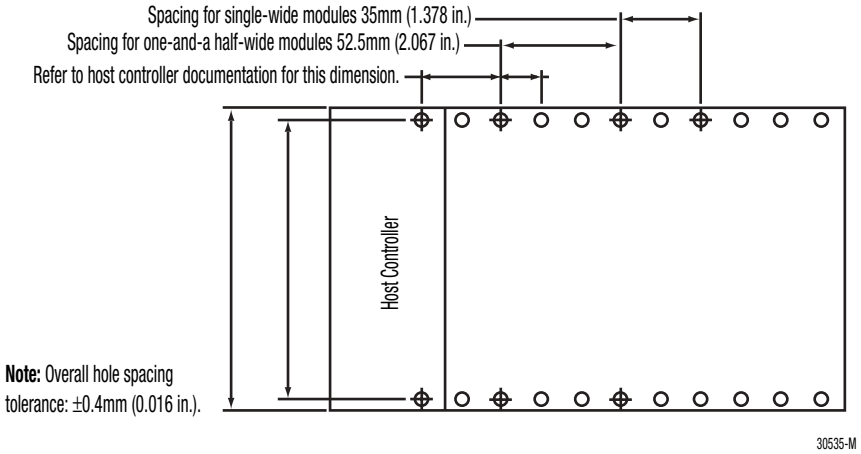
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Panel Mounting

Mount the module to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

Panel Mounting Using the Dimensional Template



Locate holes every 17.5 mm (0.689 in.) to allow for a mix of single-wide and one-and-a-half-wide modules (e.g., 1769-OA16).

Panel Mounting Procedure Using Modules as a Template

This procedure lets you use the assembled modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 7. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel, and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

NOTE: If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1 to 6 for any remaining modules.

DIN Rail Mounting

The module can be mounted using these DIN rails:
35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place.

Replacing a Single Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail).

1. Remove power. See important note on page 4.

2. On the module to be removed, remove the upper and lower mounting screws from the module (or open the DIN latches using a flat-blade or phillips style screw driver).

3. Move the bus lever to the right to disconnect (unlock) the bus.

4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the module to be removed.

5. Gently slide the disconnected module forward. If you feel excessive resistance, check that the module has been disconnected from the bus, and that both mounting screws have been removed (or DIN latches opened).

   NOTE: It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

6. Before installing the replacement module, be sure that the bus lever on the module to be installed, and on the right-side adjacent module are in the unlocked (fully right) position.

7. Slide the replacement module into the open slot.

8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module.

9. Replace the mounting screws (or snap the module onto the DIN rail).

Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

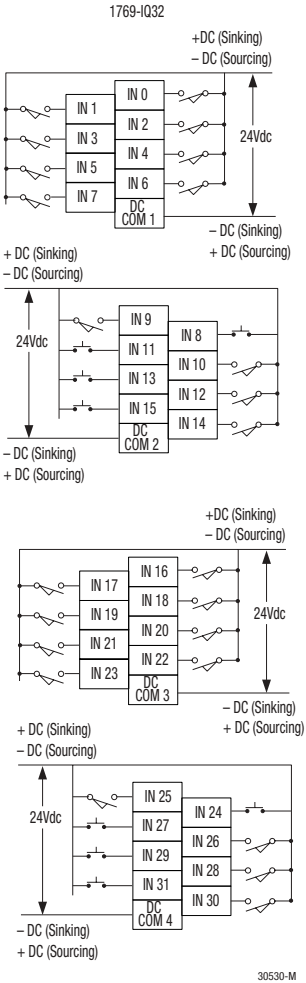
Input Wiring

Basic wiring of input devices[1] to the 1769-IQ32 is shown below.

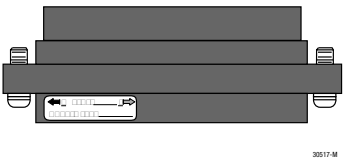
ATTENTION

- Miswiring of the module to an AC power source will damage the module.
- Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.

(1) **Sinking/Sourcing Inputs** - Sourcing/sinking describes the current flow between the I/O module and the field device. Sourcing I/O circuits supply (source) current to sinking field devices. Sinking I/O circuits are driven by a current sourcing field device. Field devices connected to the negative side (DC Common) of the field power supply are sinking field devices. Field devices connected to the positive side (+V) of the field supply are sourcing field devices. *Europe:* DC sinking input and sourcing output module circuits are the commonly used options.



A removable write-on label is included with the module. Remove the label from the door, mark the identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.

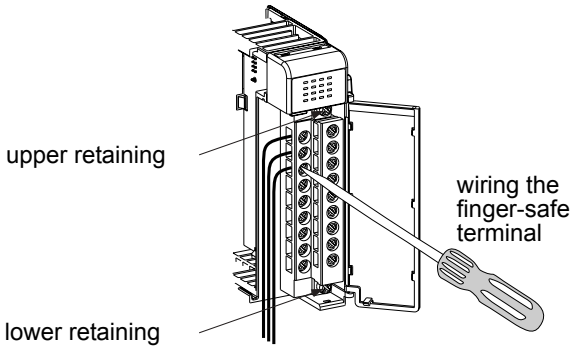


Removing the Finger-safe Terminal Block

When wiring field devices to the module, it is not necessary to remove the terminal block. If you remove the terminal block, use the write-on label on the side of the terminal block to identify the module slot lcation and type. RTB position can be indicated by circling either the 'R' for right side or 'L' for left side.

To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 Nm (4.1 in-lbs).

Wiring the Finger-safe Terminal Block



When wiring the terminal block, keep the finger-safe cover in place.

1. Loosen the terminal screws to be wired.

2. Route the wire under the terminal pressure plate. You can use the bare wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.

NOTE: The terminal screws are non-captive. Therefore, it is possible to use a ring lug [max. 1/4" o.d. with a 0.139" minimum i.d. (M3.5)] with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 Nm (6 in-lbs).

NOTE: If you need to remove the finger-safe cover, insert a screw driver into one of the square, wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts as many as two wires with these restrictions:

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)

I/O Memory Mapping

Input Data File

For each input module, slot x, word 0 in the input data file contains the current state of the field input points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r
1	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r=read

Spare/Replacement Module Parts

- Terminal Block: 1769-RTBN18 (1 per kit)

Specifications

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 52.5 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 2.07 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	440g (0.97 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 inches maximum peak-to-peak Relay Operation: 2G
Shock	Operating: 30G panel mounted (20G DIN rail mounted) Relay Operation: 7.5G panel mounted (5G DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
ESD Immunity (IEC1000-4-2)	4kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC1000-4-3)	10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC1000-4-4)	2 kV, 5 kHz
Surge Immunity (IEC1000-4-5)	2 kV common mode, 1 kV differential mode
Conducted Immunity (IEC1000-4-6)	10V, 0.15 to 80 MHz(1)

(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	1769-IQ32
Voltage Category	24V dc (sink/source[1])
Operating Voltage Range	10 to 30V dc at 30°C (86°F) 10 to 26.4V dc at 60°C (140°F)
Number of Inputs	32
Bus Current Draw (max.)	170 mA at 5V dc (0.85W)
Heat Dissipation	4.6 Total Watts *(The Watts per point, plus the minimum Watts, with all points energized.)*
Signal Delay (max.)	On Delay: 8.0 ms Off Delay: 8.0 ms
Off-State Voltage (max.)	5V dc
Off-State Current (max.)	1.5 mA
On-State Voltage (min.)	10V dc
On-State Current (min.)	2.0 mA
Inrush Current (max.)	250 mA
Nominal Impedance	5.2kohm at 24V dc, 6.1kohm at 30V dc
IEC Input Compatibility	Type 1+
Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the power supply or controller.)
Input Point to Bus (Compact Bus) Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 sec. or 1697V dc for 1 sec. 75V dc working voltage (IEC Class 2 reinforced insulation)
Isolated Groups	Group 1: inputs 0 to 7 Group 2: inputs 8 to 15 Group 3: inputs 16 to 23 Group 4: inputs 24 to 31 Isolated groups operate in either sink or source configurations.
Input Group to Input Group Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 sec. or 1697V dc for 1 sec. 75V dc working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	7
Product Code	68

(1) **Sinking/Sourcing Inputs** - Sourcing/sinking describes the current flow between the I/O module and the field device. Sourcing I/O circuits supply (source) current to sinking field devices. Sinking I/O circuits are driven by a current sourcing field device. Field devices connected to the negative side (DC Common) of the field power supply are sinking field devices. Field devices connected to the positive side (+V) of the field supply are sourcing field devices. *Europe:* DC sinking input and sourcing output module circuits are the commonly used options.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure.
- All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

AVERTISSEMENT

DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée et que l'environnement est classé non dangereux.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée ou que l'environnement est classé non dangereux.
- Ce produit doit être installé dans une armoire.

For More Information

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your Compact I/O with MicroLogix 1200 & 1500 programmable controller.	MicroLogix 1200 and MicroLogix 1500 Programmable Controllers User Manual	1764-RM001B-US-P
A more detailed description of how to install and use your Compact I/O with the 1769-ADN DeviceNet Adapter.	1769-ADN DeviceNet Adapter User Manual	1769-UM001A-US-P
A more detailed description of how to install and use your Compact I/O with the CompactLogix™ System.	CompactLogix System User Manual	1769-UM007C-EN-P
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

If you would like a manual, you can:

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Publication 1769-IN032A-EN-P - April 2003 PN 40071-154-01(1)

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Compact™ 24V dc Sink/Source Input Module

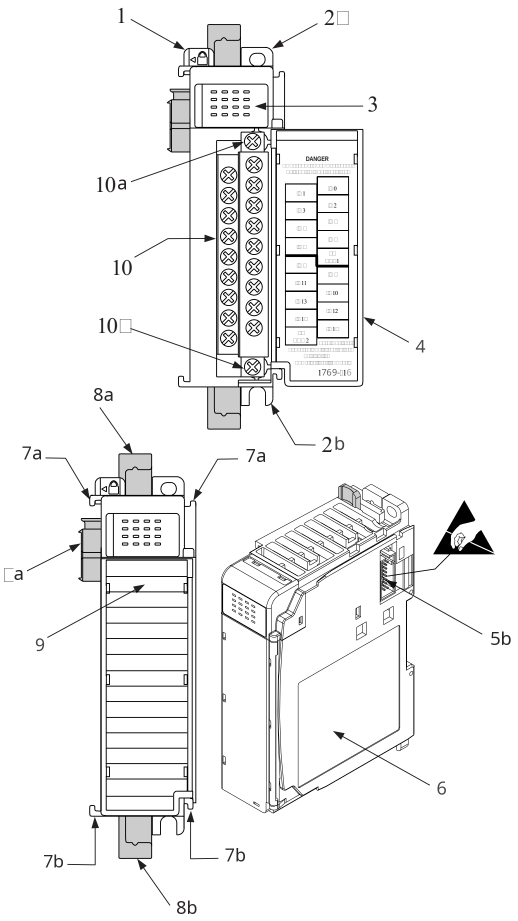
(Catalog Number 1769-IQ16)

Installation Instructions

Inside

Publication 1769-IN007B-EN-P

Module Description



Item	Description
1	bus lever (with locking function)
2a	upper panel mounting tab
2b	lower panel mounting tab
3	I/O diagnostic LEDs
4	module door with terminal identification label
5a	movable bus connector with female pins
5b	stationary bus connector with male pins
6	nameplate label
7a	upper tongue-and-groove slots
7b	lower tongue-and-groove slots
8a	upper DIN rail latch
8b	lower DIN rail latch
9	write-on label (user ID tag)
10	removable terminal block (RTB) with finger-safe cover
10a	RTB upper retaining screw
10b	RTB lower retaining screw

Module Installation

Compact I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2[1]) and to circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

Prevent Electrostatic Discharge

ATTENTION: Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the bus connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION: Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

1 [illegible] 2 [illegible]

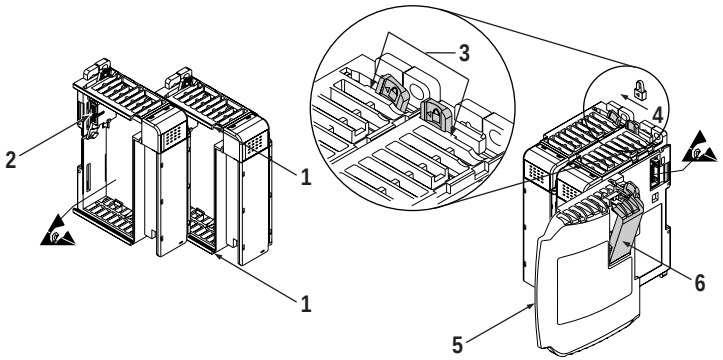
2 [illegible]

3 [illegible] 2 [illegible]

System Assembly

The module can be attached to the controller or an adjacent I/O module *before* or *after* mounting. For mounting instructions, see “Panel Mounting” on page 5, or “DIN Rail Mounting” on page 6. To work with a system that is already mounted, see “Replacing a Single Module within a System” on page 7.

The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.
2. Check that the bus lever of the module to be installed is in the unlocked (fully right) position.
3. Use the upper and lower tongue-and-groove slots (1) to secure the modules together (or to a controller).
4. Move the module back along the tongue-and-groove slots until the bus connectors (2) line up with each other.
5. Push the bus lever back slightly to clear the positioning tab (3). Use your fingers or a small screw driver.
6. To allow communication between the controller and module, move the bus lever fully to the left (4) until it clicks. Ensure it is locked firmly in place.

ATTENTION: When attaching I/O modules, it is very important that the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (5) to the last module in the system by using the tongue-and-groove slots as before.
8. Lock the end cap bus terminator (6).

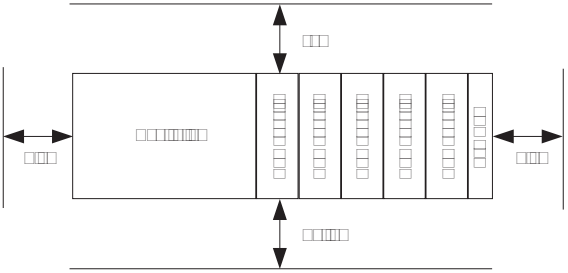
IMPORTANT: A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the serial communication bus.

Mounting Expansion I/O

ATTENTION: During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage on power up.

Minimum Spacing

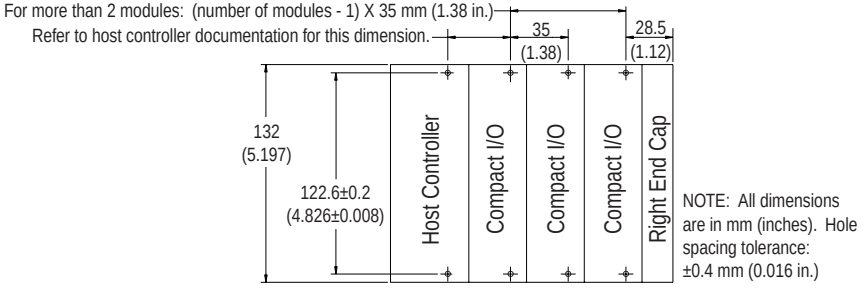
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Panel Mounting

Mount the module to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

Panel Mounting Using the Dimensional Template



Panel Mounting Procedure Using Modules as a Template

The following procedure allows you to use the assembled modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 5. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel, and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

   Note: If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.
7. Repeat steps 1 to 6 for any remaining modules.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place.

Replacing a Single Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail).

1. Remove power. See important note on page 3.
2. On the module to be removed, remove the upper and lower mounting screws from the module (or open the DIN latches using a flat-blade or phillips style screw driver).
3. Move the bus lever to the right to disconnect (unlock) the bus.
4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the module to be removed.
5. Gently slide the disconnected module forward. If you feel excessive resistance, check that the module has been disconnected from the bus, and that both mounting screws have been removed (or DIN latches opened).

   Note: It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.
6. Before installing the replacement module, be sure that the bus lever on the module to be installed, and on the right-side adjacent module are in the unlocked (fully right) position.
7. Slide the replacement module into the open slot.
8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module.
9. Replace the mounting screws (or snap the module onto the DIN rail).

Field Wiring Connections

Grounding the Module

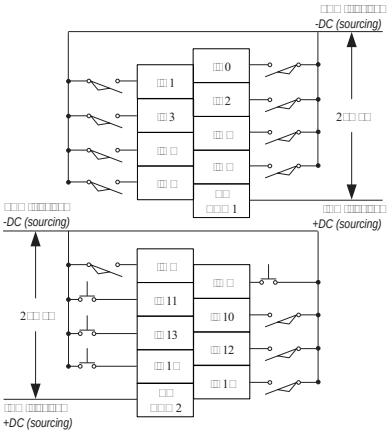
This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

Input Wiring

Basic wiring of input devices[1] to the 1769-IQ16 is shown below.

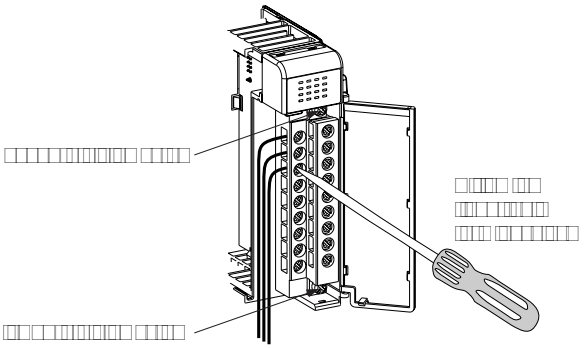
ATTENTION:

- Miswiring of the module to an AC power source will damage the module.
- Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.



1 **Sinking/Sourcing Inputs** *Europe:*

A removable, write-on label is provided with the module. Remove the label from the door, mark the identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.



Removing the Finger-Safe Terminal Block

To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 Nm (4.1 in-lbs).

Wiring the Finger-Safe Terminal Block

When wiring the terminal block, keep the finger-safe cover in place.

1. Loosen the terminal screws to be wired.
2. Route the wire under the terminal pressure plate. You can use the bare wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.

Note: The terminal screws are non-captive. Therefore, it is possible to use a ring lug [max. 1/4” o.d. with a 0.139” minimum i.d. (M3.5)] with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 Nm (6 in-lbs).

Note: If you need to remove the finger-safe cover, insert a screw driver into one of the square, wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
□□□	Cu-90°C (194°F)	#14 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)
□□□□□□□	Cu-90°C (194°F)	#16 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)

I/O Memory Mapping

Input Data File

For each input module, slot x, word 0 in the input data file contains the current state of the field input points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

□□□□

Spare/Replacement Module Parts

- Terminal Block: 1769-RTBN18 (1 per kit)
- Door Label: 1769-RL1 (2 per kit)
- Door: 1769-RD (2 per kit)

Specifications

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x35 mm (width) height including mounting tabs is138 mm 4.65 in. (height) x3. 3 in (depth) x1. 8 in (width) height including mounting tabs is 5.3 in.
Approximate Shipping Weight (with carton)	2 0g 0.6 lbs.)
Storage Temperature	- 0°C to +85°C (- 0°F to + 85°F)
Operating Temperature	0°C to +6)°C (2°F to + 4)°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (65 1 feet)
Vibration	Operating 10 to 5)0 Hz, 5G 0 0030 inches maximum peak-to-peak Relay Operation: ?G
Shock	Operating 30G panel mounted (0G DIN rail mounted) Relay Operation: 7.5G panel mounted (5G DIN rail mounted) Non-Operating: 0G panel mounted (0G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C 22 2 No. 4?) • UL 08 listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division2, Hazardous Location, Groups A, B, C, D (UL16)4, C-UL under CSA 22 2 No 213)
Radiated and Conducted Emissions	EN 008 - Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
• ESD Immunity (IEC1000-4-)	• 4kV contact, 8 kV air, 4 kV indiect
• Radiated Immunity (IEC1000-4-)	• 10 V/m, 8) to1000 MHz, 8)% amplitude modulation, +9)0 MHz keyed carrier
• Fast Transient Burst (IEC 1000-4-4)	• 2 kV, 5 kHz
• Surge Immunity (IEC1000-4-5)	• 2 kV common mode, kV differential mode
• Conducted Immunity (IEC1000-4-6)	• 10V 0 15 to 0 MH[1]

1. ma 1 0 k z 30 MHz t e nge 30 MHz 1000 MHz.

Input Specifications

Specification	1769-IQ16
Voltage Category	24V dc (sink/source[1])
Operating Voltage Range	10 to 30V dc at 30°C (86°F) 10 to 26.4V dc at 60°C (140°F)
Number of Inputs	16
Bus Current Draw (max.)	115 mA at 5V dc (0.575W)
Heat Dissipation	3.55 Total Watts *(The Watts per point, plus the minimum Watts, with all points energized.)*
Signal Delay (max.)	On Delay: 80 ms Off Delay: 80 ms
Off-State Voltage (max.)	5V dc
Off-State Current (max.)	1.5 mA
On-State Voltage (min.)	10V dc
On-State Current (min.)	2.0 mA
Inrush Current (max.)	2.0 mA
Nominal Impedance	3 KΩ
IEC Input Compatibility	Type 1+
Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the power supply or controller.)
Input Point to Bus (Compact Bus) Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 sec. or 1697V dc for 1 sec. 75V dc working voltage (IEC Class 2 reinforced insulation)
Isolated Groups	Group 1: inputs 0 to 7 Group 2: inputs 8 to 15 Isolated groups operate in either sink or source configurations.
Input Group to Input Group Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 sec. or 1697V dc for 1 sec. 75V dc working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	7
Product Code	67

1 **Sinking/Sourcing Inputs** [illegible] be [illegible] m [illegible] th [illegible] a current sourc [illegible] negative [illegible] ommon of [illegible] supply [illegible] devi es. Fe d [illegible] t e [illegible]) [illegible] he [illegible] suppy [illegible] *Europe:* [illegible].

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following ATTENTION statement applies to use in hazardous locations.

ATTENTION: EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure.
- All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s’applique à une utilisation dans des environnements dangereux.

ATTENTION: DANGER D’EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée et que l'environnement est classé non dangereux.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée ou que l'environnement est classé non dangereux.
- Ce produit doit être installé dans une armoire.

For More Information

For	Refer to this Document	Pub. No.
[illegible]	*MicroLogix 1200 and MicroLogix 1500 Programmable Controllers User Manual*	1764-RM001B-US-P
[illegible]	*1769-ADN DeviceNet Adapter User Manual*	[illegible]
[illegible]	*Industrial Automation Wiring and Grounding Guidelines*	1770-4.1

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Rockwell Automation

Publication 1769-IN007B-EN-P - June 2000 PN 40071-097-01(B)
Supercedes 1769-IN007A-EN-P - April 2000
& 1769-5.3 - January 1999

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Installation Instructions

Compact™ 16-Point AC/DC Relay Output Module

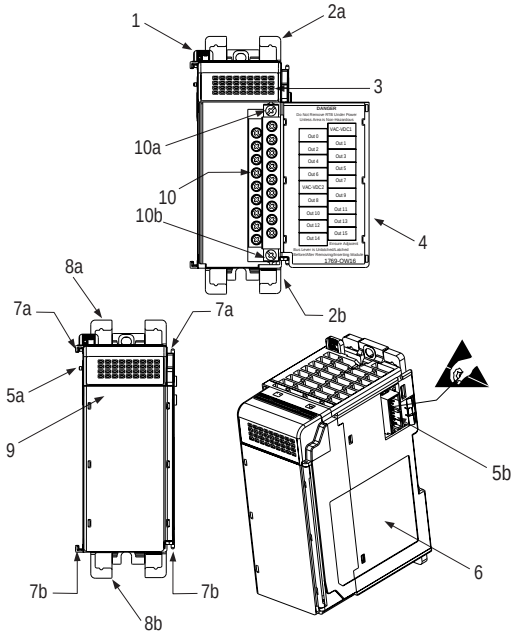
(Catalog Number 1769-OW16)

Inside

Publication 1769-IN062A-EN-P - December 2001

Module Description

The 1769-OW16 is a 16 point relay output module that can control AC or DC loads. The module has 2 isolated groups of 8 points each. This allows you to mix both AC and DC loads on one module.



Item	Description
1	bus lever (with locking function)
2a	upper panel mounting tab
2b	lower panel mounting tab
3	I/O diagnostic LEDs (Logic Side)
4	module door with terminal identification label
5a	movable bus connector with female pins
5b	stationary bus connector with male pins
6	nameplate label
7a	upper tongue-and-groove slots
7b	lower tongue-and-groove slots
8a	upper DIN rail latch
8b	lower DIN rail latch
9	write-on label (user ID tag)
10	removable terminal block (RTB) with finger-safe cover
10a	RTB upper retaining screw
10b	RTB lower retaining screw

Module Installation

Compact I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2[1]) and to circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

Prevent Electrostatic Discharge

ATTENTION

Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the bus connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION

Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

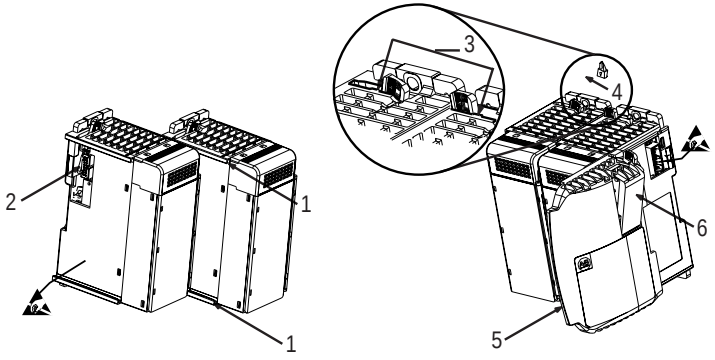
Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.
(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.
(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

System Assembly

The module can be attached to the controller or an adjacent I/O module *before* or *after* mounting. For mounting instructions, see "Panel Mounting" on page 5, or "DIN Rail Mounting" on page 7. To work with a system that is already mounted, see "Replacing a Single Module within a System" on page 7.

The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.
2. Check that the bus lever of the module to be installed is in the unlocked (fully right) position.
3. Use the upper and lower tongue-and-groove slots (1) to secure the modules together (or to a controller).
4. Move the module back along the tongue-and-groove slots until the bus connectors (2) line up with each other.
5. Push the bus lever back slightly to clear the positioning tab (3). Use your fingers or a small screw driver.
6. To allow communication between the controller and module, move the bus lever fully to the left (4) until it clicks. Ensure it is locked firmly in place.

ATTENTION

When attaching I/O modules, it is very important that the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (5) to the last module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (6).

IMPORTANT A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the serial communication bus.

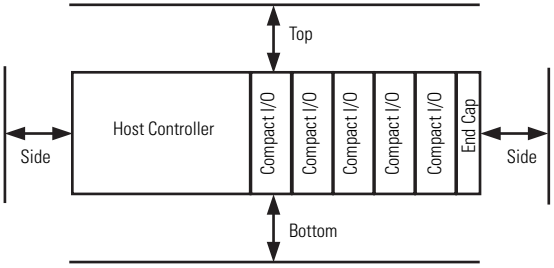
Mounting Expansion I/O

ATTENTION

During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage on power up.

Minimum Spacing

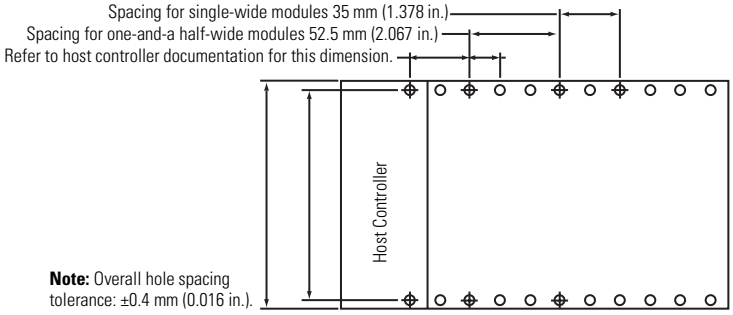
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Panel Mounting

Mount the module to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

Panel Mounting Using the Dimensional Template



Locate holes every 17.5 mm (0.689 in.) to allow for a mix of single-wide and one-and-a-half-wide modules (e.g. 1769-OA16).

Panel Mounting Procedure Using Modules as a Template

The following procedure allows you to use the assembled modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 6. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel, and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

TIP

If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1 to 6 for any remaining modules.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place.

Replacing a Single Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail).

1. Remove power. See attention note on page 3.
2. On the module to be removed, remove the upper and lower mounting screws from the module (or open the DIN latches using a flat-blade or phillips style screw driver).
3. Move the bus lever to the right to disconnect (unlock) the bus.
4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the module to be removed.
5. Gently slide the disconnected module forward. If you feel excessive resistance, check that the module has been disconnected from the bus, and that both mounting screws have been removed (or DIN latches opened).

It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

6. Before installing the replacement module, be sure that the bus lever on the module to be installed, and on the right-side adjacent module are in the unlocked (fully right) position.
7. Slide the replacement module into the open slot.
8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module.
9. Replace the mounting screws (or snap the module onto the DIN rail).

Field Wiring Connections

Grounding the Module

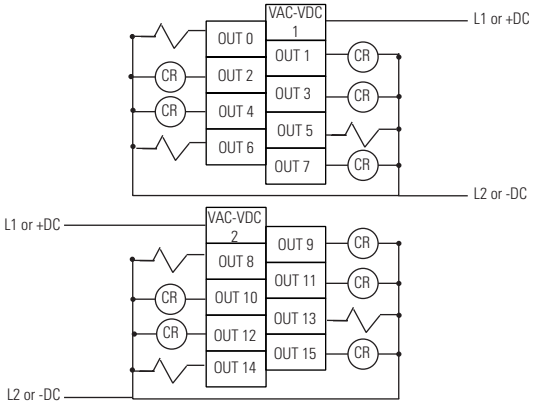
This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information. \

Output Wiring

Basic wiring(1) of output devices to the 1769-OW16 is shown below.

ATTENTION

Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.



(1) **Surge Suppression** - Connecting surge suppressors across your external inductive load will extend the life of the relay contacts. For additional details, refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1.

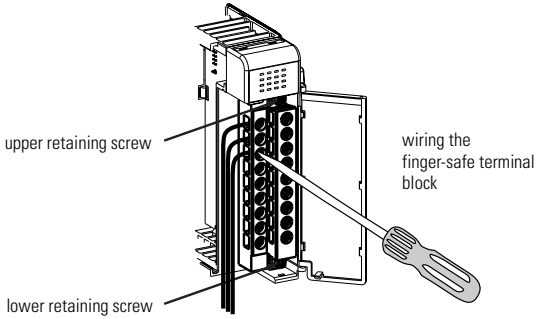
A removable, write-on label, (see page 2, item 9) is provided with the module. Remove the label from the door, mark the identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.

Removing the Finger-Safe Terminal Block

When wiring field devices to the module, it is not necessary to remove the terminal block. If you remove the terminal block, use the write-on label on the side of the terminal block to identify the module slot location and type.

To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 Nm (4.1 in-lbs).

Wiring the Finger-Safe Terminal Block



When wiring the terminal block, keep the finger-safe cover in place.

1. Loosen the terminal screws to be wired.

2. Route the wire under the terminal pressure plate. You can use the bare wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.

TIP

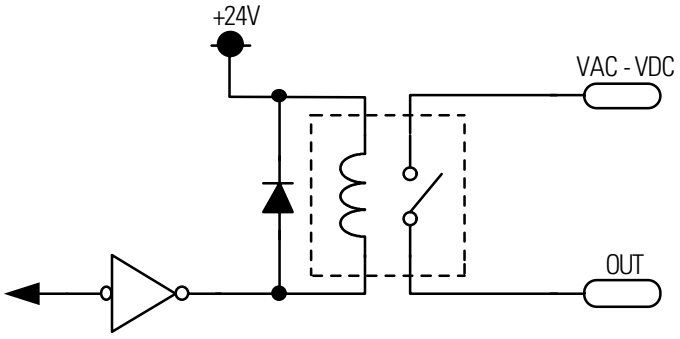
The terminal screws are non-captive. Therefore, it is possible to use a ring lug [maximum 1/4 inch o.d. with a 0.139 inch minimum i.d. (M3.5)] with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 Nm (6 in-lbs).

TIP

If you need to remove the finger-safe cover, insert a screw driver into one of the square, wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Simplified Output Circuit Diagram



Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)

I/O Memory Mapping

Output Data File

Data output bits are turned on or off using the bit positions in Word 0.

1 = output on
0 = output off

Example: To turn on bit position 12, type 1 in Word 0, Bit 12.

For each module, slot x, word 0 in the output data file contains the control program's directed state of the discrete output points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

w = write only

Output Module's Input Data File

For each module, slot x, input data file word 0 contains the state of the module's output data (output data echo) file word 0. During normal operation, these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (if supported by the controller)
- The Fault Mode configuration (if supported by the controller).

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read only

IMPORTANT The output module's input data file reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

It is important to use this input word if the controller adapter supports the Program Mode or Fault Mode function, and if it is configured to use them.

1769-OW16 Configuration File

The read/writable configuration data file allows the setup of the hold last state and user-defined safe state conditions.

The manipulation of the bits from this file is normally done with programming software (e.g. RSLogix 500, RSNetworx for DeviceNet, etc.) during initial configuration of the system. In that case, graphical screens are provided via the programmer to simplify configuration. However, some systems (e.g. 1769-ADN DeviceNet Adapter) also allow the bits to be altered as part of the control program using communication rungs. In that case, it is necessary to understand the bit arrangement.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	PFE
1	Program State for Output Array Word 0															
2	Program Value for Output Array Word 0															
3	Fault State for Output Array Word 0															
4	Fault Value for Output Array Word 0															

Program State Word

Word 1, the program state word, selects the hold last state or user-defined safe state condition for each individual output on a system transition from Run to Program.

Condition	Bit Setting
User-defined Safe State	0
Hold Last State	1

Program Value Word

The program value word, word 2, is used to program the user-defined safe state value (0=Off, 1=On). Each output is individually configurable for on or off.

Value	Bit Setting
Off	0
On	1

Fault State Word

Word 3, the fault state word, selects the hold last state or user-defined safe state condition for each individual output on a system transition from Run to Fault.

Condition	Bit Setting
User-defined Safe State	0
Hold Last State	1

Fault Value Word

The fault value word, word 4, is used to program the fault state value (0=Off, 1=On). Each output is individually configurable for on or off.

Value	Bit Setting
Off	0
On	1

Program to Fault Enable Bit (PFE)

Word 0, bit 0, allows the selection of which data value, the program or fault value, to apply to the output if a system in Program mode undergoes a system fault, resulting in a change to the Fault mode.

Value Applied	Bit Setting
Program	0
Fault	1

Module Default Condition

The modules default condition is all zeros, programming the conditions shown below.

Word or Bit Affected		Condition Applied
Word 0, Bit 0:	Program-to-Fault Enable	Program Value
Word 1:	Program State	User-defined Safe State
Word 2:	Program Value	Off
Word 3:	Fault State	User-defined Safe State
Word 4:	Fault Value	Off

Spare/Replacement Module Parts

- Terminal Block:1769-RTBN18 (1 per kit)

Specifications

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 52.5 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 2.07 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	450g (0.99 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)(1)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 inches maximum peak-to-peak Relay Operation: 2.0G
Shock	Operating: 30G panel mounted (20G DIN rail mounted) Relay Operation: 10G panel mounted (5G DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE and C-Tick compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
ESD Immunity (IEC61000-4-2)	• 4kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC61000-4-3)	• 10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC61000-4-4)	• 2 kV, 5 kHz
Surge Immunity (IEC61000-4-5)	• 2 kV common mode, 1 kV differential mode
Conducted Immunity (IEC61000-4-6)	• 10V, 0.15 to 80 MHz(2)

(1) For operation above 2000 meters, consult the factory.
(2) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Output Specifications

Specification	1769-OW16
Voltage Category	AC/DC normally open relay
Operating Voltage Range	5 to 265V ac 5 to 125V dc
Number of Outputs	16
Bus Current Draw (max.)	205 mA at 5V dc line 180 mA at 24V dc line
Heat Dissipation	4.75 Total Watts *(The Watts per point, plus the minimum Watts, with all points energized.)*
Signal Delay (max.) – resistive load	turn-on = 10 ms turn-off = 10 ms
Off-State Leakage (max.)	0 mA
On-State Current (min.)	10 mA at 5V dc
Continuous Current per Point (max.)	2.5A (Also see "Relay Contact Ratings" on page 16.)
Continuous Current per Common (max.)	10A
Continuous Current per Module (max.)	20A
Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the power supply.)
Output Point to Bus Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 sec. or 2596V dc for 2 sec. 265V ac working voltage (IEC Class 2 reinforced insulation)
Isolated Groups	Group 1: outputs 0 to 7 Group 2: outputs 8 to 15
Output Group to Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 2 sec. or 2596V dc for 2 sec. 265V ac working voltage (basic insulation) 150V ac working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	7
Product Code	85

Relay Contact Ratings

Volts (max.)	Continuous Amps per Point (max.)(1)	Amperes(2)		Voltamperes		NEMA ICS 2-125
		Make	Break	Make	Break	
240V ac	2.5A	7.5A	0.75A	1800 VA	180 VA	C300
120V ac		15A	1.5A			
125V dc	1.0A	0.22A(3)		28 VA		R150
24V dc	2.0A	1.2A(3)				

(1) The continuous current per module must be limited so the module power does not exceed 1440 VA.

(2) **Surge Suppression** - Connecting surge suppressors across your external inductive load will extend the life of the relay contacts. For additional details, refer to Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1.

(3) For dc voltage applications, the make/break ampere rating for relay contacts can be determined by dividing 28 VA by the applied dc voltage. For example, 28 VA/48V dc = 0.58A. For dc voltage applications less than 48V, the make/break ratings for relay contacts cannot exceed 2A.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure.
- All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

AVERTISSEMENT

DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée et que l'environnement est classé non dangereux.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée ou que l'environnement est classé non dangereux.
- Ce produit doit être installé dans une armoire.

For More Information

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your Compact™ I/O with MicroLogix™ 1200 & 1500 programmable controller.	MicroLogix 1500 Programmable Controllers User Manual	1764-UM001B-US-P
A more detailed description of how to install and use your Compact I/O with the CompactLogix™ System.	CompactLogix System User Manual	1769-UM007C-EN-P
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

If you would like a manual, you can:

- download a free electronic version from the internet: **www.ab.com/micrologix** or **www.theautomationbookstore.com**
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  - contacting your local distributor or Rockwell Automation representative
  - visiting **www.theautomationbookstore.com** and placing your order
  - calling 1.800.963.9548 (USA/Canada) or 001.330.725.1574 (Outside USA/Canada)

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Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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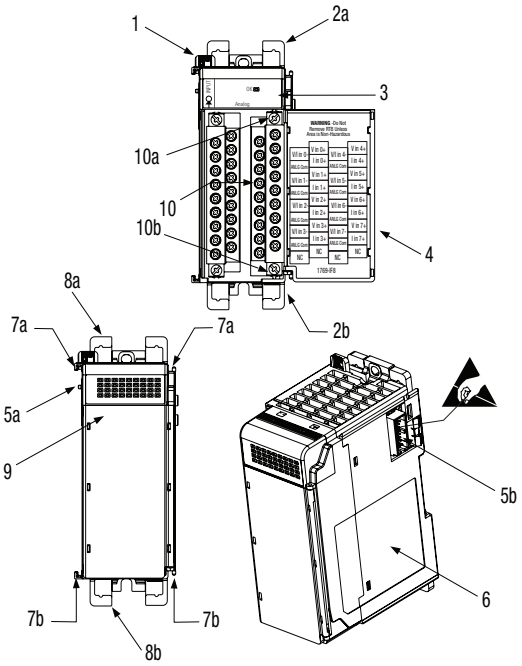
Installation Instructions

Compact I/O 1769-IF8 Analog Input Module

Inside

Publication 1769-IN067B-EN-P - September 2005

Module Description



Item	Description
1	bus lever (with locking function)
2a	upper panel mounting tab
2b	lower panel mounting tab
3	module status LED
4	module door with terminal identification label
5a	movable bus connector with female pins
5b	stationary bus connector with male pins
6	nameplate label
7a	upper tongue-and-groove slots
7b	lower tongue-and-groove slots
8a	upper DIN rail latch
8b	lower DIN rail latch
9	write-on label (user ID tag)
10	removable terminal block (RTB) with finger-safe cover
10a	RTB upper retaining screw
10b	RTB lower retaining screw

Module Installation

Compact I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2[1]) and to circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

Prevent Electrostatic Discharge

ATTENTION

Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins or the terminal block. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the bus connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION

Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

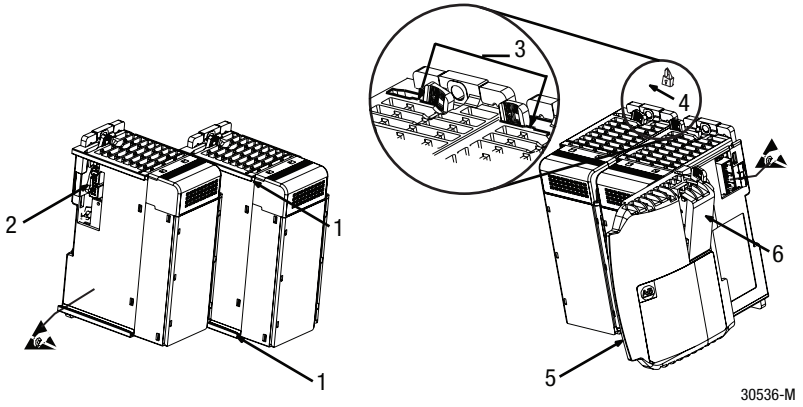
(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

System Assembly

The module can be attached to the controller or an adjacent I/O module *before* or *after* mounting. For mounting instructions, see "Panel Mounting" on page 6, or "DIN Rail Mounting" on page 7. To work with a system that is already mounted, see "Replacing a Single Module within a System" on page 7.

The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.

2. Check that the bus lever of the module to be installed is in the unlocked (fully right) position.

3. Use the upper and lower tongue-and-groove slots (1) to secure the modules together (or to a controller).

4. Move the module back along the tongue-and-groove slots until the bus connectors (2) line up with each other.

5. Push the bus lever back slightly to clear the positioning tab (3). Use your fingers or a small screwdriver.

6. To allow communication between the controller and module, move the bus lever fully to the left (4) until it clicks. Ensure it is locked firmly in place.

ATTENTION

When attaching I/O modules, it is very important that the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (5) to the last module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (6).

IMPORTANT A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the communication bus.

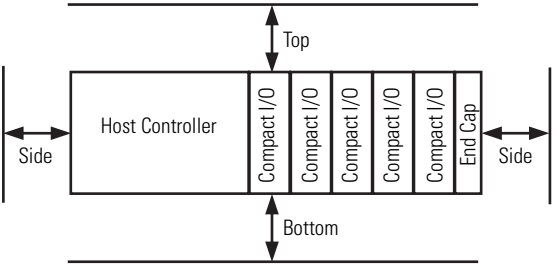
Mounting Expansion I/O

ATTENTION

During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage on power up.

Minimum Spacing

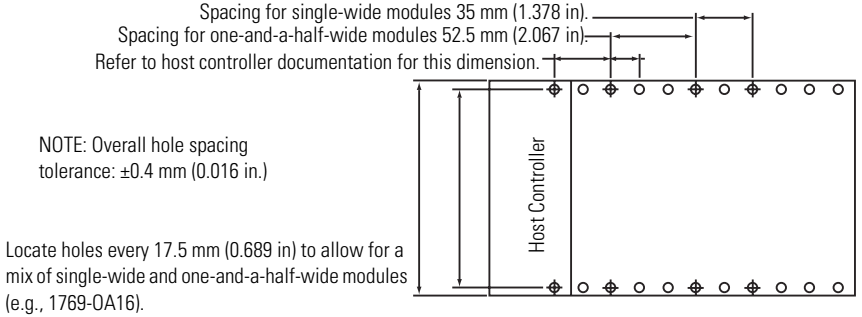
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Panel Mounting

Mount the module to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

Panel Mounting Using the Dimensional Template



Panel Mounting Procedure Using Modules as a Template

The following procedure allows you to use the assembled modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 6. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

NOTE If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1 to 6 for any remaining modules.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place.

Replacing a Single Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail). Follow these steps in order:

1. Remove power. See important note on page 3.
2. On the module to be removed, remove the upper and lower mounting screws from the module (or open the DIN latches using a flat-blade or phillips-style screwdriver).
3. Move the bus lever to the right to disconnect (unlock) the bus.
4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the module to be removed.
5. Gently slide the disconnected module forward. If you feel excessive resistance, check that the module has been disconnected from the bus and that both mounting screws have been removed (or DIN latches opened).

NOTE It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

6. Before installing the replacement module, be sure that the bus lever on the module to be installed, and on the right-side adjacent module are in the unlocked (fully right) position.
7. Slide the replacement module into the open slot.
8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module.
9. Replace the mounting screws (or snap the module onto the DIN rail).

Module Spare/Replacement Parts

- Terminal block, catalog number 1769-RTBN18 (1 per kit)

Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

System Wiring Guidelines

Consider the following when wiring your system:

- All module commons (ANLG COM) are connected in the analog module. The analog common (ANLG COM) is not connected to earth ground inside the module.
- Do not use the analog module's NC terminals as connection points.
- Channels are not isolated from each other.
- Use Belden™ 8761, or equivalent, shielded wire.
- Under normal conditions, the drain wire and shield junction must be connected to earth ground via a panel or DIN rail mounting screw at the analog I/O module end. Keep the shield connection to ground as short as possible.(1)
- To ensure optimum accuracy, limit overall cable impedance by keeping your cable as short as possible. Locate the I/O system as close to your sensors or actuators as your application will permit.
- If multiple power supplies are used with analog inputs, the power supply commons must be connected.

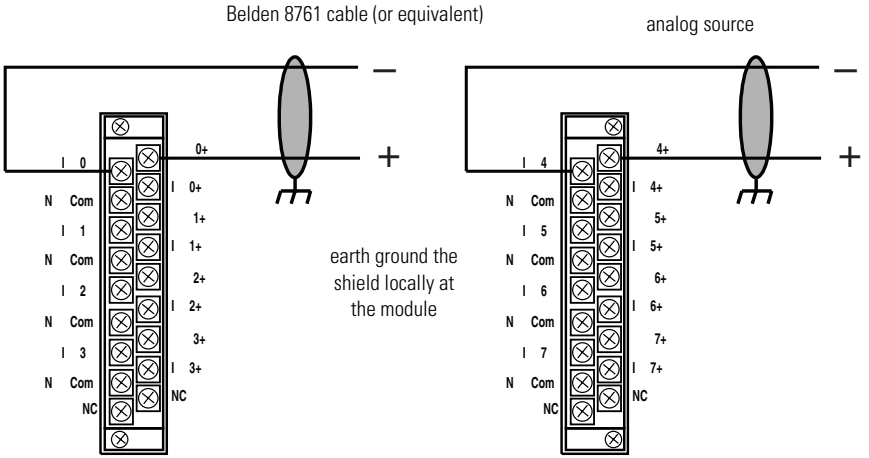
(1) In environments where high-frequency noise may be present, it may be necessary to directly ground cable shields to earth at the module end and via a 0.1µF capacitor at the sensor end.

- The 1769-IF8 module does not provide loop power for analog inputs. Use a power supply that matches the input transmitter specifications.
- Differential analog inputs are more immune to noise than single-ended analog inputs.
- Voltages on Vin+, V/Iin-, and Iin+ of the 1769-IF8 module must be within ±10V dc of analog common.

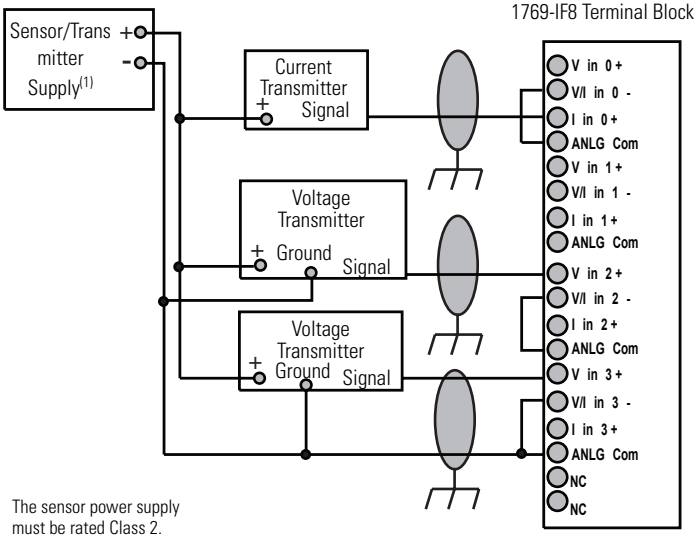
ATTENTION

Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.

Wiring Differential Inputs



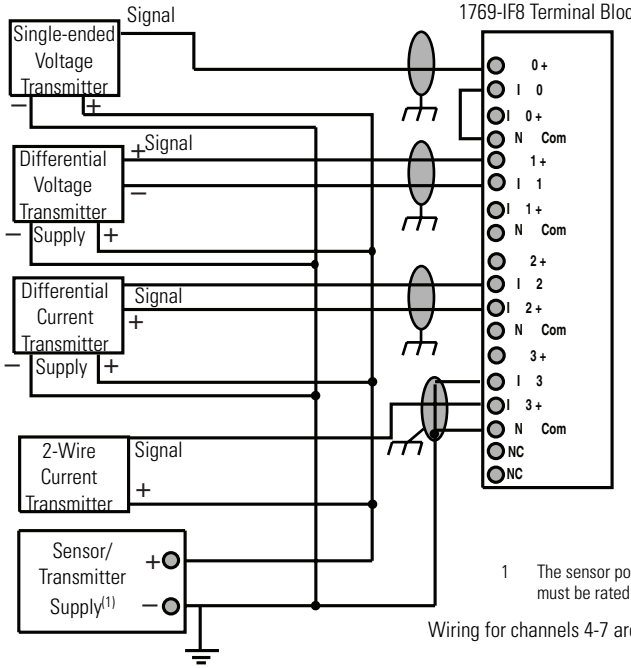
Wiring Single-Ended Sensor/Transmitter Types



1 The sensor power supply must be rated Class 2.

Wiring for channels 4-7 are identical.

Wiring Mixed Transmitter Types

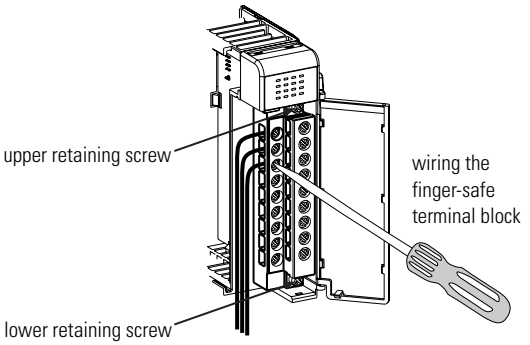


1 The sensor power supply must be rated Class 2.

Wiring for channels 4-7 are identical.

Labeling the Terminals

A removable, write-on label is provided with the module. Remove the label from the door, mark the identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.



Removing the Finger-Safe Terminal Block

When wiring field devices to the module, it is not necessary to remove the terminal block. If you remove the terminal block, use the write-on label on the side of the terminal block to identify the module slot location and type. RTB position can be indicated by circling either the 'R' for right side or 'L' for left side.

To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 Nm (4.1 in-lbs).

Wiring the Finger-Safe Terminal Block

When wiring the terminal block, keep the finger-safe cover in place.

1. Loosen the terminal screws to be wired.
2. Route the wire under the terminal pressure plate. You can use the bare wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.

NOTE The terminal screws are non-captive. Therefore, it is possible to use a ring lug [maximum 1/4 inch o.d. with a 0.139 inch minimum i.d. (M3.5)] with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 Nm (6 in-lbs).

NOTE If you need to remove the finger-safe cover, insert a screw driver into one of the square wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)

I/O Memory Mapping

IMPORTANT If you are using RSLogix 5000, version 15, please refer to RSLogix 5000, Version 15, Controller Tags on page 18.

Input Data File

For each input module, slot x, words 0-7 in the input data file contain the analog values of the inputs.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Input Data Channel 0														
1	SGN	Analog Input Data Channel 1														
2	SGN	Analog Input Data Channel 2														
3	SGN	Analog Input Data Channel 3														
4	SGN	Analog Input Data Channel 4														
5	SGN	Analog Input Data Channel 5														
6	SGN	Analog Input Data Channel 6														
7	SGN	Analog Input Data Channel 7														
8	Nu	Time Stamp Value														
9	Nu	Nu	Nu	Nu	Nu	Nu	Nu	Nu	S7	S6	S5	S4	S3	S2	S1	S0
10	L3	H3	U3	O3	L2	H2	U2	O2	L1	H1	U1	O1	L0	H0	U0	O0
11	L7	H7	U7	O7	L6	H6	U6	O6	L5	H5	U5	O5	L4	H4	U4	O4

The bits are defined as follows:

- SGN = Sign bit in two's complement format
- Nu = Not used. Bit set to 0.
- Sx = General status bit for input channels 0 through 7.
- Lx = Low alarm flag bits for input channels 0 through 7.
- Hx = High alarm flag bits for input channels 0 through 7.
- Ux = Under-range flag bits for channels 0 through 7. When set, the input signal is under normal range or an open circuit condition exists, in the case of the 4-20 mA range.
- Ox = Over-range flag bits for channels 0 through 7.

Output Data File

For each input module, slot x, word 0 in the output data file contains alarm unlatch control bits.

Word	Bit Position															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	CL[1] L7	CL[2] H7	CL L6	CL H6	CL L5	CL H5	CL L4	CL H4	CL L3	CL H3	CL L2	CL H2	CL L1	CL H1	CL L0	CL H0

(1) CL Lx = Cancel Low Process Alarm Latch x. This lets you individually cancel each low process alarm latch. Cancel = 1.

(2) CL Hx = Cancel High Process Alarm Latch x. This lets you individually cancel each high process alarm latch.

Configuration Data File

The manipulation of the bits from this file is normally done with programming software (e.g. RSLogix 500, RSNetworx for DeviceNet, etc.) during initial configuration of the system. In that case, graphical screens are provided by the programmer to simplify configuration. However, some systems, like the 1769-ADN DeviceNet Adapter, also allow the bits to be altered as part of the control program, using communication rungs. In that case, it is necessary to understand the bit arrangement. Refer to the *Compact™ Analog I/O User Manual*, publication number 1769-UM002 for additional details.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Real Time Sample Value															
1	ERTS	Reserved														
2	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl0			
3	Reserved					Inpt Dta Fm Chl0			Reserved				Inpt Tp/RngeSel Chl0			
4	S	Process Alarm High Data Value Channel 0														
5	S	Process Alarm Low Data Value Channel 0														
6	S	Alarm Dead Band Value Channel 0														
7	Pad															
8	EC	Reserved				EA	AL	EI	Reserved				Inpt Filter Sel Chl1			
9	Reserved					Inpt Dta Fm Chl1			Reserved				Inpt Tp/RngeSel Chl1			
10	S	Process Alarm High Data Value Channel 1														
11	S	Process Alarm Low Data Value Channel 1														
12	S	Alarm Dead Band Value Channel 1														
13	Pad															
14	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl2			
15	Reserved					Inpt Dta Fm Chl2			Reserved				Inpt Tp/RngeSel Chl2			
16	S	Process Alarm High Data Value Channel 2														
17	S	Process Alarm Low Data Value Channel 2														
18	S	Alarm Dead Band Value Channel 2														
19	Pad															
20	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl3			
21	Reserved					Inpt Dta Fm Chl3			Reserved				Inpt Tp/RngeSel Chl3			
22	S	Process Alarm High Data Value Channel 3														
23	S	Process Alarm Low Data Value Channel 3														
24	S	Alarm Dead Band Value Channel 3														
25	Pad															
26	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl4			

Word	Bit Position															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
27	Reserved					Inpt Dta Fm Chl4			Reserved				Inpt Tp/RngeSel Chl4			
28	S	Process Alarm High Data Value Channel 4														
29	S	Process Alarm Low Data Value Channel 4														
30	S	Alarm Dead Band Value Channel 4														
31	Pad															
32	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl5			
33	Reserved					Inpt Dta Fm Chl5			Reserved				Inpt Tp/RngeSel Chl5			
34	S	Process Alarm High Data Value Channel 5														
35	S	Process Alarm Low Data Value Channel 5														
36	S	Alarm Dead Band Value Channel 5														
37	Pad															
38	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl6			
39	Reserved					Inpt Dta Fm Chl6			Reserved				Inpt Tp/RngeSel Chl6			
40	S	Process Alarm High Data Value Channel 6														
41	S	Process Alarm Low Data Value Channel 6														
42	S	Alarm Dead Band Value Channel 6														
43	Pad															
44	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl7			
45	Reserved					Inpt Dta Fm Chl7			Reserved				Inpt Tp/RngeSel Chl7			
46	S	Process Alarm High Data Value Channel 7														
47	S	Process Alarm Low Data Value Channel 7														
48	S	Alarm Dead Band Value Channel 7														
49	Pad															

- EC = Enable Channel
- Inpt Dta Fm Chlx = Input Data Format Select.
- EA = Enable Alarm.
- AL = Alarm Latch.
- EI = Enable Interrupt.
- Inpt Tp/Rnge Sel Chlx = Input Type/Range Select.
- Inpt Filter Sel Chlx = Input Filter Select.
- Reserved = Allows for future expansion.
- ERTS = Enable Real Time Sample.

Define	To Select	Make these bit settings												
		15	14	13	12	11	10	9	8	7-4	3	2	1	0
Input Filter Selection/ -3 dB Frequency	60 Hz										0	0	0	0
	50 Hz										0	0	0	1
	10 Hz										0	0	1	0
	250 Hz										0	0	1	1
	500 Hz										0	1	0	0
Enable Interrupt	Enable								1					
	Disable								0					
Process Alarm Latch	Enable						1							
	Disable						0							
Enable Process Alarms	Enable					1								
	Disable					0								
Enable Channel	Enable	1												
	Disable	0												

Define	Indicate this	These bit settings								
		15-11	10	9	8	7-4	3	2	1	0
Input Range Select	-10 to +10V dc						0	0	0	0
	0 to 5V dc						0	0	0	1
	0 to 10V dc						0	0	1	0
	4 to 20 mA						0	0	1	1
	1 to 5V dc						0	1	0	0
	0 to 20 mA						0	1	0	1
Input Data Select	Raw/Proportional Counts		0	0	0					
	Engineering Units		0	0	1					
	Scaled for PID		0	1	0					
	Percent Range		0	1	1					

RSLogix 5000, Version 15, Controller Tags

Use the following controller tags with RSLogix 5000, version 15.

Channel 0 and 1 Configuration Data

Channel 0 and 1 configuration data is shown below. The same information applies to all channels.

-	Local:1:C		AB:1769_IF8:C:0	
	+	Local:1:C.RTSInterval	INT	Decimal
		Local:1:C.RTSEn	BOOL	Decimal
	+	Local:1:C.Ch0Filter	SINT	Decimal
		Local:1:C.Ch0AlarmInterruptEn	BOOL	Decimal
		Local:1:C.Ch0AlarmLatchEn	BOOL	Decimal
		Local:1:C.Ch0AlarmEn	BOOL	Decimal
		Local1:C.Ch0En	BOOL	Decimal
	+	Local:1:C.Ch0Range	SINT	Decimal
	+	Local:1:C.Ch0DataFormat	SINT	Decimal
	+	Local:1:C.Ch0HAlarmLimit	INT	Decimal
	+	Local:1:C.Ch0LAlarmLimit	INT	Decimal
	+	Local:1:C.Ch0AlarmDeadband	INT	Decimal
	+	Local:1:C.Ch1Filter	SINT	Decimal
		Local:1:C.Ch1AlarmInterruptEn	BOOL	Decimal
		Local:1:C.Ch1AlarmLatchEn	BOOL	Decimal
		Local:1:C.Ch1AlarmEn	BOOL	Decimal
		Local:1:C.Ch1En	BOOL	Decimal
	+	Local:1:C.Ch1Range	SINT	Decimal
	+	Local:1:C.Ch1DataFormat	SINT	Decimal
	+	Local:1:C.Ch1HAlarmLimit	INT	Decimal
	+	Local:1:C.Ch1LAlarmLimit	INT	Decimal
	+	Local:1:C.Ch1AlarmDeadband	INT	Decimal

Tag Name	To Select	Make These Bit Settings[1]								
		15-8	7	6	5	4	3	2	1	0
Ch#Filter	60 Hz							0	0	0
	50 Hz							0	0	1
	10 Hz							0	1	0
	250 Hz							0	1	1
	500 Hz							1	0	0
Ch#AlarmInterruptEn	Enable									1
	Disable									0
Ch#AlarmLatchEn	Enable									1
	Disable									0
Ch#AlarmEn	Enable									1
	Disable									0
Ch#En	Enable									1
	Disable									0
Ch#Range	-10…+10V dc							0	0	0
	0…5V dc							0	0	1
	0…10V dc							0	1	0
	4…20 mA							0	1	1
	1…5V dc							1	0	0
	0…20 mA							1	0	1
Ch#DataFormat	Raw/proportional counts								0	0
	Engineering units								0	1
	Scaled for PID								1	0
	Percent range								1	1

(1) All bit positions left blank in table must be set to 0.

Input Data

-	Local:1:I		AB:1769_IF8:I:0	
	+	Local:1:I.Fault	DINT	Binary
	+	Local:1:I.Ch0Data	INT	Decimal
	+	Local:1:I.Ch1Data	INT	Decimal
	+	Local:1:I.Ch2Data	INT	Decimal
	+	Local:1:I.Ch3Data	INT	Decimal
	+	Local:1:I.Ch4Data	INT	Decimal
	+	Local:1:I.Ch5Data	INT	Decimal
	+	Local:1:I.Ch6Data	INT	Decimal
	+	Local:1:I.Ch7Data	INT	Decimal
	+	Local:1:I.RealTimeSample	INT	Decimal
	+	Local:1:I.CombinedStatus	SINT	Binary
		Local:1:I.Ch0Status	BOOL	Decimal
		Local:1:I.Ch1Status	BOOL	Decimal
		Local:1:I.Ch2Stattus	BOOL	Decimal
		Local:1:I.Ch3Status	BOOL	Decimal
		Local:1:I.Ch4Status	BOOL	Decimal
		Local:1:I.Ch5Status	BOOL	Decimal
		Local:1:I.Ch6Status	BOOL	Decimal
		Local:1:I.Ch7Status	BOOL	Decimal
	+	Local:1:I.Ch0_1Status	SINT	Binary
		Local:1:I.Ch0OverRange	BOOL	Decimal
		Local:1:I.Ch0UnderRange	BOOL	Decimal
		Local:1:I.Ch0HAlarm	BOOL	Decimal
		Local:1:I.Ch0LAlarm	BOOL	Decimal
	+	Local:1:I.Ch1OverRange	BOOL	Decimal
		Local:1:I.Ch1UnderRange	BOOL	Decimal
		Local:1:I.Ch1HAlarm	BOOL	Decimal
		Local:1:I.Ch1LAlarm	BOOL	Decimal

	+	Local:1:I.Ch2_3Status	SINT	Binary
		Local:1:I.Ch2OverRange	BOOL	Decimal
		Local:1:I.Ch2UnderRange	BOOL	Decimal
		Local:1:I.Ch2HAlarm	BOOL	Decimal
		Local:1:I.Ch2LAlarm	BOOL	Decimal
		Local:1:I.Ch3OverRange	BOOL	Decimal
		Local:1:I.Ch3UnderRange	BOOL	Decimal
		Local:1:I.Ch3HAlarm	BOOL	Decimal
		Local:1:I.Ch3LAlarm	BOOL	Decimal
	+	Local:1:I.Ch4_5Status	SINT	Binary
		Local:1:I.Ch4OverRange	BOOL	Decimal
		Local:1:I.Ch4UnderRange	BOOL	Decimal
		Local:1:I.Ch4HAlarm	BOOL	Decimal
		Local:1:I.Ch4LAlarm	BOOL	Decimal
		Local:1:I.Ch5OverRange	BOOL	Decimal
		Local:1:I.Ch5UnderRange	BOOL	Decimal
		Local:1:I.Ch5HAlarm	BOOL	Decimal
		Local:1:I.Ch5LAlarm	BOOL	Decimal
	+	Local:1:I.Ch6_7Status	SINT	Binary
		Local:1:I.Ch6OverRange	BOOL	Decimal
		Local:1:I.Ch6UnderRange	BOOL	Decimal
		Local:1:I.Ch6HAlarm	BOOL	Decimal
		Local:1:I.Ch6LAlarm	BOOL	Decimal
		Local:1:I.Ch7OverRange	BOOL	Decimal
		Local:1:I.Ch7UnderRange	BOOL	Decimal
		Local:1:I.Ch7HAlarm	BOOL	Decimal
		Local:1:I.Ch7LAlarm	BOOL	Decimal

Tag Name	Bit Indicates This							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Combined Status	Ch7 Status	Ch6 Status	Ch5 Status	Ch4 Status	Ch3 Status	Ch2 Status	Ch1 Status	Ch0 Status
Ch0_1 Status	Ch1 LAlarm	Ch1 HAlarm	Ch1 Under Range	Ch1 Over Range	Ch0 LAlarm	Ch0 HAlarm	Ch0 Under Range	Ch0 Over Range
Ch2_3 Status	Ch3 LAlarm	Ch3 HAlarm	Ch3 Under Range	Ch3 Over Range	Ch2 LAlarm	Ch2 HAlarm	Ch2 Under Range	Ch2 Over Range
Ch4_5 Status	Ch5 LAlarm	Ch5 HAlarm	Ch5 Under Range	Ch5 Over Range	Ch4 LAlarm	Ch4 HAlarm	Ch4 Under Range	Ch4 Over Range
Ch6_7 Status	Ch7 LAlarm	Ch7 HAlarm	Ch7 Under Range	Ch7 Over Range	Ch6 LAlarm	Ch6 HAlarm	Ch6 Under Range	Ch6 Over Range

Output Data

-	Local:1:O		AB:1769_IF8:O:0	
	+	Local:1:O.AlarmUnlatch	INT	Binary
		Local:1:O.Ch0HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch0LAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch1HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch1LAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch2HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch2LAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch3HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch3LAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch4HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch4LAlarmUnlatch	BOOL	Binary
		Local:1:O.Ch5HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch5LAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch6HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch6LAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch7HAlarmUnlatch	BOOL	Decimal
		Local:1:O.Ch7LAlarmUnlatch	BOOL	Decimal

Specifications

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 52.5 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 2.07 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	450g (0.99 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. peak-to-peak
Shock	Operating: 30G, 11 ms panel mounted (20G, 11 ms DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
• ESD Immunity (IEC1000-4-2)	• 4 kV contact, 8 kV air, 4 kV indirect
• Radiated Immunity (IEC1000-4-3)	• 10 V/m , 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
• Fast Transient Burst (IEC1000-4-4)	• 2 kV, 5kHz
• Surge Immunity (IEC1000-4-5)	• 1 kV galvanic gun
• Conducted Immunity (IEC1000-4-6)	• 10 V, 0.15 to 80MHz[(1)]

(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	1769-IF8
Analog Normal Operating Ranges[1]	Voltage: ± 10V dc, 0 to 10V dc, 0 to 5V dc, 1 to 5V dc Current: 0 to 20 mA, 4 to 20 mA
Full Scale Analog Ranges[1]	Voltage: ± 10.5V dc, 0 to 10.5V dc, 0 to 5.25V dc, 0.5 to 5.25V dc Current: 0 to 21 mA, 3.2 to 21 mA
Number of Inputs	8 differential or single-ended
Bus Current Draw (max.)	120 mA at 5V dc 70 mA at 24V dc
Heat Dissipation	3.24 Total Watts (The Watts per point, plus the minimum Watts, with all points energized.)
Converter Type	Delta Sigma
Response Speed per Channel	Input filter and configuration dependent. See your user's manual.
Resolution (max.)[2]	16 bits (unipolar) 15 bits plus sign (bipolar)
Rated Working Voltage[3]	30V ac/30V dc
Common Mode Voltage Range[4]	±10V dc maximum per channel
Common Mode Rejection	greater than 60 dB at 50 and 60 Hz with the 10 Hz filter selected, respectively.
Normal Mode Rejection Ratio	-50 dB at 50 and 60 Hz with the 10 Hz filter selected, respectively.
Input Impedance	Voltage Terminal: 220K Ω (typical) Current Terminal: 250 Ω
Overall Accuracy[5]	Voltage Terminal: ±0.2% full scale at 25°C Current Terminal: ±0.35% full scale at 25°C

(1) The over- or under-range flag will come on when the normal operating range (over/under) is exceeded. The module will continue to convert the analog input up to the maximum full scale range. The flag automatically resets when within the normal operating range.

(2) Resolution is dependent upon your filter selection. The maximum resolution is achieved with the 10 Hz filter selected. For resolution with other filter selections, refer to the user manual, publication 1769-UM002A-EN-P.

(3) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential (for example, 10V dc input signal and 20V dc potential above ground).

(4) For proper operation, both the plus and minus input terminals must be within ±10V dc of analog common.

(5) Includes offset, gain, non-linearity and repeatability error terms.

Specification	1769-IF8
Accuracy Drift with Temperature	Voltage Terminal: ±0.003% per °C Current Terminal: ±0.0045% per °C
Calibration	The module performs autocalibration on channel enable and on a configuration change between channels.
Non-linearity (in percent full scale)	±0.03%
Repeatability(1)	±0.03%
Module Error over Full Temperature Range (0 to +60°C [+32°F to +140°F])	Voltage: ±0.3% Current: ±0.5%
Input Channel Configuration	via configuration software screen or the user program (by writing a unique bit pattern into the module's configuration file). Refer to your controller's user manual to determine if user program configuration is supported.
Module OK LED	On: module has power, has passed internal diagnostics, and is communicating over the bus. Off: Any of the above is not true.
Channel Diagnostics	Over- or under-range by bit reporting, process alarms
Maximum Overload at Input Terminals(2)	Voltage Terminal: ±30V dc continuous, 0.1 mA Current Terminal: ±32 mA continuous, ±7.6 V dc
System Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the system power supply.)
Recommended Cable	Belden™ 8761 (shielded)
Input Group to Bus Isolation	500V ac or 710V dc for 1 minute (qualification test) 30V ac/30V dc working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	10
Product Code	38

(1) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.

(2) Damage may occur to the input circuit if this value is exceeded.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following ATTENTION statement applies to use in hazardous locations.

WARNING

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure.
- All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

AVERTISSEMENT

DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée et que l'environnement est classé non dangereux.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée ou que l'environnement est classé non dangereux.
- Ce produit doit être installé dans une armoire.

For More Information

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your Compact I/O with MicroLogix 1500 programmable controller.	MicroLogix 1500 Programmable Controllers User Manual	1764-UM001
Detailed information on installing, programming, and troubleshooting your Compact Analog I/O modules.	Compact I/O Analog Modules User Manual	1769-UM002
A detailed description of how to install and use your Compact I/O with the 1769-ADN DeviceNet Adapter.	1769-ADN DeviceNet Adapter User Manual	1769-UM001
An overview of the MicroLogix 1500 system, including Compact I/O.	MicroLogix 1500 Programmable Controller with Compact I/O for Expansion	1764-SO001
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

If you would like a manual, you can:

- download a free electronic version from the internet: **www.ab.com/micrologix** or **www.theautomationbookstore.com**
- purchase a printed manual by:

– contacting your local distributor or Rockwell Automation representative
– visiting **www.theautomationbookstore.com** and placing your order
– calling 1.800.963.9548 (USA/Canada)
or 001.330.725.1574 (Outside USA/Canada)

MicroLogix and Compact are trademarks of Rockwell Automation.
Belden is a trademark of Belden, Inc.

Notes:

Notes:

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Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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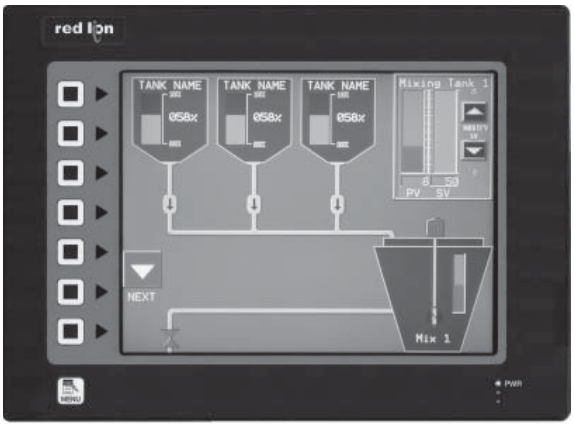
Tel +1 (717) 767-6511
Fax +1 (717) 764-0839
www.redlion.net

Bulletin No. G310-N
Drawing No. LP0581
Released 08/09

MODEL G310 - GRAPHIC LCD OPERATOR INTERFACE TERMINAL WITH VGA DISPLAY AND TOUCHSCREEN



- *CONFIGURED USING CRIMSON® SOFTWARE (VERSION 2.0 OR LATER)*
- *UP TO 5 RS-232/422/485 COMMUNICATIONS PORTS (2 RS-232 AND 1 RS-422/485 ON BOARD, 1 RS-232 AND 1 RS-422/485 ON OPTIONAL COMMUNICATIONS CARD)*
- *10 BASE T/100 BASE-TX ETHERNET PORT TO NETWORK UNITS AND HOST WEB PAGES*
- *USB PORT TO DOWNLOAD THE UNIT'S CONFIGURATION FROM A PC OR FOR DATA TRANSFERS TO A PC*
- *UNIT'S CONFIGURATION IS STORED IN NON-VOLATILE MEMORY (8MBYTE FLASH)*
- *COMPACTFLASH® SOCKET TO INCREASE MEMORY CAPACITY*
- *10.4-INCH TFT 256 COLOR VGA 640X480 PIXEL LCD*
- *OUTDOOR UNIT WITH UV RATED OVERLAY AVAILABLE*
- *8-BUTTON KEYPAD FOR ON-SCREEN MENUS*
- *THREE FRONT PANEL LEDS*
- *POWER UNIT FROM 24VDC ±20% SUPPLY*
- *RESISTIVE ANALOG TOUCHSCREEN*

c UL us LISTED 63YN
LABORATORY EQUIPMENT

FOR USE IN HAZARDOUS LOCATIONS:
Class I, Division 2, Groups A, B, C, and D
Class II, Division 2, Groups F and G
Class III, Division 2

GENERAL DESCRIPTION

The G310 Operator Interface Terminal combines unique capabilities normally expected from high-end units with a very affordable price. It is built around a high performance core with integrated functionality. This core allows the G310 to perform many of the normal features of the Paradigm range of Operator Interfaces while improving and adding new features.

The G310 is able to communicate with many different types of hardware using high-speed RS232/422/485 communications ports and Ethernet 10 Base T/100 Base-TX communications. In addition, the G310 features USB for fast downloads of configuration files and access to trending and data logging. A CompactFlash socket is provided so that Flash cards can be used to collect your trending and data logging information as well as to store larger configuration files.

In addition to accessing and controlling of external resources, the G310 allows a user to easily view and enter information. An outdoor version is available for direct sunlight applications. Users can enter data through the touchscreen or front panel 8-button keypad.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use the controller to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the controller.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2/CLASS II, DIVISION 2/CLASS III, DIVISION 2

CAUTION: Risk Of Danger.
Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

CompactFlash is a registered trademark of CompactFlash Association.

CONTENTS OF PACKAGE

- G310 Operator Interface.
- Panel Gasket.
- This hardware bulletin.
- Template for panel cutout.
- Hardware packet for mounting unit into panel.
- Terminal block for connecting power.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
G310	Operator Interface for indoor applications only, textured finish with embossed keys	G310C000
	Operator Interface for indoor or outdoor applications, glossy finish with UV rated overlay (keys are not embossed)	G310S000
G3CF	CompactFlash Card [5]	G3CFxxxx
G3RS	RS 232/485 Optional Communication Card	G3RS0000
G3CN	CANopen Optional Communication Card	G3CN0000
G3PBDP	Profibus DP Optional Communication Card	G3PBDP00
G3GSM	GSM/GPRS Modem Option Card for G3 operator interface [6]	G3GSM000
SFCRM2	Crimson [2]	SFCRM200
CBL	RS-232 Programming Cable	CBLPROG0
	USB Cable	CBLUSB00
	Communications Cables [1]	CBLxxxxx
DR	DIN Rail Mountable Adapter Products [3]	DRxxxxxx
	Replacement Battery [4]	BNL20000
	G310C Backlight Replacement [6]	CONSULT FACTORY
	G310S Backlight Replacement [6]	
G3FILM	Protective Films	G3FILM10

[1] Contact your Red Lion distributor or visit our website for complete selection.
[2] Use this part number to purchase Crimson on CD with a printed manual, USB cable, and RS-232 cable. Otherwise, download for free from www.redlion.net.
[3] Red Lion offers RJ modular jack adapters. Refer to the DR literature for details.
[4] Battery type is lithium coin type CR2025
[5] Industrial grade two million write cycles. SMART Modular Technologies model SG9CF (UL Listed Directory Category NWGQ).
[6] For use in non-hazardous locations only.

SPECIFICATIONS

1. **POWER REQUIREMENTS**:
   G310C: +24 VDC ±20% @ 33 W maximum.
   G310S: +24 VDC ±20% @ 25 W maximum.
   Must use Class 2 or SELV rated power supply.
   Power connection via removable three position terminal block.
   Notes:
   1. The front panel PWR LED indicates power.
   2. The G310's circuit common is not connected to the enclosure of the unit. See "Connecting to Earth Ground" in the section "Installing and Powering the G310."
2. **BATTERY**: Lithium coin cell. Typical lifetime of 10 years.
3. **LCD MODULE DISPLAYS**:

MODEL	G310C	G310S
SIZE	10.4-inch	10.4-inch
TYPE	TFT	TFT
COLORS	256 VGA	256 VGA
PIXELS	640 X 480	640 X 480
BRIGHTNESS	450 cd/m^2	850 cd/m^2
BACKLIGHT TYPE	CCFL	LED
BACKLIGHT LIFE *	50,000 HR TYP.	50,000 HR TYP.

*Lifetime at room temperature. Refer to "Display" in the "Software/Unit Operation" section.

4. **8-KEY KEYPAD**: for on-screen menus.
5. **TOUCHSCREEN**: Resistive analog
6. **MEMORY**:
   On Board User Memory: 8 Mbyte of onboard non-volatile Flash memory.
   Memory Card: CompactFlash Type II slot for Type I and Type II CompactFlash cards.
7. **COMMUNICATIONS**:
   USB Port: Adheres to USB specification 1.1. Device only using Type B connection.

> WARNING - DO NOT CONNECT OR DISCONNECT CABLES WHILE POWER IS APPLIED UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. USB PORT IS FOR SYSTEM SET-UP AND DIAGNOSTICS AND IS NOT INTENDED FOR PERMANENT CONNECTION.

   Serial Ports: Format and Baud Rates for each port are individually software programmable up to 115,200 baud.
   PGM Port: RS232 port via RJ12.
   COMMS Ports: RS422/485 port via RJ45, and RS232 port via RJ12.
   DH485 TXEN: Transmit enable; open collector, V_{OH} = 15 VDC, V_{OL} = 0.5 V @ 25 mA max.
   Note: For additional information on the communications or signal common and connections to earth ground please see the "Connecting to Earth Ground" in the section "Installing and Powering the G310."
   Ethernet Port: 10 BASE-T / 100 BASE-TX
   RJ45 jack is wired as a NIC (Network Interface Card).
8. **ENVIRONMENTAL CONDITIONS**:
   Operating Temperature Range: 0 to 50 °C
   Storage Temperature Range: -20 to 70 °C
   Operating and Storage Humidity: 80% maximum relative humidity (non-condensing) from 0 to 50 °C.
   Vibration According to IEC 68-2-6: Operational 10 to 55 Hz, in X, Y, Z direction for 1.5 hours, 1 g.
   Shock According to IEC 68-2-27: Operational 30 g's, 9 msec in 3 directions.
   Altitude: Up to 2000 meters.
9. **CERTIFICATIONS AND COMPLIANCES**:
   SAFETY
   UL Recognized Component, File #E179259, UL61010-1, CSA 22.2 No.61010-1
   Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
   UL Listed, File #E211967, UL61010-1, UL1604, CSA 22.2 No. 61010-1, CSA 22.2 No. 213-M1987
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Enclosure rating (Face only), UL50
   IECEE CB Scheme Test Report #E179259-A1-CB-1
   Issued by Underwriters Laboratories Inc.
   IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   IP66 Enclosure rating (Face only), IEC 529
   ELECTROMAGNETIC COMPATIBILITY
   Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power
RF conducted interference	EN 61000-4-6	Criterion B 3 V/rms

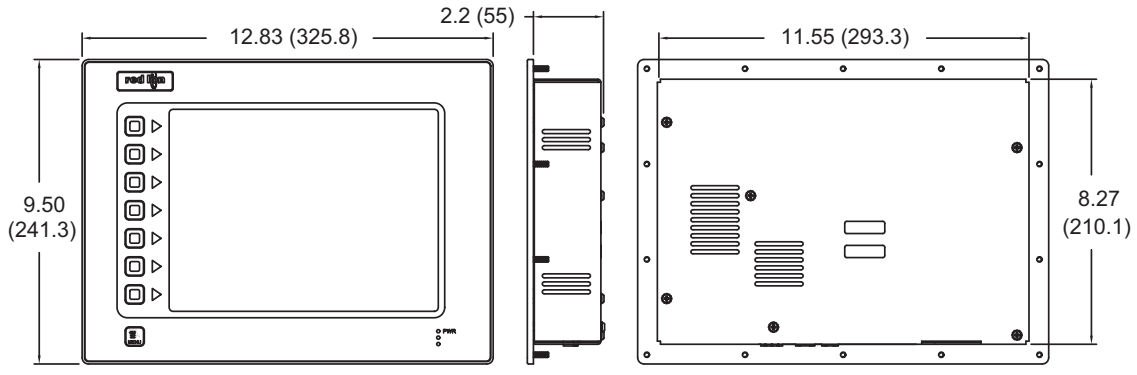
Emissions:

Emissions	EN 55011	Class A

Notes:
1. Criterion A: Normal operation within specified limits.
2. Criterion B: Temporary loss of performance from which the unit self-recovers.

10. **CONNECTIONS**: Compression cage-clamp terminal block.
    Wire Gage: 12-30 AWG copper wire
    Torque: 5-7 inch-pounds (56-79 N-cm)
11. **CONSTRUCTION**: Steel rear metal enclosure with NEMA 4X/IP66 aluminum front plate when correctly fitted with the gasket provided. Installation Category II, Pollution Degree 2.
12. **MOUNTING REQUIREMENTS**: Maximum panel thickness is 0.25" (6.3 mm). For NEMA 4X/IP66 sealing, a steel panel with a minimum thickness of 0.125" (3.17 mm) is recommended.
    Maximum Mounting Stud Torque: 17 inch-pounds (1.92 N-m)
13. **WEIGHT**: 5.53 lbs (2.51 Kg)

DIMENSIONS In inches (mm)

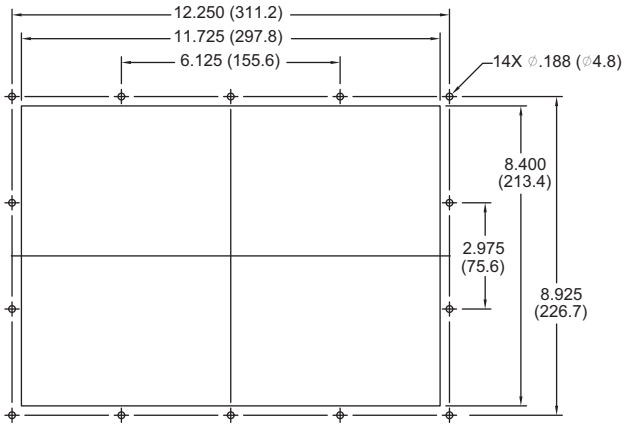


INSTALLING AND POWERING THE G310

MOUNTING INSTRUCTIONS

This operator interface is designed for through-panel mounting. A panel cut-out diagram and a template are provided. Care should be taken to remove any loose material from the mounting cut-out to prevent that material from falling into the operator interface during installation. A gasket is provided to enable sealing to NEMA 4X/IP66 specification. Install the 14 kep nuts provided and tighten evenly for uniform gasket compression.

Note: Tightening the kep nuts beyond a maximum of 17 inch-pounds (1.92 N-m) may cause damage to the front panel.



All tolerances ±0.010" (±0.25 mm).

ALL NONINCENDIVE CIRCUITS MUST BE WIRED USING DIVISION 2 WIRING METHODS AS SPECIFIED IN ARTICLE 501-4 (b), 502-4 (b), AND 503-3 (b) OF THE NATIONAL ELECTRICAL CODE, NFPA 70 FOR INSTALLATION WITHIN THE UNITED STATES, OR AS SPECIFIED IN SECTION 19-152 OF CANADIAN ELECTRICAL CODE FOR INSTALLATION IN CANADA.

CONNECTING TO EARTH GROUND

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

Each G310 has a chassis ground terminal on the back of the unit. Your unit should be connected to earth ground (protective earth).

The chassis ground is not connected to signal common of the unit. Maintaining isolation between earth ground and signal common is not required to operate your unit. But, other equipment connected to this unit may require isolation between signal common and earth ground. *To maintain isolation between signal common and earth ground care must be taken when connections are made to the unit.* For example, a power supply with isolation between its signal common and earth ground must be used. Also, plugging in a USB cable may connect signal common and earth ground.[1]

1. USB's shield may be connected to earth ground at the host. USB's shield in turn may also be connected to signal common.

POWER SUPPLY REQUIREMENTS

The G310C requires a 24 VDC power supply rated at 33 W, and the G310S requires a 24 VDC power supply rated at 25 W. Your unit may draw considerably less the rated power depending upon the options being used. As additional features are used your unit will draw increasing amounts of power. Items that could cause increases in current are additional communications, optional communications card, CompactFlash card, and other features programmed through Crimson.

In any case, it is very important that the power supply is mounted correctly if the unit is to operate reliably. Please take care to observe the following points:

- The power supply must be mounted close to the unit, with usually not more than 6 feet (1.8 m) of cable between the supply and the operator interface. Ideally, the shortest length possible should be used.
- The wire used to connect the operator interface's power supply should be at least 22-gage wire. If a longer cable run is used, a heavier gage wire should be used. The routing of the cable should be kept away from large contactors, inverters, and other devices which may generate significant electrical noise.
- A power supply with a Class 2 or SELV rating is to be used. A Class 2 or SELV power supply provides isolation to accessible circuits from hazardous voltage levels generated by a mains power supply due to single faults. SELV is an acronym for "safety extra-low voltage." Safety extra-low voltage circuits shall exhibit voltages safe to touch both under normal operating conditions and after a single fault, such as a breakdown of a layer of basic insulation or after the failure of a single component has occurred.

COMMUNICATING WITH THE G310

CONFIGURING A G310

The G310 is configured using Crimson software. Crimson is available as a free download from Red Lion's website, or it can be purchased on CD. Updates to Crimson for new features and drivers are posted on the website as they become available. By configuring the G310 using the latest version of Crimson, you are assured that your unit has the most up to date feature set. Crimson software can configure the G310 through the RS232 PGM port, USB port, or CompactFlash.

The USB port is connected using a standard USB cable with a Type B connector. The driver needed to use the USB port will be installed with Crimson. If this driver has not been installed, it can be downloaded from the website.

The RS232 PGM port uses a programming cable made by Red Lion to connect to the DB9 COM port of your computer. If you choose to make your own cable, use the "G310 Port Pin Out Diagram" for wiring information.

The CompactFlash can be used to program a G3 by placing a configuration file and firmware on the CompactFlash card. The card is then inserted into the target G3 and powered. Refer to the Crimson literature for more information on the proper names and locations of the files.

CABLES AND DRIVERS

Red Lion has a wide range of cables and drivers for use with many different communication types. A list of these drivers and cables along with pin outs is available from Red Lion's website. New cables and drivers are added on a regular basis. If making your own cable, refer to the "G310 Port Pin Outs" for wiring information.

USB, DATA TRANSFERS FROM THE COMPACTFLASH CARD

WARNING - DO NOT CONNECT OR DISCONNECT CABLES WHILE POWER IS APPLIED UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. USB PORT IS FOR SYSTEM SET-UP AND DIAGNOSTICS AND IS NOT INTENDED FOR PERMANENT CONNECTION.

In order to transfer data from the CompactFlash card via the USB port, a driver must be installed on your computer. This driver is installed with Crimson and is located in the folder C:\Program Files\Red Lion Controls\Crimson 2.0\Device\ after Crimson is installed. This may have already been accomplished if your G310 was configured using the USB port.

Once the driver is installed, connect the G310 to your PC with a USB cable, and follow "Mounting the CompactFlash" instructions in the Crimson 2 user manual.

ETHERNET COMMUNICATIONS

Ethernet communications can be established at either 10 BASE-T or 100 BASE-TX. The G310 unit's RJ45 jack is wired as a NIC (Network Interface Card). For example, when wiring to a hub or switch use a straight-through cable, but when connecting to another NIC use a crossover cable.

The Ethernet connector contains two LEDs. A yellow LED in the upper right, and a bi-color green/amber LED in the upper left. The LEDs represent the following statuses.

LED COLOR	DESCRIPTION
YELLOW solid	Link established.
YELLOW flashing	Data being transferred.
GREEN	10 BASE-T Communications
AMBER	100 BASE-TX Communications

The Crimson manual contains additional information on Ethernet communications.

RS232 PORTS

The G310 has two RS232 ports. There is the PGM port and the COMMS port. Although only one of these ports can be used for programming, both ports can be used for communications with a PLC.

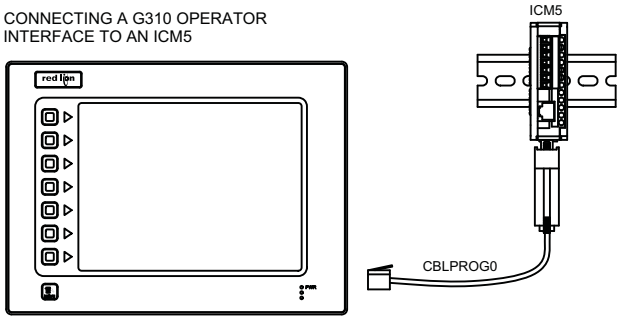
The RS232 PGM port can be used for either master or slave protocols with any G310 configuration.

Examples of RS232 communications could involve another Red Lion product or a PC. By using a cable with RJ12 ends on it, and a twist in the cable, RS232 communications with another G3 product or the Modular Controller can be established. Red Lion part numbers for cables with a twist in them are CBLPROG0 [1], CBLRLC01 [2], or CBLRC02 [3].

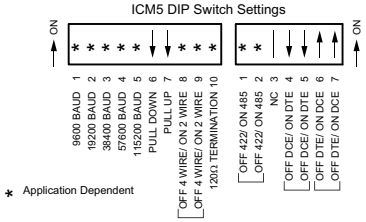
G3 RS232 to a PC

Connections			
G3: RJ12	Name	PC: DB9	Name
4	COMM	1	DCD
5	Tx	2	Rx
2	Rx	3	Tx
	N/C	4	DTR
3	COM	5	GND
	N/C	6	DSR
1	CTS	7	RTS
6	RTS	8	CTS
	N/C	9	RI

CONNECTING A G310 OPERATOR INTERFACE TO AN ICM5

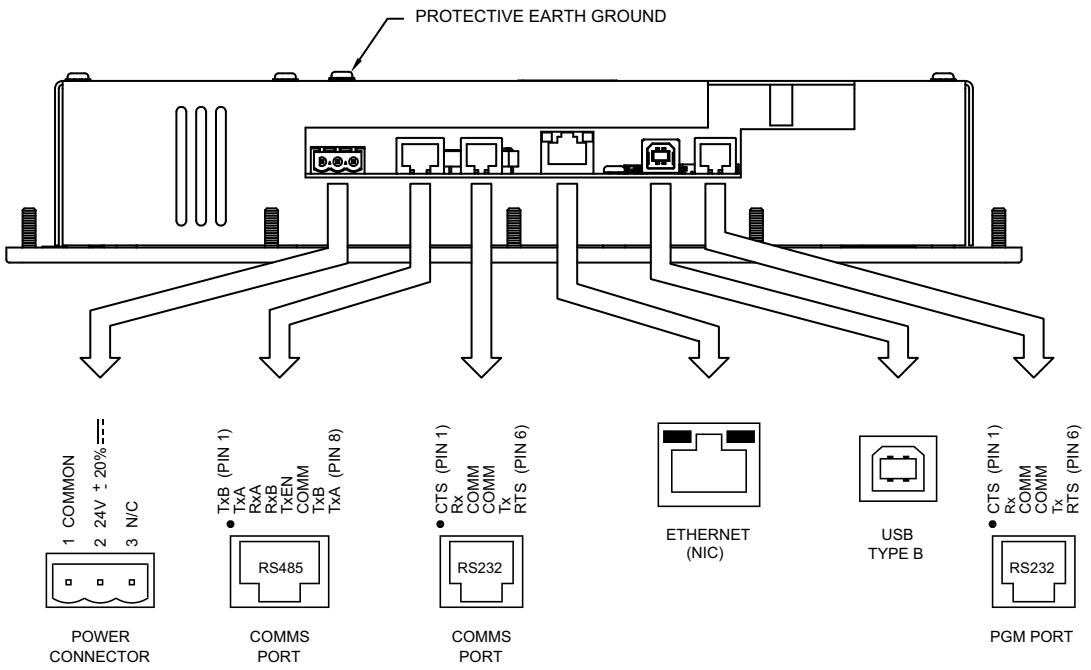


ICM5 DIP Switch Settings



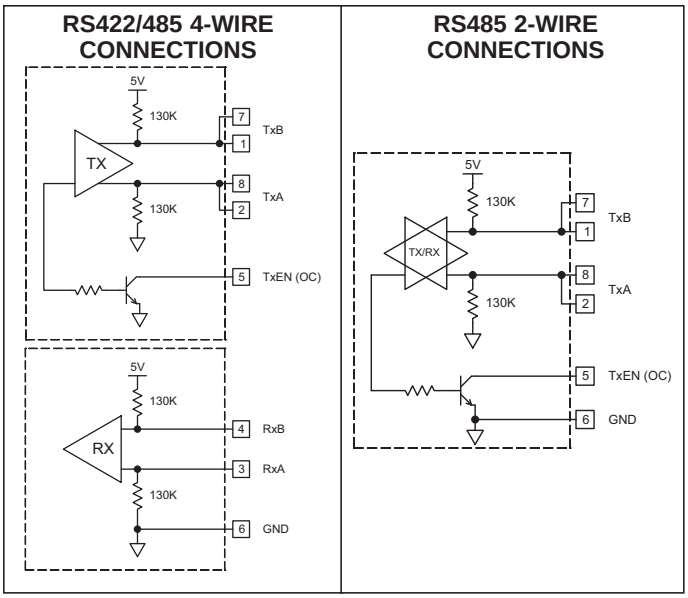
[1] CBLPROG0 can also be used to communicate with either a PC or an ICM5.
[2] DB9 adapter not included, 1 foot long.
[3] DB9 adapter not included, 10 feet long.

G310 PORT PIN OUTS



RS422/485 COMMS PORT

The G310 has one RS422/485 port. This port can be configured to act as either RS422 or RS485.



***Note**: All Red Lion devices connect A to A and B to B, except for Paradigm devices. Refer to www.redlion.net for additional information.*

DH485 COMMUNICATIONS

The G310's RS422/485 COMMS port can also be used for Allen Bradley DH485 communications.

WARNING: **DO NOT** use a standard DH485 cable to connect this port to Allen Bradley equipment. A cable and wiring diagram are available from Red Lion.

G3 to AB SLC 500 (CBLAB003)

Connections			
RJ45: RLC	Name	RJ45: A-B	Name
1	TxB	1	A
2	TxA	2	B
3, 8	RxA	-	24V
4, 7	RxB	-	COMM
5	TxEN	5	TxEN
6	COMM	4	SHIELD
4, 7	TxB	-	COMM
3, 8	TxA	-	24V

Examples of RS485 2-Wire Connections

G3 to Red Lion RJ11 (CBLRLC00) DLC, IAMS, ITMS, PAXCDC4C

Connections			
G3: RJ45	Name	RLC: RJ11	Name
5	TxEN	2	TxEN
6	COM	3	COM
1	TxB	5	B-
2	TxA	4	A+

G3 to Modular Controller (CBLRLC05)

Connections			
G3	Name	Modular Controller	Name
1,4	TxB	1,4	TxB
4,1	RxB	4,1	RxB
2,3	TxA	2,3	TxA
3,2	RxA	3,2	RxA
5	TxEN	5	TxEN
6	COM	6	COM
7	TxB	7	TxB
8	TxA	8	TxA

SOFTWARE / UNIT OPERATION

CRIMSON SOFTWARE

Crimson software is available as a free download from Red Lion's website or it can be purchased on a CD, see "Ordering Information" for part number. The latest version of the software is always available from the website, and updating your copy is free.

DISPLAY

This operator interface uses a liquid crystal display (LCD) for displaying text and graphics. The G310C and older G310S displays utilize a cold cathode fluorescent tube (CCFL) for lighting the display. The newer G310S units use an LED backlight. Both backlight types can be dimmed for low light conditions.

Display backlights have a limited lifetime. Backlight lifetime is based upon the amount of time the display is turned on at full intensity. Turning the backlight off when the display is not in use can extend the lifetime of your backlight. This can be accomplished through the Crimson software when configuring your unit.

BACKLIGHT REPLACEMENT

CAUTION:

LED Backlight

The LED backlight is not field replaceable. Unit must be returned to Red Lion Controls for repair.

CCFL Backlight

Backlight is not field replaceable for hazardous location applications. Unit must be returned to Red Lion Controls for repair.

The backlight assembly is field replaceable in non-hazardous locations only. Refer to the instructions included in the appropriate backlight replacement kit.

FRONT PANEL LEDS

There are three front panel LEDs. Shown below is the default status of the LEDs.

LED	INDICATION
RED (TOP, LABELED "PWR")	
FLASHING	Unit is in the boot loader, no valid configuration is loaded.[1]
STEADY	Unit is powered and running an application.
YELLOW (MIDDLE)	
OFF	No CompactFlash card is present.
STEADY	Valid CompactFlash card present.
FLASHING RAPIDLY	CompactFlash card being checked.
FLICKERING	Unit is writing to the CompactFlash, either because it is storing data, or because the PC connected via the USB port has locked the drive.[2]
FLASHING SLOWLY	Incorrectly formatted CompactFlash card present.
GREEN (BOTTOM)	
FLASHING	A tag is in an alarm state.
STEADY	Valid configuration is loaded and there are no alarms present.

1. The operator interface is shipped without a configuration. After downloading a configuration, if the light remains in the flashing state continuously, try cycling power. If the LED still continues to flash, try downloading a configuration again.
2. Do not turn off power to the unit while this light is flickering. The unit writes data in two minute intervals. Later Microsoft operating systems will not lock the drive unless they need to write data; Windows 98 may lock the drive any time it is mounted, thereby interfering with logging. Refer to "Mounting the CompactFlash" in the Crimson 2 User Manual.

KEYPAD

The G310 keypad consists of eight keys for on-screen menus.

TOUCHSCREEN

This operator interface utilizes a resistive analog touchscreen for user input. The unit will only produce an audible tone (beep) when a touch on an active touchscreen cell in sensed. The touchscreen is fully functional as soon as the operator interface is initialized, and can be operated with gloved hands.

TROUBLESHOOTING YOUR G310

If for any reason you have trouble operating, connecting, or simply have questions concerning your new G310, contact Red Lion's technical support. For contact information, refer to the back page of this bulletin for phone and fax numbers.

EMAIL: techsupport@redlion.net
Web Site: http://www.redlion.net

BATTERY & TIME KEEPING

WARNING - EXPLOSION HAZARD - THE AREA MUST BE KNOWN TO BE NON-HAZARDOUS BEFORE SERVICING/ REPLACING THE UNIT AND BEFORE INSTALLING OR REMOVING I/O WIRING AND BATTERY.

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN DISCONNECTED AND THE AREA IS KNOWN TO BE NON-HAZARDOUS.

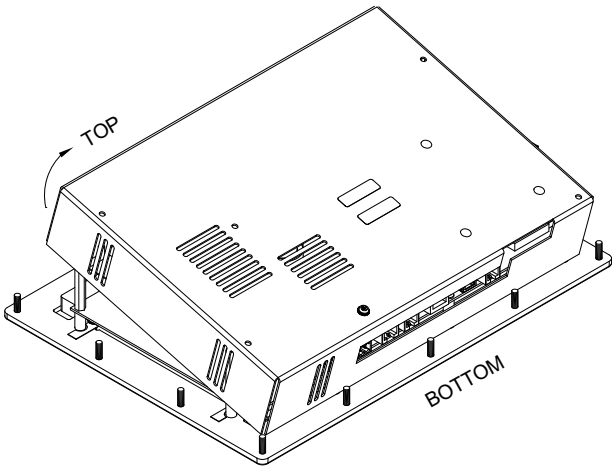
A battery is used to keep time when the unit is without power. Typical accuracy of the G310 time keeping is less than one minute per month drift. The battery of a G310 unit does not affect the unit's memory, all configurations and data is stored in non-volatile memory.

CAUTION: RISK OF ELECTRIC SHOCK
The inverter board, attached to the mounting plate, supplies the high voltage to operate the backlight. Touching the inverter board may result in injury to personnel.

CAUTION: The circuit board contains static sensitive components. Before handling the operator interface without the rear cover attached, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the operator interface at a static controlled clean workstation. Also, do not touch the surface areas of the circuit board. Dirt, oil, or other contaminants may adversely affect circuit operation.

To change the battery of a G310, remove power, cabling, and then the rear cover of the unit. To remove the cover, remove the five screws designated by the arrows on the rear of the unit. Then, by lifting the top side, hinge the cover, thus providing clearance for the connectors on the bottom side of the PCB as shown in the illustration below. Install in the reverse manner.

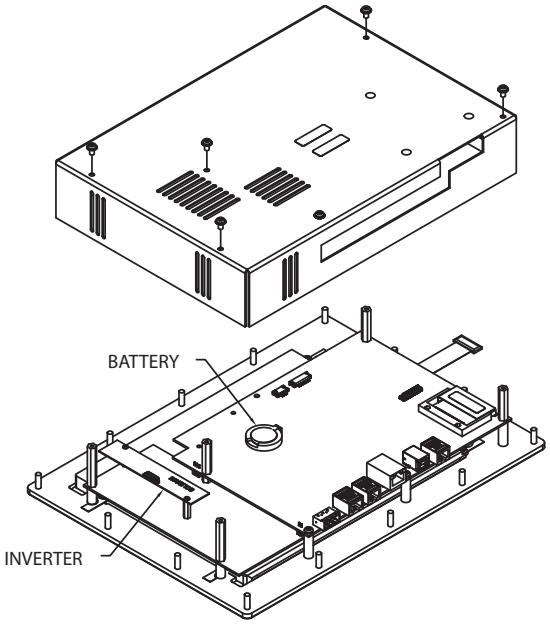
Remove the old battery* from the holder and replace with the new battery. Replace the rear cover, cables, and re-apply power. Using Crimson or the unit's keypad, enter the correct time and date.



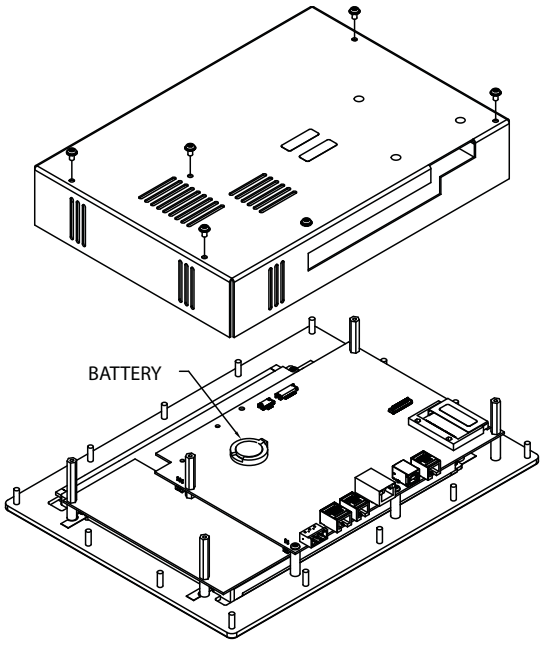
** Please note that the old battery must be disposed of in a manner that complies with your local waste regulations. Also, the battery must not be disposed of in fire, or in a manner whereby it may be damaged and its contents come into contact with human skin.*

The battery used by the G310 is a lithium type CR2025.

G310C



G310S



OPTIONAL FEATURES AND ACCESSORIES

INDOOR VERSUS OUTDOOR

Red Lion offers two versions of its G310 unit. The G310C000 uses an overlay with a textured finish and keys that are embossed. This overlay is not rated for outdoor use. The G310S000 uses an overlay with a glossy finish that uses UV rated material for outdoor use. The keys on this overlay are not embossed. The display is significantly brighter than the G310C000.

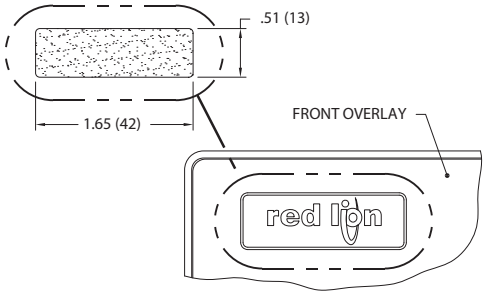
OPTIONAL COMMUNICATION CARD

Red Lion offers optional communication cards for fieldbus communications. These communication cards will allow your G310 to communicate with many of the popular fieldbus protocols.

Red Lion is also offering a communications card for additional RS232 and RS422/485 communications. Visit Red Lion's website for information and availability of these cards.

CUSTOM LOGO

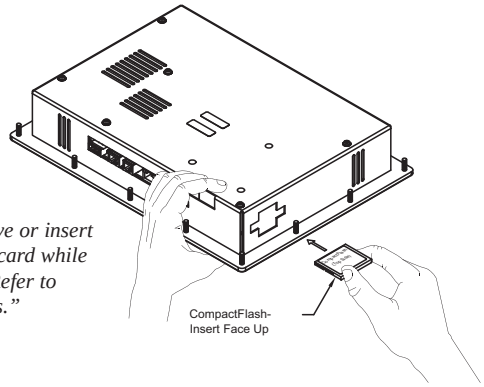
Each G3 operator interface has an embossed area containing the Red Lion logo. Red Lion can provide custom logos to apply to this area. Contact your distributor for additional information and pricing.



COMPACTFLASH SOCKET

CompactFlash socket is a Type II socket that can accept either Type I or II cards. Use cards with a minimum of 4 Mbytes and a maximum of 2 Gbytes with the G310's CompactFlash socket. Cards are available at most computer and office supply retailers.

CompactFlash can be used for configuration transfers, larger configurations, data logging, and trending.



Note: Do not remove or insert the CompactFlash card while power is applied. Refer to "Front Panel LEDs."

Information stored on a CompactFlash card by a G310 can be read by a card reader attached to a PC. This information is stored in IBM (Windows®) PC compatible FAT16 file format.

NOTE

For reliable operation of this and other Red Lion products, one of the following brands of CompactFlash card must be used...

SimpleTech	SMART® Modular
SanDisk®	Silicon Systems

Not all of the above manufacturers offer CompactFlash cards recognized to UL standards, which may be required for your application.

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

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Red Lion Controls
Headquarters
20 Willow Springs Circle
York PA 17406
Tel +1 (717) 767-6511
Fax +1 (717) 764-0839

Red Lion Controls
Europe
Printerweg 10
NL - 3821 AD Amersfoort
Tel +31 (0) 334 723 225
Fax +31 (0) 334 893 793

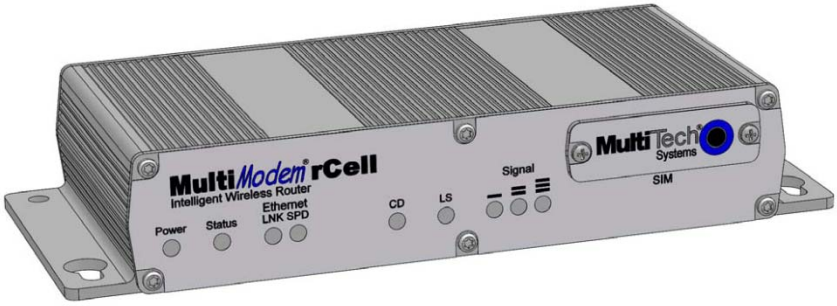
Red Lion Controls
India
54, Vishvas Tenement
GST Road, New Ranip,
Ahmedabad-382480 Gujarat, India
Tel +91 987 954 0503
Fax +91 79 275 31 350

Red Lion Controls
China
Unit 101, XinAn Plaza
Building 13, No.99 Tianzhou Road
ShangHai, P.R. China 200223
Tel +86 21 6113-3688
Fax +86 21 6113-3683

MultiModem® rCell

Intelligent Wireless Router

User Guide



MultiTech® Systems

MultiModem® rCell User Guide
Intelligent Wireless Router
MTCBA-Xx-EN2 , MTCBA-Xx-EN2-GP
S000485D, Revision D

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Revisions

Revision	Date	Description
A	08/31/10	Initial release of MultiModem rCell with GPS and without GPS for C1,E1,G2,H4, and EV2 models.
B	10/25/10	Added Sprint and Verizon Activation into a new Carrier Activation chapter (Chapter 3) and restructured installation.
C	12/27/10	Changed Carrier Activation chapter to incorporate new website activation.
D	10/19/11	Applied template. Removed references to product CD and to printed quick start guide.

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Contacting Multi-Tech Support

Online Support Portal: **https://support.multitech.com**
To better serve our customers, manage support requests and shorten resolution times, we have created the online web portal allowing you to submit questions regarding Multi-Tech products directly to our technical support team. Get answers to your most complex questions, ranging from implementation, troubleshooting, product configuration, firmware upgrades and much more.
To create an account and submit a Support Case on the Portal, visit https://support.multitech.com.

Knowledge Base and Support Services: **www.multitech.com/support.go**
The Knowledge Base provides immediate answers to your questions and gives you access to support resolutions for all Multi-Tech products. Visit our support area on the website for other support services.

World Headquarters
Multi-Tech Systems, Inc.
2205 Woodale Drive, Mounds View, Minnesota 55112 U.S.A.
Phone: 763-785-3500 or 800-328-9717 Fax: 763-785-9874
Internet Address: www.multitech.com

Technical Support
Business Hours: M-F, 9am to 5pm CST

Country	By Email	By Phone
Europe, Middle East, Africa:	support@multitech.co.uk	(44) 118 959 7774
U.S., Canada, all others:	support@multitech.com	(800) 972-2439 or (763) 717-5863

Warranty
Warranty information can be found at: http://www.multitech.com/warranty.go

Contents

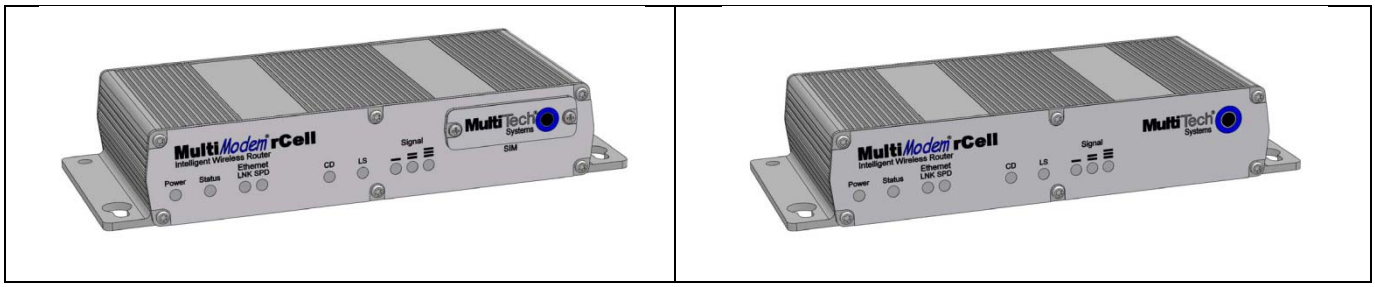
Chapter 1 – Product Overview

This User Guide describes the MultiModem® rCell intelligent wireless routers with an Ethernet II interface. You can configure the MultiModem rCell Router for one of three connectivity modes: always-on, wake-up on ring, or dial-on demand.

The always-on network connection automatically establishes a wireless data connection and allows for around the clock surveillance, monitoring or real time data acquisition of any remote Ethernet device such as a Web camera. If the data link is dropped due to poor reception or a complete loss of service, this feature automatically re-establishes the data link.

The wake-up on ring configuration allows the router to "wake up" and initiate a connection when it detects an incoming ring. For security reasons, you can setup the router to wake up based on a particular caller ID number. This configuration is ideal for reducing the costs associated with the modem being online and available 24/7.

When configured for dial-on demand, the router only accesses the Internet when data is present. This configuration is ideal for sharing Internet access among networked computers.



Model	Description
MTCBA-E1-EN2	Quad-band E-GPRS Class 12 performance without GPS option
MTCBA-E1-EN2-GP	Quad-band E-GPRS Class 12 performance with GPS option
MTCBA-G2-EN2	Quad-band GPRS Class 10 performance without GPS option
MTCBA-G2-EN2-GP	Quad-band GPRS Class 10 performance with GPS option
MTCBA-C1-EN2	Multi-band CDMA2000 1xRTT performance without GPS option
MTCBA-C1-EN2-GP	Multi-band CDMA2000 1xRTT performance with GPS option
MTCBA-H4-EN2	Tri-band UMTS/HSPA 7.2 performance without GPS option
MTCBA-H4-EN2-GP	Tri-band UMTS/HSPA 7.2 performance with GPS option
MTCBA-EV2-EN2	Dual-band 800/1900 MHz EV-DO Rev A performance without GPS option
MTCBA-EV2-EN2-GP	Dual-band 800/1900 MHz EV-DO Rev A performance with GPS option

Related Documentation

The following table describes additional documentation for each model.

Model	Additional Documentation
MultiModem MTCBA-E1-EN2 (EDGE)	You can configure the MultiModem MTCBA-E1-EN2 wireless router using the EDGE AT Commands. For more information refer to the Reference Guide for the MultiModem Wireless EDGE Modems, part number S000474x.
MultiModem MTCBA-G2-EN2 (GPRS)	You can configure the MultiModem MTCBA-G2-EN2 wireless modem using the GPRS AT Commands. For more information, refer to the Reference Guide for the MultiModem Wireless GPRS Modems, part number S000463x
MultiModem MTCBA-C1-EN2 (CDMA)	You can configure the MultiModem MTCBA-C1-EN2 wireless router using the CDMA-C1 AT Commands. For more information, refer to the Reference Guide for the MultiModem Wireless CDMA-C1 Modems, part number S000478x.
MultiModem MTCBA-H4-EN2 (HSPA)	You can configure the MultiModem MTCBA-H4-EN2 wireless router using the HSPA AT Commands. These commands are documented in the Reference Guide part number S000483x.
MultiModem MTCBA-EV2-EN2 (EV-DO)	You can configure the MultiModem MTCBA-EV2-EN2 wireless router using the EV-DO AT Commands. These commands are documented in the Reference Guide part number S000482x.

Safety Warnings

Ethernet Ports Caution

The Ethernet ports are **not** designed to be connected to a Public Telecommunication Network or used outside the building.

Handling Precautions

All devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. Although input protection circuitry has been incorporated into the devices to minimize the effect of this static build up, proper precautions should be taken to avoid exposure to electrostatic discharge during handling and mounting.

Caution: Maintain a separation distance of at least 20 cm (8 inches) between the transmitter's antenna and the body of the user or nearby persons. The router is not designed for, nor intended to be, used in applications within 20 cm (8 inches) of the body of the user.

RF Interference Issues

It is important to follow any special regulations regarding the use of radio equipment due in particular to the possibility of radio frequency, RF, interference. Please follow this safety advice:

- Switch OFF your Wireless MultiModem when in an aircraft. The use of cellular telephones in an aircraft may endanger the operation of the aircraft, disrupt the cellular network and is illegal. Failure to observe this instruction may lead to suspension or denial of cellular telephone services to the offender, or legal action or both.
- Switch OFF your Wireless MultiModem when around gasoline or diesel-fuel pumps and before filling your vehicle with fuel.
- Switch OFF your Wireless MultiModem in hospitals and any other place where medical equipment may be in use.
- Respect restrictions on the use of radio equipment in fuel depots, chemical plants or where blasting operations are in progress.
- There may be a hazard associated with the operation of your Wireless MultiModem close to inadequately protected personal medical devices such as hearing aids and pacemakers. Consult the manufacturers of the medical device to determine if it is adequately protected.
- Operation of your Wireless MultiModem close to other electronic equipment may also cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.

Vehicle Safety

- Do not use your Router while driving, unless equipped with a correctly installed vehicle kit allowing 'Hands-Free' Operation.
- Respect national regulations on the use of cellular telephones in vehicles. Road safety always comes first.
- If incorrectly installed in a vehicle, the operation of router telephone could interfere with the correct functioning of vehicle electronics. To avoid such problems, be sure that qualified personnel have performed the installation. Verification of the protection of vehicle electronics should be part of the installation.
- The use of an alert device to operate a vehicle's lights or horn on public roads is not permitted.

Internal Lithium Battery

- A lithium battery located within product provides backup power for the timekeeping capability. The battery has an estimated life expectancy of ten years.
- When the battery starts to weaken, the date and time may be incorrect. If the battery fails, the board must be sent back to Multi-Tech Systems for battery replacement.
- Lithium cells and batteries are subject to the Provisions for International Transportation. Multi-Tech Systems Inc. confirms that the Lithium batteries used in the Multi-Tech product(s) referenced in this manual comply with **Special Provision 188 of the UN Model Regulations, Special Provision A45 of the ICAO-TI/IATA-DGR (Air), Special Provision 310 of the IMDG Code, and Special Provision 188 of the ADR and RID (Road and Rail Europe).**

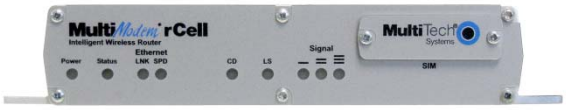
Warning! There is danger of explosion if the battery is incorrectly replaced!

Front Panel

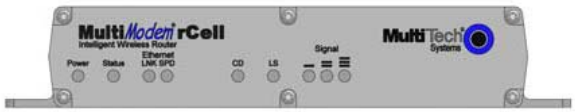
The front panel contains the following LEDs:

- Power and Status LEDs—The Power LED indicates that DC power is present. The Status LED blinks when the unit is functioning normally
- Two Ethernet LEDs—The two Ethernet LEDs indicate transmit and receive activity and connection speed of 10 or 100Mbps on the Ethernet link.
- Two modem LEDs—The two modem LEDs indicate carrier detection and link status.
- Three signal LEDs—The three signal LEDs display the signal strength level of the wireless connection.

The SIM door on the right side of the router provides access to the SIM card holder on the E1, G2, and H4 versions.



Model MTCBA-E1/G2/H4-EN2



Model MTCBA-C1/EV2-EN2

<table>
<tr><th colspan="5">LED Indicators</th></tr>
<tr><td>Power</td><td colspan="4">Indicates presence of DC power when lit.</td></tr>
<tr><td>Status</td><td colspan="4">The LED is a solid light when the rCell is booting up, saving the configuration, restarting, or updating the firmware. When the Status LED begins to blink, the router is ready.</td></tr>
<tr><td>LNK</td><td colspan="4">Link. Blinks when there is transmit and receive activity on the Ethernet link. It shows a steady light when there is a valid Ethernet connection.</td></tr>
<tr><td>SPD</td><td colspan="4">Speed. Lit when the Ethernet is linked at 100 Mbps. If it is not lit, the Ethernet is linked at 10 Mbps.</td></tr>
<tr><td>CD</td><td colspan="4">Carrier Detect. Lit when data connection has been established.</td></tr>
<tr><td>LS</td><td colspan="4">Link Status Dependent on Model</td></tr>
<tr><td></td><td>-E1 version* (AT^SSYNC=1)</td><td>G2 version</td><td>C1version</td><td>-H4 and EV2 versions</td></tr>
<tr><td></td><td>Permanently off. ME is in one of the following modes: Power Down mode, Airplane mode Non-Cyclic Sleep mode with no temporary wake-up event in progress.

600 ms on/600 ms off

Limited Network Service: No SIM card inserted or no PIN entered, or network search in progress or ongoing user authentication, or network login in progress.

75 ms on/3 sec off

Idle mode: The mobile is registered to the GSM network (monitoring control channels and user interactions). No call is in progress.

75 ms on/ 75 ms off/75 ms on/3 sec off

One or more GPRS contexts activated.

500 ms on/ 25 ms off

Packet switched data transfer in progress.

Permanently on

CSD call – Connected to remote party.</td><td>Permanently On: Not registered on network.

Flashing states:

200 ms on/2 sec off

Registered on network.

200 ms on/600 ms off

Registered on the network and communications in progress

100 ms on/200 ms off

Software downloaded is either corrupted or non-compatible (“bad software”)</td><td>Permanently On: Not registered on network.

Flashing states:

200 ms on/2 sec off

Registered on network.

200 ms on/600 ms off

Registered on the network and communications in progress

100 ms on/200 ms off

Software downloaded is either corrupted or non-compatible (“bad software”)</td><td>Permanently On: Powered on and connected, but not transmitting or receiving.

Slow flashing state (5 Seconds)

Powered on searching for a connection.

Fast flashing state (0.3 seconds) Transmitting and receiving.</td></tr>
<tr><td>Signal</td><td colspan="4">ALL OFF - Unit is off, not registered on network, or extremely week signal (0 < = RSSI < 6).

1 Bar “ON” – Very weak signal (7 < = RSSI <14)

1 Bar and 2 Bar “ON” – Weak signal (15 < = RSSI <23)

1 Bar, 2 Bar, and 3 Bar “ON” – Good signal (24 <= RSSI > = 31)</td></tr>
</table>

* To be accurate, the AT^SSYNC command must be set to 1 so that the factory default LED timings are used.

Package Contents

This section describes items in the MultiModem rCell package.

Your wireless provider supplies the SIM card.

Unbundled Package with No Accessories

1 router

Note: You supply mounting screws, AC or DC power supply, and an antenna.

Bundled Package with Accessories

1 router

1 antenna

1 Ethernet cable

1 RS-232 cable

1 power supply

Note: You supply mounting screws.

Specifications

Features	MTCBA-E1-EN2	MTCBA-C1-EN2	MTCBA-G2-EN2	MTCBA-H4-EN2	MTCBA-EV2-EN2
Performance	**EDGE:** E-GPRS Class 12, **GPRS:** Class 10	CDMA2000 1xRTT	GPRS Class 10	HSPA	CDMA2000 1xRTT EV-DO Rev. A
Band, Frequency	Quad-band GSM/GPRS/EDGE 850/900/1800/1900 MHz	Dual-band 800/1900 MHz CDMA; 800 MHz and 800/1900 MHz with R-UIM support	Quad-band GSM 850/900/1800/1900 MHz	HSUPA / HSDPA / UMTS Triple-band: 2100/1900/850 MHz with Rx diversity	Dual-band 800/1900 MHz CDMA; 800 MHz and 800/1900 MHz with R-UIM support
Packet Data	**EDGE:** E-GPRS Up to 240K bps, coding scheme MCS1-9, mobile station Class B, LLC layer, 4 time slots **GPRS:** Full PBCCH support, coding scheme 1-4, mobile station Class B	Up to 153.6K bps forward and reverse	Up to 85.6K bps, coding schemes CS1 to CS4	HSDPA data service of up to 7.2 Mbps HSUPA data service of up to 5.76 Mbps	Peak download 3.1 Mbps, peak upload 1.8 Mbps
Circuit-Switched Data	Up to 14.4K bps, non-transparent	IS-95A, IS-95B up to 14.4K bps forward and reverse	Up to 14.4K bps transparent and non-transparent	Up to 14.4K bps transparent and non-transparent	IS-95A, IS-95B up to 14.4K bps forward and reverse
Short Message Services-SMS	Text & PDU, Point-to-Point (MO/MT), cell broadcast	Text & PDU, Point-to-Point (MO/MT), cell broadcast	Text & PDU, Point-to-Point, cell broadcast	Text & PDU, Point-to-Point (MO/MT), cell broadcast	Text & PDU, Point-to-Point (MO/MT), cell broadcast
Antenna Connector	RF Antenna: 50 ohm SMA (female connector)	RF Antenna: 50 ohm SMA (female connector)	RF Antenna: 50 ohm SMA (female connector)	RF Antenna: 50 ohm SMA (female connector)	RF Antenna: 50 ohm SMA (female connector)
SIM Connector	Standard 1.8 and 3V SIM receptacle	-	Standard 1.8 and 3V SIM receptacle	Standard 1.8 and 3V SIM receptacle	-
RS232 Connector	DE9				
Power Connector	2.5mm miniature (screw-on)				
Voltage	9V to 32 VDC				
Physical Description	7”W x 1.24”H x 2.93”D 0.75lbs 17.78cmW x3.15cmH x7.44cmD 0.340Kg				
Operating Temperature *	-35° to +75° C*	-40° to +85° C*	-40° to +85° C*	-30° to +60° C*	-40° to +75° C*
Storage Temp	-40° to +85° C				
Humidity	Relative humidity 20% to 90% noncondensing				
Certifications	**EMC Compliance** FCC Part 15 EN55022 EN55024 **Radio Compliance**	**EMC Compliance** FCC Part 15 **Radio Compliance** FCC Part 22, 24 RSS132,133	**EMC Compliance** FCC Part 15 EN55022 EN55024 **Radio Compliance**	**EMC Compliance** FCC Part 15 EN55022 EN55024 **Radio Compliance**	**EMC Compliance** FCC Part 15 **Radio Compliance** FCC Part 22, 24 RSS132,133

Features	MTCBA-E1-EN2	MTCBA-C1-EN2	MTCBA-G2-EN2	MTCBA-H4-EN2	MTCBA-EV2-EN2
	FCC Part 22, 24 RSS132,133 EN301 489-1 EN489-3 (-GP only) EN301 489-7 EN301 511 AS/ACIF S042.1, S042.3 **Safety:** UL60950-1 cUL60950-1 IEC60950-1 **Network:** PTCRB	**Safety:** UL60950-1 cUL60950-1 IEC60950-1 **Network:** CDG 1&2	FCC Part 22, 24 RSS132,133 EN301 489-1 EN489-3 (-GP only) EN301 489-7 EN301 511 AS/ACIF S042.1, S042.3 **Safety:** UL60950-1 cUL60950-1 IEC60950-1 AS/NZS60950-1 **Network:** PTCRB	FCC Part 22, 24 RSS132,133 EN301 489-1 EN489-3 (-GP only) EN301 489-7 EN301 511 AS/ACIF S042.1, S042.3 **Safety:** UL60950-1 cUL60950-1 IEC60950-1 **Network:** PTCRB	**Safety:** UL60950-1 cUL60950-1 IEC60950-1 **Network:** CDG 1&2

* UL Listed @ 40° C, limited by power supply. UL Certification does not apply or extend to an ambient above 40° C and has not been evaluated by UL for ambient greater than 40° C.

" UL has evaluated this device for use in ordinary locations only. Installation in a vehicle or other outdoor locations has not been evaluated by UL. UL Certification does not apply or extend to use in vehicles or outdoor applications or in ambient above 40° C."

Power Specifications

MTCBA-E1-EN2	MTCBA-C1-EN2	MTCBA-G2-EN2	MTCBA-H4-EN2	MTCBA-EV2-EN2
Sleep:0.175A,1.6W@9V, 0.090A,1.8W@ 20V, 0.060A,1.9W @ 32V **Typical:** 0.277A, 2.5W@9V, 0.133A, 2.7W@ 20V, 0.089A, 2.8W @ 32V **Max:** 0.506A, 4.5W @ 9V, 0.240A, 4.8W @ 20V, 0.150A, 4.8W @ 32V **Peak:** 2.50A @ 9V, 1.00A @ 20V, 0.60A @ 32V	**Sleep:** 0.186A,1.7W @ 9V, 0.091A,1.8W @ 20V, 0.061A, 2.0W @ 32V **Typical:** 0.283A, 2.6W @ 9V, 0.137A, 2.7W @ 20V, 0.088A, 2.8W @ 32V **Max:** 0.457A, 4.1W, @ 9V, 0.214A, 4.3W, @ 20V, 0.138A, 4.4W @ 32V	**Sleep:**0.163A,1.5W @ 9V, 0.082A,1.6W @ 20V, 0.055A,1.8W @ 32V **Typical:** 0.240A, 2.2W @ 9V, 0.114A, 2.3W @ 20V, 0.077A, 2.5W @ 32V **Max:** 0.340A, 3.0W @ 9V, 0.153A, 3.1W @ 20V, 0.100A, 3.2W @ 32V **Peak:** 1.300A @ 9V,0.518A @ 20V, 0.343A @ 32V	**GSM 850** **Sleep** 0.205A, 1.89W @9v, 0.110A, 2.20W @20v, 0.068A, 2.18W @32v **Typical** 0.240A, 2.21W @9v, 0.114A, 2.28W @20v, 0.077A, 2.46W @32v **Max** 0.429A, 3.91W @9v, 0.153A, 3.06W @20v, 0.100A, 3.20W @32v **Peak** 2.50A @9v, 0.812A @20v, 0.500A @32v **HSPA** **Sleep** 0.205A, 1.89W @9v, 0.110A, 2.20W @20v, 0.068A, 2.18W @32v **Typical** 0.480A, 4.38W @9v, 0.230A, 4.60W @20v, 0.148A, 4.74W @32v **Max** 0.640A, 5.79W @9v, 0.290A,	**CDMA2000** **Sleep** 0.125A, 1.15W @9v, 0.060A, 1.20W @20v, 0.044A, 1.41W @32v **Typical** 0.215A, 1.98W @9v, 0.130A, 2.60W @20v, 0.085A, 2.72W @32v **Max** 0.600A, 5.45W @9v, 0.297A, 5.94W @20v, 0.195A, 6.05W @32v **EV-DO** **Sleep** 0.125A, 1.15W @9v, 0.060A, 1.20W @20v, 0.044A, 1.41W @32v **Typical** 0.335A, 3.08W @9v, 0.190A, 3.30W @20v, 0.125A, 4.00W @32v **Max** 0.672A, 6.10W @9v, 0.320A, 6.40W @20v, 0.204A, 6.53W @32v

			5.80W @20v, 0.190A, 6.08W @32v	
MTCBA-E1-EN2-GP **Sleep:**0.188A,1.7W @ 9V, 0.095A,1.9W @ 20V, 0.061A,1.9W @ 32V **Typical:** 0.297A, 2.7W @ 9V, 0.138A, 2.8W @ 20V, 0.092A, 2.9W @ 32V **Max:** 0.513A, 4.5W @ 9V, 0.240A, 4.8W @ 20V, 0.152A, 4.8W @ 32V **Peak:** 2.50A@ 9V, 1.000A@ 20V, 0.625A@ 32V	MTCBA-C1-EN2-GP **Sleep:** 0.186A,1.7W @ 9V, 0.091A,1.8W @ 20V, 0.061A,2.0W @ 32V **Typical:** 0.384A, 3.5W @ 9V, 0.193A, 3.9W @ 20V, 0.122A, 3.9W @ 32V **Max:** 0.541A, 4.8W, @ 9V, 0.256A, 5.1W, @ 20V, 0.162A, 5.2W @ 32V	MTCBA-G2-EN2-GP **Sleep:**0.195A,1.8W @ 9V, 0.099A,2.0W @ 20V, 0.066A,2.1W @ 32V **Typical:** 0.285A, 2.6W @ 9V, 0.136A, 2.7W @ 20V, 0.093A, 3.0W @ 32V **Max:** 0.408A, 3.7W @ 9V, 0.183A, 3.7W @ 20V, 0.120A, 3.8W @ 32V **Peak:** 2.25A @ 9V, 0.960A@ 20V, 0.650A @ 32V	**1.** MTCBA-H4-EN2-GP **GSM 850** **Sleep** 0.270A, 2.48W @9v, 0.130A, 2.60W @20v, 0.087A, 2.78W @32v **Typical** 0.320A, 2.94W @9v, 0.160A, 3.20W @20v, 0.104A, 3.33W @32v **Max** 0.590A, 5.37W @9v, 0.280A, 5.60W @20v, 0.180A, 5.76W @32v **Peak** 2.50A @9v, 0.812A @20v, 0.500A @32v **HSPA** **Sleep** 0.270A, 2.48W @9v, 0.130A, 2.60W @20v, 0.087A, 2.78W @32v **Typical** 0.540A, 4.93W @9v, 0.265A, 5.30W @20v, 0.172A, 5.50W @32v **Max** 0.780A, 7.06W @9v, 0.370A, 7.40W @20v, 0.240A, 7.68W @32v	**2.** MTCBA-EV2-EN2-GP **CDMA2000** **Sleep** 0.245A, 2.26W @9v, 0.125A, 2.50W @20v, 0.083A, 2.66W @32v **Typical** 0.340A, 3.12W @9v, 0.166A, 3.32W @20v, 0.110A, 3.52W @32v **Max** 0.690A, 6.27W @9v, 0.330A, 6.60W @20v, 0.210A, 6.72W @32v **EV-DO** **Sleep** 0.0465A, 2.27W @9v, 0.125A, 2.50W @20v, 0.238A, 7.62W @32v **Typical** 0.370A, 3.40W @9v, 0.220A, 4.40W @20v, 0.145A, 4.64W @32v **Max** 0.780A, 7.13W @9v, 0.374A, 7.48W @20v, 0.385A, 7.62W @32v

Note: Multi-Tech Systems, Inc. recommends that the customer incorporate a 10% buffer into their power source when determining product load.

RF Specifications

	GSM 850	EGSM 900	GSM 1800	GSM 1900	CDMA 800	CDMA 1900
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1800 MHz	1930 to 1990 MHz	869 to 894 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz	824 to 849 MHz	1850 to 1910 MHz
RF Power Stand	2W at 12.5% duty cycle	2W at 12.5% duty cycle	1W at 12.5% duty cycle	1W at 12.5% duty cycle	-	-

Cellular Information

Antenna System for Cellular Devices

The cellular/wireless performance depends on the implementation and antenna design. The integration of the antenna system into the product is a critical part of the design process; therefore, it is essential to consider it early so the performance is not compromised. If changes are made to the certified antenna system of the MultiModem, then recertification is required by specific network carriers such as Sprint. The Antenna System is defined as the UFL connection point from the MultiModem to the specified cable specifications and specified antenna specifications.

PTCRB Requirements for the Antenna

There cannot be any alteration to the authorized antenna system. The antenna system must maintain the same specifications. The antenna must be the same type, with similar in-band and out-of-band radiation patterns.

FCC Requirements for the Antenna

The antenna gain, including cable loss, for the radio you are incorporating into your product design must not exceed the requirements at 850 MHz and 1900 MHz as specified by the FCC grant for mobile operations and fixed mounted operations as defined in 2.1091 and 1.1307 of the FCC rules for satisfying RF exposure compliance. The antenna used for transmitting must be installed to provide a separation distance of at least 20cm from all persons and must not transmit simultaneously with any other antenna transmitters. User and installers must be provided with antenna installation instructions and transmitter operating conditions to satisfying RF exposure compliance.

Antenna Specifications

CDMA RF Specifications

	CDMA 800	CDMA 1900
Frequency RX	869 to 894 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	1850 to 1910 MHz

CDMA Antenna Requirements/Specifications

Frequency Range	824 – 894 MHz / 1850 – 1990 MHz
Impedance	50 Ohms
VSWR	VSWR shall not exceed 2.0:1 at any point across the bands of operation
Typical Radiated Gain	3 dBi on azimuth plane
Radiation	Omni-directional
Polarization	Vertical
Antenna Loss	Free space not to exceed -3dB
TRP/TIS	The total radiated power (TRP) at the antenna shall be no less than +21/20 dBm for PCS/CELL channels respectively, and the total isotropic sensitivity (TIS) at the antenna shall be no less than -104/104 dBm for PCS/CELL channels respectively.

GSM/EGSM RF Specifications

	GSM 850	EGSM 900	GSM 1800	GSM 1900
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz

GSM Antenna Requirements/Specifications

Frequency Range	824 – 960 MHz / 1710 – 1990 MHz
Impedance	50 Ohms
VSWR	VSWR shall not exceed 2.0:1 at any point across the bands of operation
Typical Radiated Gain	3 dBi on azimuth plane
Radiation	Omni-directional
Polarization	Vertical
Antenna Loss	Free space not to exceed -3db
TRP/TIS	Including cable loss the total radiated power (TRP) at the antenna shall be no less than +22/24.5 dBm for 850/1900 MHz respectively, and the total isotropic sensitivity (TIS) at the antenna shall be no less than -99/101.5 dBm for 850/1900 MHz respectively.

GPS (Global Positioning) RF Specifications

	GPS L1
Frequency RX	1575.42
LNA Bias Voltage	5V
LNA Current Consumption	40mA Max

GPS Antenna Requirements/Specifications

Frequency	1575MHz
Impedance	50 Ohms
VSWR	1.5db
Input voltage	3.0V +/- 0.3V
GPS TIS	The total isotropic sensitivity (TIS) at the antenna shall be no less than 47 dBm

Global Positioning System (GPS)

Point the GPS toward the sky, as the GPS antenna needs to find the satellites that provide location information.

Technical Specifications

Receiver Type	L1 Frequency, GPS C/A code, SBAS Capable, 51 Channel Acquisitions, 14 Channel Tracking
Accuracy	Position 2.5m CEP, Velocity 0.1m/sec
Open Sky TTFF	Hot start 1 second, Cold start 29 seconds average, Reacquisition <1s
Sensitivity Tracking	-161dBm
Update Rate	1 Hz standard
Dynamics	4G
Operational Limits	Altitude <18,000m or Velocity < 515m/s
Datum	Default WGS-84
Interface	UART
Protocol	NMEA-0183, V3.01, GGA, GLL, GSA, GSV, RMC, VTG

Global Positioning System (GPS) – Underwriters Laboratories, Inc. Statement

Underwriters Laboratories Inc. (“UL”) has not tested the performance or reliability of the Global Positioning System (“GPS”) hardware, operating software or other aspects of this product. UL has only tested for fire, shock or casualties as outlined in UL’s Standard(s) for Safety.UL60950-1 Certification does not cover the performance or reliability of the GPS hardware and GPS operating software. UL MAKES NO REPRESENTATIONS, WARRANTIES OR CERTIFICATIONS WHATSOEVER REGARDING THE PERFORMANCE OR RELIABILITY OF ANY GPS RELATED FUNCTIONS OF THIS PRODUCT.

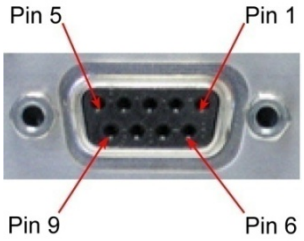
RS232 9-Pin Functions of the Female End Connector

The following table explains the pin functions.

External Power	
Signal	**IN/OUT**
Pin 1 CD	O
Pin 2 RX	O
Pin 3 TX	I
Pin 4 DTR	I
Pin 5 GND	--
Pin 6 DSR*	O
Pin 7 RTS	I
Pin 8 CTS	O
Pin 9 RI	O

Serial Cable

Female Connector



Note: The DSR signal on pin 6 is always asserted by the router.

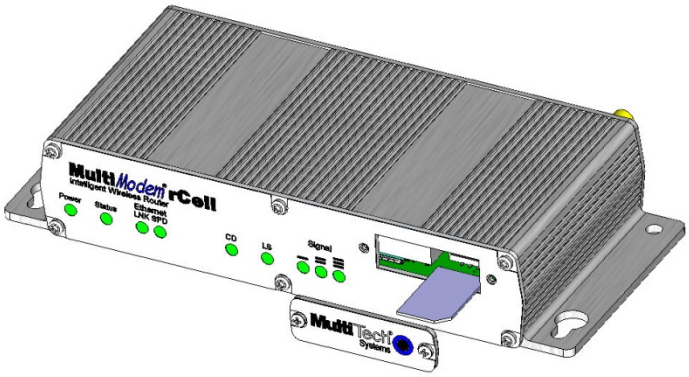
Chapter 2 – Installing the Router

Inserting the SIM Card into Holder, for GSM Network Access

The router requires the power supply connection to begin operation. It also requires a SIM card (Subscriber Identity Module) to operate on a GSM network. To install the SIM, do the following:

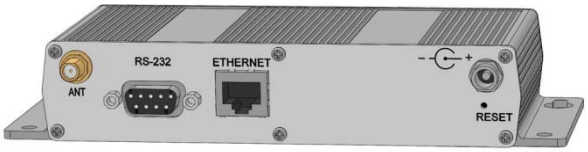
1. Using a small Phillips screwdriver, remove the two SIM door screws and remove the SIM door.

   Note: When changing a SIM, ensure that power is removed from the unit.

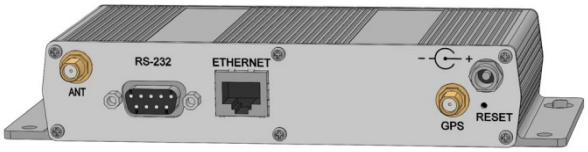


2. Insert the SIM card into the card holder. The above graphic illustrates the correct SIM card orientation.
3. Verify that the SIM card fits into the holder properly and then replace the cover.

Making the Connection

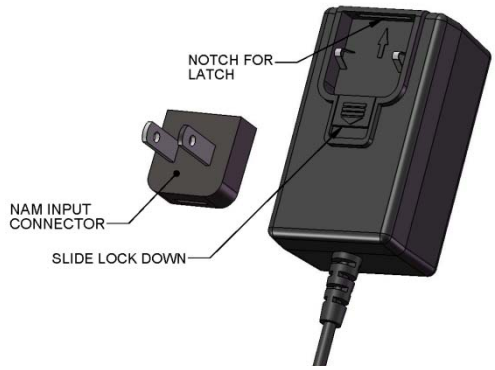


MTCBA-XX-EN2



MTCBA-XX-EN2-GP (GPS antenna)

1. Connect a suitable antenna to the SMA connector (see antenna specifications in Chapter 1)
2. Optional: If you have the GPS version, connect a suitable GPS antenna to the GPS connector. Ensure that when you position the GPS antenna, the antenna can see the sky to locate the satellites for accurate values.
3. Using an Ethernet cable, connect one end of the cable to the ETHERNET connector on the back of the router and the other end to your computer either directly or through a switch or hub.
4. If you are connecting a customer's serial legacy device to the router, connect the serial, RS-232 cable from the customer's device to the RS232 connector on the back of the router.
5. Depending on the power source, connect either the power supply module with the appropriate blade or the optional DC power cable. If you are using the power supply module, remove the protective shipping cover. Attach the appropriate interchangeable blade piece to the power supply module.



6. Screw on the power lead from the power supply module into the power connection on the router. Plug the power supply into your power source.

Using Optional Direct DC Power

1. Screw-on the DC power cable to the power connector on the router.
2. Then attach the two wires at the other end of the DC power cable to a DC fuse/terminal block in which you are mounting the router.
3. Connect the red wire to the "+" (positive) terminal and the black wire to the "–" (negative) terminal. Be sure the GND connection is correct.

Warning: Over-voltage protection is provided on the device. To ensure complete protection, you may want to add additional filtering to the DC input.

Notes:

- For an application involving a battery: you can use permanent “+” or key-switched “+” source. Connect the power supply to its source (for example, in a mobile situation, to the DC fuse/terminal block).
- The **POWER** LED. The **POWER** LED lights after power-up.
- The **Status** LED is a solid ON when the router is booting up, saving a configuration, or updating firmware. When the **Status** LED begins to blink, the router is ready.

Using the Reset Button

Press and hold in the **Reset** button until the Status Light goes out. Then release the button. This sets the username and password back to admin and admin, as well as sets the IP address to the default of 192.168.2.1.

Powering Down and Resetting Hardware for MTCBA-C1 Router

Before you turn off power to the router, and before you reset the hardware, it is recommended you complete the following sequence.

The shutdown sequence informs the network that the mobile station is going offline, and saves critical data to the module‘s non-volatile memory (flash).

1. Issue the following command:

   AT+CFUN=0 (issue this command)

2. Wait for this response from the modem

   +WIND:10 ()

You can now power off the router or reset it.

If you do not see the +WIND:10 response, you may need to activate the unsolicited message by using the command AT+WUSLMSK=00020000,0

Optional – Attaching the Router to a Flat Surface

Before you mount your router to a permanent surface, verify signal strength. For more information, refer to Verify Signal Strength in this chapter.

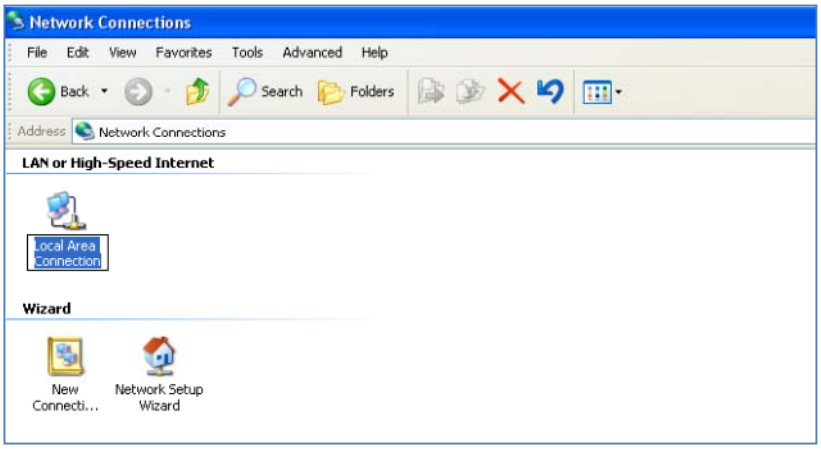
The router can be panel mounted with screws spaced according to the measurement shown.

Note: Use either #6 or #8 pan head screws for all four mount locations.

Setting TCP/IP Address

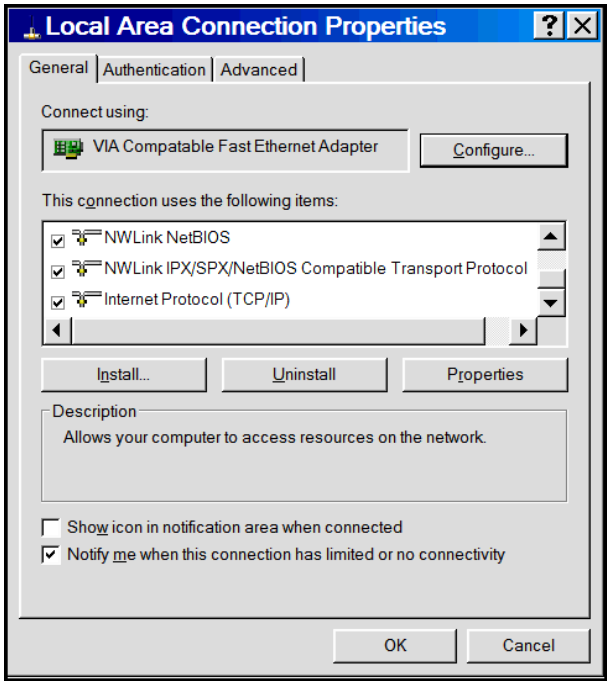
This section describes how to configure a TCP/IP address so the computer can communicate with the router.

1. From the **Start** menu, select **Control Panel**. In the window that opens, double-click **Network Connections**. The **Network Connections** window opens.

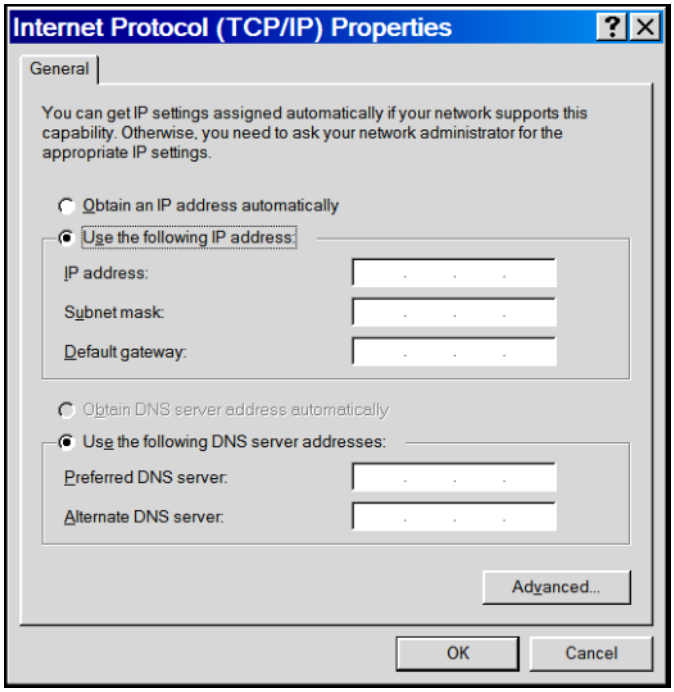


2. Right-click **Local Area Connection**. From the menu that appears, select **Properties**.

   The Local Area Connection Properties window opens.



3. Select **Internet Protocol [TCP/IP]**.
4. Click **Properties**. The Internet Protocol (TCP/IP) Properties window opens.



Note: If this window displays your current IP configuration, it is recommended that you record this information for future reference. This information is handy, for example, if you want to return the computer to its original settings.

Setting a Static IP Address

To set a static IP address:

1. Select **Use the following IP address**.
2. In the IP address field type the IP address of the computer, for example 192.168.2.x.

   Note: The **x** in the address stands for numbers 101 and up.
3. In the **Subnet mask** field, type the number of the subnet mask, for example: 255.255.255.0
4. In the **Default Gateway** field, type the default gateway, for example, 192.168.2.1

   Note: The computer settings must be in the same subnet range as the router.

   The factory default settings for the router are:

   IP Address: 192.168.2.1

   Subnet Mask: 255.255.255.0
5. Select **Use the following DNS server addresses**.

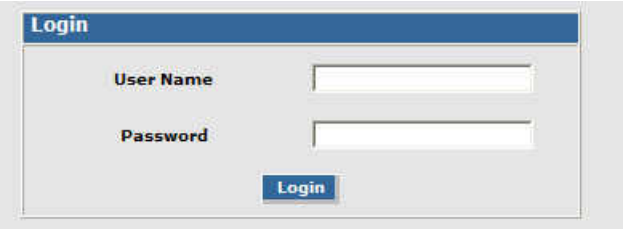
   a. Enter the IP Address for the Preferred DNS Server. Example: 205.171.3.65

   b. Click **OK**.
6. To close the Local Area Properties window, click **OK**.
7. Close the Control Panel.
8. Repeat these steps for each computer on your network.

Configuring Ethernet Interface

You use the router's factory-installed Web Management software to configure the Ethernet interface. Access this software using a Web browser.

1. Ensure that the Status LED is blinking, indicating that the router is ready.
2. On the computer, open a Web browser
3. In the browser's address field, type the default Gateway Address: http://192.168.2.1
4. After entering the Address, the **Login** page opens.



   a. In the **User Name** field, type the default user name: **admin** (all lower-case).

   b. In the **Password** field, type the default password: **admin** (all lower-case).

   c. Click **Login**. The Web Management Home page opens.

   The user name and password are case-sensitive. You must use lower-case for both.

   A password can be up to 12 characters. If Windows displays the **AutoComplete** message, click **No** so that the operating system does not remember the password. This helps maintain computer security.

   It is recommended that you change the default password to better protect the security of your router. Use a safe password.

Quickly Configuring the Router by Using Wizard Setup

The Wizard Setup tool helps you quickly configure the router. Benefits of using this tool include:

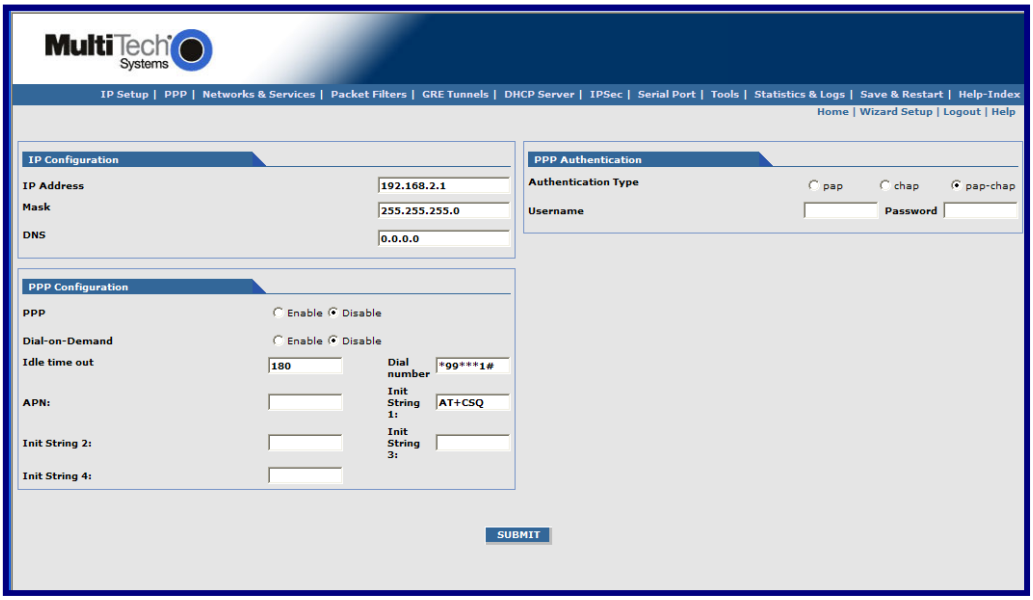
- Saves time by allowing you to configure the basic setup in one place.
- The information entered defaults to other windows that require this information.
- Lets you enter and save information needed to create a connection to the Internet.

This section describes how to configure the basic parameters to start using your router. You can configure more than the basics by using other features of the Web Management software. For more information, see Chapter 3.

To use Wizard Setup to setup basic router features:

1. From the Web Management software's menu bar, select **Wizard Setup**.

2. The Wizard Setup page opens, where a minimum router configuration is provided.



The table that follows describes the basic parameters you need to set before you can connect to the Internet.

IP Configuration	
IP Address	The default is 192.168.2.1. To change it, type a new IP address.
Mask	The default is 255.255.255.0
DNS	Enter the primary DNS IP address for the system. The default is 0.0.0.0
PPP Configuration	
PPP	The default is **disable**. To connect to the Internet, you need to enable PPP. Depending on the model, commands may need to be issued to the integrated cellular modem before connecting to the wireless service. To issue commands to the integrated cellular modem, PPP must be disabled and telnet port 5000 used.
Dial-on-Demand	The default is **disable**.
Idle Time Out	Sets the time the PPP link stays active before disconnecting. Setting the value to zero causes the link to stay active continuously.
Dial Number	Enter the dial number. This number connects you to the Internet. For GSM, the number is *99***1#. For CDMA, the Dial Number is **#777**.
APN	For GSM models, enter the APN (Access Point Name). Your wireless service provider assigns the APN. If you don't know the name, ask your provider for it. An access point is an IP network to which a MultiModem rCell Router connects. The Web Management software asks for the APN on the Wizard Setup and the PPP screen. For CDMA models, the APN does not apply.
Init String	You can set up to 4 router initialization strings.
PPP Authentication	
Authentication Type	Select the radio button of the authentication protocol used to negotiate with the remote peer: PAP, CHAP, or PAP-CHAP. The default is PAP-CHAP
Username	Enter the PPP Username. This name authenticates the remote peer.
Password	Enter the PPP Password. This password authenticates the remote peer.

3. To save changes, click **Submit**.

4. To cause your changes to go into effect, from the Menu bar, click **Save & Restart**. The router reboots.

   You don't need to click **Save & Restart** after every change you make. You can submit several changes on various pages, and then click **Save & Restart**.

Verifying Signal Strength

This section describes how to verify signal strength by using telnet to communicate directly with the modem.

Before You Begin

- Ensure that the Status LED is blinking, indicating that the router is ready.
- Ensure that PPP is disabled.

To verify signal strength:

1. Use one of the following methods to open a command prompt:
   - From the Start menu, select Run. In the Open window, enter cmd and then press ENTER.
   - From the **Start** menu, select **All Programs, Accessories**, **Command Prompt**
2. In the command window, type **telnet 192.168.2.1 5000**
3. At the Login prompt, type the default user name: **admin** (all lower-case). Press **ENTER**
4. At the Password prompt, type the default password: **admin** (all lower-case). Press **ENTER**
5. In the command window, type **AT+CSQ** . The router responds with the received signal strength (rssi).

Signal Strength – RSSI	
10 – 31	Sufficient
0 – 9	Weak or Insufficient
99	Insufficient

6. To find the best location in which to run the router, check the signal from a few different locations.

Verifying Provider Fees

Your provider charges you for data usage so be aware of your payment obligations. If you use the router for large data transfers, Multi-Tech recommends an unlimited data plan with your account. Multi-Tech is not responsible for any charges relating to your cellular bill.

Activating an Account for Wireless Devices

See Multi-Tech's Cellular Activation Website at http://www.multitech.com/activation.go for information on activating your cellular modem.

Setting Up the Account to Enable Remote Configuration

You can remotely configure the MultiModem over the Internet if your wireless provider has provisioned some features for you.

- Make sure your wireless network provider has provisioned for mobile terminated data.
- The provider also needs to setup a fixed or dynamic public IP address to which the network can redirect any incoming connection.

Chapter 3 - Using the WEB Management Software

This chapter describes how to configure the router by using the Web Management software.

Software Interface Overview

This section explains the menu structure and the navigation buttons of the router's Web Management software.

Menu Bar Overview

You can select the following items from the menu bar:

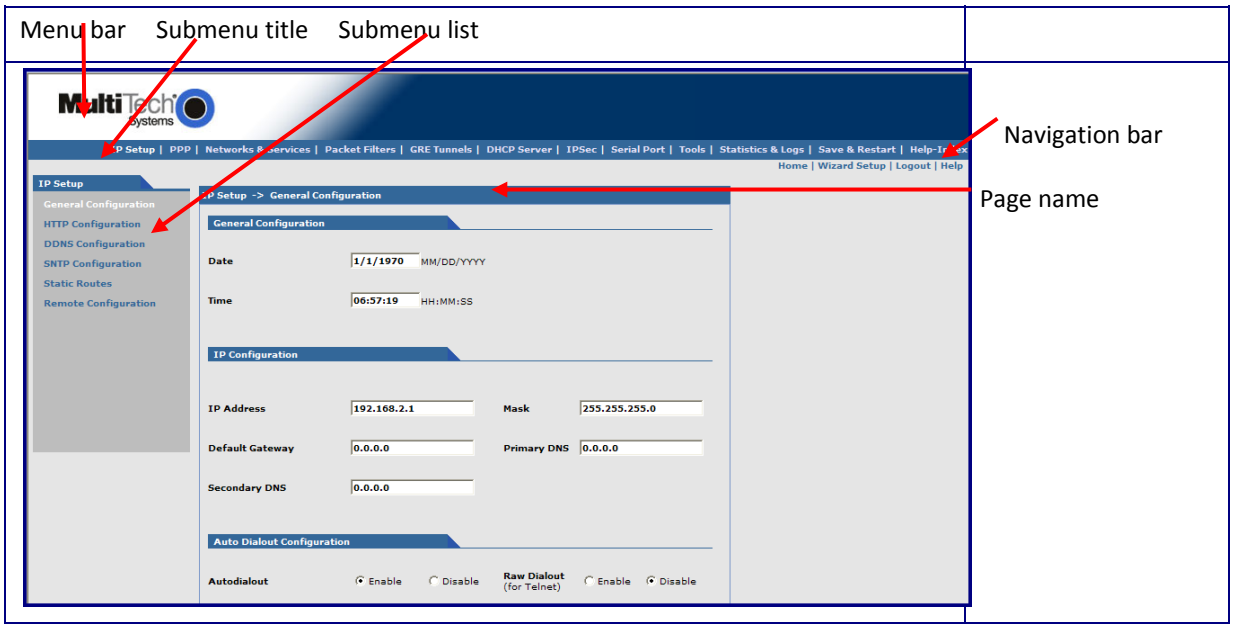
IP Setup	Sets up a General Configuration, HTTP, DDNS, SNTP, Static Routes, and Remote Configuration.
PPP	Used to configure the PPP authentication, dial-on-demand, router authentication, and Wakeup on Call.
Networks & Services	Used to configure networks and services to make them available to other functions such as allowed packet filters, static routes, remote configuration, DNAT, and GRE tunnels and routes.
Packet Filters	Defines filter rules, DNAT configuration, and ICMP rules.
GRE Tunnels	Used to define Generic Routing Encapsulation (GRE). Defines the remote network and the tunnel through which traffic is routed.
DHCP Server	Used to configure the DHCP server settings.
IPSec	Allows the device to support LAN-to-LAN VPN tunneling with 3DES and AES 128-192-256 encryption support
Serial Port	Adds support for RS-232 serial port so that Ethernet and legacy serial devices can share the same cellular connection.
Tools	Sets DDNS Force Update, displays DDNS Status, resets the modem, and provides interfaces for Firmware Upgrade, Load Configuration, and Save Configuration.
Statistics & Logs	Shows statistics and logs maintained by the router.
Save & Restart	Saves your settings and reboots your router.
Help Index	Opens the online Help file.

Submitting, Saving and Restarting Overview

Nearly every page of the software's interface includes a Submit button. This button allows you to save changes you make to the software pages and their parameters.

To ensure your changes go into effect, you must eventually use **Save & Restart**, located on the Menu bar. You do not need to click Save& Restart after each change you make. You can change several areas, and then click Save & Restart.

Overview of the Web Management Software's Interface



Navigation bar

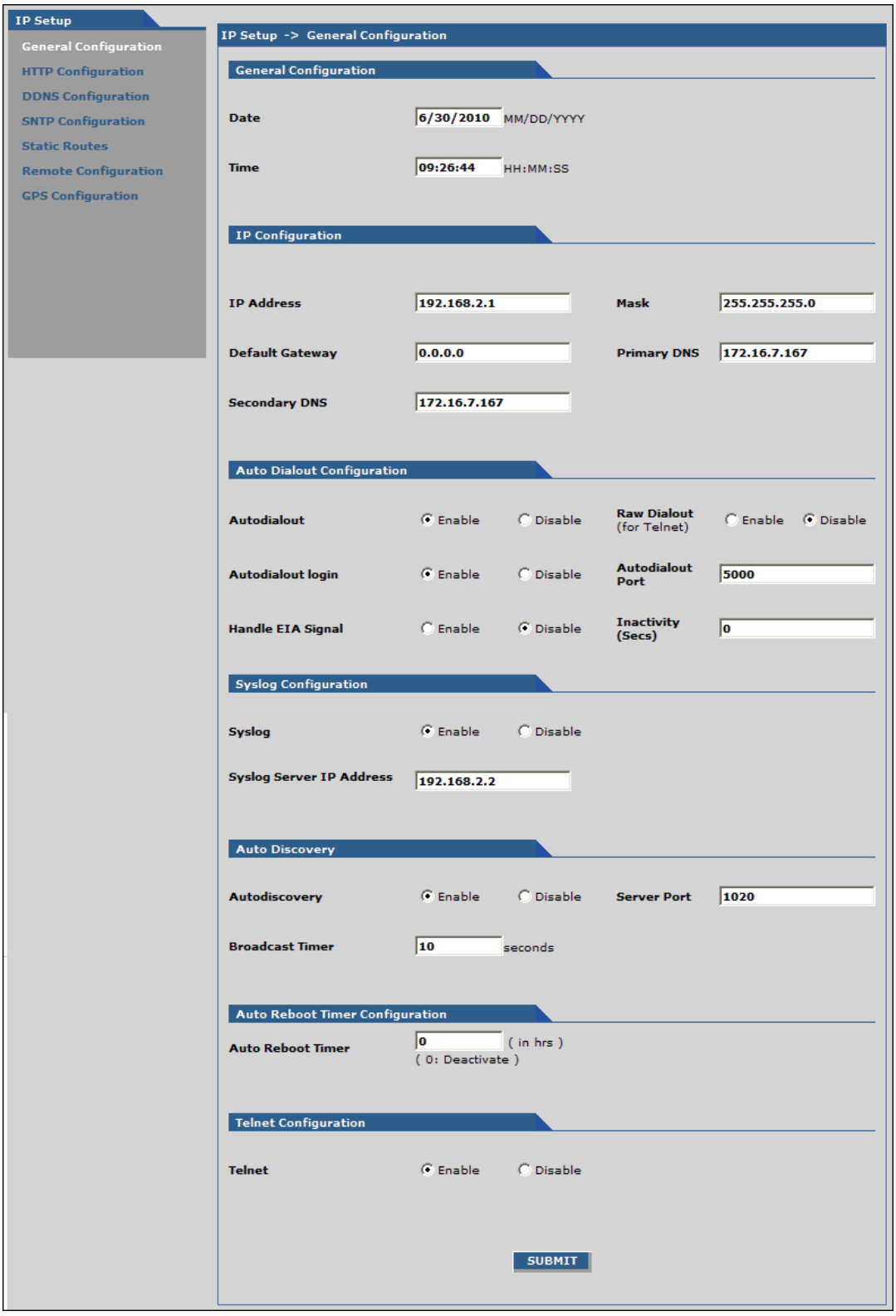
Home	To return to the home page, click **Home**.
Wizard Setup	To use the Wizard Setup tool for quick set up of your MultiModem, click Wizard Setup. This tool helps you configure basic settings needed to run the rCell Router.
Logout	To log out of the software, click **Logout**. You return to the login screen.
Help	To open an online help file, click **Help**.

Submenus

The submenus display on the left side of the page. The following table lists the submenu selections under each main menu category.

IP Setup	PPP	Networks & Services	Packet Filters	GRE Tunnels
General Configuration HTTP Configuration DDNS Configuration SNTP Configuration Static Routes Remote Configuration GPS Configuration	PPP Configuration Wakeup on Call Power On Config Modem Commands	Network Configuration Service Configuration	Packet Filters DNAT Configuration Advanced	GRE Tunnels GRE Routes
DHCP Server	**IPSec**	**Serial Port**	**Tools**	**Statistics & Logs**
Subnet Settings Fixed Addresses	IP Sec	Serial Port Settings Client Settings Server Settings	Tools Firmware Upgrade Load Configuration Save Configuration	SysInfo Ethernet PPP PPP Trace DHCP Statistics GRE Statistics Modem Info Service Status TCP/UDP Client Live Log TCP/UDP Server Live Log IPSec Live Log IPSec Log Traces

IP Setup, General Configuration Parameters



General Configuration Group

In the General Configuration group , set the general system-based parameters.

Date The system date: **MM/DD/YYYY**

Time **HH:MM:SS**. A real time clock is part of SNTP to display proper time.

IP Configuration Group

Use the IP Configuration group to configure the Ethernet interface. If desired see Appendix A for a table of commonly supported subnets.

IP Address (Default is 192.168.2.1),

Mask (Default 255.255.255.0),

Default Gateway (Default 0.0.0.0),

Primary DNS (Default 0.0.0.0),

Secondary DNS (Default 0.0.0.0).

Auto Dial out Configuration Group

Auto Dialout Check the box to enable or disable Auto Dialout. Default is Enable. The Auto Dialout settings allow you to use the integrated cellular modem directly with no router functions. This is accomplished using redirector software on your computer. This software creates a virtual serial port allowing your computer to communicate with the integrated cellular modem over IP using telnet.

Raw Dialout Check the box to enable or disable raw mode for an Auto Dialout session. Default is Disable.

Auto Dialout Login Check the box to enable or disable Auto Dialout Login feature. Default is Enable. The Auto Dialout port is the telnet port used by the redirector software on your computer to communicate to the integrated cellular modem.

Auto Dialout Port Enter the serial Auto Dialout Port number. Default is 5000.

Handle EIA Signal Check the box to enable or disable the EIA standard signal characteristics (time and duration) used between different electronic devices.

Inactivity Enter the seconds that the auto dialout session stays active before going inactive.

Syslog Configuration Group

Syslog Check the box to enable or disable Syslog. Default is Disable.

Syslog Server IP Address If a Remote Syslog Server IP Address is specified, the syslog feature acts as a remote Syslog.

Auto Discovery Group

Auto Discovery Check the box to enable or disable Auto Discovery to broadcast (MAC level), the MAC Address, IP Address, and DHCP information to the configured server port. Default is Enable. The router sends a broadcast packet on the specified server port every 10 seconds or whatever interval the broadcast timer is set to.

Server Port Enter the Server Port Number. Default port is 1020.

Broadcast Timer Enter the amount of time in seconds for the auto-discovery packet granularity of periodic broadcasting. Default is 10 seconds.

Auto Reboot Timer Configuration Group

Auto Reboot Timer: Enter the hours that lapse between each automatic reboot. The default of zero deactivates the timer. Range is 0 to 999.

Telnet Configuration Group

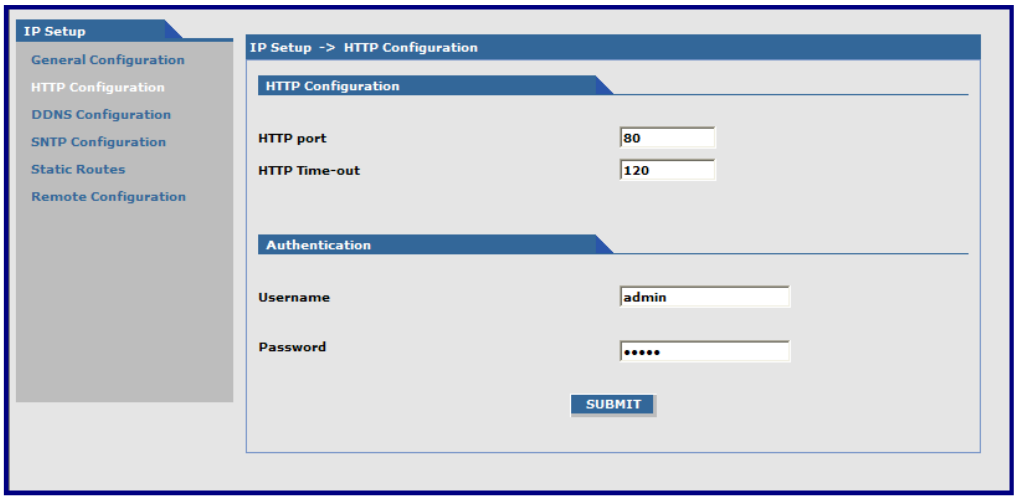
Enables or disables the Telnet port. The default is Enable. This is specifically for telnet port 23 for technical support debug. You can still access the integrated cellular modem using port 5000 when this is disabled. Ensure that PPP is also disabled before telnetting to the port.

Submitting and Saving Your Changes

Click **Submit** to save these settings.

Click **Save and Restart** after you complete and submit all the pages where you changed parameters.

IP Setup, HTTP Configuration Parameters



HTTP Configuration Group

HTTP Port Enter the port number on which the HTTP server listens for requests. The default is 80.

HTTP Time-Out Set the HTTP session in seconds. The default is 120 seconds.

Authentication Group

Use the Authentication group to change the user name and password. The Username and password combination provide access the Web Management software, as well as telnet access to the router and integrated cellular modem.

Username Enter the name of a user who is allowed access to the Web Management software. Default is **admin**.

Password Enter the Password associated with the user who is allowed access to the Web Management software. Default is **admin**. It can be up to100 characters. Use a safe password. Your first name spelled backwards is not a sufficiently safe password; a password similar to xfT35$4 is better.

Submitting and Saving Your Changes

To save these settings, click **Submit**.

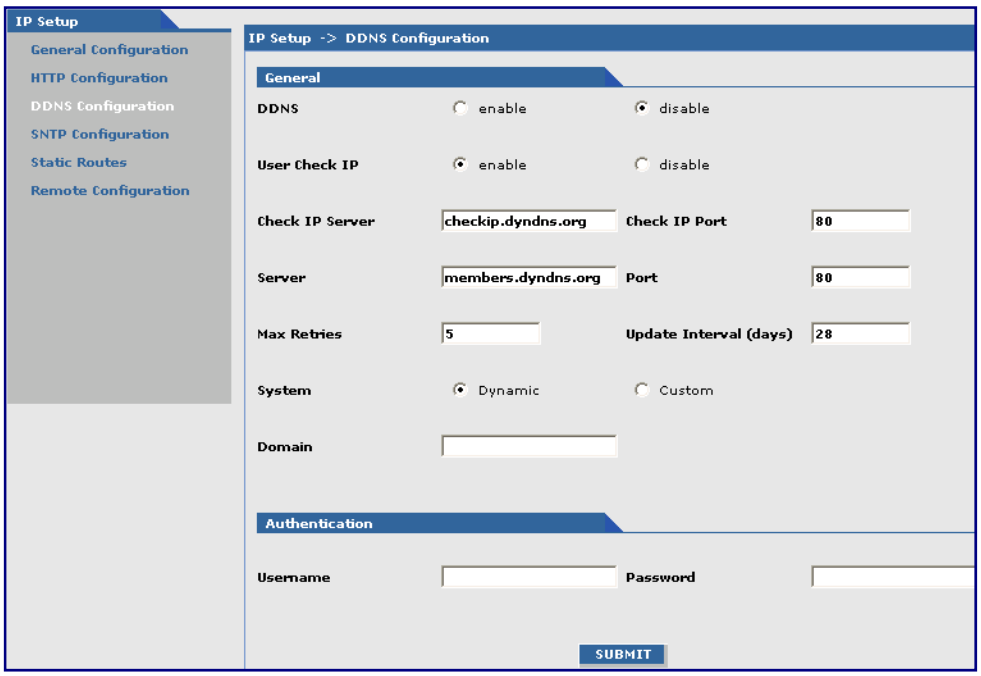
To ensure your changes go into effect, click **Save and Restart**.

IP Setup, DDNS Configuration Parameters

DDNS (Dynamic Domain Naming System) allows you to have a static domain name with a dynamic IP address.

When the dynamic IP address changes, it is submitted to the DDNS server. Here, the domain name is updated to point to the new IP address.

You must register with a DDNS server to use this feature.



General Group

This section describes the parameters that you can configure in the General group.

DDNS Check the Enable or Disable box. This enables/disables DDNS. Default is Disable.

Use Check IP Check the Enable or Disable box. If enabled, the program queries the server to determine the IP address before it performs the DDNS update (the IP address is still assigned by the wireless provider and the DDNS is updated based on the address returned by Check IP Server). If disabled, the program performs the DDNS update using the IP address that it obtains from the PPP link. Default is Enable.

Check IP Server Enter the Server name from which the currently assigned IP address is obtained. This server is a server the router accesses to check its current IP address.

Check IP Port Enter the port number of the Check IP Server. Default is 80.

Server Enter the Server name to which the IP Address change is registered; for example, members.dyndns.org

Port Enter the Server port number. Default is 80.

Max Retries Enter the maximum number of tries that are allowed if the update fails. Default is 5. Range is 0 – 100.

Update Interval Enter the interval, in days, that lapse before the IP Address can change. At the end of this interval, the existing IP Address is updated in the server so that it does not expire. Default is 28 days. Range is 1 – 99 days.

System Sets the system registration type as either Dynamic or Custom. Default is Dynamic.

Domain Enter the registered Domain name.

Authentication Group

This section describes the parameters that you can configure in the Authentication group.

Username Enter the Username of the person who can access the DDNS Server. Default is NULL. You received your username when you registered with the DDNS service.

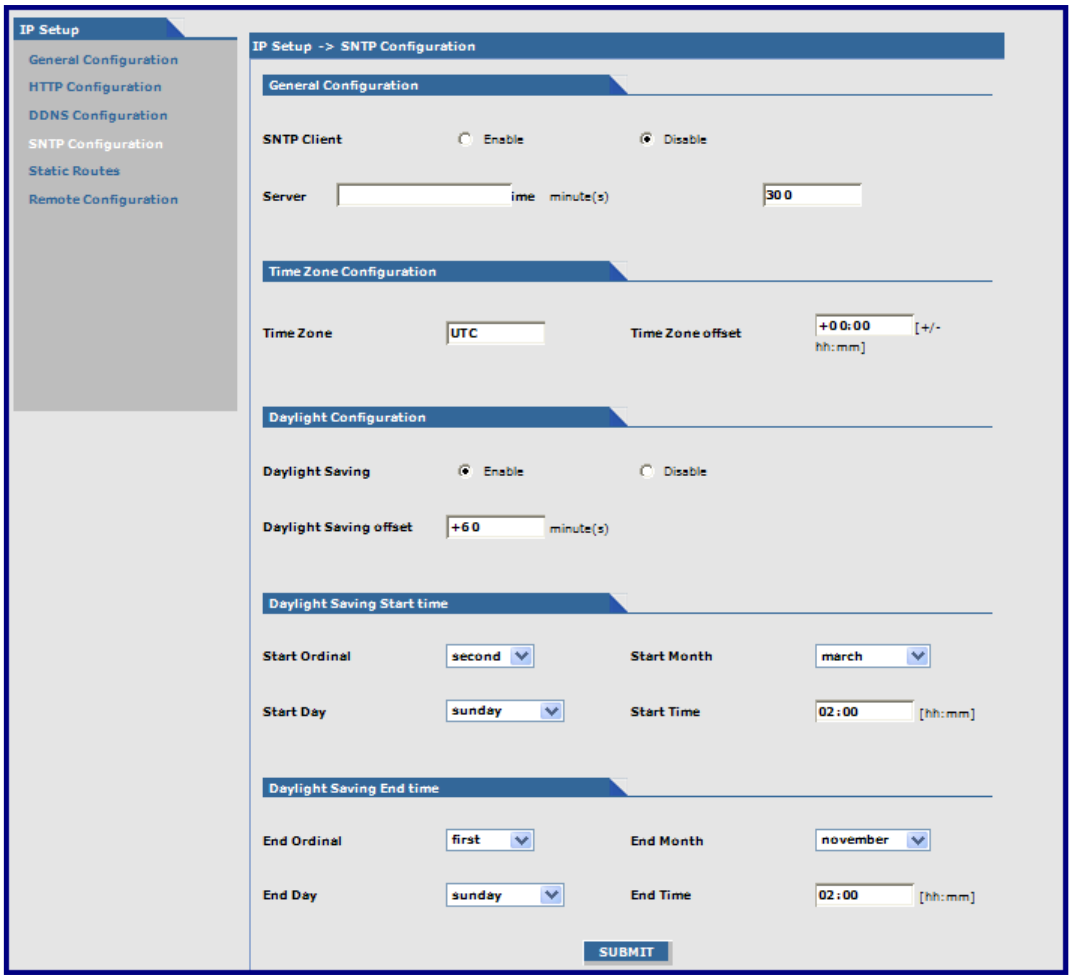
Password Enter the Password of the user who can access the DDNS Server. Default is NULL. You received your password when you registered with the DDNS service.

Submitting and Saving Your Changes

To save the changes you made to these parameters, click **Submit**.

To ensure your changes go into effect, click **Save and Restart**.

IP Setup, SNTP Configuration Parameters



General Configuration Group

SNTP Client Enable or disable the SNTP Client to contact the configured server on the UDP port 123 and set the local time. The default is Disable.

Server Enter the SNTP server name or IP address that the SNTP Client contacts to update the time. No default.

Polling Time Enter the time, in minutes, after which the SNTP client requests the server to update the time. Default is 300 minutes.

Time Zone Configuration Group

Time Zone: Enter the time zone. Default is UTC (Universal Coordinated Time, Universal Time). See the following website for Time Zone information:

http://wwp.greenwichmeantime.com/info/current-time.htm

Time Zone Offset: Enter +/- hh:mm. Default is +00:00. Offset is the amount of time varying from the standard time of a Time Zone.

Daylight Configuration Group

Daylight Saving Enable or disable Daylight Saving mode. The default is Enable.

Daylight Saving Offset Set the offset to use during Daylight Saving mode. Default is +60 minutes. Enter the time in + / - minutes

.

Daylight Saving Start Time Group

Start Ordinal Set the start ordinal to use during Daylight Saving mode. Options are first, second, third, fourth and last. Default is second. Daylight Saving time usually starts at the same time on the same day of the week in the same month every year. Each day of the week occurs four or five times a month. Therefore, select the week in which daylight saving time starts, either the first, second, third, fourth or the last of the month.

Start Month Set the start month to use during Daylight Saving mode. Default is March.

Start Day Set the start weekday to use during Daylight Saving mode. Default is Sunday.

Start Time Set the start time to use during Daylight Saving mode. Default is 02:00 (hh:mm).

Daylight Saving End Time Group

End Ordinal Set the end ordinal to use during Daylight Saving mode. Select the week in which daylight saving time ends. Options are first, second, third, fourth and last. Default is first.

End Month Set the end month to use during Daylight Saving mode. Default is November.

End Day Set the end weekday to use during Daylight Saving mode. Default is Sunday.

End Time Set the end time to use during Daylight Saving mode. Default is 02:00 (hh:mm).

Submitting and Saving Your Changes

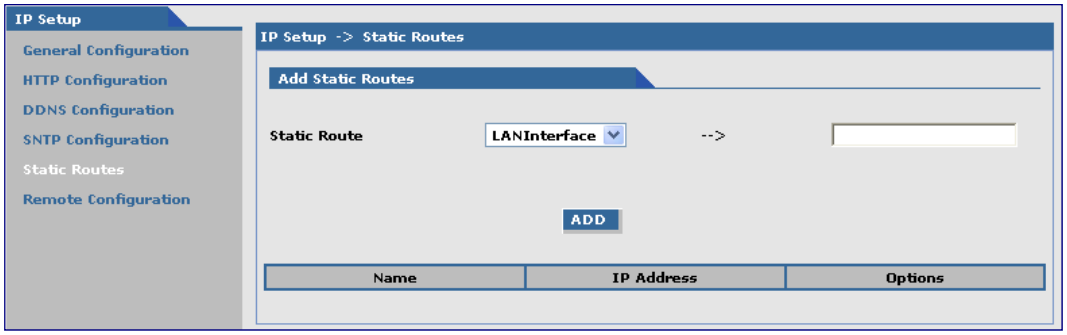
To save your changes, click **Submit**.

To ensure your changes go into effect, click **Save and Restart**.

IP Setup, Static Routes Parameters

Networked computers use routing information to identify whether they are sending data packets directly to the firewall or to another network.

After you define and add a route, you can use the table at the bottom of the group to delete or edit the route.



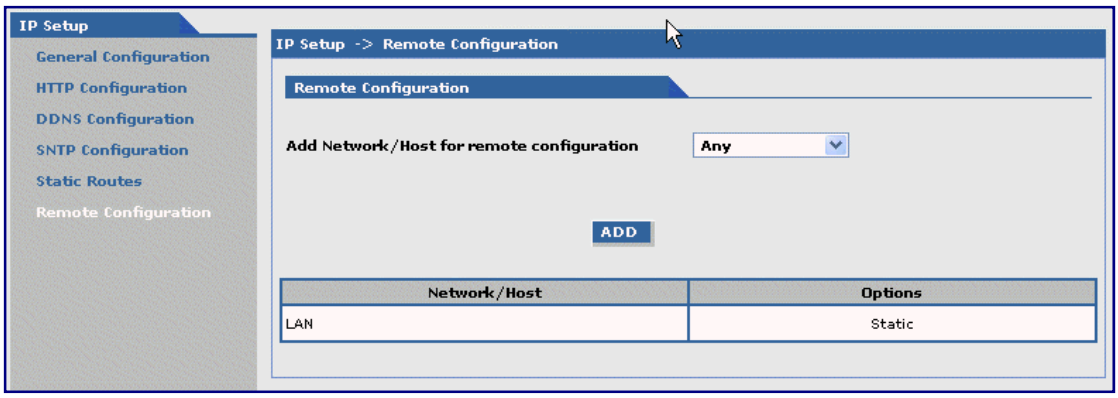
Add Static Routes Group

IP packets destined for the network indicated in the drop down list are routed to the IP address in field pointed to by the arrow. You can define the networks in the drop down list under the 'Networks & Services' tab. The Static Route page does not display until the network is defined under **Networks & Services.**

Static Route: Select a static route from the drop down list, and then click **Add**.

Add Button: After you click **Add**, the new route appears in the table.

IP Setup, Remote Configuration Parameters



Remote Configuration Group

To add a network or host for remote configuration:

1. From the drop down list, select a network or host. Options are Any, LAN, and WAN Interface.

   To define more networks or hosts use the **Network & Services** tab.

2. Click **Add.** The network or host is added and appears in the table.
3. Repeat these steps for all that apply.
4. To delete **Any** and **WAN Interface** in the **Options** columns after either is added, click **Delete**.

IP Setup, GPS Configuration Parameters

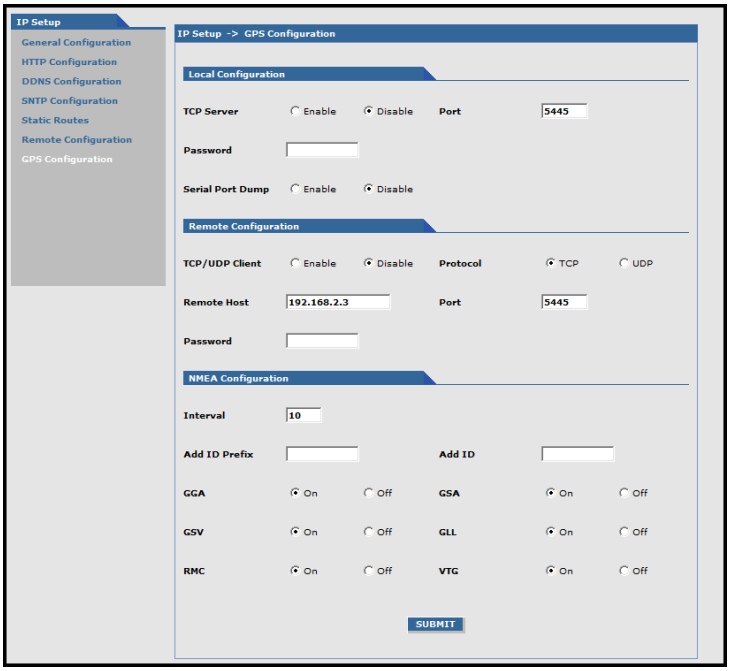
An rCell unit with a –GP build option enables the GPS Configuration. The –GP option allows you to configure forwarding of NMEA (National Marine Electronics Association) sentences from the built in GPS receiver to a device connected to the serial port or over the network to a remote host.

The TCP Server, TCP/UDP Client and Serial Port Dump can be enabled simultaneously.

All enabled sentences are forwarded periodically using the interval specified in the NMEA Configuration group. Before forwarding, the rCell inserts an ID Prefix and ID to each enabled NMEA sentence.

Available NMEA sentences are: GPGGA, GPGSA, GPGSV, GPGLL, GPRMC, GPVTG.

For detailed descriptions of the supported NMEA sentences, see the Universal IP AT Commands Reference Guide. You can download this guide from the Multi-Tech website.



Local Configuration Group

The Local Configuration group allows you to configure the TCP server port and allows for a serial port dump.

TCP Server Enable or disable TCP Server. The default is Disable.

Port Sets the port on which the server is listening. The default is 5445. The port range is from 1 to 5 digits, each digit between 0 and 9 inclusive. Note that numbers above 65,535 are illegal as the port identification fields are 16 bits long in the TCP header.

Password If a password is supplied, the TCP server requests that the remote client supply a password before sending the NMEA sentences.

Serial Port Dump Enable or disable the Serial Port. The default is Disable. The serial port configuration settings are used to configure the port. The serial port client/server must be disabled in order to use the serial port for GPS.

Remote Configuration Group

The Remote Configuration group allows the device to connect to a remote server using the IP and port information for uploading GPS data.

TCP/UDP Client Enable or disable the TCP/UDP Client and defines the protocol of the client. The defaults are Disable and TCP.

Remote Host Displays the IP address and port number of the Remote Host.

Password If the Remote Host requests a password, the password entered here is sent to the server in response.

NMEA Configuration Group

The NMEA Configuration allows you to configure the time interval, any additional prefix or ID information and forward NMEA sentences.

Interval The Interval is defined in seconds. The default is 10 seconds. The range is 1 to 255 seconds.

Add ID Prefix The ID Prefix is 0 to 10 character prefix added to the ID.

Add ID The ID is a unique remote asset identification string. You can specify up to 20 characters for the ID string. The & and $ are invalid characters. The ID must follow the standard NMEA sentence structure. The Universal IP AT Commands Reference Guide, which you can download from the Multi-Tech website, describes sentence structure.

NMEA Sentences GGA, GSA, GSV, GLL, RMC, and VTG are the NMEA sentences. You can turn each sentence On or Off. The default is On.

Communication Examples

Communication is shown from the remote side.

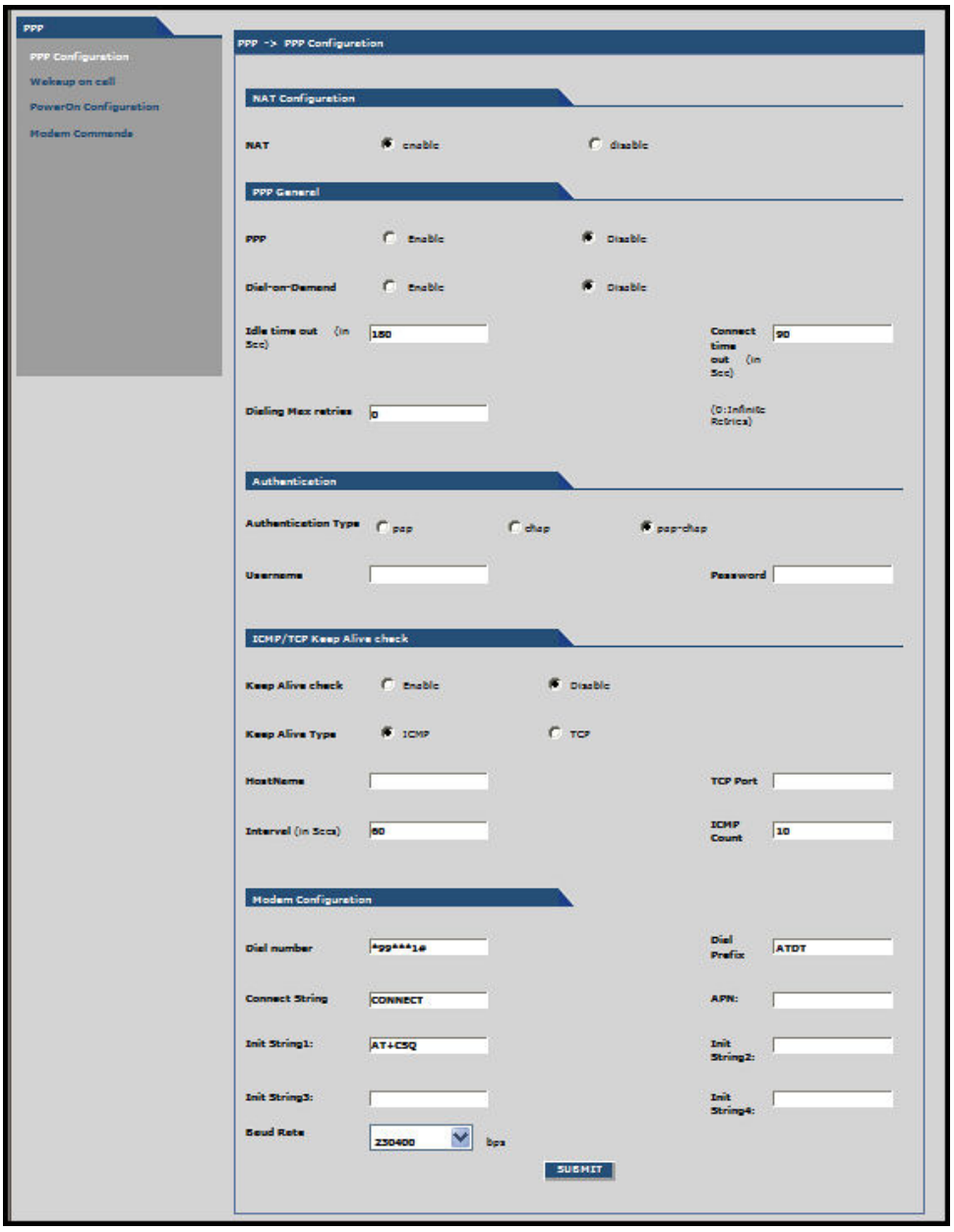
TCP Server example

read: "PASSWORD\r\n"
write: "serverpasswd\r\n"
read: "OK\r\n"
read: "&&rcell$GPGGA,192913.002,4505.9845,N,09311.7705,W,1,10,1.0,249.0,M,-29.0,M,,0000*6F\r\n"
read: "&&rcell$GPGSA,A,3,13,07,03,05,19,06,23,08,16,10,,,1.8,1.0,1.6*3F\r\n"
read: "&&rcell$GPGSV,3,1,12,07,59,308,33,13,59,202,32,03,55,083,33,19,50,136,33*76\r\n"
read: "&&rcell$GPGSV,3,2,12,06,43,065,26,23,35,177,26,08,24,296,27,16,19,059,21*79\r\n"
read: "&&rcell$GPGSV,3,3,12,10,14,286,29,05,07,321,28,24,06,087,23,21,01,029,*76\r\n"
read: "&&rcell$GPGLL,4505.9845,N,09311.7705,W,192913.002,A,A*43\r\n"
read: "&&rcell$GPRMC,192913.002,A,4505.9845,N,09311.7705,W,000.0,117.3,220710,,,A*76\r\n"
read: "&&rcell$GPVTG,117.3,T,,M,000.0,N,000.0,K,A*09\r\n"
read: "&&rcell$GPGGA,192915.002,4505.9842,N,09311.7699,W,1,10,1.0,248.9,M,-29.0,M,,0000*62\r\n"
read: "&&rcell$GPGSA,A,3,13,07,03,05,19,06,23,08,16,10,,,1.8,1.0,1.6*3F\r\n"
read: "&&rcell$GPGSV,3,1,12,07,59,308,33,13,59,202,33,03,55,083,33,19,51,136,33*76\r\n"
read: "&&rcell$GPGSV,3,2,12,06,43,065,25,23,35,177,26,08,24,296,27,16,19,059,21*7A\r\n"
read: "&&rcell$GPGSV,3,3,12,10,14,286,28,05,07,321,28,24,06,087,23,21,01,029,*77\r\n"
read: "&&rcell$GPGLL,4505.9842,N,09311.7699,W,192915.002,A,A*46\r\n"
read: "&&rcell$GPRMC,192915.002,A,4505.9842,N,09311.7699,W,000.0,117.3,220710,,,A*73\r\n"
read: "&&rcell$GPVTG,117.3,T,,M,000.0,N,000.0,K,A*09\r\n"

TCP Client Example with password

write: "PASSWORD\r\n"
read: "clientpasswd\r\n"
write: "OK\r\n"
read: "&&rcell$GPGGA,193038.002,4505.9798,N,09311.7646,W,1,10,1.0,230.2,M,-29.0,M,,0000*6B\r\n"
read: "&&rcell$GPGSA,A,3,13,07,03,05,19,06,23,08,16,10,,,1.8,1.0,1.5*3C\r\n"
read: "&&rcell$GPGSV,3,1,12,07,60,309,31,13,59,201,30,03,54,082,30,19,51,135,28*75\r\n"
read: "&&rcell$GPGSV,3,2,12,06,42,064,21,23,34,177,25,08,24,297,20,16,18,060,20*70\r\n"
read: "&&rcell$GPGSV,3,3,12,10,13,285,31,05,07,320,28,24,07,086,26,21,01,028,*7E\r\n"
read: "&&rcell$GPGLL,4505.9798,N,09311.7646,W,193038.002,A,A*4B\r\n"
read: "&&rcell$GPRMC,193038.002,A,4505.9798,N,09311.7646,W,000.0,117.3,220710,,,A*7E\r\n"
read: "&&rcell$GPVTG,117.3,T,,M,000.0,N,000.0,K,A*09\r\n"
read: "&&rcell$GPGGA,193040.002,4505.9796,N,09311.7646,W,1,10,1.0,230.1,M,-29.0,M,,0000*69\r\n"
read: "&&rcell$GPGSA,A,3,13,07,03,05,19,06,23,08,16,10,,,1.8,1.0,1.5*3C\r\n"
read: "&&rcell$GPGSV,3,1,12,07,60,309,32,13,59,201,29,03,54,082,31,19,51,135,28*7F\r\n"
read: "&&rcell$GPGSV,3,2,12,06,42,064,22,23,34,177,26,08,24,297,19,16,18,060,21*7B\r\n"
read: "&&rcell$GPGSV,3,3,12,10,13,285,32,05,07,320,28,24,07,086,25,21,01,028,*7E\r\n"
read: "&&rcell$GPGLL,4505.9796,N,09311.7646,W,193040.002,A,A*4A\r\n"
read: "&&rcell$GPRMC,193040.002,A,4505.9796,N,09311.7646,W,000.0,117.3,220710,,,A*7F\r\n"
read: "&&rcell$GPVTG,117.3,T,,M,000.0,N,000.0,K,A*09\r\n"

PPP, PPP Configuration Parameters



NAT Configuration Group

NAT: Enable or disable NAT (Network Address Translation). The default is Enable.

Note: For routing to take effect, enable then save the configuration.

Enabling NAT

Your LAN can use one set of IP addresses for internal traffic and a second set of addresses for external traffic. The router with NAT does the simple IP routing between the LAN interface and the WAN interface. NAT hides the LAN address behind a single IP address on the wireless side.

Your internal addresses are shielded from the public Internet.

Disabling NAT

The router functions without performing any address translation on the packets passing through it.

Masquerading of packets originating from the LAN is disabled.

Address translation of packets arriving from the WAN is also disabled.

Any DNAT Configuration previously setup in the DNAT Configuration screen is disabled. This prevents the user from adding any DNAT rules, which if allowed defeat the purpose of enabling Routing.

PPP General Group

PPP: Enable or disable PPP. The default is Disable. When enabled, the unit functions as a router. PPP must be disabled to access the integrated cellular modem directly using telnet port 5000. If PPP is enabled, you cannot access the integrated cellular modem.

Dial-on-Demand: Enable or disable Dial-on-Demand. The default is Disable. If you disable it, the router always stays connected unless the Idle Time Out expires. When Dial-on-Demand is enabled, use the 'Wakeup on Call' settings under the PPP menu to configure the settings for re-establishment of the connection.

Idle Time Out: Set the amount of idle time that passes before the router timeouts. The default is 180 seconds. If the time expires, the PPP connection to the Internet disconnects. Any IP packets from the LAN side or IP traffic from the wireless side resets this timer and prevents the connection from dropping.

Connect Time Out: Set the number of seconds to wait for a connection while in receive mode before timing out.

Dialing Max Retries: Enter the number of dialing retries allowed. The default is zero, which means an infinite number is allowed. Range 0 to 100.

Authentication Group

Authentication Type: Set the authentication protocol type that negotiates with the remote peer: pap/chap/pap-chap. Default is pap-chap.

Username: Enter the Username with which the remote peer authenticates. You can leave this field blank, if desired. Username is limited to 60 characters.

Password: Enter the Password with which the remote peer authenticates. You can leave this field blank, if desired. Password is limited to 60 characters.

ICMP Keep Alive Check

Keep Alive Check: Enable or disable Keep Alive Check. The default is Disable. This is used to periodically check that the Internet connection is up. If it is not, the router tries to reconnect.

Keep Alive Type: Select ICMP or TCP (the protocol type for Keep Alive).

Host Name: Enter the Host Name or IP Address for Keep Alive Check. No default.

TCP Port: Enter the TCP Port number to connect with the TCP server.

Interval: Set the number of seconds for Keep Alive Check. Default is 60 seconds.

ICMP Count: Set the number of ICMP Keep Alive Checks to be sent to the specified host. Default is 10.

Modem Configuration Group

To know the proper information to enter into this group, refer to the Customer Activation Notices included with the product.

Dial Number: Set the dial number to be dialed. Default is NULL.

For GSM models, the Dial Number is ***99***1#**

For CDMA models, the Dial Number is **#777**

Dial Prefix: Set the modem dial prefix. The default is ATDT.

Connect String: Set the modem Connect String. The default is CONNECT.

APN: Enter the APN (Access Point Name). The APN is assigned by your wireless service provider.

Init String 1-4: Configure the modem init strings. You can set up to 4 modem initialization strings.

Baud Rate: The Baud Rate option is only displayed on certain models and is set at 230.4K, by default. The default setting is set for maximum performance. Setting the baud rate higher, particularly on the G2 models, is not recommended as it may adversely affect the performance.

Submitting and Saving Your Changes

To save these settings, click **Submit**.

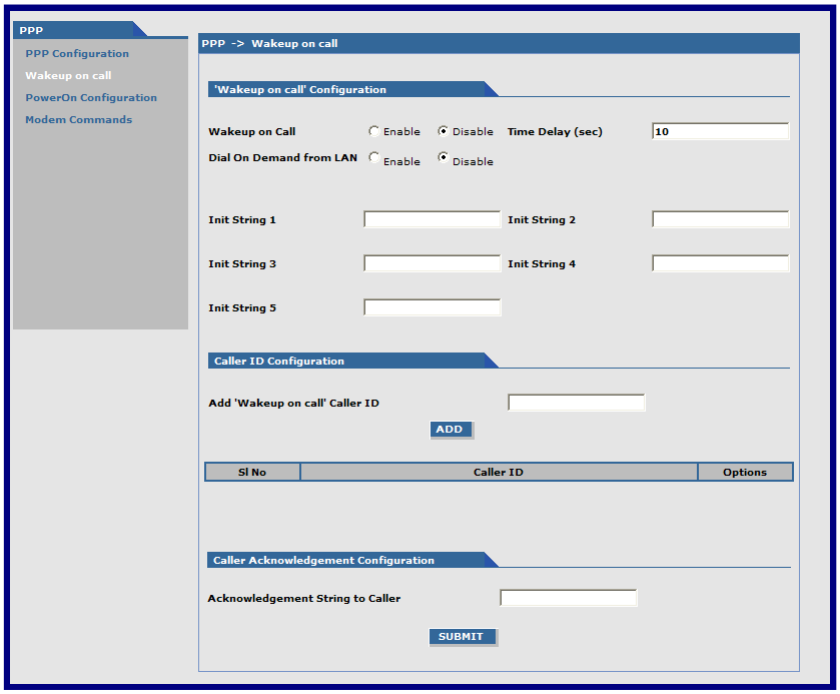
To ensure your changes go into effect, click **Save and Restart**.

PPP, Wakeup-on-Call Parameters

The Wakeup-on-Call feature allows the router to wake up and initiate a connection when there is an incoming call or LAN activity. . The Wakeup-on-Call feature reduces the cost incurred when a router is online and available 24/7.

If you desire some security with this feature, you can set up the router to wake up based on Caller ID or SMS instead of allowing all incoming calls to wake up the router. Dial-on-Demand in the IP Setup menu must be enabled for wakeup-on-call features to go into effect.

Note: When provisioning this feature, you must allow incoming calls, SMS capability, and caller-id.



Wakeup-on-Call Configuration Group

Wakeup on Call: Enable or disable the Wakeup-on-Call feature. The default is Disable. Wakeup on Call occurs when a ring or caller ID is detected. This triggers the router to reconnect after the 'Time Delay' expires.

Time Delay: Enter the amount of time that you want to pass between the reception of a call and the initiation of the Wakeup-on-Call connection. A time delay is needed to make sure that the incoming call has ended before the connection is initiated. The default is 10 seconds.

Dial-on-Demand from LAN: The default is disable. When enabled, the router reconnects when it sees IP traffic on the LAN is needed to route. If this feature is disabled, Dial-on-Demand initiates a PPP connection to the Internet only from the WAN, not from the LAN.

Init Strings: Configure the router initialization strings. These init strings need to be specific to the integrated cellular modem. Some initialization may be required for the integrated cellular modem to accept SMS for 'Wakeup on Call'. Init-num can range from 1-5. The default is NULL. Refer to the following table for examples of Init Strings depending on model.

Model	Init 1	Init 2	Init 3	Init 4	Ack	Comment
C1-EN2-GP			AT+CNMI=2,2,0,0,1	AT+CLIP=1	AT+CNMA	Ring with CLI, SMS with ACK
E1-EN2-GP	AT+CMGF=1	AT+CSMS=1	AT+CNMI=2,2,0,0,1	AT+CLIP=1	AT+CNMA	Ring with CLI, SMS with ACK
G2-EN2-GP	AT+CMGF=1	AT+CSMS=1	AT+CNMI=2,2,0,0,1	AT+CLIP=1	AT+CNMA	Ring with CLI, SMS with ACK
H4-EN2*			AT+CLIP=1			Ring with CLI
H4-EN2- GP*			AT+CLIP=1			Ring with CLI
EV2-EN2*			AT+CLIP=1			Ring with CLI
EV2-EN2- GP*			AT+CLIP=1			Ring with CLI

***Does NOT support** Wakeup On Call using SMS.

Submit: Click **Submit** to save these settings.

Caller ID Configuration Group

Add "Wakeup on Call" Caller ID: To add Caller ID to the Wakeup-on-Call function, enter the Caller ID that can wake up the router. Enter 'RING' (all Caps) to wake up on any call. Enter a CID phone number or an SMS message. Ensure the SMS message string does not contain any spaces between words.

After entering the Caller ID, click the **Add** button. The Caller ID displays at the bottom of the page. You can enter any number of IDs.

A Caller ID can be edited or deleted using Options, which are available once a Caller ID is displayed.

Caller Acknowledgement Configuration

Acknowledgement String to Caller: The configured string of (0 to 40 characters) that is sent to the integrated cellular modem upon receiving a valid caller ID from the WAN. The default is NULL string.

Note: If the string is not configured, acknowledgement to the caller is not sent upon successful caller ID reception.

Submitting and Saving Your Changes

To save these settings, click **Submit**.

To ensure your changes go into effect, click **Save and Restart**.

Wakeup-On-Call Examples

Example 1 – Set Up the Ethernet Router to Activate on Incoming SMS Message

1. On the **PPP > PPP Configuration** page, configure the following parameters:
   - PPP General

     Make sure that **PPP** is Enabled (the default).

     Make sure Dial-on-Demand is Enabled (the default).

     Set the Idle Time Out to the number of seconds you desire.
   - Authentication

     Your wireless service provider may require you to have a separate PPP Username and Password. If so, enter them here.

     Note: If a username and password are required, your wireless provider likely gave these items to you when you activated your account.
   - Modem Configuration

     Make sure your Dial Number is entered correctly.

     For GSM models, the Dial Number is ***99***1#**

     For CDMA models, the Dial Number is #**777**

     Enter your APN. Your wireless service provider assigns the APN.

     Example: AT+CGDCONT=1,"IP","Internet" The Example: AT+CGDCONT=1,"IP","Internet" needs to be removed. Just the APN name needs to be entered in the APN field.
2. To save the changes made on this page, click **Submit**.

3. On the **PPP > Wakeup-on-Call** screen, configure the following parameters:

   - Wakeup-on-Call Configuration

     Select Enable for **Wakeup-on-Call**.

   - Set the Time Delay. You can use the 10 second default.

     Enter the Init Strings from the model dependent table described in the Wakeup-on-Call Configuration.

4. To save the changes made on this page, click **Submit**.

   - Caller ID Configuration

     Enter an SMS to add to the Caller ID list.

     Note: Add the SMS message string into the Caller ID list. The SMS message string must not contain any spaces between words. When the configured string matches the SMS message string, it activates the Wakeup-on-Call feature.

     To save each message as it is entered into the Caller ID list click **Add**.

   - Caller Acknowledgement Configuration

     Enter a configured string (0 to 40 characters) that is sent to the integrated cellular modem upon receiving a valid Caller ID from the WAN.

     Set the Wakeup Acknowledgement string configuration with the command **at+cnma**

     To save the Acknowledgement Configuration, click the Submit.

5. To ensure your changes go into effect, click **Save and Restart**. The device saves all the settings and reboots the computer.

Example 2 – Determine if the router Is Supporting Incoming Calls and Caller ID

1. On the ***PPP > PPP Configuration*** page, make sure that **PPP** is **Disabled**.
2. On the PPP > Wakeup-on-Call screen, make sure that Wakeup-on-Call is Disabled.
3. To open a command prompt, from the **Start** button and select **Run**.
4. Type **CMD** to open the command window. Click **OK**.
5. When the command window opens, telnet to the router**.**

   Note: 5000 is the router port number.

   d. Enter your username and password to login.

   e. Enter an AT command to make sure you receive a response; i.e., OK.

   f. To determine the dial number of your router, enter the command AT+CNUM.

   For the Wakeup-on-Call function to work the RING or CALLER ID information must appear.
6. To determine if the RING message shows, from another phone, call your router using the dial number of your router.
7. To enable Caller ID, enter the **AT+CLIP=1** command. Make the call again to verify Caller ID information.

   Some wireless providers do not provide caller ID information if you have only a data plan.

Example 3 – Set Up the Ethernet Router to Activate on ALL Incoming Calls

1. On the ***PPP >PPP Configuration*** page, set up the following parameters:

   PPP General

   - Make sure that PPP is Enabled.
   - Make sure Dial-on-Demand is Enabled.
   - Set the Idle Time Out to the number of seconds you desire.

   Authentication

   - Your wireless service provider may require you to have a separate PPP User name and Password. If so, enter them here.

     Note: If a username and password are required, your wireless provider likely gave you these items when you activated your account.

   Modem Configuration

   - Make sure your Dial Number is entered correctly:
   - For GSM models, the Dial Number is *99***1#
     - For CDMA models, the Dial Number is #777

   Submit

     - Click the **Submit** button to save the changes made on this screen.

2. On the ***PPP > Wakeup-on-Call*** screen, set up the following parameters:

   Wakeup-on-Call Configuration

   - Select Enable for Wakeup-on-Call.
   - Set the Time Delay to 3 seconds. You can use the 10 second default.
   - Ensure all Init Strings are empty.
   - Submit Button
   - Click the Submit button to save these settings.

   Caller ID Configuration

   - Enter the string RING to the Caller ID list.
   - Click the Add Button to save the string to the Caller ID list.

3. To ensure your changes go into effect, click **Save and Restart**. The device saves all the settings and reboots the computer.

Example 4 – Set Up the Ethernet Router to Activate on Matching Caller IDs Only:

1. On the ***PPP > PPP Configuration*** screen, set up the following parameters:

   PPP General

   - Make sure that PPP is Enabled.
   - Make sure Dial-on-Demand is Enabled.
   - Set the Idle Time Out to the number of seconds you desire.

   Authentication

   - Your wireless service provider may require you to have a separate PPP username and password. If so, enter them here.

     Note: If a username and password are required, your wireless provider likely gave you these items when you activated your account.

   Modem Configuration

   - Make sure your Dial Number is entered correctly:

     For GSM models, the Dial Number is ***99***1#**

     For CDMA models, the Dial Number is **#777**

2. To save the changes, click **Submit**.
3. On the ***PPP > Wakeup-on-Call*** screen, set up the following parameters:

   Wakeup-on-Call Configuration

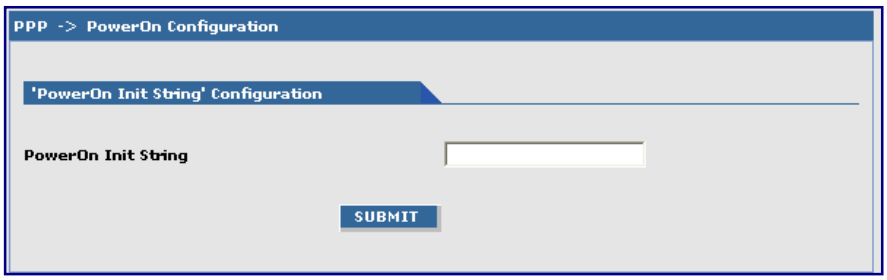
   - Select **Enable** for Wakeup-on-Call.
   - Set the Time Delay. You can use the 10 second default.
   - Enter the Init Strings:
   - To set Wakeup Init String 1 type **AT+CLIP=1**.
   - To save settings, click Submit.

   Caller ID Configuration

   - To add a caller's ID, to the Caller ID list, type that id.
   - Click **Add**.
   - To save each Caller ID as it is entered to the Caller ID list, click **Add**.
   - To ensure your changes go into effect, click **Save and Restart**. The device saves all the settings and reboots the computer.

PPP, Power-On Configuration Parameters

The Power-On Configuration feature allows you to set an initialization string that is sent to the router upon boot up.



Power-On Init String: You can enter a string of 0 to 40 characters that is sent to the router upon boot up. All commands initializes before you proceed with regular PPP related activity.

Note: When no initialization string is configured, regular functions of the router is retained.

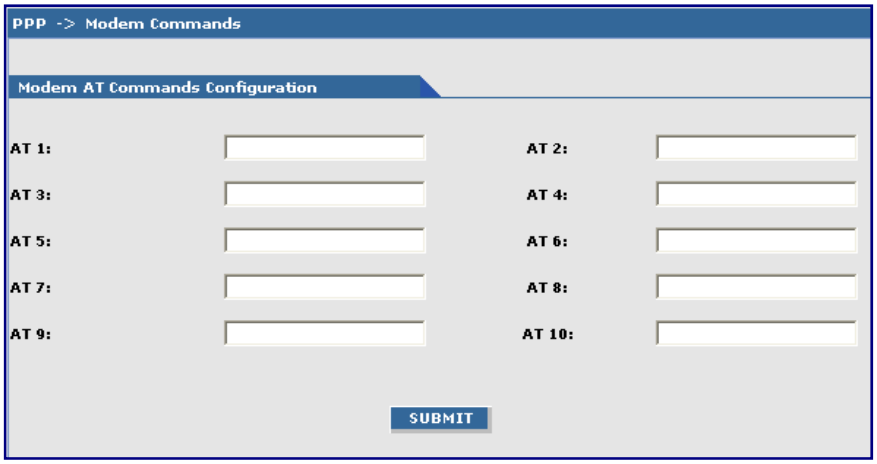
To save this setting click **SUBMIT**.

To ensure your changes go into effect, click **Save and Restart**.

PPP, Modem Commands Parameters

You can configure modem commands to allow an external application to query modem information.

- The application can use the URL HTTP://xxx.xxx.xxx.xxx/modeminfor.html to determine the IP address that is currently assigned to the integrated cellular modem after the PPP connection is established.
- You can also display the results of up to ten AT commands.



Modem AT Commands Configuration Group

These commands are sent when a PPP connection to the network is initiated.

Useful HSDPA AT commands include:

Command	Description
AT+CGSN	Product Serial Number
AT+CGMR	Software Version
AT+CNUM	Wireless Subscriber Number
AT+COPS?	Network Information (Operator)
AT+CREG?	Network Registration
AT+CSQ	Signal Quality

Retrieving Modem Information without using a browser:

To obtain the integrated cellular modem information without using a browser:

1. Make a TCP connection to port 80 (same as the Web Admin port) and send data as:

   GET /atinfor.html HTTP/1.1

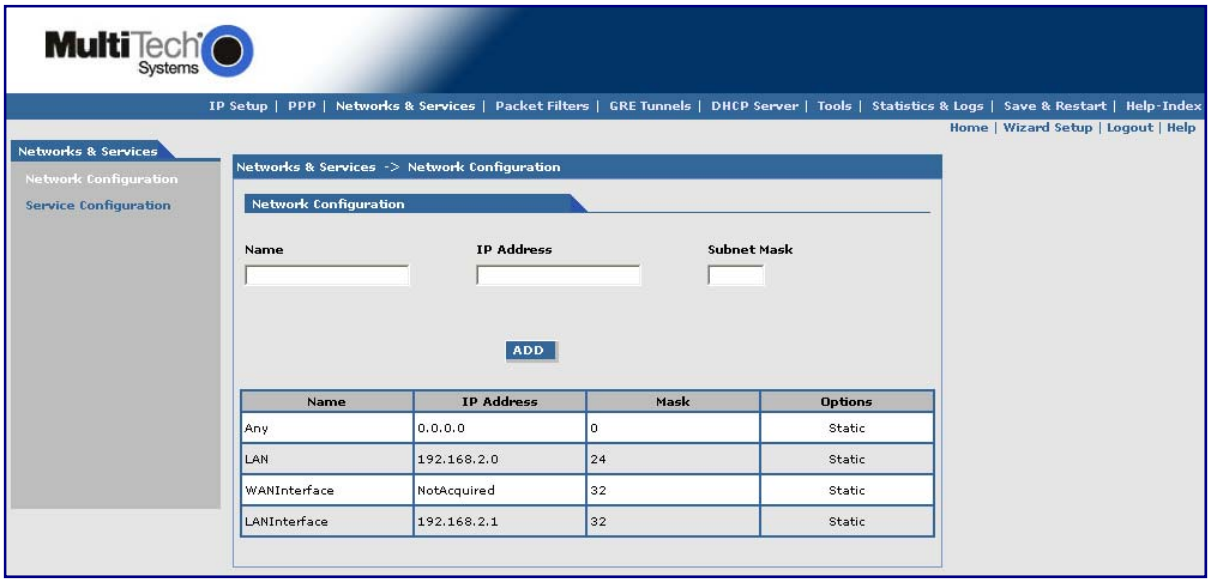
2. Press Enter twice.

Refer to the AT Command Reference Guides for other commands.

Networks & Services, Network Configuration Parameters

Network Configuration Group

Use this group to add networks or hosts. After you define and add a network, you can delete or edit it by using the table.



Configuring the Network

Before you configure the network, note the following:

- You cannot edit a Network/Host Name.
- You cannot delete a Network/Host another configuration is using it.
- Network/Host changes are reflected in all the configurations in the Web Management software where they are used.
- Network/Hosts that you add here are displayed in the following sections: Static Routes, DNAT, and Packet Filters.

To configure:

1. In the **Name** field, type the name of the Network/Host. Make sure the same address-mask pair does not already appear in the list. The Name is limited to 15 characters maximum.
2. In the **IP Address** field, type the IP Address of the Network/Host. Make sure the same address-mask pair does not already appear in the list.
3. In the **Subnet Mask** field, type the Network Mask of the Network/Host. For Host addresses, the mask is entered as 32.

   Note: See Appendix A -- Table of Commonly Supported Subnets.
4. To add the network, click **Add**. The defined network appears in the table.

Networks & Services, Service Configuration Parameters

Service Configuration Group

These parameters let you specify the standard set of well known services available on the system. These services enable the configuration of the user-defined services. You can delete or edit services after defining and adding them. Use the table at the bottom of the screen.

Name	Protocol	S-Port	D-Port	Options
Any	any	1:65535	1:65535	Static
DNS-tcp	tcp	1:65535	53	Static
DNS-udp	udp	1:65535	53	Static
FTP	tcp	1024:65535	20:21	Static
FTP-CONTROL	tcp	1024:65535	21	Static
H323	tcp	1024:65535	1720	Static
HTTP	tcp	1024:65535	80	Static
HTTPS	tcp	1024:65535	443	Static
IDENT	tcp	1024:65535	113	Static
IMAP	tcp	1024:65535	143	Static
netbios-dgm-tcp	tcp	138	138	Static
netbios-dgm-udp	tcp	138	138	Static
netbios-ns-tcp	tcp	137	137	Static
netbios-ns-udp	udp	137	137	Static
netbios-ssn-tcp	tcp	1024:65535	139	Static
netbios-ssn-udp	udp	1024:65535	139	Static
NEWS	tcp	1024:65535	119	Static
POP3	tcp	1024:65535	110	Static
PPTP	tcp	1024:65535	1723	Static
SMTP	tcp	1024:65535	25	Static
SNMP	udp	1024:65535	161	Static
SNTP	tcp	1024:65535	123	Static
SOCKS	tcp	1024:65535	1080	Static
SQUID	tcp	1024:65535	3128	Static
SSH	tcp	1:65535	22	Static
TFTP	udp	1:65535	69	Static
TELNET	tcp	1024:65535	23	Static
TRACEROUTE	udp	1024:65535	33000:34000	Static

Configuring New Services

Before you configure the network, note the following:

- A Service Name cannot be edited.
- A Service cannot be deleted if it is used in another configuration.
- Service changes are reflected in all the configurations in the Web Management software where they are used.
- Services added here are displayed in the following sections: DNAT, Packet Filters.

To configure:

1. For the new service, configure the following parameters:

   Name: Enter the name of the Service which is limited to 16 characters. It has to be unique.

   Protocol: Enter the type of protocol (TCP, UDP).

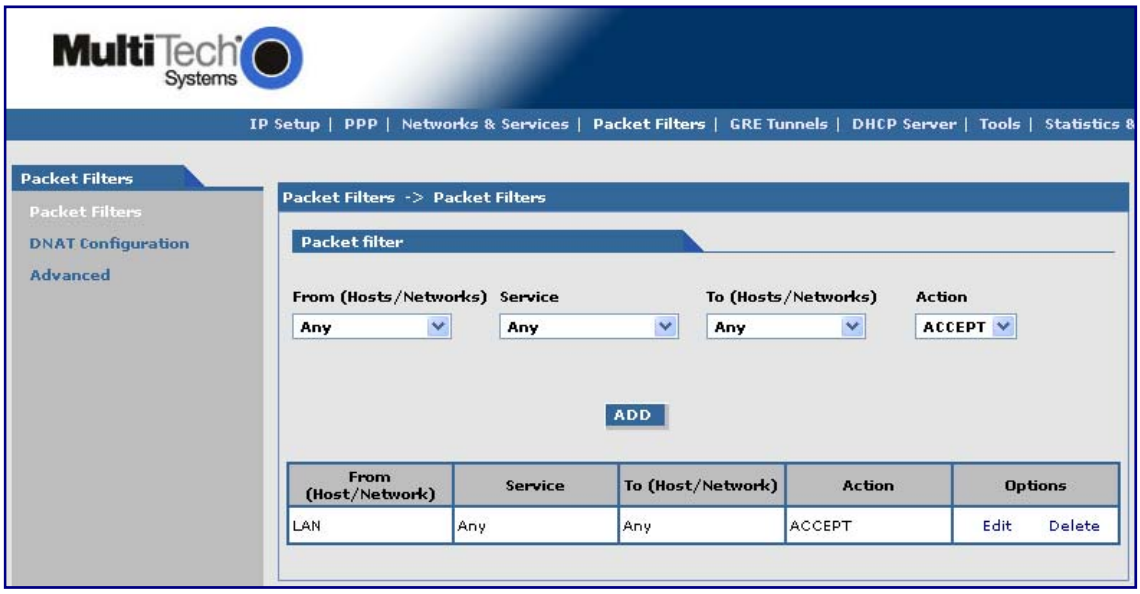
   Source Port: Enter the Destination Port for this service. The source and destination ports can be entered either as a single port or a range using a colon as the separator.

   Destination Port: Enter the name of the Destination Port for the service.

2. Click **Add**. The new service is added and appears on the page.

Packet Filters, Packet Filters Parameters

You can Delete or Edit a packet filter rule after it has been defined and added by using the table at the bottom of the screen.



Packet Filter Group

From (Host/Networks): Enter the network/host from which the packet must originate for the filter rule to match. The Any option, which matches all IP addresses regardless of whether they are officially assigned addresses or private addresses, may also be entered. The network/host must be pre-defined in the Networks section.

Service: Enter the service that is to be matched with the filter rule. These services must be pre-defined in the Services section. These services precisely define the traffic to be filtered.

To (Host/Networks): Enter the network/host to which the packet must send for the filter rule to match. The Any option, which matches all IP addresses regardless of whether they are officially assigned addresses or private addresses, may also be entered. The network/host must be pre-defined in the Networks section.

Action: Enter the action that the packet filter executes if the rule matches any traffic traversing the firewall. Types of actions defined are:

- **Accept:** Allows/accepts all packets that match this rule.
- **Reject*:*** Blocks all packets that match this rule. The host sending the packet is informed that the packet has been rejected.
- **Drop:** Blocks all packets that match this rule, but the host is not informed; that is, this is a silent drop.
- **Log:** Packets matching the rule; that is, the corresponding source address, destination address, and service are logged.

Add Button: Click the **Add** button. The defined packet filter rule is added and appears at the bottom of the screen.

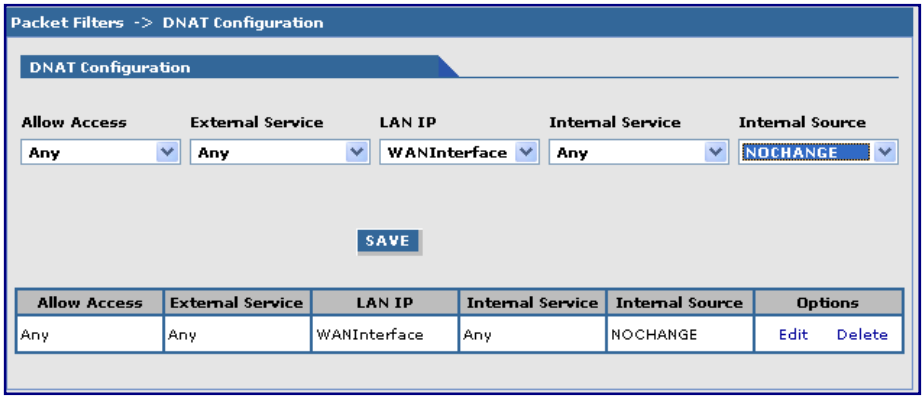
Packet Filters, DNAT Configuration Parameters

DNAT Configuration Group

Destination Network Address Translation (DNAT) allows you to place servers within the protected network and make them available for a certain service to the outside world. The DNAT process running on the router translates the destination address of incoming packets to the address of the real network server on the LAN. The packets are then forwarded.

You can Delete or Edit a DNAT rule after it has been defined and added by using the table at the bottom of the screen.

Note: When adding rules, at least one host must be defined in the Network Configuration section.



Allow Access: Select a network or host to which IP packets are allowed and re-routed. The network/host must be pre-defined in the Network Configuration section.

External Service: Select the External Service that you want allowed. The service must be defined in the Service Configuration section.

LAN IP: Select the LAN IP to which the packets are to be diverted. Only one host can be defined as the destination.

Internal Service: Select the Internal Service to be the destination.

Internal Source: Select the source address for packets that are going to be sent. If you do not want to change the address, select **NOCHANGE**.

Save Button: Click **Save**. The defined DNAT configuration is added and appears at the bottom of the page. Entries can be deleted or edited by clicking the **Edit** or the **Delete** buttons.

Example: Setting Up DNAT and Port Forwarding to an Internal Device

Note: The internal device can be camera, meter, security device, and so on.

Situation: Assume the device is on a LAN with an IP address of 192.168.2.100 and the port to access the device is port 7700.

1. In the **Network & Services > Network Configuration** group, define the following parameters:

   Name – Enter a name for the LAN device.

   IP Address and Subnet Address – Enter the IP address and subnet address of the device.

   Example: Name = MeterIP

   IP Address = 192.168.2.100

   Subnet Address = 255.255.255.255. The subnet mask in the network configuration is not defined using x.x.x.x notation. It uses 'bit' notation. So 255.255.255.255 = 32.

2. To save this configuration, click **Add**.
3. In the **Network & Services > Service Configuration** group, define a service name. For this example, the service is a meter.

   Name – Enter a name for the service (use a name that identifies the service for you). **Example:** MeterPort

   Protocol – Select a protocol. **Example:** tcp or udp

   S-Port / Client – Enter the source port for this service. Example: 1:65535

   D-Port / Server – Enter the destination port for this service. Example: 7700

   Add – Click the **Add** button to save this configuration.
4. In the Packet Filters > DNAT Configuration group, define the DNAT rule.

   Allow Access – Select the original target network/host of the IP packets that you now want rerouted. The original target network/host is the one previously defined in the Network Configuration section. **Example:** Any

   External Service – Select the External Service that you want allowed. The service must be defined in the Service Configuration section.

   LAN IP – Select the LAN IP to which the packets are to be diverted. Only one host can be defined as the destination.

   Internal Service – Select the Internal Service to be the destination.

   Pre DNAT Service – Select the service for the Pre-DNAT destination. This service was just defined in the Service Configuration section. **Example:** MeterPort

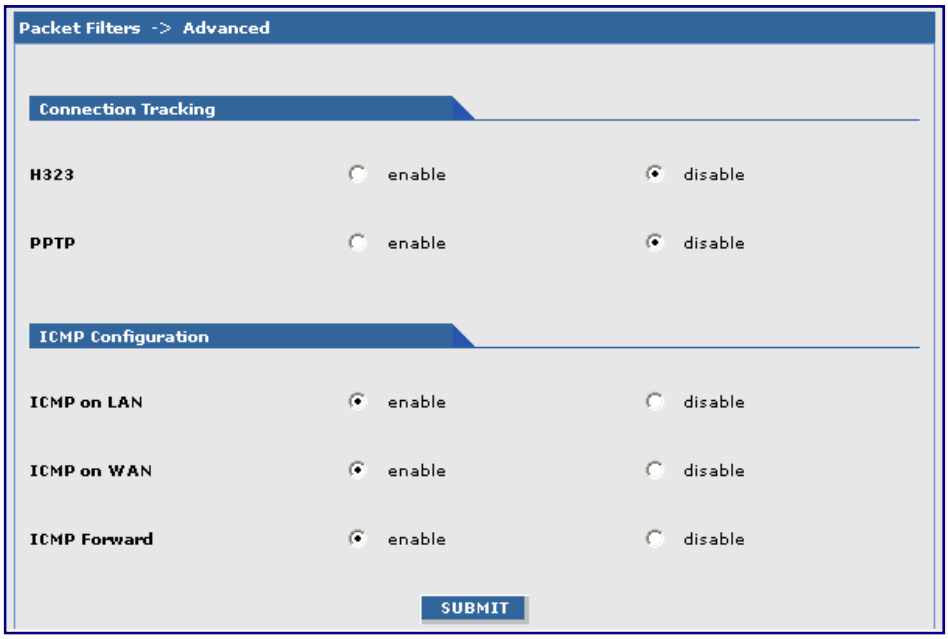
   Post DNAT IP – Select the destination to which the IP packets are to be diverted. Only one host can be defined as the Post DNAT destination. **Example:** MeterIP

   Post DNAT Service – Select the service for the Post DNAT configuration. **Example:** MeterPort

   Internal Source – Select the source address for packets that are going to be sent. If you do not want to change the address, select **NOCHANGE**. **Example:** NOCHANGE
5. To save this configuration, click **Save.**

   Note: You must click **Save and Restart** once you have completed and submitted all the screens on which you have made changes. The device saves all the settings and reboot the computer.

Packet Filters, Advanced Parameters



Connection Tracking Group

H323: Enable or disable the forwarding of H323 packets across the firewall.

PPTP: Enable or disable PPTP Packet Pass-through (PPTP NAT support).

Note: H323 and PPTP are disabled by default.

ICMP Configuration Group

Use the Internet Control Message Protocol (ICMP) to test the network connections and the firewall. You can also use ICMP for diagnostic purposes. ICMP on Firewall and ICMP Forwarding always apply to all IP addresses; i.e., Any. When these are enabled, all IP hosts can Ping the firewall (ICMP on Firewall) or the network behind it (ICMP Forwarding).

ICMP on LAN: Enable or disable the transfer of ICMP packets on the LAN interface.

ICMP on WAN: Enable or disable the transfer of ICMP packets on the WAN interface.

ICMP Forward: Enable or disable the forwarding of ICMP packets through the firewall into the local network.

Note: ICMP on the LAN, WAN, and Forward are enabled by default.

Submitting and Saving Your Changes

To save these settings, click **Submit**.

To ensure your changes go into effect, click **Save and Restart**.

GRE Tunnels

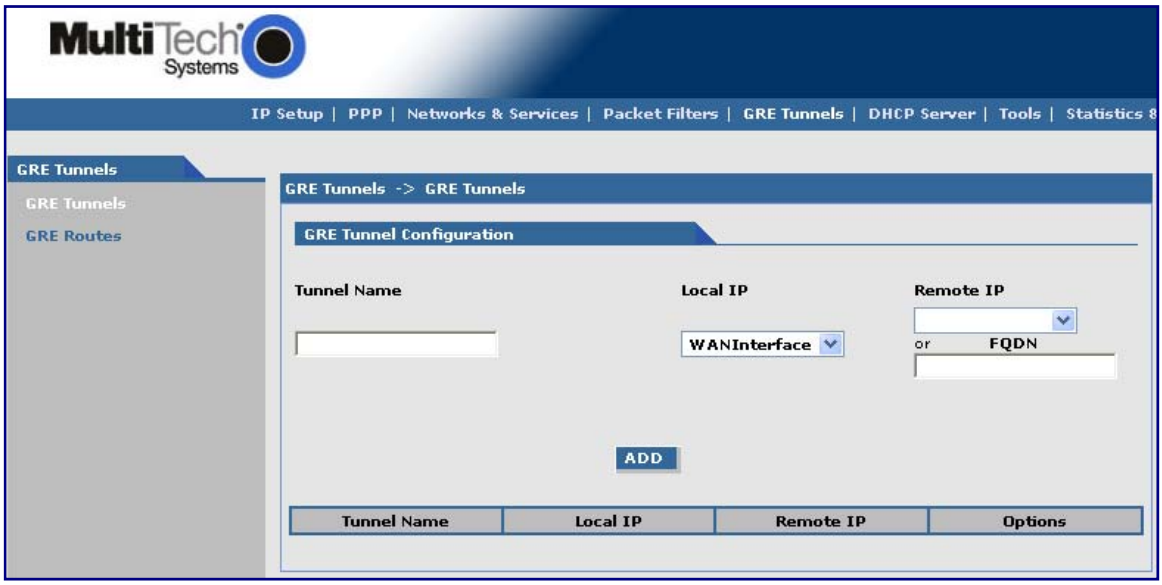
Generic Routing Encapsulation (GRE) includes GRE tunneling and GRE routing

First, you create the GRE Tunnels by using the GRE Tunnel Configuration group.

Then, you configure the routes for the remote networks that are routed through a tunnel, by using the GRE Routes Configuration group. All the traffic destined to remote networks associated to a tunnel are routed through that tunnel.

GRE Tunnels > GRE Tunnels

Tunneling allows the use of a public network to convey data on behalf of two remote private networks. It is also a way to transform data frames to allow them to pass networks with incompatible address spaces or even incompatible protocols. If you want to read more about how this works, see the online Help.



GRE Tunnel Configuration Group

Tunnel Name: Enter a name for the new tunnel.

Local IP: Select the local interface on which the tunnel is created. Eventually, the packets destined for this tunnel are routed through it.

Note: When adding a tunnel, use only one of the following: **Remote IP** or **FQDN**.

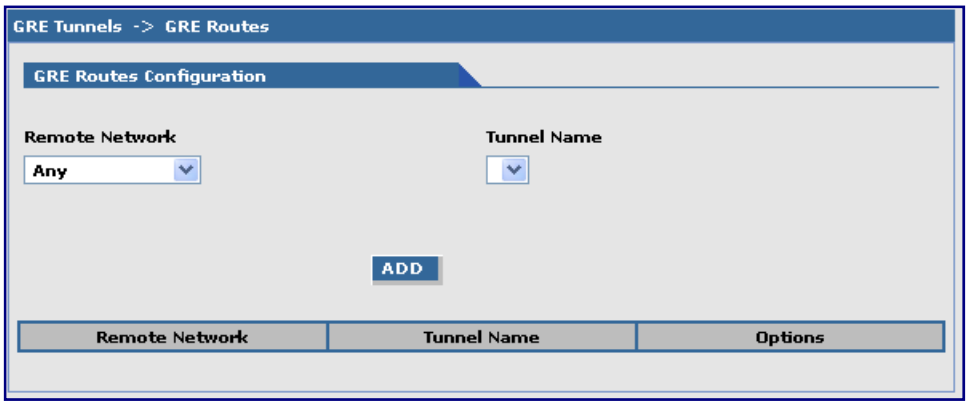
Remote IP: Select the Remote IP address that marks the other end point of the tunnel. This is where the routed packets are received).

OR

FQDN: Enter the FQDN (Fully Qualified Domain Name) for the Remote IP, which can be either the IP Address or an FQDN.

Add Button: Click the **Add** button. The defined GRE tunnel configuration is added and appears at the bottom of the screen.

GRE Tunnels > GRE Routes Configuration



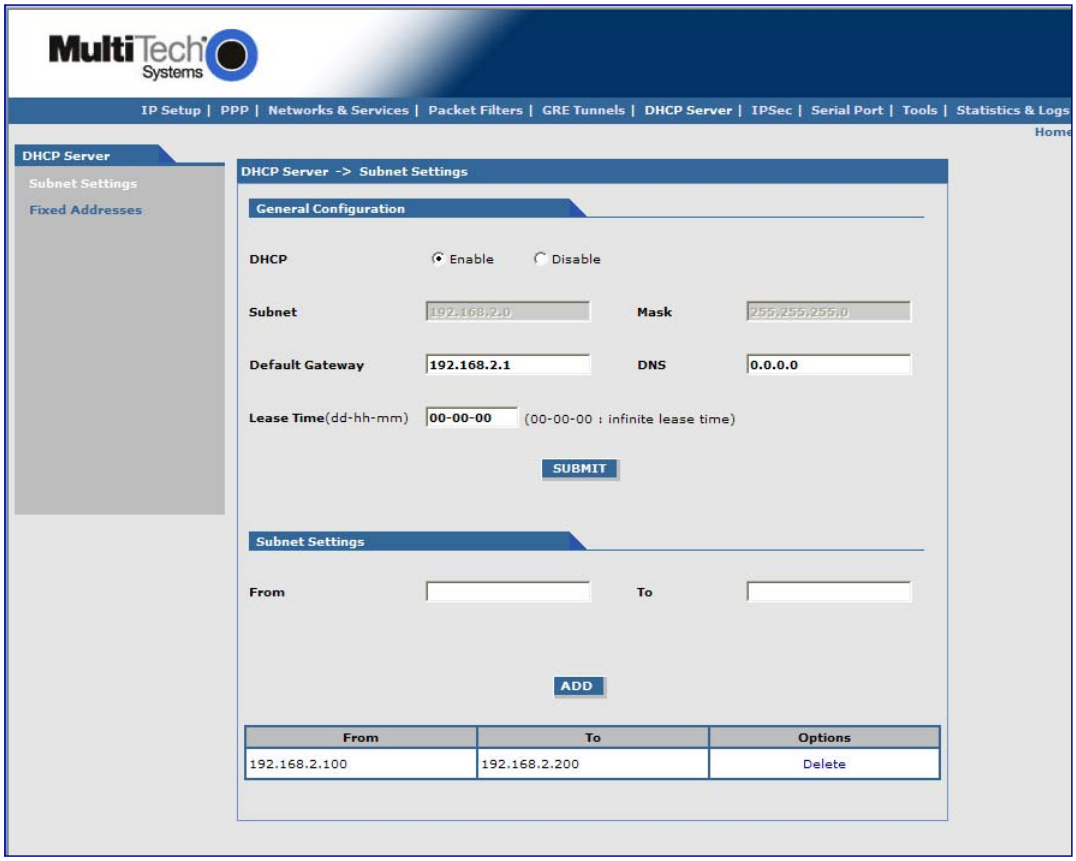
Remote Network: Select the remote network for which the traffic destined to it must be routed through the given tunnel.

Tunnel Name: Select the name of the tunnel through which the traffic is routed.

Note: To add a tunneled route, the remote network and the tunnel must have been defined in Network Configuration. The tunnel configuration must be completed before setting the GRE route configuration.

Add Button: Click **Add**. The defined GRE route configuration is added and appears at the bottom of the page.

DHCP Server, Subnet Settings



General Configuration

DHCP (Dynamic Host Configuration Protocol) is a protocol that allows individual devices on an IP network to get their own network configuration information (IP address, subnet mask, broadcast address, etc.) from a DHCP server. The overall purpose of DHCP is to make it easier to administer a large network.

DHCP: Enable or disable the DHCP server.

Subnet: Enter the subnet address. If you want to change the DHCP subnet address, you first have to delete all the subnet settings below.

Mask: Enter the subnet mask.

Gateway: Enter the gateway address.

DNS: Enter the DNS address.

Lease Time: Select the DHCP Lease Time from the selection box. Lease time is set in days, hours, and minutes. A Lease Time of 00-00-00 is an Infinite Lease Time.

To save your changes, click **SUBMIT**.

To ensure your changes go into effect, click **Save and Restart**.

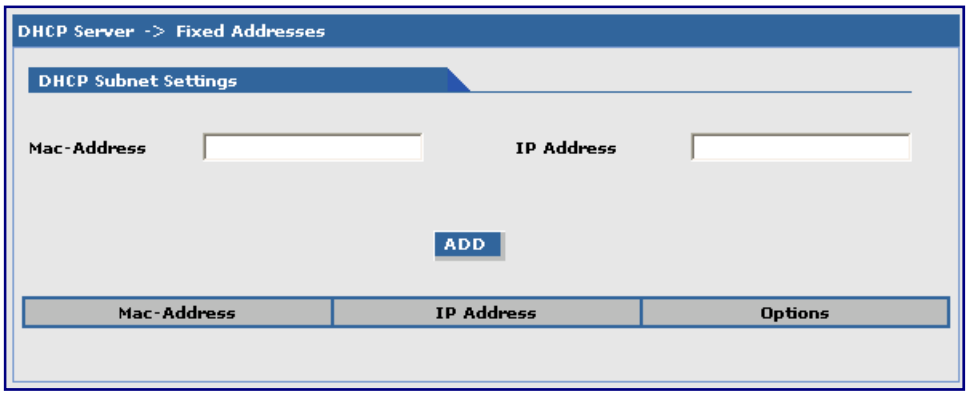
Subnet Settings

From-To Range: Enter the range of IP addresses to be assigned by DHCP.

Add: Click the **Add** button. The address range is added and appears in the table at the bottom of the screen. Once the range displays, you can delete if necessary.

Note: See Appendix A Commonly Supported Subnets.

DHCP Server > Fixed Addresses



DHCP Fixed Configuration

The DHCP server can be made to assign a fixed IP address for a particular user by identifying the MAC address. This binding can be made permanent by configuring it here. The same IP address is not be used for any DHCP client with a different MAC address, even if there is no active DHCP connection with that IP address.

MAC Address: Enter the MAC address to which the specified IP address binds.

IP Address: Enter the fixed IP address to be assigned.

Add: Click the **Add** button. The addresses are added and appear in the table at the bottom of the page from where they can be deleted or changed.

IPSec

The IPSec (IP Security) protocol suite, based on modern cryptographic technologies, provides security services like encryption and authentication at the IP network layer. It secures the whole network traffic providing guaranteed security for any application using the network.

You can use IPSec to create private secured tunnels between two hosts, two security gateways, or a host and a security gateway. Up to three tunnels can be active at any given time. You can save more than three active tunnels, but they are not active.

IPSec provides encryption and authentication services at the IP level of the protocol stack. IPSec can protect any traffic carried over IP.

Authentication and Encryption Overview

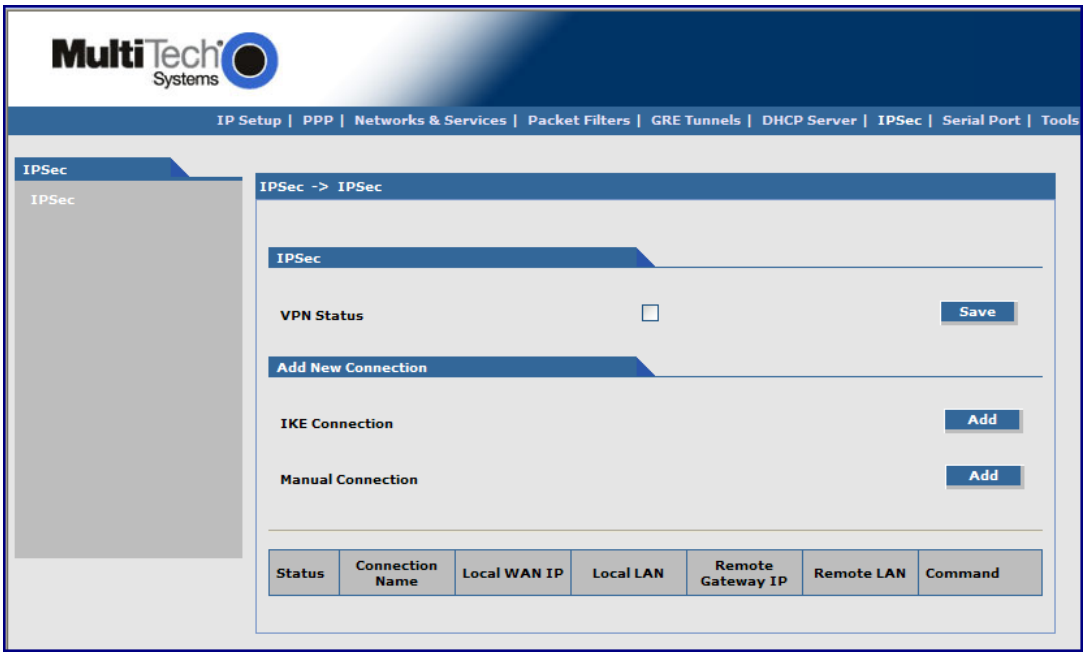
IPSec provides the following services:

- Authentication only
- Encryption only

To transmit and receive data securely over an unprotected network:

1. Select the type of IPSec service—authentication or encryption—required for the connection.
2. Establish a secure connection by a key exchange process, using one of the following:
   - Manual Keying where the authentication and encryption keys are provided manually on both sides of the connection.
   - Auto Keying using IKEv2 Protocol where the authentication and encryption keys are generated on either side of the connection and exchanged by different methods.
3. Transfer data using the connection.

IPSec > IPSec



IPSec

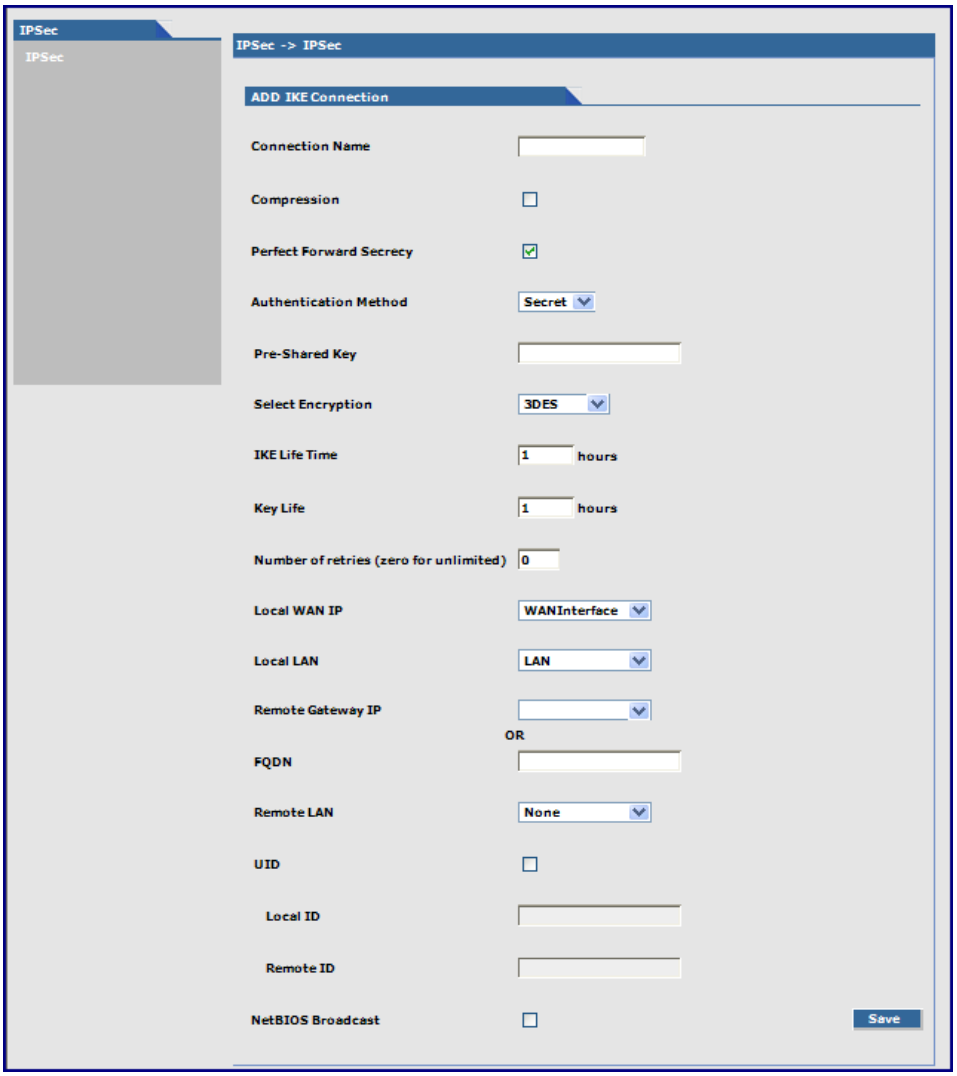
VPN Status: Check the VPN Status checkbox to enable IPSec. Click **Save**.

Add a New Connection

Add IKE Connection: Click **Add IKE Connection**. A page opens where you can configure an IKE connection.

Add Manual Connection: Click **Add Manual Connection**. A page opens where you can configure a manual connection.

Add IKE Connection



Add an IKE Connection

Connection Name: Type a name for the connection.

Compression: Check the compression checkbox to enable IPCOMP, the compression algorithm.

Perfect Forward Secrecy (PFS): Check the PFS checkbox to enable PFS, a concept in which the newly generated keys are unrelated to the older keys). This is enabled by default.

Authentication Method: Authentication can be done using Pre-Shared Secrets.

Pre-Shared Key: The Pre-Shared Key must be agreed upon and shared by the VPN endpoints. Configured it at both endpoints of the tunnel.

Select Encryption: Select the encryption method. 3DES is recommended. Options include 3DES, AES-128, AES-192, AES-256

IKE Life Time: The duration for which the ISAKMP SA lasts, from successful negotiation to expiration. The default value is one hour and the maximum is 8 hours.

Key Life: The duration for which the IPSec SA lasts, from successful negotiation to expiration. The default value is one hour and the maximum is 24 hours.

Number of Retries: Specify the number of retries for the IPSec tunnel. Enter zero for unlimited retries.

Local WAN IP: This is the interface initiating the IPSec tunnel.

Local LAN: Internal subnet of the local security gateway for which the security services are provided. If the router acts as a host, configured as None.

Remote Gateway IP: Interface where the IPSec tunnel ends. In the case of a Road Warrior with a Dynamic IP address, configure to **ANY**.

FQDN: FQDN is a Fully Qualified Domain Name that resolves to the Local Wan IP of the router or in the case of GRE/IPSEC, it is used to identify the Wan IP of the remote location. This is provided by your ISP or created by you if you are using a Dynamic DNS service. When FQDN is selected, leave the Remote Gateway IP blank.

Remote LAN: Internal subnet of the remote security gateway for which the security services are provided. If the remote end is the host, set this to None.

UID (Unique Identifier String): Check the UID box to enable the Local ID and Remote ID. Local ID and Remote ID are active only when UID is enabled.

Local ID

Enter a string identifier for the local security gateway.

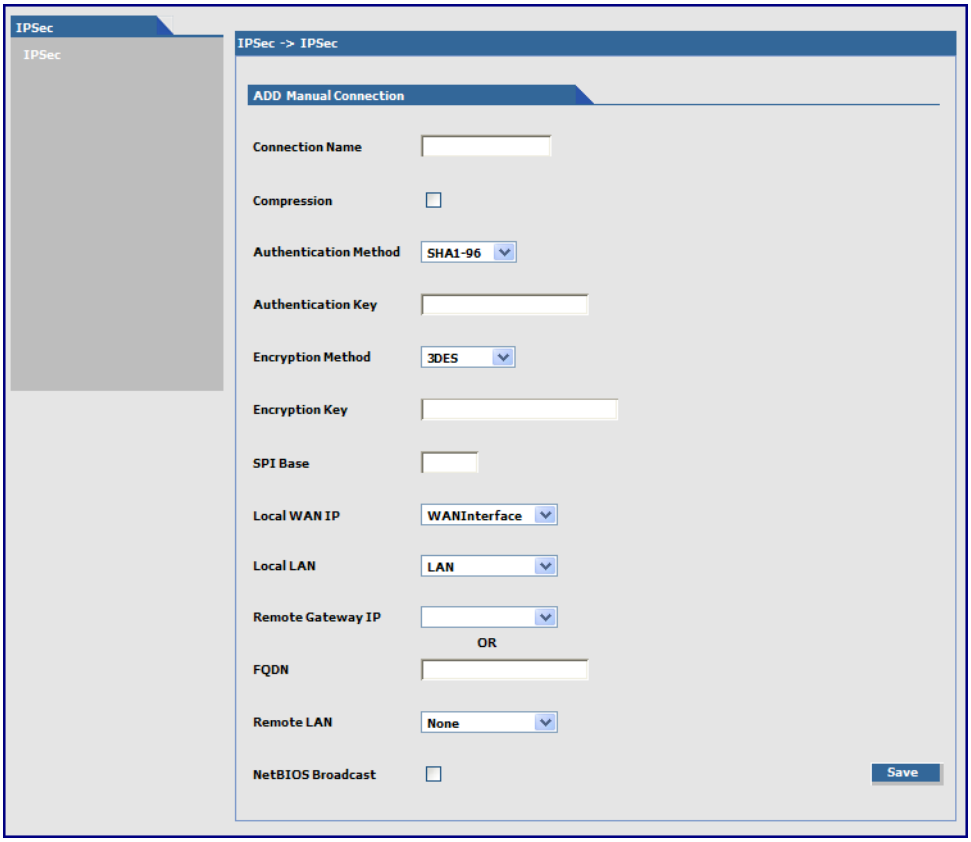
Remote ID

Enter a string identifier for the remote security gateway.

NetBIOS Broadcast: Check this option to enable broadcasts over the connection. It allows computers on the network to share Microsoft file and printer sharing information.

Save Button: Click the Save button to save these settings.

Add Manual Connection



Connection Name: Type name to identify the connection.

Compression: Check the compression checkbox to enable IPCOMP, the compression algorithm.

Authentication Method: Select the authentication algorithms used for the respective security services. Options are MD5-96 and SHA1-96.

Authentication Key: The VPN firewall can use either MD5-96 or SHA1-96 for authentication. For example, MD5-96 with a key of abcdefgh12345678.

Authentication Protocol	Key Length	Accepted Characters
SHA1-96	Must be 20 characters	Alphanumeric characters
MD5-96	Must be 16 characters	Alphanumeric characters

Encryption Method: Select the encryption method. Options include 3DES, AES-128, AES-192, AES-256, and NULL (no encryption).

Encryption Key: The router can use any one of the methods specified in its encryption algorithm. For example 3DES uses 24 alphanumeric characters (192 bits) as its encryption key. Example: 1234567890abcdefabcdabcd

Encryption Protocol	Key Length	Accepted Characters
Null	Must be 24 characters	Alphanumeric Characters
3DES	Must be 24 characters	Alphanumeric Characters
AES-128	Must be 16 characters	Alphanumeric Characters
AES-192	Must be 24 characters	Alphanumeric Characters
AES-256	Must be 32 characters	Alphanumeric Characters

SPI Base: The Security Parameter Index identifies a manual connection. The SPI is a unique identifier in the SA (Secure Association – a type of secure connection) that allows the receiving computer to select the SA under which a packet is processed. The SPI Base is a number needed by the manual keying code. Enter any 3-digit hexadecimal number, which is unique for a security association. Enter in the format of 0xhex (0x100 through 0xfff is recommended). If you have more than one manual connection, then the SPI Base must be different for each one.

Left Next Hop: Next Hop is the address of the next device in a routing table's path that moves a packet to its destination. You can configure this setting or leave it as a static value: 0.0.0.0. When not configured, the value is set to the Gateway of the Box/Gateway configured on the Interface/Right IP. The selection is based on the Left and Right IP.

Local WAN IP: Select the Interface to initiate the IPSec tunnel (Left Security Gateway).

Local LAN: Select the internal subnet of the local security gateway for which the security services are to be provided. If the router acts as a host, configure as **None**. Other options are Any, LAN, LAN Interface, WAN 1, WAN 1 Interface.

Remote Gateway IP: Select the interface in which the IPSec tunnel ends. In the case of Road Warriors with a Dynamic IP addresses, set to **ANY**. Other options include: LAN, LAN Interface, WAN 1, WAN 1 Interface, and None.

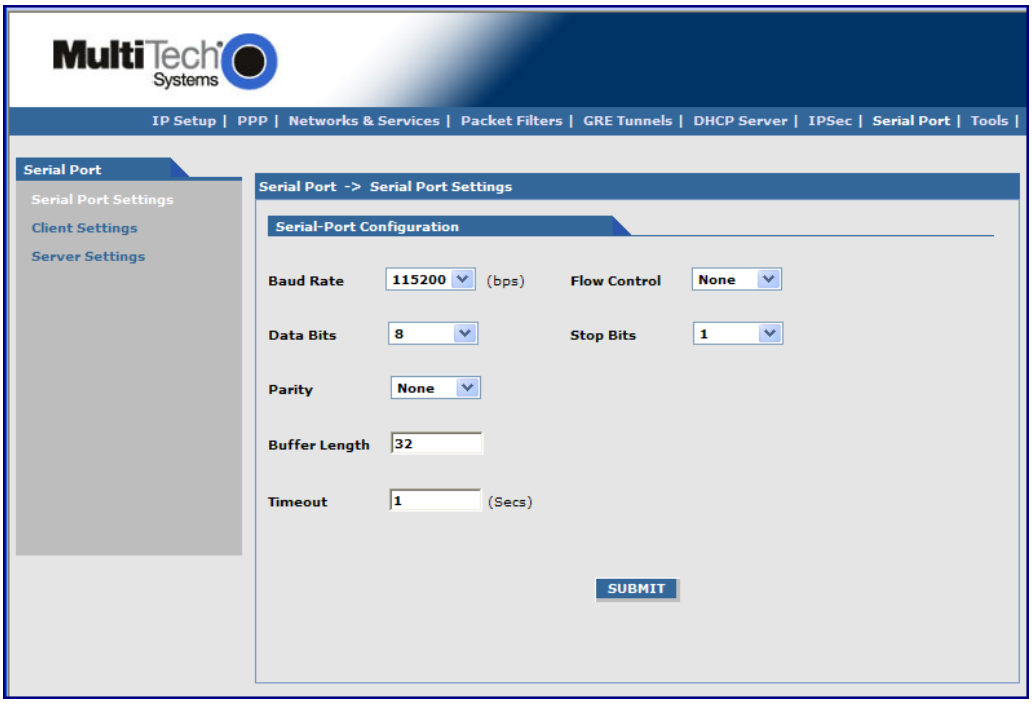
FQDN: FQDN is a Fully Qualified Domain Name that resolves to the Local Wan IP of the router or in the case of GRE/IPSEC, it is used to identify the Wan IP of the remote location. This is provided by your ISP or created by you if you are using a Dynamic DNS service. When FQDN is selected, leave the Remote Gateway IP blank.

Remote LAN: This is the internal subnet of the remote security gateway for which the security services are to be provided. If the remote end is a host, set to **None**.

NetBIOS Broadcast: Check this option to enable broadcasts over the connection. This allows computers on the network to share Microsoft file and printer sharing information.

Save Button: Click **Save** to save these settings.

Serial-Port, Serial Port Settings Parameters



Serial-Port Configuration Group

Serial-Port Configuration lets you configure the serial terminal connected to the RS-232 connector DE9 on the back of the unit.

Baud Rate: Sets the baud-rate at which the serial terminal is communicating. The default is 115200.

Flow Control: Sets the flow control for the serial port. Options are None or RTS-CTS. The default is None.

Data Bits: Sets the data bits for the serial port. Data bit selection is 7 or 8. The default is 8.

Stop Bits: Sets the stop bits for the serial port. Options are 1 or 2. The default is 1.

Parity: Sets the parity for the serial port. Options are None, Even, or Odd. The default is None.

Buffer Length: Sets the length up to which the data from the serial device is buffered before IP transmission. The default length is 32-characters.

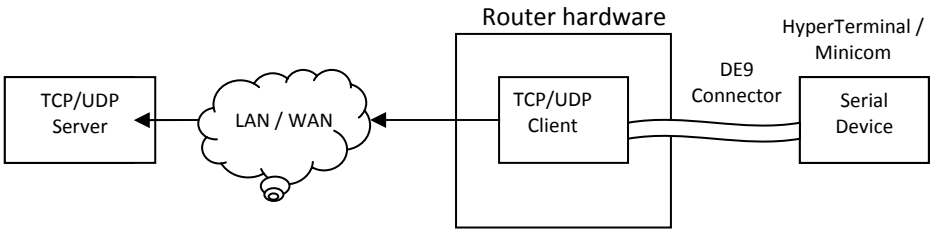
Timeout: Sets the timeout value for the serial terminal of how long it waits before IP transmission. The default is 1-second.

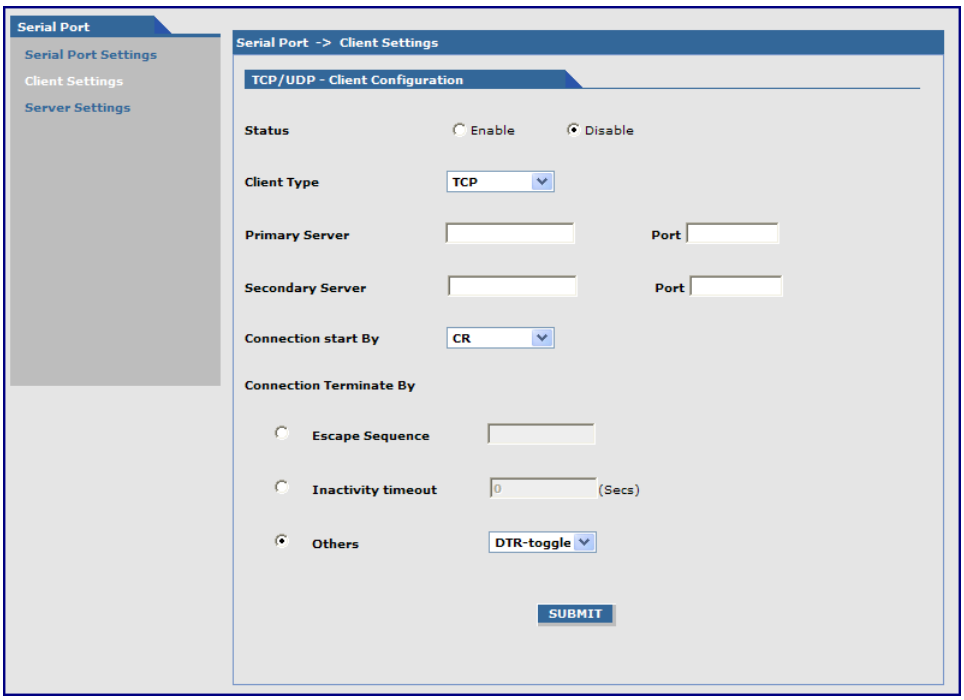
Submit Button: Click **Submit** to save these settings.

Serial Port, Client Settings Parameters

The TCP/UDP client feature enables the router to act as a proxy TCP/UDP client to the serial terminal connected to the DE9, RS232 port on the router thus facilitating the serial terminal to access any TCP/UDP server on the LAN/WAN. Once the session, serial terminal to TCP/UDP server, is opened successfully, it allows two-way traffic between the serial device and the remote server.

Initial connection setup for the TCP/UDP client is as follows:





TCP/UDP – Client Configuration Group

Configures TCP/UDP Client through which the serial terminal connected to the RS-232 connector, DE9 on the back of the unit communicates with the remote TCP/UDP server on the LAN/WAN.

Status: Sets the client status to either Enable or Disable. The default is Disable.

Client Type: Sets the client to either TCP or UDP. The default is TCP.

Primary Server: Enter the Primary Server IP address or Hostname. The default is blank.

Port: If a Primary Server IP address or hostname is enabled, enter the port number of the server.

Secondary Server: Enter the Secondary Server IP address or Hostname. The default is blank.

Port: If a Secondary Server IP address or hostname is enabled, enter the port number of the server.

Connection start By: Sets the trigger (Carriage Return (CR), DTR Assert, or Always on) in the serial port by which the connection starts. The default is Carriage Return (CR).

Connection Terminate By: Sets the connection terminate sequence as follows:

Escape Sequence: Set the escape sequence characters at which the connection terminates.

Inactivity timeout: Set the inactivity timeout at which the connection terminates.

Others: Use to set the other terminating sequences: DTR-toggle or Always-On.

DTR-toggle: If DTR status goes low, the connection terminates.

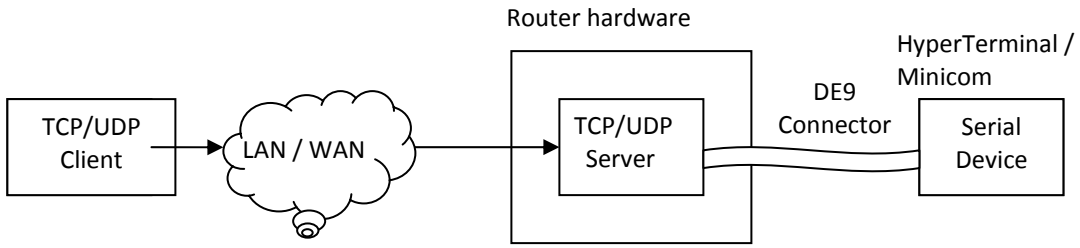
Always-On: Sets the terminate sequence as Always-on.

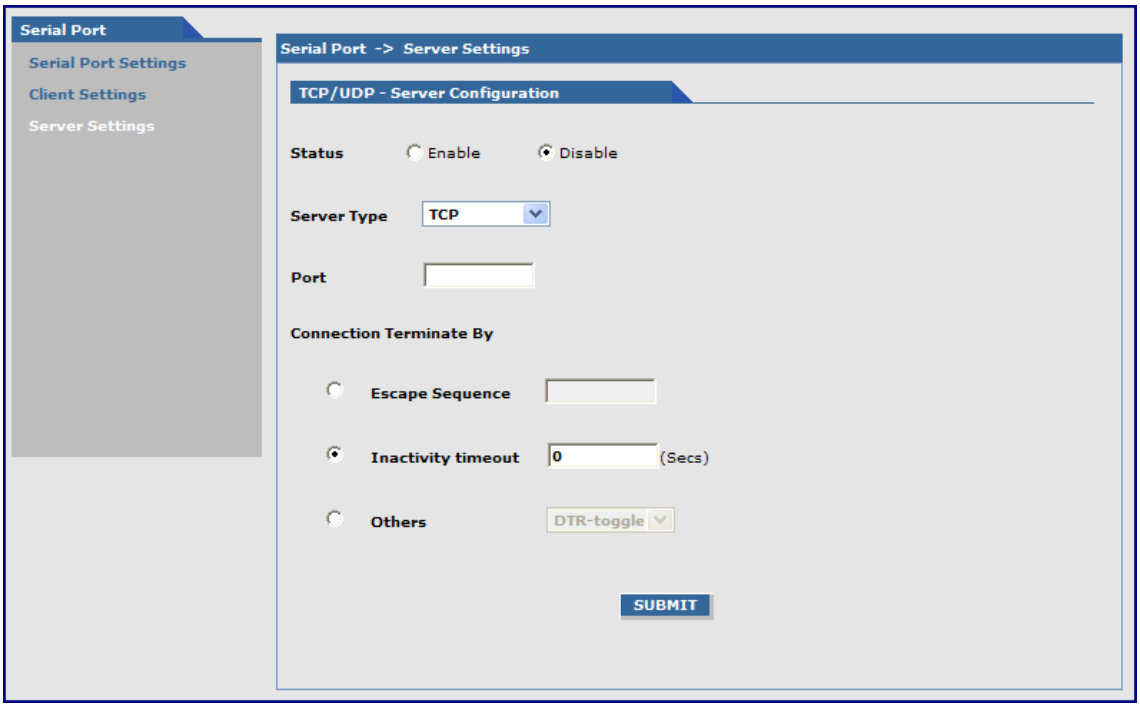
Submit Button: Click Submit to save these settings.

Serial Port, Server Settings Parameters

This feature enables a TCP/UDP client on the Ethernet network to connect to the remote serial terminal connected to the DE9, RS232 port on the router. The router acts as a TCP/UDP server which allows two way traffic between the TCP/UDP client and the remote terminal on the serial port.

The initial connection setup for the TCP/UDP server is shown in the figure that follows.





TCP/UDP – Server Configuration Group

Configures TCP/UDP Server through which the serial terminal connected to the RS-232 connector, DE9 on the back of the unit listens for the remote TCP/UDP client to communicate on the LAN/WAN.

Status: Sets the client status to either Enable or Disable. The default is Disable

Server Type: Sets the client to either TCP or UDP. The default is TCP.

Port: Sets the server port. The default is None

Connection Terminate By: Sets the connection's terminate sequence as follows:

Escape Sequence: Set the escape sequence characters at which the connection terminates.

Inactivity timeout: Set the inactivity timeout at which the connection terminates.

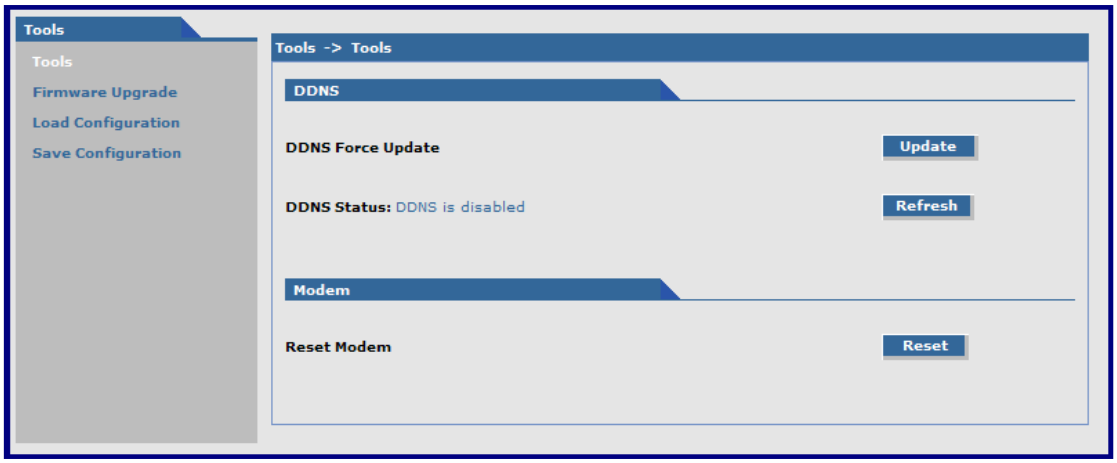
Others: The other terminating sequences are: DTR-toggle or Always-On.

DTR-toggle: If DTR status goes low, the connection terminates.

Always-On: Sets the terminate sequence as Always-on.

Submit Button: Click Submit to save these settings.

Tools, Tools Parameters



DDNS Group

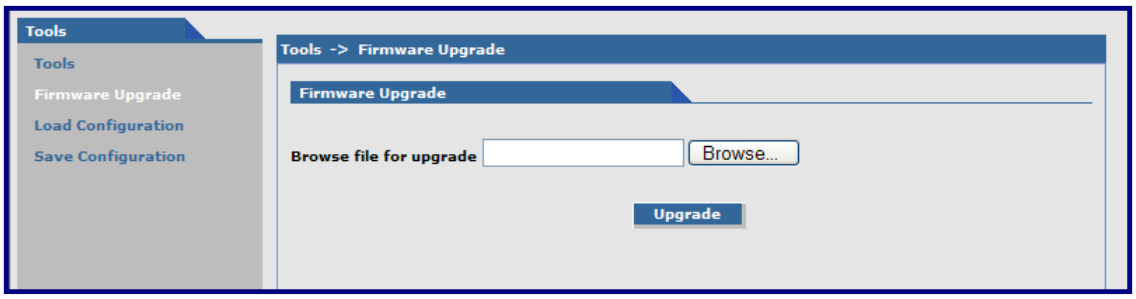
DDNS Force Update: Click **Update** to update the DDNS server with your current dynamically assigned IP address.

DDNS Status: Click **Refresh** to display the DDNS Status after a forced update.

Modem Group

Reset Modem: Click **Reset** to reset the integrated cellular modem.

Tools, Firmware Upgrade Parameters



Firmware Upgrade Group

Use the Firmware Upgrade group to upgrade the firmware for the router. You can find and download all Multi-Tech firmware upgrades from the Multi-Tech Website.

Before you upgrade your firmware, note the following:

- Save your present configuration in case you want to use it again.
- The new firmware is written into flash memory.
- A firmware upgrade takes at least 4 minutes. Do not turn off power during this time because the firmware is being downloaded.
- Do not upgrade the firmware remotely through the Cellular wireless connection.

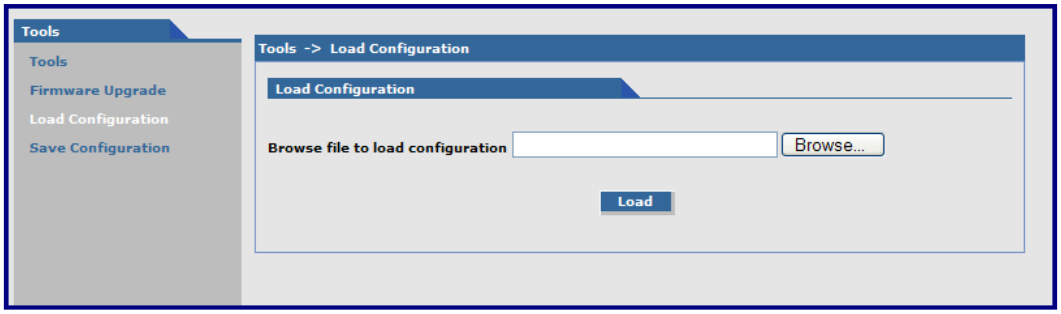
To upgrade firmware:

1. Navigate to the area where you stored the firmware upgrade. To do so, click **Browse**.
2. Select the mtcba-en2-u-xxx.bin file and press **Enter**. The file name displays in the **Browse file for upgrade** field. Make sure you select the correct BIN file; otherwise, your router can become inoperable.
3. Click **Upgrade**.

When upgrade is completed, the program returns to the main login screen.

4. After the firmware upgrade is complete, verify the configuration is as expected.
   - In particular, check that the DHCP scope settings are set properly.
   - Also, up to four IPSEC tunnels can be active at any given time. You can save more than four active tunnels, but they are not active.

Tools, Load Configuration Parameters



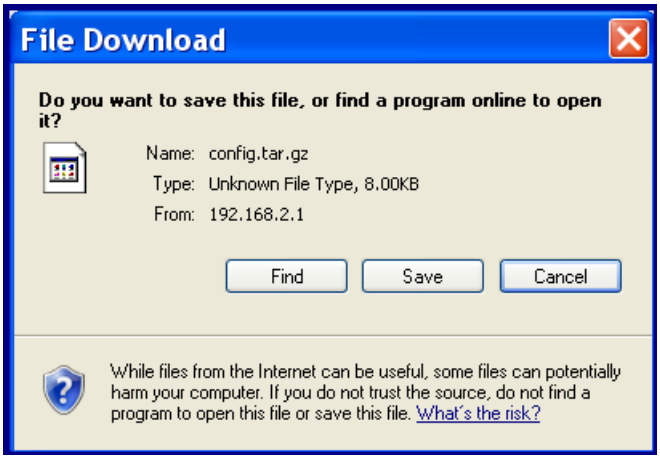
Load Configuration Group

Browse File for Load Configuration: Click **Browse** to open the file that allows you to locate the configuration file. When found, highlight the file name and press **Enter** so that the file name displays in the field. Then click **Load**.

Notes:

- The new configuration is written into the flash.
- A Configuration Upgrade takes at least 3 seconds to download and 60 seconds to install the settings and reboot. Reboot happens automatically.

When you click **Load**, the following dialog box opens. It shows the name of the file you selected.



Click the **Find**, **Save**, or **Cancel** buttons as desired.

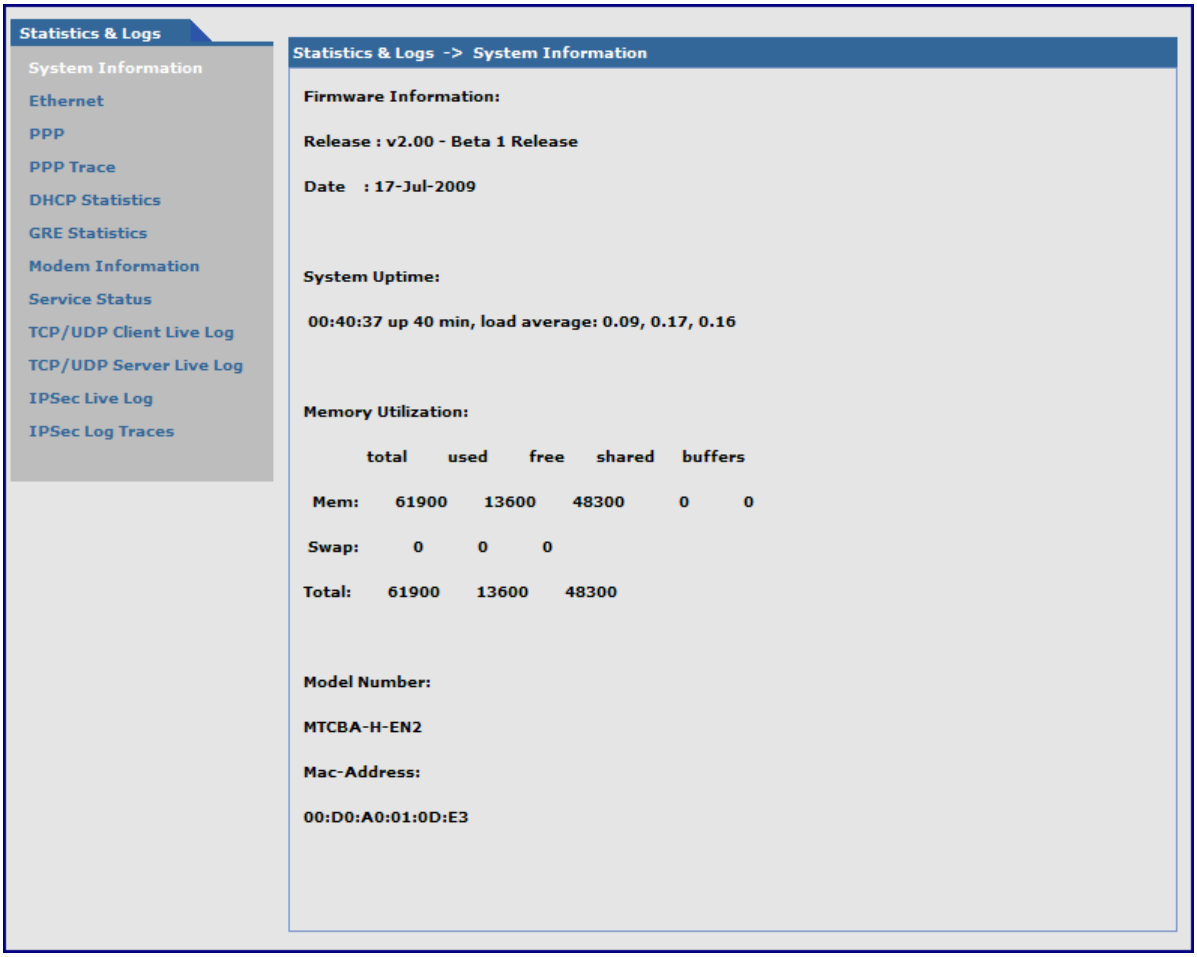
Tools, Save Configuration

Click this option to save the configuration.

Statistics & Logs

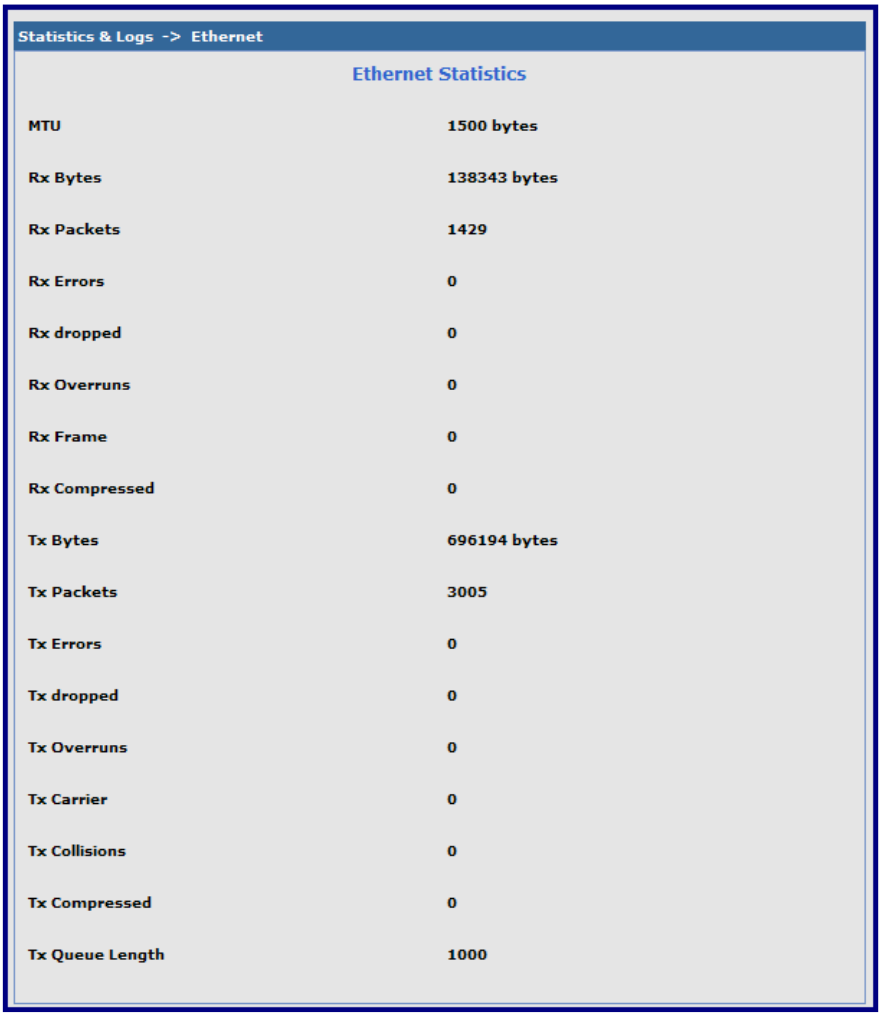
Statistics & Logs > System Information

This is an example of the Statistics & Logs System Information.



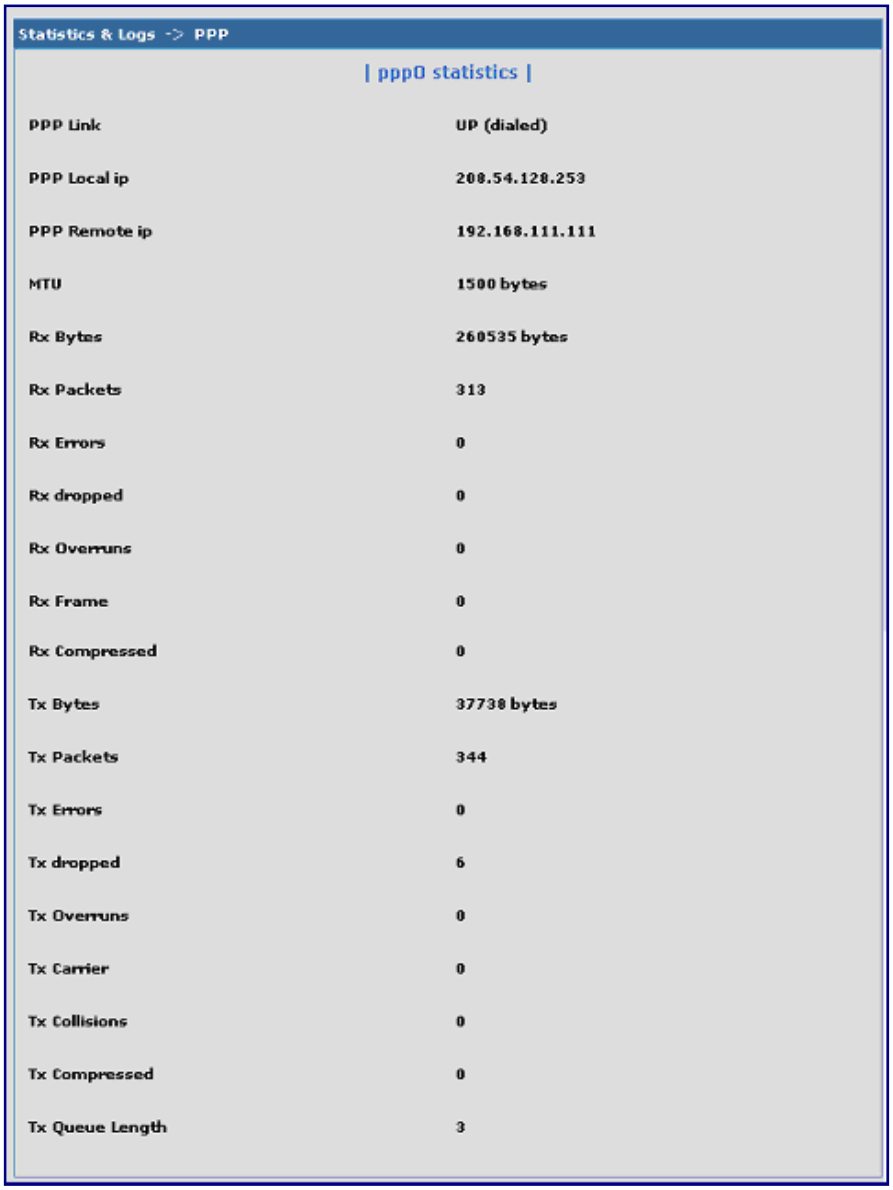
Statistics & Logs > Ethernet

This is an example of the Ethernet Statistics & Logs page. It shows Ethernet statistics.



Statistics & Logs > PPP

This is an example of the PPP Statistics & Logs page. It shows PPP statistics when PPP is enabled.

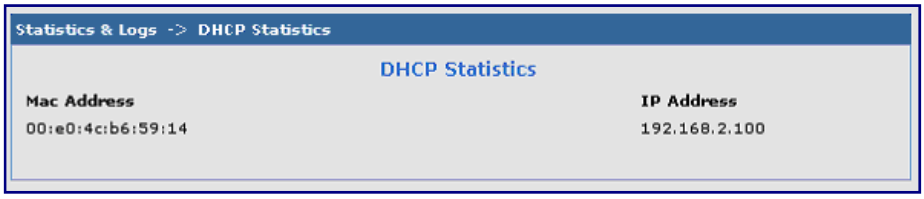


Statistics & Logs > PPP Trace

This is an example of the PPP Trace Statistics & Logs page. It shows the PPP trace messages.

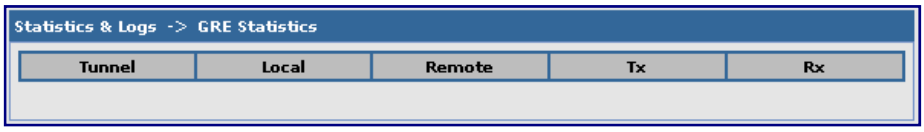
Statistics & Logs > DHCP Statistics

This is an example of the DHCP Statistics & Logs page. It shows the statistics of DHCP leases.



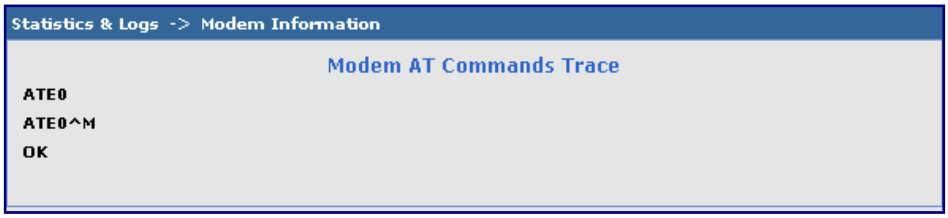
Statistics & Logs > GRE Statistics

This page displays the statistics of active tunnels.



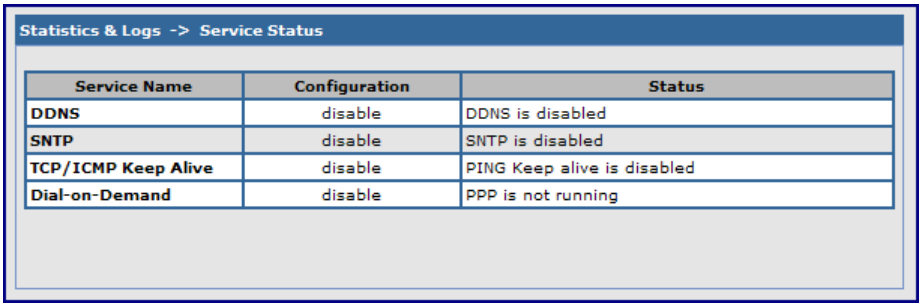
Statistics & Logs > Modem Information

This page displays the modem commands set on the **PPP > Modem Commands** page and also displays the results of the commands.



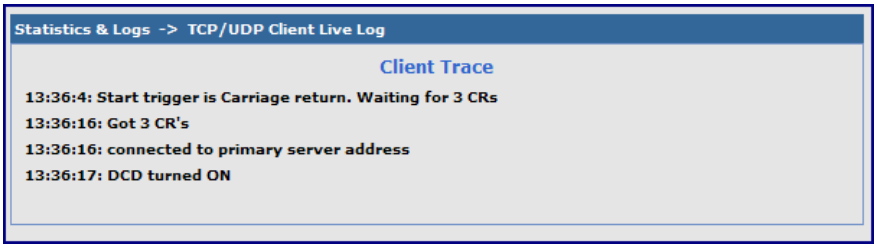
Statistics & Logs > Service Status

This page displays the summary of the service status.



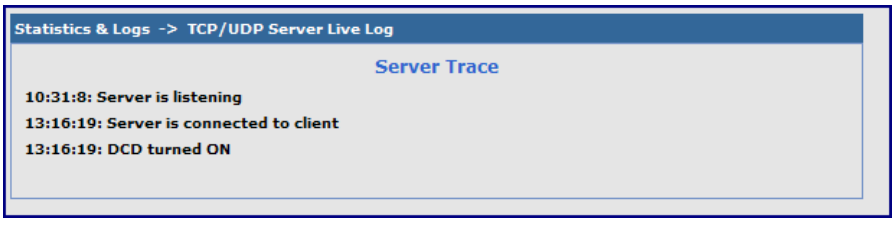
Statistics & Logs > TCP/UDP Client Live Log

This page displays the TCP/UDP Client Live Log.



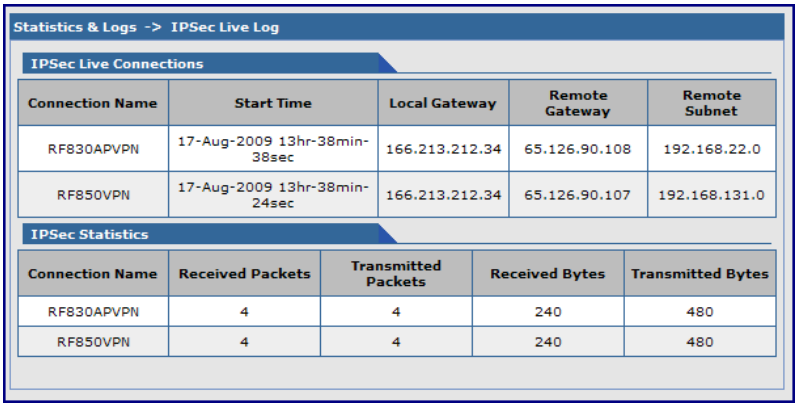
Statistics & Logs > TCP/UDP Server Live Log

This page displays the TCP/UDP Server Live Log.



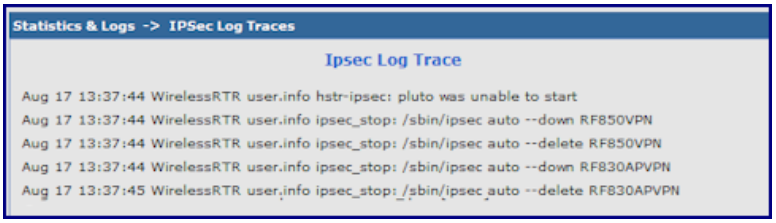
Statistics & Logs > IPSec Live Log

This page displays the IPSec Live Log.



Statistics & Logs > IPSec Log Traces

This page displays the IPSec Log Traces.



Appendix A – Commonly Supported Subnets

This table lists commonly supported subnets organized by address.

	Network Number	Hosts Available	Broadcast Address
255.255.255.128	N.N.N.0	N.N.N.1-126	N.N.N.127
/25	N.N.N.128	N.N.N.129-254	N.N.N.255
	Network Number	**Hosts Available**	**Broadcast Address**
255.255.255.192	N.N.N.0	N.N.N.1-62	N.N.N.63
/26	N.N.N.64	N.N.N.65-126	N.N.N.127
	N.N.N.128	N.N.N.129-190	N.N.N.191
	N.N.N.192	N.N.N.193-254	N.N.N.255
	Network Number	**Hosts Available**	**Broadcast Address**
255.255.255.224	N.N.N.0	N.N.N.1-30	N.N.N.31
/27	N.N.N.32	N.N.N.33-62	N.N.N.63
	N.N.N.64	N.N.N.65-94	N.N.N.95
	N.N.N.96	N.N.N.97-126	N.N.N.127
	N.N.N.128	N.N.N.129-158	N.N.N.159
	N.N.N.160	N.N.N.161-190	N.N.N.191
	N.N.N.192	N.N.N.193-222	N.N.N.223
	N.N.N.224	N.N.N.225-254	N.N.N.255
	Network Number	**Hosts Available**	**Broadcast Address**
255.255.255.240	N.N.N.0	N.N.N.1-14	N.N.N.15
/28	N.N.N.16	N.N.N.17-30	N.N.N.31
	N.N.N.32	N.N.N.33-46	N.N.N.47
	N.N.N.48	N.N.N.49-62	N.N.N.63
	N.N.N.64	N.N.N.65-78	N.N.N.79
	N.N.N.80	N.N.N.81-94	N.N.N.95
	N.N.N.96	N.N.N.97-110	N.N.N.111
	N.N.N.112	N.N.N.113-126	N.N.N.127
	N.N.N.128	N.N.N.129-142	N.N.N.143
	N.N.N.144	N.N.N.145-158	N.N.N.159
	N.N.N.160	N.N.N.161-174	N.N.N.175
	N.N.N.176	N.N.N.177-190	N.N.N.191
	N.N.N.192	N.N.N.193-206	N.N.N.207
	N.N.N.208	N.N.N.209-222	N.N.N.223
	N.N.N.224	N.N.N.225-238	N.N.N.239
	N.N.N.240	N.N.N.241-254	N.N.N.255

	Network Number	Hosts Available	Broadcast Address
255.255.255.248	N.N.N.0	N.N.N.1-6	N.N.N.7
/29	N.N.N.8	N.N.N.9-14	N.N.N.15
	N.N.N.16	N.N.N.17-22	N.N.N.23
	N.N.N.24	N.N.N.25-30	N.N.N.31
	N.N.N.32	N.N.N.33-38	N.N.N.39
	N.N.N.40	N.N.N.41-46	N.N.N.47
	N.N.N.48	N.N.N.49-54	N.N.N.55
	N.N.N.56	N.N.N.57-62	N.N.N.63
	N.N.N.64	N.N.N.65-70	N.N.N.71
	N.N.N.72	N.N.N.73-78	N.N.N.79
	N.N.N.80	N.N.N.81-86	N.N.N.87
	N.N.N.88	N.N.N.89-94	N.N.N.95
	N.N.N.96	N.N.N.97-102	N.N.N.103
	N.N.N.104	N.N.N.105-110	N.N.N.111
	N.N.N.112	N.N.N.113-118	N.N.N.119
	N.N.N.120	N.N.N.121-126	N.N.N.127
	N.N.N.128	N.N.N.129-134	N.N.N.135
	N.N.N.136	N.N.N.137-142	N.N.N.143
	N.N.N.144	N.N.N.145-150	N.N.N.151
	N.N.N.152	N.N.N.153-158	N.N.N.159
	N.N.N.160	N.N.N.161-166	N.N.N.167
	N.N.N.168	N.N.N.169-174	N.N.N.175
	N.N.N.176	N.N.N.177-182	N.N.N.183
	N.N.N.184	N.N.N.185-190	N.N.N.191
	N.N.N.192	N.N.N.193-198	N.N.N.199
	N.N.N.200	N.N.N.201-206	N.N.N.207
	N.N.N.208	N.N.N.209-214	N.N.N.215
	N.N.N.216	N.N.N.217-222	N.N.N.223
	N.N.N.224	N.N.N.225-230	N.N.N.231
	Network Number	**Hosts Available**	**Broadcast Address**
	N.N.N.232	N.N.N.233-238	N.N.N.239
	N.N.N.240	N.N.N.241-246	N.N.N.247
	N.N.N.248	N.N.N.249-254	N.N.N.255

	Network Number	Hosts Available	Broadcast Address
255.255.255.252	N.N.N.0	N.N.N.1-2	N.N.N.3
/30	N.N.N.4	N.N.N.5-6	N.N.N.7
	N.N.N.8	N.N.N.9-10	N.N.N.11
	N.N.N.12	N.N.N.13-14	N.N.N.15
	N.N.N.16	N.N.N.17-18	N.N.N.19
	N.N.N.20	N.N.N.21-22	N.N.N.23
	N.N.N.24	N.N.N.25-26	N.N.N.27
	N.N.N.28	N.N.N.29-30	N.N.N.31
	N.N.N.32	N.N.N.33-34	N.N.N.35
	N.N.N.36	N.N.N.37-38	N.N.N.39
	N.N.N.40	N.N.N.41-42	N.N.N.43
	N.N.N.44	N.N.N.45-46	N.N.N.47
	N.N.N.48	N.N.N.49-50	N.N.N.51
	N.N.N.52	N.N.N.53-54	N.N.N.55
	N.N.N.56	N.N.N.57-58	N.N.N.59
	N.N.N.60	N.N.N.61-62	N.N.N.63
	N.N.N.64	N.N.N.65-66	N.N.N.67
	N.N.N.68	N.N.N.69-70	N.N.N.71
	N.N.N.72	N.N.N.73-74	N.N.N.75
	N.N.N.76	N.N.N.77-78	N.N.N.79
	N.N.N.80	N.N.N.81-82	N.N.N.83
	N.N.N.84	N.N.N.85-86	N.N.N.87
	N.N.N.88	N.N.N.89-90	N.N.N.91
	N.N.N.92	N.N.N.93-94	N.N.N.95
	N.N.N.96	N.N.N.97-98	N.N.N.99
	N.N.N.100	N.N.N.101-102	N.N.N.103
	N.N.N.104	N.N.N.105-106	N.N.N.107
	N.N.N.108	N.N.N.109-110	N.N.N.111
	N.N.N.112	N.N.N.113-114	N.N.N.115
	N.N.N.116	N.N.N.117-118	N.N.N.119
	N.N.N.120	N.N.N.121-122	N.N.N.123
	N.N.N.124	N.N.N.125-126	N.N.N.127
	N.N.N.128	N.N.N.129-130	N.N.N.131
	N.N.N.132	N.N.N.133-134	N.N.N.135
	N.N.N.136	N.N.N.137-138	N.N.N.139
	N.N.N.140	N.N.N.141-142	N.N.N.143
	N.N.N.144	N.N.N.145-146	N.N.N.147
	N.N.N.148	N.N.N.149-150	N.N.N.151
	N.N.N.152	N.N.N.153-154	N.N.N.155
	N.N.N.156	N.N.N.157-158	N.N.N.159
	N.N.N.160	N.N.N.161-162	N.N.N.163
	N.N.N.164	N.N.N.165-166	N.N.N.167
	N.N.N.168	N.N.N.169-170	N.N.N.171
	N.N.N.172	N.N.N.173-174	N.N.N.175
	N.N.N.176	N.N.N.177-178	N.N.N.179
	N.N.N.180	N.N.N.181-182	N.N.N.183
	N.N.N.184	N.N.N.185-186	N.N.N.187
	N.N.N.188	N.N.N.189-190	N.N.N.191
	N.N.N.192	N.N.N.193-194	N.N.N.195
	N.N.N.196	N.N.N.197-198	N.N.N.199
	N.N.N.200	N.N.N.201-202	N.N.N.203
	N.N.N.204	N.N.N.205-206	N.N.N.207
	N.N.N.208	N.N.N.209-210	N.N.N.211

	N.N.N.212	N.N.N.213-214	N.N.N.215
	N.N.N.216	N.N.N.217-218	N.N.N.219
	N.N.N.220	N.N.N.221-222	N.N.N.223
	N.N.N.224	N.N.N.225-226	N.N.N.227
	N.N.N.228	N.N.N.229-230	N.N.N.231
	N.N.N.232	N.N.N.233-234	N.N.N.235
	N.N.N.236	N.N.N.237-238	N.N.N.239
	N.N.N.240	N.N.N.241-242	N.N.N.243
	N.N.N.244	N.N.N.245-246	N.N.N.247
	N.N.N.248	N.N.N.249-250	N.N.N.251
	N.N.N.252	N.N.N.253-254	N.N.N.255

Appendix B – Regulatory Compliance

CE

EMC, Safety, and R&TTE Directive Compliance

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of Member States relating to electromagnetic compatibility;

and

Council Directive 2006/95/EC of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits;

and

Council Directive 1999/5/EC of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

FCC Part 15 Class A Statement

This equipment has been tested and found to comply with the limits for a **Class A** digital device, pursuant to 47 CFR Part 15 regulations. The stated limits in this regulation are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the CFR 47 rules. Operation of this device is subject to the following conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference that may cause undesired operation.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement Canadien sur le matériel brouilleur.

Appendix C – Environmental Information

July, 2005

Waste Electrical and Electronic Equipment (WEEE)

The WEEE directive places an obligation on EU-based manufacturers, distributors, retailers and importers to take-back electronics products at the end of their useful life. A sister Directive, ROHS (Restriction of Hazardous Substances) complements the WEEE Directive by banning the presence of specific hazardous substances in the products at the design phase. The WEEE Directive covers all Multi-Tech products imported into the EU as of August 13, 2005. EU-based manufacturers, distributors, retailers and importers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the WEEE requirements.

Instructions for Disposal of WEEE by Users in the European Union

The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

REACH Statement

Registration of Substances:

After careful review of the legislation and specifically the definition of an "article" as defined in EC Regulation 1907/2006, Title II, Chapter 1, Article 7.1(a)(b), it is our current view Multi-Tech Systems, Inc. products would be considered as "articles". In light of the definition in § 7.1(b) which requires registration of an article only if it contains a regulated substance that "is intended to be released under normal or reasonable foreseeable conditions of use," our analysis is that Multi-Tech Systems, Inc. products constitute nonregisterable articles for their intended and anticipated use.

Substances of Very High Concern (SVHC):

Per the candidate list of Substances of Very high Concern (SVHC) published October 28, 2008 we have reviewed these substances and certify the Multi-Tech Systems, Inc. products are compliant per the EU "REACH" requirements of less than 0.1% (w/w) for each substance.

If new SVHC candidates are published by the European Chemicals Agency, and relevant substances have been confirmed, that exceeds greater than 0.1% (w/w), Multi-Tech Systems, Inc. will provide updated compliance status.

Multi-Tech Systems, Inc. also declares it has been duly diligent in ensuring that the products supplied are compliant through a formalized process which includes collection and validation of materials declarations and selective materials analysis where appropriate. This data is controlled as a part of a formal quality system and will be made available upon request.

Restriction of the Use of Hazardous Substances (RoHS)

Multi-Tech Systems, Inc.

Certificate of Compliance

2002/95/EC

Multi-Tech Systems, Inc. confirms that this product now complies with the chemical concentration limitations set forth in the directive **2002/95/EC** of the European Parliament (Restriction Of the use of certain Hazardous Substances in electrical and electronic equipment - **RoHS**)

These Multi-Tech Systems, Inc. products do not contain the following banned chemicals:

Lead, [Pb] < 1000 PPM

Mercury, [Hg] < 1000 PPM

Hexavalent Chromium, [Cr+6] < 1000 PPM

Cadmium, [Cd] < 100 PPM

Polybrominated Biphenyl, [PBB] < 1000 PPM

Polybrominated Diphenyl Ether, [PBDE] < 1000 PPM

Notes:

1. Lead usage in some components is exempted by the following RoHS annex; therefore, higher lead concentration could be found.
   a. Lead in high melting temperature type solders (i.e., tin-lead solder alloys containing more than 85% lead).
   b. Lead in electronic ceramic parts (e.g., piezoelectronic devices).

China ROHS

依照中国标准的有毒有害物质信息

根据中华人民共和国信息产业部 (MII) 制定的电子信息产品 (EIP) 标准 - 中华人民共和国《电子信息产品污染控制管理办法》（第 39 号），也称作中国 RoHS，下表列出了 Multi-Tech Systems Inc. 产品中可能含有的有毒物质 (TS) 或有害物质 (HS) 的名称及含量水平方面的信息。

成分名称	有害/有毒物质/元素					
	铅 (PB)	汞 (Hg)	镉 (CD)	六价铬 (CR6+)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板	O	O	O	O	O	O
电阻器	X	O	O	O	O	O
电容器	X	O	O	O	O	O
铁氧体磁环	O	O	O	O	O	O
继电器/光学部件	O	O	O	O	O	O
IC	O	O	O	O	O	O
二极管/晶体管	O	O	O	O	O	O
振荡器和晶振	X	O	O	O	O	O
调节器	O	O	O	O	O	O
电压传感器	O	O	O	O	O	O
变压器	O	O	O	O	O	O
扬声器	O	O	O	O	O	O
连接器	O	O	O	O	O	O
LED	O	O	O	O	O	O
螺丝、螺母以及其它五金件	X	O	O	O	O	O
交流-直流电源	O	O	O	O	O	O
软件/文档 CD	O	O	O	O	O	O
手册和纸页	O	O	O	O	O	O
底盘	O	O	O	O	O	O

X 表示所有使用类似材料的设备中有害/有毒物质的含量水平高于 SJ/Txxx-2006 限量要求。

O 表示不含该物质或者该物质的含量水平在上述限量要求

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CDMA 1xEV-D0

AT Commands Reference Guide

CDMA 1xEV-D0 AT Commands Reference Guide for the following products:

SocketModem® (MTSMC-EV2)
MultiModem® Cell (MTCBA-EV2)
MultiModem® iCell (MTCMR-EV2)
MultiModem® rCell (MTCBA-EV2-EN2)

PN S000482B, Version B

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Revisions

Revision Level	*Date*	*Description*
A	08/10/10	Initial release.
B	08/24/10	Add MultiModems to the list of products that this AT command set supports.

Trademarks

Multi-Tech Systems, Inc. registered trademarks include: ***SocketModem, MultiModem*** and the Multi-Tech logo.

World Headquarters

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, Minnesota 55112
Phone: 763-785-3500 or 800-328-9717
Fax: 763-785-9874
Internet Address: http://www.multitech.com

Technical Support

Please refer to the Copyright/Technical Support page in the product User Guide or Developer Guide.

Contents

Chapter 1 – Introduction

Document Structure

Following this introduction is a section on basic elements important to understanding and communicating with the modem. This includes discussions of the QNC (Quick Net Connect) call setup process and interaction with the CDMA Interworking Function (IWF), as well as notes on the connection between the host (DTE) and the Wireless modem (DCE).

The document then presents the commands, registers, result codes, and defaults provided in the command state of the modem.

Commands are often termed AT commands since this character sequence (originated by Hayes™) is used to prefix each specific command.

In addition to the commands, the definitions and use of status registers are also described.

Commands are referenced in strict alphabetical order. This facilitates searches for the syntax, parameters, and operation of specific commands. To help locate whether or not a command exists to perform a desired function, tables organize the commands into these groups:

- Basic modem operation actions – commands that make the modem execute an immediate action, such as dialing, or restoring settings.
- Basic modem configuration – settings governing the modem's behavior when executing basic operations.
- Advanced modem configuration – settings governing the modem's behavior related to advanced operations (for example, Mobile IP).
- Account activation and management commands.
- Device and service interrogation commands – commands to determine the services available, information about and the status of the modem.
- Voice operation – related to configuring, making, and controlling voice calls.
- SMS operations – commands to check, receive, and delete, incoming messages, and to originate outgoing messages.
- GPS – commands (See Universal IP AT Commands Guide).

In addition to the commands, the definitions and use of status registers are also described. The factory / reset defaults are listed in a separate table.

Result codes, both numeric and verbose, are provided in a separate table.

Extended Cellular Result Codes are also listed separately.

Conventions

The following format conventions are used in this reference.

Character codes or keystrokes that are described with words or standard abbreviations are shown within angle brackets using a different font: such as <CR> for Carriage Return and <space> for a blank space character.

Numeric values are decimal unless prefixed as noted below.

Hexadecimal values are shown with a prefix of 0x, i.e. in the form 0x3D.

Binary values are shown with a prefix of 0b, i.e. in the form 0b00111101.

Command and register syntax is noted using an alternate font: !DSMS=<i>[,m].

The "AT" characters are not shown, but must be included before all commands except as noted in the reference tables.

Characters that are required are shown in uppercase; parameters are noted in lowercase. Required parameters are enclosed in angle brackets (<i>) while optional parameters are enclosed within square brackets ([m]). The brackets are not to be included in the command string.

The default settings are noted in the command tables. Note that these are the factory default settings and not the default parameter value assumed if no parameter is specified. The factory defaults are also noted in a section at the end of each operational mode reference.

Result Code – This is a numeric or text code that is returned after all commands (except resets). Only one result code is returned for a command line regardless of the number of individual commands contained on the line.

Response – This term indicates a response from the modem that is issued prior to a result code. Reading registers or issuing commands that report information will provide a response followed by a result code unless the command generates an error.

For a discussion of how the modem frames these two elements, see “Framing”.

Responses and result codes from the modem, or host system software prompts, are shown in this font:

CONNECT 14400

Modem Basics

CDMA Basics

To help understand the call connection process in CDMA modems, a basic knowledge of the CDMA network helps. Two primary services are available using a CDMA 1xEVDO modem:

- IS-95B, a circuit switched type of connection; and
- 1x/1xEVDO, a packet switched connection.

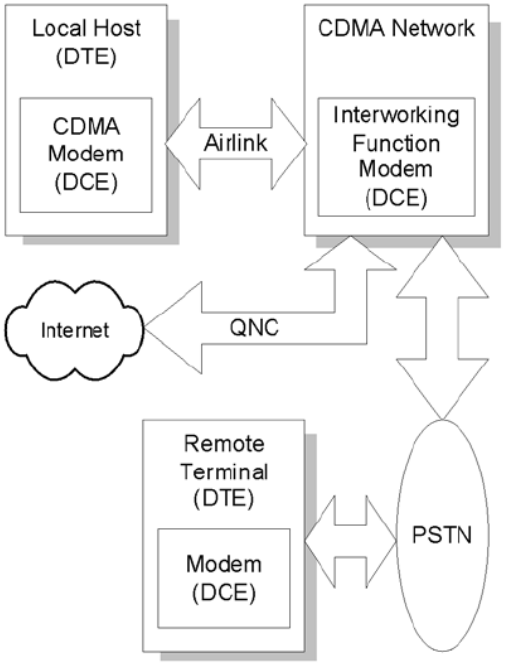
Traditional Wire Line

Before looking at the call setup process in CDMA, let's take a moment to review the traditional wire line modem. A call is established by the local modem placing the call over the Public-Switched Telephone Network (PSTN). The local and remote modems are connected and handshake the data protocol to use. The local modem can monitor the call progress by picking up the dial tone, busy, ring, and answer from the PSTN wire line connection.

CDMA IS-95B

Not being connected to the PSTN, the modem must first connect to the CDMA network. The CDMA service provider connects the call to either the PSTN or (by using QNC) the Internet. This environment uses an Interworking Function (IWF) to bridge the two systems.

CDMA IS-95B Call Connection Block Diagram



When using IS 95, there is special handling of AT commands. For a detailed explanation, consult Appendix A

Where traditional wire line has only the local host and modem on one side, the CDMA IS-95 model requires two modems on the local side: the IWF and the Wireless radio modem. These two modems must work as a team to make a data connection.

For Internet connections, the interworking function can use a special feature called QNC (Quick Net Connect). The IWF provides a link to the Internet without going through the PSTN.

Establishing a standard point-to-point call requires the cellular modem to configure a modem at the IWF. It is the IWF modem that actually connects to the PSTN and dials the number. Call progress is not directly available to the local modem, although some information can be exchanged. When the IWF has completed the handshake with the remote modem, the local modem is advised and the connection is complete.

CDMA 1X

In areas where this service is provided, the modem can connect much like a local area network card. The connection can be “always on” and only actively used when there is packet data to send or receive.

CDMA 1X offers higher speed data operations than are available with IS-95 service. IS 95 is limited to 14.4 kbps. The packet services of CDMA 1X use a fundamental channel at 9600 bps and can add supplemental channels when needed to boost speed to as high as 153.6 kbps.

CDMA 1xEV-DO

In areas where this service is provided, the modem can provide packet data services at a much higher data rate, as shown in the following table.

Data Service		Theoretical Maximum Data Rate	Typical Data Rate
1xEV-DO rev. 0	Upload	153 kbps	40–80 kbps
	Download	2.4 Mbps	400–700 kbps
1xEV-DO rev. A	Upload	1.8 Mbps	300–400 kbps
	Download	3.1 Mbps	600–1300 kbps

Voice Service

Also added to the modem is the ability to make and receive voice calls. This allows the modem to serve as a cellular telephone.

Host Connection Basics

The embedded modem provides a USB interface and optional serial port interfaces. To support the high data rate of the 1xEVDO service the USB is highly recommended. The “Modem Port” presented is the interface available for performing AT commands.

Modes, States, and Conditions

Discussion of the operation of the modem requires understanding the settings of the modem and just how it is handling the data being sent to it. Describing the modem as being in a particular “mode” is not sufficient to capture the various characteristics of the modem in any given case.

To improve clarity, this document uses the words “mode”, “state”, and “condition” to reflect different elements of the modem’s configuration. This section describes the various modes, states, and conditions that are used in the reference.

The CDMA 1X modems operate very much like a landline modem. There are, however, some differences in that the modem supports multiple connection options.

One method of operation is to place a call just like a landline modem would (asynchronous serial). We call this a CSC (Circuit Switched Cellular) call. This type of connection supports data communication, and is available in IS-95 service areas.

An alternate (and more common) method is to place a QNC call by dialing a special number provided by your carrier. QNC provides a mechanism to connect to the Internet using PPP, without using an intermediate modem. This is functionally identical to using Dial-Up Networking for a PPP connection to an Internet Service Provider (TCP/IP) on a standard landline modem. QNC offers a faster call connection time than standard CSC calls. This is also available in IS-95 coverage.

EV-DO products introduce a third data connection type, using 1X service. This is a packet data connection that does not tie up a circuit (or channel), but rather operates like a packet switched network, in which multiple users share the resources and only use them when there is data to send or receive.

These three calling options are simply different methods of placing what amounts to a data call. As such they are not included in the classification of modes, states, and conditions.

The commands and registers used depend on the modem's operating mode. The state of the modem and its condition also determine how the modem will behave in any given situation.

Modes

For the purposes of this document, the following are the modes of operation: Data and Voice.

Data (CSC, QNC, or Packet)

Connections to a PCS or cellular network for data transfers. This includes asynchronous (CSC) calls, PPP packet connections to the network (QNC), and 1X packet service connections.

Voice

The product is being used for voice communication. In addition to the basic modes (data and voice), there are states and conditions to consider.

States

The modem's state, in conjunction with its condition, governs how the modem handles traffic to and from the host (DTE), and to and from a remote modem. Data mode can support up to three states: Command, Pass through, and Data.

Command

The modem exchanges data with the host (DTE) as AT commands and replies. This state handles commands at the modem without the use of the airlink to the IWF modem. Voice modes are always in command state.

Passthrough

The modem has an active airlink with the IWF but is otherwise in the Command state. Data from the local host is passed through the modem to the IWF where it is executed as an AT command and then reflected back for execution by the local modem. This state only applies to IS-95 calls, not 1X packet connections.

Data

Communication is passed between the host and a remote terminal or network as computer data.

Note: Voice modes do not support the data state. Even while off hook with a voice call active, the modem still communicates over the serial connection in command state. Commands can be issued and executed while a voice call is in progress.

Conditions

In addition to mode and state the modem can be in one of two conditions: online and offline.

Online

Actively connected to a remote terminal or network (off-hook).

Offline

Disconnected from any remote terminal or network (on-hook).

While in offline condition the modem can only be:

- In command state (without an airlink), or
- In pass through state with an airlink to the IWF modem but without an active call.

In the online condition, the modem can be:

- In data state, which passes data through the modem between the host (DTE) and the remote terminal or network.
- In pass through state (IS-95B), which exchanges commands and replies between the host (DTE) and the IWF modem (DCE). The data is not sent all the way through the active connection to the remote terminal. The remote connection is still active (carrier is maintained) but data is not forwarded to the remote end.

State Transitions

On power up the modem is in command state.

Command to Data State

The modem changes to data state when a session is opened either by dialing a connection (or answering a data or fax call). When a session opens, the modem issues the CONNECT message and asserts the DCD control signal.

> **Note:** Due to multi-processing in the modem, the DCD signal may be asserted slightly before the modem has completed the transition to data state. The host device should allow a delay of 100 ms after receiving the complete CONNECT message and DCD signal before beginning transmission; otherwise some data may be lost.

Data to Command State

When the modem changes to command state, an OK result is issued. This may be preceded by another result (such as NO CARRIER) to indicate that the session was closed by an event outside the modem. A closed session requires the modem to return to command state.

Several events can cause the modem to transition from data to command state based on mode.

SLIP mode transitions:

- DTR is deasserted, with a configuration to use DTR (&D1 or &D2)
- The modem receives the escape sequence as a SLIP frame: (0xC0 +++ 0xC0)
- The modem is reset or power-cycled

PPP mode transitions:

- DTR is deasserted, with a configuration to use DTR (&D1 or &D2)
- PPP negotiates command state
- The modem is reset or power-cycled

Modem Buffers

Communication with the modem is buffered to allow the modem to provide a variety of features and speed configurations. This section provides an introduction to the types of buffering performed by the modem.

Command Buffer

When in command state, the modem buffers the input from the host until a <CR> is entered. The buffered data can be edited using the backspace <BS>. The modem (with Echo enabled) may echo the sequence <BS><space><BS> for human readability.

There is a limit of 518 characters to one command line, excluding the AT prefix and the <CR> termination. If the command buffer length is exceeded, the modem continues to echo input (which is not buffered) until the <CR> is received. When the <CR> is entered, the modem returns the ERROR result code without executing any commands in the line. Once over the limit, the <BS> does not bring you back under the limit; the ERROR code is still returned.

The command buffer is distinct from the data receive and transmit buffers. The command buffer retains the contents of the last issued command until the AT command prefix is received for the next command.

Data Buffers

Data being transmitted or received is buffered in several ways depending on the mode and nature of the connection. Some caution must be taken when disconnecting to ensure that any buffered data in the modem has been properly processed prior to breaking the connection.

Specific settings for buffer controls are described in the relevant commands and registers. Normal configuration of the modem does not require you to adjust these settings.

Speed Buffering

The simplest form of buffering allows for line speed differences and busy conditions between the host (DTE) and modem and between the modem and the remote terminal or network. The network side of the connection can have rates up 153.6 kbps, while the local host connection can be at one of many different speeds from 300 bps to 230.4 kbps.

Where large amounts of data are being exchanged, local hardware flow control must be used to prevent buffer overflows. To reduce packet loss, the CDMA protocol incorporates flow control on the network connection.

Command Handling

AT can be issued as a command without parameters. It acts like a “ping” to the modem and always gives a result code of “OK”. If there is no response from the modem, try issuing ATQ0 (Quiet mode off). If this fails, try the “+++” escape sequence or resetting the modem.

Commands may be entered in upper or lower case.

Concatenation

More than one command can be included in a single line, although some commands or their parameters must be placed at the end of the line. When concatenating commands, a space between basic commands is optional. Where extended commands (those beginning with a non-alphabetic character) are concatenated, they must be separated by a semi-colon.

Commands are executed in the order entered. If a command results in the ERROR result code, the balance of the command line is ignored. Only one result code is returned for the entire command line.

Parameters

Most AT commands support one or more parameters, usually a number. Parameter ranges are specified in the reference.

Commands that normally accept a single numeric option switch ([n]) and are issued without that parameter assume a value of zero (0).

Defaults shown in the command tables are those for the factory settings of the modem and are not the defaults assumed for a command issued without parameters.

Registers

Some registers are read only. If an attempt is made to write to a read only register, the ERROR result code is returned.

Some registers store the setting of commands. Changing the register is equivalent to changing the command setting. See the Table of S-Registers for the standard default values.

See the Table of Stored Profile Settings for the factory defaults.

Responses and Result Codes

Most commands return only a result code however some commands request information, which is provided by the modem as a response prior to the result code.

Possible Result Codes

Result codes are not shown in the command tables unless special conditions apply. Generally the result code OK is returned when the command has been executed. ERROR may be returned if parameters are out of range, and is returned if the command is not recognized, or the command is not permitted in the current mode, state, or condition of the modem.

See the Table of Result Codes, giving both the numeric and verbose results.

Human vs. Machine Interface

The AT command interface was designed for human interaction. When an intelligent host is managing a modem, the interface may need to be altered; result code words replaced with numbers, for example. Framing characters (line feeds and carriage returns) must be properly understood to ensure the host system properly parses the responses and result codes.

As shipped the modem is configured with these settings:

- Echo enabled (E1): which causes the modem to echo characters received from the host back to it while in command state. The backspace is echoed as <BS>.
- Quiet result codes disabled (Q0): which enables the modem to issue result codes following commands. Quiet on (Q1) suppresses result codes entirely; responses remain unaffected.
- Verbose result codes (V1): which provides results in English text appended with <CR><LF>. Verbose off (V0) returns the results as ASCII numeral codes. Numeric codes are much easier to process.

With Echo on (E1 - the default), data received from the local host while in command state is echoed back to the host. This can present problems to machine control, which is not interested in an echo of its own commands to the modem. In some configurations the echo should be turned off (E0).

The configuration for most machine-controlled hosts is more likely to be set to Echo Off, and Verbose Off or possibly Quiet On.

Framing

The framing of the response and result elements by <CR><LF> depends heavily on the settings of the modem. In particular the settings of Verbose (V) and Quiet (Q) modes alter the framing of both responses and result codes.

These elements are normally formatted for human reading with a terminal program, however users wishing to have software read and adjust to these responses and result codes must understand how they are framed.

Framing Characters

The modem will frame replies with carriage return and line feed characters as they are defined in registers S3 and S4 respectively. These are normally the ASCII values 13 <CR> and 10 <LF>. For the purposes of the discussion here, they are referred to as <CR> and <LF>.

If there are any problems determining the exact framing of the response and result codes, use a protocol analyzer to monitor the exchanges.

Response Framing

Regardless of command settings, responses are in ASCII text with a trailing <CR><LF>. Where a response has more than one line, each line is terminated with a <CR><LF>. The programmer must know the number of lines expected in the response.

The setting of Verbose (V) on (=1) triggers a leading <CR><LF> prior to the first line of the response. If Verbose is off (=0), there are no leading characters prior to the first line of response.

The setting of Quiet (Q) has no impact on responses.

Result Code Framing

Every command returns a result code unless the Quiet command is enabled. If Quiet (Q) is on (=1), then there are no framing characters nor any result code returned; the modem is truly silent with respect to result codes.

A leading <CR><LF> is inserted ahead of the result code if Verbose (V) is on (=1), otherwise there are no leading characters prior to the ASCII numeral result.

The result code is always followed by a <CR>. There is a trailing <LF> only if Verbose is on. Samples:

V=1 <CR><LF>OK<CR><LF>

V=0 0<CR>

Chapter 2 – Overview of Commands

Introduction

The modem supports commands for:

- IS 95B data service
- 1X packet service
- SMS
- GPS (See Universal IP AT Commands Guide)

AT Commands Summary by Function

The reference tables are presented in strict ASCII alphabetical order (including prefixes). This format allows quick look-up of each command to verify syntax, parameters, and behaviors. It does not lend itself to finding whether or not the modem has a command to perform a particular service or setting.
The summary in this section organizes the commands into functional groups to allow you to more quickly locate a desired command when the operation is known but the command is not.

Basic Operation Action Commands

Command	Description
&F	Factory Settings Restore
&V	View Configuration
+++	Escape from Data State to Command State
A	Answer – Manual
D	Dial
H	Hook Control
O	Online (Remote)
Z	Profile Restore
-DTMFB	DTMF Burst
-DTMFK	DTMF Key
-RESET	Reset
-SHTDWN	Shutdown
-TONMUT	Tone Mute

Basic Modem Configuration Commands

Command	Description
&C	Data Carrier Detect Control
&D	Data Terminal Ready Options
+CFG	Configuration String
+CMUX	Multiplex Option
+CQD	Command State Inactivity Timer
+CRC	Cellular Result Codes
+CRM	Local (Rm) Interface Protocol
+CTA	Packet Data Inactivity Timer
+CXT	Cellular Extension
+FCLASS	Modem Operating State

Command	Description
+ICF	Character Framing
+ILRR	Local Rate Reporting
+IPR	Fixed Port (Rm) Rate
+MA	Modulation Auto mode
+MR	Modulation Reporting
+MS	Modulation Selection
+MV18R	V.18 Reporting
+MV18S	V.18 Selection
+WWKUP	Wake-up Events Mask
E	Echo (Command State)
L	Loudness (Speaker Volume)
M	Mute (Speaker Control)
P	Pulse Dialing
Q	Quiet – Result Code Display Option
S	S-Register Read and Write
T	Tone Dialing
V	Verbose – Result Code Form
X	Result Code/Call Progress Control
-HDSET	Headset Detection Option
-TONDUR	Tone Duration

Advanced Modem Configuration Commands

Command	Description
!APPSUBTYPES	Application subtypes negotiated for the four streams
!MUFWDRESET	Resets all the data reported by !MUFWDSTATS.
!MUFWDSTATS	Current Multi-User Forward Traffic Channel Statistics
!PERSONALITY	Current personality and its negotiated protocol subtypes
!PROTSUBTYPES	Negotiated subtypes for all protocols in all stored personalities
!SCPCUSTCONFIG	Current Session Configuration Protocol Customer configuration
!SESSIONSTATUS	Current HDR session status
!SIPID	Simple IP setup (user ID)
!SIPPWD	Simple IP setup (password)
!SLEEPPARMS	1xEV-DO Rev. A sleep parameters (slot cycle indexes and sleep periods)
!SUFWDCCSTATS	Current Single User Forward Channel Statistics (Single User packet early slot termination count for all supported DRCs on Forward Control Channel)
!SUFWDCRCS	Current Single User Forward Channel Statistics (Single User packet CRCs and Packet Error Rate).
!SUFWDRESET	Resets the data reported by !SUFWDCCSTATS, !SUFWDCRCS, and !SUFWDTCSTATS.
!SUFWDTCSTATS	Current Single User Forward Channel Statistics (Single User packet early slot termination count for all supported DRCs on Forward Traffic Channel)
$QCMIP	Mobile IP behavior
$QCMIPEP	Enables/disables the currently active Mobile IP user profile.
$QCMIPGETP	Query a user profile
$QCMIPNAI	Set the Network Access ID (NAI) for the currently active profile
$QCMIPP	Select one of the Mobile IP user profiles to be the current active profile

Account Activation Commands

The modem supports modem account activation via the AT command interface.

Command	Description
-NAMLCK	NAM Lock—enter the subsidy lock or SPC required to write account data
-NAMVAL	NAM Values—query or set the account data

Device and Service Interrogation Commands

Command	Description
I	Product identification information
!ECIO	Ec/Io
!GMODE	Mode of the modem
!MDMVER	Version of the modem firmware
!PREV	Protocol Revision
!PRLVER	PRL version
!RSSI	Received Signal Strength Indication
!STATUS	Modem status report
!SYSTIME	CDMA time
+CAD?	Analog or Digital Service (Read-only) (local only)
+CBIP?	Base Station IP Address (Read-only)
+CMIP	Mobile Station IP Address (Read-only)
+CSQ	Signal Quality (Read-only)
+CSS?	Serving System (Read-only)
+GCAP	Get Capabilities
+GMI	Get Manufacturer
+GMM	Get Model Number
+GMR	Get Revision
+GOI	Get ISO ID
+GSN	Get ESN
+WGETWK	Request Wake-up Reason

SMS Messages Commands

The modem supports sending and receiving SMS (Short Message Service) messages.

Command	Description
!CNTSMS	Count of SMS messages in the modem
!DASMS	Delete All SMS messages
!DSMS	Delete SMS message (selective)
!GSMS	Get SMS message from the modem
!SSMS	Send SMS message, or query the send status

Chapter 3 – ! Prefix Commands

Result codes are not shown in the following commands unless special conditions apply. Generally, the result code OK is returned when the command has been executed. ERROR may be returned if parameters are out of range and is returned if the command is not recognized or is not permitted in the current state or condition of the modem. A full list of result codes (verbose and numeric) is provided in the Result Code Table later in this manual.

!APPSUBTYPES Negotiated Subtypes

Syntax: AT!APPSUBTYPES

Description: Application subtypes negotiated for the four streams.

Example: AT!APPSUBTYPES
Stream0: Default Signaling Application
Stream1: Default Packet Application for SN
Stream2: Default Packet Application for AN
Stream3: Default Test Application
OK

!CNTSMS Count SMS

Syntax: AT!CNTSMS

Description: Reports the number of messages stored in the modem as follows:

New Urgent Msg	{Index = 1}:	<n>
New Regular Msg	{Index = 2}:	<r>
Old Messages	{Index = 3}:	<o>
Voice Messages	{Index = 4}:	<v>

The Index number corresponds to the SMS list index used to retrieve and delete messages. The counters n, r, o, and v indicate the number of messages in each list.

When retrieving (!GSMS) or deleting (!DSMS), the message number is base 1, so the highest message number in any list is the same as the reported count.

!DASMS Delete All SMS

Syntax: AT!DASMS

Description: Deletes all SMS messages from all four SMS lists. Use this command with care, as confirmation is not required.

!DSMS= Delete SMS (Selective)

Syntax: !DSMS=<i>[,m]

Description: Deletes one or all messages from one of the index lists (for the definitions of the SMS index lists, see !CNTSMS).

Parm	Meaning
i	Message list (index 1, 2, 3, or 4)
m	Message number

Message number 1 is the oldest message, and the number reported by !CNTSMS, is the most recent message.

If the message number parameter is omitted, then all messages in the specified index list are deleted.

Normally messages are only deleted from list 3 (old).

!ECIO? Ec/Io

Syntax: AT!ECIO?

Description: If there is an active pilot, returns the current Ec/Io in units of 1dB. See also !RSSI.

!GMODE Mode of the Modem

Syntax: AT!GMODE

Description: Asks for the mode of the modem. Returns either “ONLINE” or “OFFLINE”

!GSMS? Get SMS

Syntax: AT!GSMS?<i,m>

Description: Read an SMS message from the modem. The message read is determined by the parameters:

Parm	Meaning
i	message list (index 1, 2, or 3)
m	message number

Message number 1 is the oldest message, and the number reported by !CNTSMS, is the most recent message.

After a new message is read, it is placed in message list index 3 (old messages).

The following information may be displayed:

- Message center timestamp (optional)
- Originating address
- Priority (optional)
- User data

!MDMVER? Version of the Modem Firmware

Syntax: AT!MDMVER?

Description: Returns the firmware version being run on the modem.
See also +GMR (Get Revision).

!MUFWDRESET Reset Data in !MUFWDSTATS

Syntax: AT!MUFWDRESET

Description: Resets all the data reported by !MUFWDSTATS.

!MUFWDSTATS Current Traffic Channel Statistics

Syntax: AT!MUFWDSTATS

Description: Current Multi-User Forward Traffic Channel Statistics.
!MUFWDRESET resets the data reported by this command.

Example:

at!mufwdstats
FORWARD TRAFFIC CHANNEL

CRC Count			**Termination Slot Count**			
--------Good CRCs		**----Bad CRCs**	1	2	3	4
DRC3_128	**0**	**-**	0	0	0	0
DRC3_256	**0**	**-**	0	0	0	0
DRC3_512	**0**	**-**	0	0	0	0
DRC3_1024	**0**	**0**	0	0	0	0
DRC5_2048	**0**	**0**	0	0	0	0
DRC8_3072	**0**	**0**	0	0		
DRC10_4096	**0**	**0**	0	0		
DRC13_5120	**0**	**0**	0	0		

Packet Error Rate (%): 0.000
OK

!PERSONALITY? Displays Current Personality

Syntax: AT!PERSONALITY?

Description: Displays the Current Personality and its negotiated protocol subtypes.

Example:

at!personality?
Current Personality: 0
Physical Layer Protocol Subtype: 0
Control Channel MAC Protocol Subtype: 0
Access Channel MAC Protocol Subtype: 0
Fwd Traffic Channel MAC Protocol Subtype: 0
Rev Traffic Channel MAC Protocol Subtype: 0
Key Exchange Protocol Subtype: 0
Authentication Protocol Subtype: 0
Encryption Protocol Subtype: 0
Security Protocol Subtype: 0
Idle State Protocol Subtype: 0
Generic MM Cap Disc Protocol Subtype: 0
Generic Virtual Stream Protocol Subtype: 0
OK

!PREV? Protocol Revision

Syntax: AT!PREV?

Description: Queries the modem for the current protocol revision reported by the current base station the modem is communicating with. The response is a decimal digit as noted below.

Value	Meaning
1	JSTD-008 (PCS)
2	IS-95
3	IS-95A (cellular)
4	Minimum requirements for IS-95B
5	Full requirements for IS-95B
6	CDMA 1X Rev. 0
7	CDMA 1X Rev. 1

!PRLVER? PRL Version

Syntax: AT!PRLVER?

Description: Returns the version of the PRL stored in the modem.

!PROTSUBTYPES? Negotiated Subtypes

Syntax: AT!PROTSUBTYPES?

Description: Displays Negotiated Subtypes for all protocols in all stored personalities.

Example:

at!protsubtypes
Number of Stored Personalities: 1
Current Personality: 0
Personality: 0
Physical Layer Protocol Subtype: 0
Control Channel MAC Protocol Subtype: 0
Access Channel MAC Protocol Subtype: 0
Fwd Traffic Channel MAC Protocol Subtype: 0
Rev Traffic Channel MAC Protocol Subtype: 0
Key Exchange Protocol Subtype: 0
Authentication Protocol Subtype: 0
Encryption Protocol Subtype: 0
Security Protocol Subtype: 0
Idle State Protocol Subtype: 0
Generic MM Cap Disc Protocol Subtype: 0
Generic Virtual Stream Protocol Subtype: 0
OK

!RSSI? Received Signal Strength Indication

Syntax: AT!RSSI?

Description: Reports the current RSSI (P(AGC)+Ec/Io) in dBm using a (N-1)/N IIR filter for smoother display. When no signal is present it reports -125. Reported values can be interpreted as follows:

< -90 = very poor
-90 to -86 = poor
-85 to -81 = fair
-80 to -76 = good
> -76 = excellent

This command is supported in the online command state and in the command state.

!SCPCUSTCONFIG? Current Session Configuration Protocol Customer Configuration

Syntax: AT!SCPCUSTCONFIG?

Description: Sets or reads the current Session Configuration Protocol Customer configuration.

Example:

at!scpcustconfig?
1 - Custom Configuration is Active

Protocol Subtypes:

1 - Subtype 2 Physical Layer
0 - Enhanced CCMAC
1 - Enhanced ACMAC
1 - Enhanced FTCMAC
0 - Enhanced 3 RTCMAC
0 - Enhanced 1 RTCMAC
0 - Enhanced Idle

Broadcast Subtypes:

0 - Generic Broadcast Enabled

Applications Subtypes:

1 - SN Multiflow Packet App
OK

To set this item, enter 13 hex bytes. Example:

at!scpcustconfig=01,0D,00,00,00,00,00,00,00,01,00,00,00
OK

!SESSIONSTATUS Current Session Status

Syntax: AT!SESSIONSTATUS=<lower_byte>,<upper_byte>

Description: !SESSIONSTATUS (Sets the current Session Status)
!SESSIONSTATUS? (Reads the current Session Status)

Value	Meaning
0	Inactive—there is no session
1	Default—there is a session, but no negotiation has been completed
2	Active—there is a session, and all parameters have had at least one chance to be negotiated

In testing and debugging procedures, it is useful to force the session status to Inactive, so that Session negotiation and configuration occur upon the next power up. For the change to occur, the modem must be reset.

When the HDR session is negotiated, the session status is stored in NV RAM. Upon next power up, if the session status is Active, the session parameters are not renegotiated, unless a new network is acquired.

Example:

```
at!sessionstatus
HDR Session Status: 2
OK
at!sessionstatus=00,00
OK
at!sessionstatus?
HDR Session Status: 0
OK
```

!SIPID= User ID Information for Simple IP Setup

Syntax: AT!SIPID=<user id>

Description: Sets the User ID information for a simple IP setup.

!SIPPWD= Password Information for Simple IP Setup

Syntax: AT!SIPPWD=<passwrd>

Description: Sets the password information for a simple IP setup.

!SLEEPPARMS Sleep Parameters

Syntax: AT!SLEEPPARMS

Description: Returns 1xEV-DO Rev. A sleep parameters (slot cycle indexes and sleep periods). Slot cycle timeouts are listed in Julian time format (year month day day-of-week hour:minutes:seconds).

Example 1:

at!sleepparms
Slot Cycle1:3
Slot Cycle2:0
Slot Cycle3:0
Slot Cycle1 Timeout:1980 01 06 6 00:00:00
Slot Cycle2 Timeout:1980 01 06 6 00:00:00
OK

Example 2:

at!sleepparms
HDR Rev. A not currently available
OK

!SSMS= Send SMS

Syntax: AT!SSMS=<p>,<dest>,[cb],"<text>"

AT!SSMS? Reports the progress of the last message sent

Description: !SSMS= sends an SMS message using these parameters:

Parm	Meaning	Range
p	priority	0 = normal 1 = interactive 2 = urgent 3 = emergency (Actual priority transmitted depends on the carrier.)
dest	destination #	Phone number of destination, maximum of 32 characters; only 0–9, #, and * permitted.
cb	callback #	(this is optional) Phone number for reply, same 32 character limit
text	message body	Up to 227 bytes of data (not including the compulsory quote marks).

The text is enclosed in quotations. The quote character cannot appear in the body text.

Body text over the carrier-defined limit is truncated and sent anyway. Messages of length 228 or greater result in an ERROR.

The query form (!SSMS?) reports the progress of the last message sent.
Possible responses are:

none	No SMS messages being sent.
pending	Message has not left the modem (an attempt to use !SSMS= again yields an ERROR result code.)
sent	Successfully sent to the network.
failed	Sending failed and should be retried.

If you send a second message after receiving the "sent" response for the first message, subsequent queries will report the status of the second message.

!STATUS Status of the Modem

Syntax: AT!STATUS

Description: Reports the modem's status as follows:

Current band: <band>
Current channel: <chan>
SID: <sid> NID: <nid> 1xRoam: <n>
HDRRoam: <n>
Temp: <temp> State: <state> Sys Mode:<mode>
Pilot [NOT] acquired
Modem has [NOT] registered
HDR revision: <HRD_rev>

<band> is either OFFLINE, PCS CDMA, Cellular CDMA, PCS Sleep, Cellular Sleep, HDR PCS, or HDR Cellular

<n> for the roaming indicator. Values larger than 2 indicate ERI usage; to obtain the ERI banner, icon state, and icon image, parse the carrier's ERI file.

<temp> is the radio temperature in degrees C.

<mode> is either NO SRV, CDMA or HDR

NOT appears if the pilot has not been found or the modem has not registered.
<HRD_rev> is displayed only if the modem has 1xEV-DO service.
The value is either 0 or A. See also +CSS? (Serving System).

!SUFWDCCSTATS Current Single User Forward Channel Statistics on DRCs

Syntax: AT!SUFWDCCSTATS

Description: Reports the current Single User Forward Channel Statistics (Single User packet early slot termination count for all supported DRCs on Forward Control Channel; (columns are tab separated).

!SUFWDRESET resets the data reported by this command.

Example:

at!sufwdccstats
FORWARD CONTROL CHANNEL - Early Termination
Slot Count
1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16
DRC0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0
DRC1 0 0 0 0 0 0 0 0
OK

!SUFWDCRCS Current Single User Forward Channel Statistics on CRCs

Syntax: AT!SUFWDCRCS

Description: Reports the current Single User Forward Channel Statistics (Single User packet CRCs and Packet Error Rate).

!SUFWDRESET resets the data reported by this command.

Example:

at!sufwdcrcs

FORWARD TRAFFIC CHANNEL		
	Good CRCs	**Bad CRCs**
DRC0	0	0
DRC1	0	0
DRC2	0	0
DRC3	0	0
DRC4	0	0
DRC5	0	0
DRC6	0	0
DRC7	0	0
DRC8	0	0
DRC9	0	0
DRC10	0	0
DRC11	0	0
DRC12	0	0
DRC13	0	0
DRC14	0	0
FORWARD CONTROL CHANNEL		
	Good CRCs	**Bad CRCs**
DRC0	0	0
DRC1	0	0

Packet Error Rate (%): 0.000

OK

!SUFWDRESET Resets Data

Syntax: AT!SUFWDRESET

Description: Resets the data reported by !SUFWDCCSTATS, !SUFWDCRCS, and !SUFWDTCSTATS.

!SUFWDTCSTATS Current Single User Forward Channel Statistics

Syntax: AT!SUFWDTCSTATS

Description: Current Single User Forward Channel Statistics (Single User packet early slot termination count for all supported DRCs on Forward Traffic Channel).

!SUFWDRESET resets the data reported by this command.

Example:

at!sufwdtcstats
FORWARD TRAFFIC CHANNEL - Early Termination
Slot Count
1 2 3 4 5 6 7 8 9 10 11
12 13 14 15 16
DRC0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0
DRC1 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0
DRC2 0 0 0 0 0 0 0 0
DRC3 0 0 0 0
DRC4 0 0
DRC5 0 0 0 0
DRC6 0
DRC7 0 0
DRC8 0 0
DRC9 0
DRC10 0 0
DRC11 0
DRC12 0
DRC13 0 0
DRC14 0
OK

!SYSTIME? CDMA Time

Syntax: AT!SYSTIME?

Description: Queries the CDMA time. If the modem has not acquired a system, then the system time may not be available; some time in 1980 is displayed.

The format is:
YYYYMMDDWHHMMSS (W is day of week, 0=Monday)

For example:
200309183180142 = Thursday, Sep 18, 2003, 18:01:42

Chapter 4 – $ Prefix Commands

$QCCAV Answer Voice

Syntax: AT$QCCAV

Description: (Voice builds only). Answers an incoming call as a voice call. Use –SPKMUT (Speaker Mute) to manually turn off mute on the audio path before answering the call.

Contrast with A (Answer).

See also +CDV (Dial Voice) and +CHV (Hang-up Voice).

$QCMIP Mobile IP (MIP) Behavior

Syntax: AT$QCMIP

Description: Sets the Mobile IP (MIP) behavior.

Value	Meaning
0	Mobile IP disabled. Simple IP only. Mobile IP preferred.
1	In the initial MIP registration, if the network does not support Mobile IP, then the mobile automatically reverts to Simple IP. However, if a Mobile IP session is registered and then the mobile enters a network that does not support Mobile IP, the mobile will drop the session and inform the upper layers of the failure.
2	Mobile IP only. The mobile will make data calls only when Mobile IP is supported in the network. During a MIP session, if the mobile hands off to a network that does not support MIP, then the mobile will drop the session and inform the upper layers of the failure.

If a connected data device wants to use its own Mobile IP implementation, the mobile's IP implementation should be disabled by setting AT$QCMIP to 0.

$QCMIPEP Enables/Disables the Currently Active Mobile IP User Profile

Syntax: AT$QCMIPEP

Description: Enables/Disables the currently active Mobile IP user profile.

Value	Meaning
0	To disable the currently active profile, use AT$QCMIPEP = 0.
1	To enable the currently active profile, use AT$QCMIPEP = 1.

See also $QCMIPP.

$QCMIPGETP Query a User Profile

Syntax: AT$QCDMIPGETP

Description: $QCDMIPGETP = 1-5 (profile number).The command returns the following parameters for the selected profile:

- NAI
- Home Addr
- Primary HA
- Secondary HA
- MN-AAA SPI
- MN-HA SPI
- Rev Tun (Reverse Tunneling)
- MN-AAA SS
- MN-HA SS

If a profile number is not entered, then the AT command returns all the information corresponding to the currently active profile.

$QCMIPNAI Set the Network Access ID (NAI) for the Currently Active Profile

Syntax: AT$QCMIPNAI

Description: Sets the Network Access ID (NAI) for the Currently Active Profile:

AT$QCMIPNAI= "user@domain", 0 or 1

Value	Meaning
0	Do not store in NOVRAM
1	Store in NOVRAM

The double quotes (“ ”) are required only if the string contains a comma.

$QCMIPP Select One of the Mobile IP User Profiles to Be the Current Active Profile

Syntax: AT$QCMIPP

Description: AT$QCMIPP can be used to configure specific dial-up for various user profiles.

AT$QCMIPP = 1-5 (profile number)

To enable/disable a currently active profile, see $QCMIPEP.

$QCVAD= Sets or Reads the Mode for Answering Data Calls

Syntax: AT$QCVAD=<n> (Set Command)
AT$QCVAD? (Read Command)

Description: $QCVAD= sets the mode for answering data calls with A (Answer) or auto answer via S0=1.

$QCVAD? reads the mode for answering data calls with A (Answer) or auto answer via S0=1.

Value	Setting
0	OFF (answer as voice). Default.
1	Fax (Fax not supported) for next call, then revert to OFF (voice)*
2	Fax (Fax not supported)for all calls
3	Async data for next call, then revert to OFF (voice)*
4	Async data for all calls

*Reverting to voice happens at the first of these events:

- An incoming call arrives (answered or not)
- Ten minutes elapse without receiving a call
- The modem is reset (or power-cycled)
- The setting is changed by command

The CDMA network requires the call type to be negotiated before the call is answered. This command sets the call negotiation the modem makes prior to answering.

Chapter 5 – & Prefix Commands

&C Data Carrier Detect Control

Syntax: AT&C<value>

Description: The modem controls the RLSD output in accordance with the parameter supplied. This command sets the DCD On or Off.

Value	Setting
0	Sets DCD to remain On at all times.
1	Sets DCD to follow the physical connection. Default
2	DCD follows the state of the TCP/UDP connection.

Response: OK
Otherwise ERROR

&D Data Terminal Ready Options

Syntax: AT&D[n]>

Description: Determines what actions the modem takes in response to the Data Terminal Ready (DTR) signal from the host (DTE). For action to be taken, DTR must be off for a period of 2–10 milliseconds.

Note: This command has no impact on the use of DTR to terminate a voice call on the modem, nor does it affect the use of DTR to control modem shutdown.

Value	Setting
0	Ignore DTR
1	Enter command state for an on-to-off DTR transition. The modem condition (on or offline) is not affected. (Currently not supported.)
2	Hang up and enter command state for an on-to-off DTR transition. Auto-answer is disabled if DTR is off. Default.

&F Factory Settings Restore

Syntax: AT&F

Description: Reloads the factory-stored default configurations into active memory. For information on factory settings, see the Stored Profile Settings Table later in this manual.

This command is functionally the same as Z (Reset). If there is an active call, the command executes and the call is dropped.

&V View Configuration

Syntax: AT&V[n]

Description: Displays the active profile (commands and S-register contents).

Any numeric parameter is ignored.

Chapter 6 – +C Prefix Commands

+CAD? Analog or Digital Service

Syntax: AT+CAD? (Read-only) (local only)

Description: Reports the current service mode of the modem in the form +CAD: n.

Value	Meaning
0	No service available
1	CDMA Digital service is available
2	TDMA Digital service is available
3	Analog service is available

+CBIP? Base Station IP Address (Read-only)

Syntax: AT+CBIP? (Read-only) (local only)

Description: Reports the IP address (in dotted-decimal format) of the Base Station if there is a currently active call. If there is no active call, the following response is returned:

0.0.0.0

OK

See also +CMIP (Mobile IP Address).

+CDV Dial Voice

Syntax: AT+CDV [options]

Description: Initiates a voice call. Because of the options available in this command, another AT command cannot follow it on the same line. All characters following the +CDV command are taken as parameter options. For a list of dialing option parameters and restrictions, see the D (Dial) command. The options available are the same as those described for async data dialing.

Voice dialing leaves the modem in command state. This allows use of commands to control microphone and speaker options, and to generate DTMF tones if needed.

See also +CHV (Hang-up Voice).

Note: This command is needed for Verizon

+CFG= Configuration String

Syntax: AT+CFG="<str>" (Sets a configuration)
AT+CFG? (Reads a configuration)

Description: This command sets a configuration string of up to 248 characters. The string parameter must be enclosed within quotation marks (0x22). You cannot append any other commands after it in the same command line.

This string is transmitted to the Base Station as the last step of establishing the transport layer of the airlink. The default setting is null. Any setting replaces the previous value.

+CHV Hang-up Voice

Syntax: AT+CHV [0]

Description: Terminates a voice connection previously established with +CDV (Dial Voice) or $QCCAV (Answer Voice). The only valid parameter is zero, which is optional.

See also H (Hook Control).

+CMIP? Mobile Station IP Address

Syntax: AT+CMIP? (Read only)

Description: Returns the IP address assigned to the modem for this connection. This address is temporary only. The network assigns an IP address on an as-needed basis.

If there is no current network connection, hence no local IP address, the modem issues no response, only the OK result code.

See also +CBIP (Base Station IP Address).

+CMUX= Multiplex Option

Syntax: AT+CMUX=<f[,r]> (Sets the Multiplex Option)
AT+CMUX? (Reads the Multiplex Option)

Description: Selects the maximum number of multiplex options for the forward and reverse links valid within the context of the data service selected by the +CRM (Local Interface Protocol) command. The first parameter is for the forward link (from the Base Station to the modem) and the second is for the reverse link (from the modem to the Base Station).

Parm	Value	Meaning
f	1 - F	Hexadecimal value for Multiplex Option for the forward link.
r	1 - 2	Multiplex Option for the reverse link.

If parameter **r** is omitted, it is assumed to have the same value as **f**, provided **f** is 1 or 2; otherwise, the ERROR result is returned.

Values for the two parameters must be either both odd or both even. If odd values are used, the modem originates data calls using Rate Set 1. If both are even, originated calls use Rate Set 2.

Note: This command is included for compatibility.

+CQD= Command State Inactivity Timer

Syntax: AT+CQD=<n> (Sets the Command State Inactivity Timer)
AT+ CQD? (Reads the Command State Inactivity Timer)

Description: This timer determines when (or if) the modem will release a call if there is no activity on the connection between the modem and the IWF, for the specified period. The entry represents a multiple of five seconds. That is, each unit represents 5 seconds.

Value	Meaning
0	Disables the timer
1–255	Indicates timer value in steps of five seconds.

The default value is 10 – meaning a timer setting of 50 seconds.
See also +CTA (Packet mode Inactivity Timer).

Note: This command is included for compatibility.

+CRC= Cellular Result Codes

Syntax: AT+CRC=<n> (Enables or disables cellular result codes)
AT+CRC? (Reads the cellular result code value)

Description: Enables or disables cellular result codes for call progress.

Value	Meaning
0	Disables cellular result codes. Default.
1	Enables cellular result codes

The extended cellular result codes are in Extended Cellular Result Codes Table.

Extended cellular call progress codes are in the Extended Cellular Call Progress Codes Table later in this manual.

+CRM= Local (Rm) Interface Protocol

Syntax: AT+CRM=<n> (Sets the Local Interface Protocol)
AT+CRM? (Reports the protocol for local (DCE - DTE) interface.

Description: Reports (or sets) the protocol for the local (DCE - DTE) interface. This value is set automatically by the modem, based on the data received.

Value	Meaning
0	Asynchronous Data or Fax
1	Packet data service, Relay Layer interface
2	Packet data service, Network Model (Default)

+CSQ? Signal Quality

Syntax: AT+CSQ? (Read-only)

Description: Reports the received Signal Quality Measure (SQM) and Frame Error Rate (FER). The response is in the form +CSQ: <SQM>, <FER>. If no cellular service is available, the values reported are both 99. If the modem has acquired service but is not in an active call, the SQM value is valid but the FER is still undetectable.

SQM	Meaning
0-31	00 is lowest quality signal, 31 is the highest. This is based on received signal strength.
99	Value not known or is not detectable.

FER	Meaning
0	<0.01%
1	0.01% >= FER < 0.1%
2	0.1% >= FER < 0.5%
3	0.5% >= FER < 1.0%
4	1.0% >= FER < 2.0%
5	2.0% >= FER < 4.0%
6	4.0% >= FER < 8.0%
7	FER >= 8.0%
99	Value is not known or is not detectable.

See also !RSSI for received signal strength in dBm.

+CSS? Serving System

Syntax: AT+CSS? (Read-only)

Description: Reports the cellular band and system on which the modem is registered. The response is in the form +CSS: <class>, <band>, <system>.

<class>	Meaning
0	Current band class is unsupported by this command.
1	800 MHz Cellular
3	1900 MHz PCS

<band>	Meaning
A - F	Registered on a band system indicated.
Z	Not registered system Meaning
0–32767	System ID of the network that the modem is currently registered with.
99999	Modem is not registered.

See also !STATUS (Status).

+CTA= Packet Data Inactivity Timer

Syntax: AT+CTA=<n> (Sets the Packet Data Inactivity Timer)
AT+CTA? (Reads the value)

Description: This timer determines when (or if) the modem will use dormant mode on the network. If a timer value is set, the modem releases the radio resource if there is no activity (RLP data frames) on the connection between the modem and the network for the specified period.

The modem maintains the PPP session with the local host, and the network retains the PPP session at its end, only the intervening "physical link" layer is dropped. The modem restores the link when traffic resumes.

Each unit represents 1 second.

Value	Meaning
0	Disables the timer (default)
1–255	Indicates timer value in seconds.

Note: When set to 0, the network governs the dormant mode timing.

See also +CQD (Command State Inactivity Timer).

+CXT= Cellular Extension

Syntax: AT+CXT=<n> (Enables/disables the passing of unrecognized AT commands)
AT+ CXT? (Reads the value)

Description: Enables and disables the passing of unrecognized AT commands to the IWF. If disabled, the modem replies with ERROR to unrecognized commands. If enabled, the modem opens the transport layer airlink and enters pass through state.

Use H0 (on-hook) to close the airlink.

Value	Meaning
0	Do not pass unrecognized commands. (Default)
1–255	Open a transport layer connection and pass the unrecognized command to the IWF.

Chapter 7 – +F Prefix Command

+FCLASS= Modem Operating State

Syntax: AT+FCLASS=[n]

Description: Sets the modem's data state.

Value	Setting
0	Data. Default

Note: Fax is not supported.

Chapter 8 – +G Prefix Commands

+GCAP Get Capabilities

Syntax: AT+GCAP

Description: Reports the modem's additional capabilities in one or more lines of text containing AT+ commands. This is used to determine if services the user needs can be performed by the modem. The services and commands reported can be any or all of:

Response	Description (related commands)
+FCLASS	Fax support (Fax not supported)
+MS	Modulation control (+MS, +MR)
+MV18S	V.18 modulation control (+MV18S, +MV18R)
+ES	Error control (+ES, +EB, +ER, +EFCS, +ETBM)
+CIS707-A	IS-707-A (High Speed Packet Data Services)
CIS-856	IS-856 (High Rate Packet Data Air Interface)
+DS	Data compression (+DS, +DR)

See also +CGCAP (Get IWF Capabilities).

+GMR Get Revision

Syntax: AT+GMR

Description: Reports the modem firmware version: revision level (see the following paragraphs) and date, followed by the version for the Preferred Roaming List (PRL) in use. It also reports the hardware revision.

Example of interpreting the firmware revision level: p2006001:
P: Production release

The next two digits indicate the product ID:

Value	Product
28	MC5728V

The next three digits indicate the firmware build version: for example, 060 corresponds to firmware build version 0.60.

The next two digits (in some cases, four) indicate the point release within the above build version. In our example, 06001 means point release .01 in firmware build 0.60.

The command also returns version information on some or all of the following:

	Description
QCOM	Boot images
BOOT	SWI Boot Loader: Product/product family description (for example, SWI6800 or SWI6800V2), followed by: • "FP" (Full Production), "FD" (Full Development), or "PP" (Point Production) • Major revision number (2 digits) • Minor revision number (2 digits) • Point release number (optional) **Note:** Depending on the modem model, the above information may not apply.
APPL	Application code

SWOC	Software on Card image: “CDPC”, followed by the 5-digit decimal CDPC (CD Product Code), followed by the CD version: • Major revision number (2 digits) • Minor revision number (2 digits) • Point release number (2 digits)
USBD	USB descriptor table
USB VID	USB Vendor ID

Examples with Interpretation of Each Line of the Modem’s Response:

AT+GMR

p2110100,5077 [Aug 07 2007 14:29:37]

Production Release (p). Firmware version 1.01. Point release 00.

QCOM: SWI6800V2_FD.00.32

Boot Image: SWI6800V2 family. Major revision 00. Minor revision 32.

BOOT: SWI6800V2_FP.01.01 2007/08/09 10:37:43

SWI Boot Loader: SWI6800V2 family. Major revision 01. Minor revision 01. Build date Aug 9, 2007.

APPL: SWI6800V2_FP.01.01 2007/08/09 10:37:43

Application Code: SWI6800V2 family. Major revision 01. Minor revision 01. Build date Aug 9, 2007.

USBD: SWI6800V2_GENERIC.00.00

USB Descriptor Table: SWI6800V2 family. Generic build. Major revision 00. Minor revision 00.

SWOC: CDPC_00004_01.01.02

Software on Card image, CDPC (CD Product Code) = 00004. CD version: major revision 01, minor revision 01, point release 02.

USB VID: 0x1199 PID: 0x0028

USB Vendor ID 0x1199; product: 28.

See also +CGMR (Get IWF Revision) and I (Product Identification Information).

+GMI Get Manufacturer

Syntax: AT+GMI

Description: Reports the modem’s manufacturer.

See also +CGMI (Get IWF Manufacturer).

+GMM Get Model Number

Syntax: AT+GMM

Description: Reports the modem model.

See also +CGMM (Get IWF Model).

+GOI Get ISO ID

Syntax: AT+GOI

Description: Reports the modem's ISO system registration code (if any). The code provides a method of uniquely defining an object. The cellular modems have no ID string (null).
See also +CGOI (Get IWF ISO ID).

+GSN Get ESN

Syntax: AT+GSN

Description: Reports the modem's electronic serial number. The modem reports an eight character ASCII string of hexdigits (no spaces).
See also +CGSN (Get IWF ESN).

Chapter 9 – +I Prefix Commands

+ICF= Character Framing

Syntax: AT+ICF=<[f],[p]>
AT+ICF? (Queries the settings)

Description: Settings with this command are ignored. Normally, this command sets the local serial port (DTE - DCE) connection character framing.

The modem uses a true serial interface, but the modem's support is limited to:

8-bit data
1 stop bit
no parity (the parity setting is ignored)

Note: These are the default values.

Parm	Value	Meaning
f (format)	3	8 data bits, 1 stop bit (no other values are permitted)
p (parity)	0–3	value is ignored

See also +IPR (Fixed Port Rate).

+ILRR Local Rate Reporting

Syntax: AT+ILRR[=0]
AT+ILLR? (Queries the settings)

Description: Enables and disables the reporting of the local rate to the host (DTE).

Note: The modems do not support local rate reporting. This command is provided for compatibility only and only accepts a setting of 0 (off).

+IPR – Set Serial Speed

Description: Sets the serial speed.

Syntax: **AT+IPR=<serial speed value>**

Values: **300** to **921600**

Display: AT+IPR? Displays the current serial speed.
AT+IPR=? Displays a list of all possible values (serial speeds).

Default: **115200**

Chapter 10 – +M Prefix Commands

+MA= Modulation Auto Mode

Syntax: AT+MA=<str>
AT+MA? (Queries the settings)

Description: Sets the additional modulations that the Base Station may use to connect with the destination modem in Auto Mode operation. This is used for originating and answering operations on data calls and is additional to the modulation setting using the +MS (Modulation Selection) command.

The default setting is null.

For details on parameters and use, see IS-131.

+MR= Modulation Reporting

Syntax: AT+MR=<n>
AT+MR? (Queries the settings)

Description: Enables or disables the extended intermediate result codes for +MCR:<carrier> and +MRR:<rate>[,rx_rate] from the IWF to the modem. For details on the intermediate result codes possible, see IS-131.

To query the IWF for confirmation that the command is supported, use +GCAP (Get Capabilities). The +MS result must be in that response.

If reporting is enabled, the intermediate result is sent when modulation has been determined and before error control or data compression are negotiated. This is before the final result code (e.g. CONNECT) is sent.

Value	Meaning
0	Disables reporting of modulation connection. Default.
1	Enables reporting.

+MS= Modulation Selection

Syntax: AT+MS=<parms>
AT+MS? (Queries the settings)

Description: Controls the manner and operation of the modulation capabilities in the IWF. To query the IWF for confirmation that the command is supported, use +GCAP (Get Capabilities). The +MS result must be in that response.

The default setting is null.

For details on parameters and use, see IS-131.

+MV18R= V.18 Reporting

Syntax: AT+MV18R=<n>
AT+MV18R? (Queries the settings)

Description: Enables or disables the extended result codes for +MV18R: from the IWF to the modem.

To query the IWF for confirmation that the command is supported, use +GCAP (Get Capabilities). The +MV18S result must be in that response.

Value	Meaning
0	Disables reporting of V.18 result codes. Default.
1	Enables reporting.

The possible intermediate result codes are:

+MV18: 5BIT	Indicates connection with 5-bit (Baudot) mode
+MV18: EDT	Indicates connection with EDT
+MV18: DTMF	Indicates connection with DTMF
+MV18: V21	Indicates connection with V.21
+MV18: V23	Indicates connection with V.23
+MV18: B103	Indicates connection with Bell 103-type modulation
+MV18: V18	Indicates connection with V.18

+MV18S= V.18 Selection

Syntax: AT+MV18S=[m],[ans],[fb]
AT+MV18S? (Queries the settings)

Description: Controls the manner and operation of the V.18 capabilities in the IWF (if present in the IWF).

To query the IWF for confirmation that the command is supported, use +GCAP (Get Capabilities). The +MV18S result must be in that response.

Parm	Value	Meaning
m	0	Disable V.18 operation. Default.
	1	V.18 operation, auto detect mode
	2	V.18, connect in 5-bit (Baudot) mode
	3	V.18, connect in DTMF mode
	4	V.18, connect in EDT mode
	5	V.18, connect in V.21 mode
	6	V.18, connect in V.23 mode
	7	V.18, connect in Bell 103-type mode
s	0	Disable V.18 answer operation. Default.
	1	No default specified (auto-detect)
	2	V.18 operation, connect in 5-bit (Baudot) mode
	3	V.18, connect in DTMF mode
	4	V.18, connect in EDT mode
fb	0	Disable fallback. Default.
	1	Enable fallback to re-acquisition after 2 seconds of no transmission.

The default setting is +MV18S=0,0,0 – meaning V.18 operation is disabled.

Chapter 11 – +W Prefix Commands

+WGETWK Request Wake-Up Reason

Syntax: AT+ WGETWK

Description: Responds with the reason of the last wake-up event. The response is a decimal digit representing the bit-mask below.

If no events have triggered, the response is a zero.

Value	Meaning If Set to This Value
0	No event
1	Ring received
2	Radio coverage restored
2	SMS message received

+WWKUP= Wake-Up Events Mask

Syntax: AT+WWKUP=<n>
AT+WWKUP? (Reports the settings)

Description: Sets or reports the bit-mask used to identify events that generate a wake-up from the modem to the host device. A setting of zero disables all wake-up signals. The default setting is 5; wake on ring and SMS received.

When this command is issued, the last wake-up event reason (see +WGETWK on page 76) is reset to 0.

Bit	Meaning when set 0 Wake-up on ring received (Default is set)
1	Wake-up on radio coverage restored (Default is clear)
2	Wake on SMS received (Default is set)
3 – 7	Reserved

Chapter 12 – No Prefix Commands

+++ Escape

Syntax: +++

Description: The +++ Escape Sequence is not preceded by AT. Applies only to asynchronous calls.

Used to exit data state and enter command state; this is not preceded by AT and does not require <CR>.

The escape character is fixed as the plus sign "+" (0x2B). The guard time between normal transmission data and the escape sequence is specified as 1 second and cannot be changed. Therefore, the modem requires a minimum of 1 second of inactivity on the serial input, three plus sign characters, followed by 1 second of inactivity.

If a PPP session is active, then use PPP to escape data state.

A Answer (Manual)

Syntax: ATA

Description: Instructs the modem to immediately go off-hook and attempt to establish a connection without waiting for a ring. This is used to answer an incoming call if auto answer (S0) is disabled.

The command presumes a RING has been received. If the command is issued without a RING, behavior depends on the state. If the modem is in command state, it replies with OK and remains in command state. Should the modem be in pass through state without a call pending, the Answer command is sent to the IWF modem. This typically goes off-hook and looks for the carrier. When none is detected, the NO ANSWER or NO CARRIER result is returned. This is, however, dependent on the IWF modem.

The modem looks for the carrier to negotiate the connection and issues either:

- CONNECT and enters data state; or,
- NO CARRIER and remains in command state.

D Dial

Syntax: ATD

Description: Initiates a data call. To dial a voice call, use +CDV.

Because of the options available in this command, another AT command cannot follow it on the same line. All characters following the D command are taken as parameter options.

Several types of data calls are possible, based on the option(s) entered.

Packet Data Calls

Traditional CDMA data call dialing uses the parameter "#777". This triggers the modem to try a connection using the detected service type: 1X or QNC (IS-95). It is possible that 1X service may be detected in an area that offers 1x voice service, but only IS-95 data service. The use of passwords can differ between a QNC and 1X call on some networks as well. In these situations the call is likely to fail.

You should force the modem to attempt one service type or the other by using dedicated dial strings dictated by the carrier. Typically (but not in all cases) the strings are:

- #762 "QNC" – Connect to QNC using IS-95 service
- #19788 "1XRTT" – Connect PPP using 1X service

Your connection software must manage use of the correct password for the type of service used.

Async (CSC) Data

The type of call opened depends on the setting of +FCLASS. The modem does not actually dial the number in the string. For an IS-95 call, the dial string is passed to the IWF where a modem there issues the dial over the PSTN. Prior to passing the dial command, the modem sends the IWF modem the string defined in +CFG (Configuration String) to configure the IWF modem for the call.

For dialing an async data call, the parameter string options are included on one command line with or without spaces. There is a limit of 35 characters in the dial options string. Upon successful answer and connection, the modem goes into data state. There is a time limit set in register S7

(Wait for Carrier) for the entire process.

The options listed below are commonly supported, but specific IWF modem capabilities govern the list of supported parameters.

Opt.	Meaning
0 - 9	Any digit (0-9) (*, #, A, B, C, or D are also permitted). The phone number may also include the formatting characters brackets (and), hyphen -, and <space>. These characters are ignored.
T	Tone (DTMF) dialing - ignored by the modem.
P	Pulse dialing - ignored by the modem.
W	Wait for dial tone before processing the remaining characters in the dial string. The duration of the wait is limited by register S7 (Wait for Carrier).
,	Pause before processing the remaining characters in the dial string. The pause time is set by register S8 (Comma Pause Time).
$	Wait for billing (bong) tone before processing balance of string.
@	Wait for quiet answer; limited by register S7 (Wait for Carrier).
!	Hook flash. Causes the modem to go on-hook briefly and then returns to off-hook. This is used to access certain calling features on the PSTN.

Result Codes:

The possible result codes are determined by the call monitoring set by X[n] (Result Code Select). See the table of possible result codes later in this manual.

E Echo

Syntax: ATE[n]

Description: Controls echoing of characters received from the host (DTE) back to the host when in command state. This also affects framing of responses. For details, see “Framing”.

Value	Setting
0	Disable echo
1	Enable echo. Default.

H Hook Control

Syntax: ATH[0]

Description: Go ON-Hook to disconnect a data/fax call. (To end a voice call, use +CHV)

If the modem was already on-hook, no change is made. The only parameter allowed is 0 (zero), which is optional. The modem goes from online condition to offline condition.

See also +CHV (Hang-up Voice).

I Product Identification Information

Syntax: ATI

Description: Shows Product Identification Information.

Note: Depending on your modem model, the types of information may vary.

Example:

```
ATI
Manufacturer: Multi-Tech Systems, Inc.
Model: C597 Rev 1.0 (2)
Revision: p2314500,4012 [Mar 06 2008 17:19:08]
```

For information and examples on interpreting the (firmware) Revision, QCOM and other return values, see +GMR.

```
QCOM:       SWI6800V2_FD.00.32
BOOT:       SWI6800V2_FP.01.45 2008/03/07 16:36:13
APPL:       SWI6800V2_FP.01.45 2008/03/07 16:36:13
USBD:       SWI6800V2_GENERIC.00.01
SWOC:       CDPC_00005_01.01.01
USB VID:    0x1199 PID: 0x0023
ESN:        0x60684203
+GCAP:      +CIS707-A, CIS-856, CIS-856-A, +MS, +ES, +DS, +FCLASS
```

See +GCAP.

```
SKU:        0x2BAF
```

L Loudness (Speaker Volume)

Syntax: ATL[n]

Description: This command is provided for compatibility reasons; the modem takes no action. Parameters are ignored.

For control of voice mode speaker levels, see -SPKVOL.

M Mute (Speaker Control)

Syntax: ATM[n]

Description: This command is provided for compatibility reasons; the modem takes no action. Parameters are ignored.

For control of voice mode microphone and speaker muting, see –MICMUT and -SPKMUT.

O Online (Remote)

Syntax: ATO

Description: **Currently not supported.**

Causes the modem to go from command state (online condition) to data state. The modem responds with the normal CONNECT response codes (if enabled) as if the connection were new.

This command is executed by the IWF modem. If the CDMA modem was in an offline condition and without an airlink, the NO CARRIER and OK result codes are returned. If the modem was offline and the airlink was established (pass through state) but without a call in place, the IWF modem attempts to process the command. The typical result is either NO ANSWER or NO CARRIER. This is, however, dependent on the IWF modem.

P Pulse Dialing

Syntax: ATP

Description: This command is provided for compatibility reasons; the modem takes no action.

Q Quiet (Result Code Display Option)

Syntax: ATQ[n]

Description: Controls the return or suppression of result codes to the host (DTE).

Value	Setting
0	Disables Quiet mode (enables return of result codes.) Default.
1	Enables Quiet mode (disables return of result codes).

Result Codes:

OK	n = 0
	Otherwise the result code is suppressed (n=1).

S<n>= S-Register Set/Query

Syntax: ATS<n>=<x> (Sets S-Register)
ATS<n>? (Queries S-Register)

Description: Sets or queries the contents of the specified S-register (n) to the new value (x). Where parameter values are omitted, zeros are assumed.

Var.	Range
n	Valid S-register number (for values, see the Table of S-Registers later in this manual.
x	as determined by the S-register (n).

Result Codes:

OK	S-register n set to x.
ERROR	Invalid S-register value (n) or setting (x) outside of permitted range.

T Tone (Set DTMF Dialing)

Syntax: ATT

Description: This command is provided for compatibility reasons; the modem takes no action. For information on DTMF tone generation on the modem. See –DTMFB, -DTMFK, -TONDUR, and -TONMUT.

V Verbose (Result Code Form)

Syntax: ATV[n]

Description: Specifies whether the modem displays the result codes in numeric format or as words (verbose). For a numerical list of the Table of Result Codes later in this manual.

Note that numeric codes are returned as ASCII character numerals.

This command also affects framing of responses. For details, see “Response framing”.

Value	Setting
0	Numeric result codes
1	Verbose result codes. Default.

Result Codes:

OK	(0) n = 0, 1 (returned in the new setting)
	ERROR (4) otherwise

X Result Code Select/Call Progress Control

Syntax: ATX<n>

Description: Enables tone detection options used in the dialing and handshaking process. As options are chosen, the result codes are also affected. The prime function is to control the modem call response capabilities when the D (Dial) command is issued.

Dial Tone Detection

When disabled, the modem waits for the period set in register S6 (Wait for Blind Dial) and blind dials. When enabled, the modem allows five seconds to receive at least 1 second of dial tone. If none is detected, then the result code is NO DIAL TONE.

Busy Signal Detection

When disabled, the modem waits for the period set in register S7 (Wait for Carrier). If no connection is made, then the result code is NO CARRIER. When enabled, the modem can return the result code BUSY if detected.

Values enable (✓or disable (×) tone detection and result codes as indicated in the chart below:

Value	No Dial Tone	Busy Signal	
1	×	×	
2	✓	×	
3	×	✓	
4	✓	✓	Default

Z Profile Restore

Syntax: ATZ

Description: The modem goes on-hook (drops any active call) and then resets the command and register parameters to the defaults.

For information on factory settings, see the Table of Stored Profile Settings later in this manual.

Chapter 13 – -Prefix Commands

-DTMFB= DTMF Burst

Syntax: AT-DTMFB=<key1> [<key2>,<key3>,…]

Description: Generates a string of DTMF tones under the timings defined by -TONDUR (Tone Duration). This command can be overridden by -TONMUT (Tone Mute). The values of <key> can be any of 0–9, *, and #, up to a total of 32 keys. Spaces, quotes, brackets, dashes, and commas are not permitted in the string.

-DTMFK= DTMF Key

Syntax: AT-DTMFK=<key>

Description: Generates a single key DTMF tone for the duration set by -TONDUR (Tone Duration). This command can be overridden by -TONMUT (Tone Mute). The values of “key” can be any of 0–9, *, and #.

-ECHO= Echo Cancellation Level

Syntax: AT-ECHO=<n> (Sets Echo Cancellation Level)
AT-ECHO? (Queries Echo Cancellation Level)

Description: Sets and queries the environment for the echo cancellation profile. The modem has five environments available.

The setting is stored in non-volatile memory.

Parm	Meaning
0	Factory default (headset) (same as 3) (Default)
1	No echo cancellation
2	Handset
3	Headset
4	Acoustic (AEC)
5	Speaker-phone

-HDSET= Headset Detection Option

Syntax: AT-HDSET=<n> (Sets Headset Detection Option)
AT-HDSET? (Queries Headset Detection Option)

Description: Sets and queries the detection option for the voice headset. The setting is stored in non-volatile memory.

Parm	Meaning
0	Do not use headset detection. Always report “not inserted” via CnS message.
1	Do not use headset detection. Always report “inserted” via CnS message. Default.
2	Use headset detection. Report current headset detected state via CnS message.

There is no AT command to report whether a headset is detected when setting 2 is used. Headset detection is only reported via CnS messages.

-MICMUT= Microphone Mute

Syntax: AT-MICMUT=<n> (Sets Microphone Mute)
AT-MICMUT? (Queries Headset Detection Option)

Description: Sets and queries the state of the microphone mute. This value is not stored in non-volatile memory. The setting is considered temporary, and reverts to the default (OFF) at the beginning of a new call, and when the modem is power-cycled, reset, or when the profile is restored (&F and Z).

Parm	Meaning
0	Microphone mute is OFF. Default.
1	Mute is ON

-NAMLCK= NAM Lock

Syntax: AT-NAMLCK=<n>

Description: Stores a pass code number for comparison to the modem’s 6-digit OTSL (One Time Subsidy Lock), MSL (Master Subsidy Lock), or SPC (Service Provisioning Code). The service provider provides this number to you at the time of service activation.

If the number is an acceptable format, the OK result code is returned. If the parameter’s format is rejected (such as too many digits), the ERROR result is returned.

The actual comparison of the pass code entered with this command and the lock codes encoded in the modem does not take place until an attempt is made to write a NAM profile account using -NAMVAL.

-NAMVAL= NAM Values

Syntax: AT-NAMVAL=<nam> [,<MDN>,<MIN>,<SID>,<NID>] (Set command)

AT-NAMVAL?<nam> (Reads the current account information)

Description: This command has three functions related to the account or NAM (Number Assignment Module):

Set the Active Account Index

The modem supports one account. Using only the <nam> parameter (0) sets that account as the active account used by the modem.

Read the Current Account Information

The query form of the command will report the details of the specified account (0):

MDN: 9999999999	(10 digit phone number)
MIN: 9999999999	10-digit MIN (encoded and stored into MIN1 and MIN2)
SID: 99999	(System ID)
NID: 99999	(Network ID)

Write Account Activation Data

This form requires the optional parameters. The modem will first compare the pass code stored using –NAMLCK (page 84). If the pass code fails to match, the ERROR result is returned. If the OK result is received, the NAM profile account was successfully activated.

The parameter values are as noted for the query form of the command. The service provider will tell you what numbers to enter for NUM, MIN, SID, and NID.
NAM must be 0.

Following writing the values, the modem must be reset to have the values take effect.

-RESET Soft Reset

Syntax: AT-RESET

Description: Resets the modem gracefully, shutting down any active connection. The modem issues the OK result before completing the reset cycle. The reset is complete after approximately 5–15 seconds, after CTS has been deasserted and then reasserted.

-SHTDWN Shutdown

Syntax: AT-SHTDWN

Description: Forces the modem into a shutdown state, gracefully closing any open connection. This shutdown is deeper than the one achieved by using the control signals on the modem; it includes closing the serial connections.

Following this command, the modem can be restarted only by power cycling or a hardware reset.

The Shutdown Acknowledge control line is asserted when the shutdown is complete.

-SPKMUT= Speaker (Headset) Mute

Syntax: AT-SPKMUT=<n> (Set command)

AT-SPKMUT? (Query command)

Description: Sets and queries the state of the speaker mute. This value is not stored in non-volatile memory. The setting is considered temporary, and reverts to the default (OFF) when a new call is started, or the modem is power cycled, reset, or when the profile is restored (&F and Z).

Parm	Meaning
0	Speaker mute is OFF. Default.
1	Mute is ON

Note: This setting does not affect the setting of –SPKVOL (Speaker Volume).

-SPKVOL= Speaker (Headset) Volume

Syntax: AT-SPKVOL=<n> (Set command)

AT-SPKVOL? (Query command)

Description: Sets and queries the volume level of the voice circuit speaker.

The value is stored in non-volatile memory, making it persistent across resets and power-cycles.

Parm	Meaning
0	muted
1	-20 dB
2	-16 dB
3	-12 dB (Default)
4	-18 dB
5	-4 dB
6	0 dB

-STGLVL= Side Tone Gain Level

Syntax: AT-STGLVL=<n> (Set command)

AT-STGLVL? (Query command)

Description: Sets or queries the amount of side tone gain; that is the volume of the speaker's own voice (microphone input) that is presented to the earpiece (speaker output).

Parm	Meaning
0	-84 dB
1	-36 dB
2	-32 dB (Default)
3	-28 dB
4	-24 dB
5	-20 dB
6	-16 dB

-TONDUR= Tone Duration

Syntax: AT-TONDUR=<key,on,off> (Set command)

AT-TONDUR? (Query command)

Description: Sets and queries the timing, in milliseconds, for generating DTMF tones using single key tones (-DTMFK) and bursts (-DTMFB). Settings are stored in non-volatile memory.

Parm	Range	Meaning
key	100–3000	Key duration for single key tones (-DTMFK) Default = 300 ms
on		On time for tones in bursts (-DTMFB)
	95–144	95 ms
	145–194	150 ms
	195–244	200 ms (Default)
	245–294	250 ms
	295–344	300 ms
	345–350	350 ms
off		Off time between tones in bursts.
	60–109	60 ms
	110–159	100 ms (Default)
1	60–200	150 ms

-TONMUT= Tone Mute

Syntax: AT-TONMUT=<n> (Set command)

AT-TONMUT? (Query command)

Description: Sets and queries the mute setting on the generation of DTMF tones via -DTMFK and -DTMFB. Settings are stored in non-volatile memory.

Parm	Meaning
0	DTMF mute is OFF (tones can be generated) (Default)
1	Mute is ON

Chapter 14 – Status Registers

Some of these registers relate to the call progress timing at the IWF with the PSTN connection. These are noted below using the (Remote) tag.

Table of S-Registers

Reg.	Description	Range	Default	Units
0	**Auto answer** The modem auto answers after a delay specified by S0. If S0=0, then auto answer is turned off. The delay is equivalent to [<value> - 1] x 6 seconds. Examples: 1 = no delay 3 = 12 seconds	0–255	000	(n-1)*6 s
3	**Carriage Return Character** The standard end of line character used to indicate the end of an AT command. This character is also used as the carriage return character for framing responses and result codes in command state.	0–127	013 (CR)	ASCII
4	**Line Feed Character** The standard line feed character sent by the modem to the host at the end of a response or return code in command state.	0–127	010 (LF)	ASCII
5	**Backspace Character** This register sets the character recognized as a backspace during command entry.	0–127	008 (BS)	ASCII
6	**Wait for Blind Dial (Remote)** This register denotes the wait time, in seconds, before a blind dial (no dial tone detection). The value of S6 is used when the X (Result Code Select/Call Progress Control) command is set to 1, or 3. X settings of 2 and 4 enable dial tone detection and disable blind dialing. Therefore, when X is set to 2 or 4, the value of S6 is irrelevant.	2–10	002	Seconds
7	**Wait For Carrier (Remote)** If no carrier from the remote modem is detected within the specified time, the modem goes on-hook.	1–255	060	Seconds
8	**Comma Pause Time (Dial Modifier) (Remote)** Whenever a dial command contains the comma character, the contents of this register specify the pause time for each comma.	0–255	002	Seconds
9	**Carrier Detect Response Time (Remote)** Specifies the time that the received carrier must be present for the modem to recognize it and turn on Data Carrier Detect (DCD) if applicable. The implementation is entirely at the IWF modem.	0–255	006	0.1 s

10	**Lost Carrier Hang-up Delay (Remote)** Specifies the amount of time that the carrier from the remote modem can be lost before the modem goes on-hook. This allows temporary disruptions to carrier without disconnecting. A setting of 255 causes the modem to disable Carrier Detect and presume carrier is always present.	1–255	014	0.1 s
11	**DTMF Dialing Speed (Remote)** This specifies the duration of tones in DTMF dialing. This register is not used by the -DTMFB command. See -TONDUR (Tone Duration).	50–255	095	0.001 s

Chapter 15 – Result Codes

This table provides a numerical list of the standard result codes possible.

Basic Result Codes

Code	Verbose	Meaning
0	OK	Command executed without errors
1	CONNECT	Connected at any of the supported speeds
2	RING	Alerting Signal (Ring) signal received from the network
3	NO CARRIER	Carrier signal lost or not detected. Unable to activate the service.
4	ERROR	Command not recognized or could not be executed. Illegal command. Error in command line. Command line exceeds buffer size. Parameters out of range.
6	NO DIAL TONE	Dial tone not detected within timeout and subsequent commands not processed
7	BUSY	Reorder (Busy) signal detected and subsequent commands not processed
8	NO ANSWER	Five seconds of silence not detected after ring back when "@" (quiet answer) dial modifier is used

Extended Cellular Result Codes

This table provides a numerical list of extended result codes that may be supported by the IWF. Note that IWF systems may not support some or all of these codes.

Code	Verbose	Meaning
11	RING ASYNC	Indicates an incoming CSC call
12	RING FAX	(Fax Not Supported) Indicates an incoming CSC Fax call
13	RING PACKET	Indicates an incoming packet data mode call
21	NO SERVICE	Origination was attempted while the modem was not able to acquire a CDMA Paging Channel
22	NO ASYNC SERVICE	The base station rejected the async service option request
23	NO FAX SERVICE	The base station rejected the fax service option request
25	BAD REQUEST	An intercept was received after call origination
26	PAGED	The modem attempted to originate a call after receiving a page
27	RETRY	Reorder received after call origination
28	PAGE FAIL	The modem received a page but not an alert
29	LINK FAIL	The modem has lost the Traffic Channel
30	RELEASE	The call has been released

Extended Cellular Call Progress Result Codes

The following extended result codes may be enabled when the +CRC=1 setting is used. Support for these rests with the IWF. These are primarily call progress indications. Note that if Verbose is off (V0), these codes are suppressed; there are no numeric equivalents for call progress codes.

Code	Verbose	Meaning
	+CERROR: INIT FAILED <failed command>	Initialization String failed during transport layer initialization. If +CRC=0 then result code 4 ERROR is returned
	+CPROG: ANSWER	Indicated remote DCE has answered
	+CPROG: BONGTONE	Billing tone was detected
	+CPROG: DIALING<num>	Indicates PSTN dialing
	+CPROG: DIALTONE	Dial tone was detected
	+CPROG: QUIET ANSWER	Indicates Quiet Answer
	+CPROG: RINGING	Indicates PSTN ringing
	+CPROG: VOICE	Voice detected on PSTN connection
*	+RING <service mode>	Indicates an incoming call to the modem in the service mode indicated: ASYNC or STU-III (not supported)
* See numbers 11–13 in Table of Extended Cellular Result Codes on previous page		

Chapter 16 – Stored Profile Settings

The CDMA 1X modems do not support a user- defined profile. Both Z (Reset) or &F (Factory Settings Restore) restore the following settings.

Stored Profile Settings for Commands

Command	Description	Factory Settings
$QCMIP	Mobile IP behavior	Carrier dependent
$QCMIPNAI	Network Access ID (NAI) for the Mobile IP general user profile	Carrier dependent
$QCMIPP	Active Mobile IP user profile	
E	Echo (Command State)	1 (enabled)
L	Loudness - Speaker Control	0 (ignored)
M	Mute - Speaker Control	0 (ignored)
Q	Quiet - Result Code Display Option	0 (Codes returned)
V	Verbose - Result Code Form	1 (Words)
X	Result Code Select/Call Progress Control	4 (all codes)
&C	Data Carrier Detect Control	2 (UNIX wink)
&D	Data Terminal Ready Options	2 (Hang up)
+CFG	Configuration String	(null)
+CMUX	Multiplex Option	C (Forward link) 2 (Reverse link)
+CQD	Command State Inactivity Timer	10 (50 seconds)
+CRC	Cellular Result Codes	0 (disabled)
+CRM	Local (Rm) Interface Protocol	0 (async data)
+CXT	Cellular Extension	0 (do not pass)
+ICF	Character Framing	3, 3 (ignored)
+ILRR	Local Rate Reporting	0 (off)
+IPR	Fixed Port (Rm) Rate	115200 (ignored)
+MA	Modulation Auto Mode	(null)
+MR	Modulation Reporting	0
+MS	Modulation Selection	(null)
+MV18R	V.18 Reporting	0 (disabled)
+MV18S	V.18 Selection	0, 0, 0

Stored Profile Setting for S-Registers

Command	Description	Factory Settings
S0	Auto-answer mode	0 (disabled)
S3	Carriage Return Character	013 (CR)
S4	Line Feed Character	010 (LF)
S5	Backspace Character	008 (BS)
S6	Wait for Blind Dial (Remote)	002 (2 seconds)
S7	Wait for Carrier (Remote)	060 (60 seconds)
S8	Comma Pause Time (Remote)	002 (2 seconds)
S9	Carrier Detect Response Time (Remote)	006 (0.6 seconds)
S10	Lost Carrier Hang-up Delay (Remote)	014 (1.4 seconds)
S11	DTMF Dialing Speed (Remote)	095 (0.095 s)

Appendix A – Working With the IWF

Introduction

Note: The information in Appendix A applies to cellular accounts with Circuit-Switched Data service. Check with your service provider to see which services are enabled for your account.

When operating a CDMA modem in IS 95B Circuit-Switched Cellular (CSC) service, the local modem and the IWF modem must work as a team to perform the duties that a traditional wire line modem handles alone. To support this teamwork, the modem has an extensive set of commands to query the PCS network and IWF for information about the services and capabilities available. There are also commands to configure the IWF modem as well as commands to configure the local modem.

The modem is designed to keep this dependency as transparent as possible. Commands that configure the IWF modem are typically stored at the local modem until a connection request is made. At that time, the commands are sent as a block to the IWF to set up the modem team for the call. Settings stored at the local modem will report the user setting even though the command is intended for execution / implementation at the IWF.

The airlink radio connection between these two modems operates on two levels. There is the traditional link to exchange user data between the local and remote terminal applications, and a second link to exchange operational information between the local modem and the IWF modem. This second link is largely transparent to the user.

The modem control information is exchanged using a transport layer of the airlink that is independent of an active data call. The modem can open the airlink specifically to exchange command settings without having an incoming or outgoing call on the usual data link. Normal call setup will trigger the local modem to open the airlink for the transport of the dial command. The data aspect of the link is not opened until the IWF has established the call through to the remote terminal.

The two modems use the transport layer of the airlink to stay synchronized. In simple operation, the user would not be aware that there are actually two modems on the local side of the connection. The local modem and the IWF modem co-ordinate their functions without specific user actions.

Local and Remote Commands

Some commands in this reference are noted as “(Remote)”. This indicates that the command is related to query or configuration of the IWF modem.

There are essentially three classes of commands: Local Only, Shared, and Remote-only.

Local Only

These are commands that control or query the local modem only. There are only a very few commands like this that are not shared. Local only commands return an ERROR result when the airlink to the IWF is active, but return valid results when the modem is on-hook. I5 is an example.

Shared

These commands appear to execute on the local modem. In fact these commands only store settings that are later used to configure the IWF, which must actively use the settings in establishing a call on the PSTN. The local modem does not need to create an airlink to the IWF for these commands. When an airlink is needed, the settings are sent to the IWF as part of the initialization of the link.

Remote-only

Some commands require the IWF to provide the response. The local modem treats these as unrecognized commands. If configured (using +CXT), the local modem will open the airlink and pass the command to the IWF, then relay the response to the local host; otherwise the local modem returns ERROR for unrecognized commands. These commands work on the transport layer in the airlink between the two modems. A command such as +CGCAP is in this class.

Still other commands are only meaningful if there is an established call because the data involved is transient and only exists in the presence of a call. +CMIP (page 61) is used to query for the current IP address of the modem. The modem is assigned an IP address by the network only when there is an active IS 95B call.

This is an example of another type of remote-only command.

Remote-only commands are noted in the reference with the tag “(Remote)”. If the tag is not shown, the command may be shared. Shared commands are “stored” at the local modem and are sent to configure the IWF when the airlink is established.

Airlink Control

Most of the time, the modem is operating independently (idle)—without an airlink established to the IWF or beyond. When AT commands are issued to query, configure, and set up a call, the modem may automatically establish the airlink as needed. When the call is terminated, or the modem is not actively configuring the IWF, the airlink is dropped to free the radio band for other users.

Knowing when the transport layer is active and when it is not is critical to proper interpretation of the result codes. If the link is not in place, remote-only commands give the ERROR result code. The command is unknown to the local modem or is related to a data object only available from the IWF. The same command responds differently when the airlink is established.

Establishing the Airlink

For the local modem to communicate with the IWF, an airlink is opened between them. The local modem can open this link without initiating a call through the PSTN or Quick Net Connect to a remote system. There are two primary methods to establish the airlink:

- Initiate or answer a call. Using ATD to initiate a call or ATA to answer a call causes the local modem to open the link.
- Issue a remote-only command (or any command unrecognized by the local modem) with the modem set using +CXT=1 (Cellular Extension enabled).

  If +CXT=0 (disabled), then the local modem gives the ERROR result code for unrecognized commands. When the cellular extension is enabled, the modem will open the airlink and pass the command to the IWF for processing.

If the modem can find a channel but is not permitted to register, it attempts to establish the airlink result in the NO CARRIER result.

Initializing the Airlink

Note: To control the configuration process, the local modem and the IWF have a standard default setting. Unlike standard wire line modems that allow a user configuration (profile) to be saved and restored on reset, CDMA modems support only the factory defaults on reset. A nonstandard user configuration must be sent to the local modem after any reset, ATZ, or power-cycle.

The local modem automatically initializes the airlink each time it is opened. The initialization process involves first sending the IWF all needed AT commands to configure it to match the (non-default) settings of the local modem itself. This ensures that both modems are synchronized. The second step to initializing the link is to send the IWF the contents of the +CFG string (page 59). These are commands selected by the user to configure the IWF for a particular operation.

Once the airlink is established, the local modem will pass the command that initiated the link (ATD, ATA, or the unrecognized command line) to the IWF.

Pass through and Reflection

In many respects, the local modem operates as a pass through modem providing the local host device with a radio link to the IWF modem. In many cases commands are passed through the local modem for execution at the IWF. The IWF then reflects the command back to the local modem on the transport layer of the airlink. Both modems are kept synchronized with respect to their configuration.

When a command is entered into the local modem (with the airlink active) the command is passed through to the IWF without any processing locally. The IWF controls the command line echo (if enabled). There is a noticeable delay in the echo time when the airlink is active and when it is not.

The IWF processes the command line and reflects it back to the local modem. Only if the IWF is successful at executing the command is the command reflected back to the local modem for processing locally. If the command fails, the ERROR result is passed back and through to the local host. This ensures the two modems are kept synchronized.

For further details on how the command line is processed, see “Command Handling”.

Closing the Airlink

The airlink is closed whenever a call terminates through:

- Normal disconnection (ATH)
- Loss of carrier (disconnection at the remote end or break in the PSTN connection)
- Loss of cellular coverage

If the modem has an airlink established but is not in an active call, the link can be closed by the IWF if there is no traffic (commands or replies) for the duration set with +CQD. This timer defaults to 50 seconds. The link can be closed before this time by issuing the H command.

When the airlink is closed, the local modem reports to the host (DTE) with the NO CARRIER result code.

Modem Defaults and Configurations

To summarize the discussion above:

- Both the local modem and the IWF share common defaults.
- The user cannot save a non-standard default configuration.
- Upon initialization of the airlink, the IWF is reset to default, and then any non-default values stored at the local modem are sent to the IWF to configure both modems to the same settings.
- When the airlink is active, all commands are executed by the IWF first.
  Settings are reflected back to the local modem to keep them synchronized.

When the airlink connection is closed, the local modem retains the settings last used, while the IWF modem is reset to defaults. When the next airlink is opened, the local modem may connect to a different modem at the IWF, so the local modem must repeat the initialization process. The user does not need to reconfigure the local modem for each call, although reconfiguration will be needed if the local modem is reset or power-cycled.

Appendix B – ASCII Table

Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex
NUL	0	00	SP	32	20	@	64	40	‘	96	60
SOH	1	01	!	33	21	A	65	41	a	97	61
STX	2	02	“	34	22	B	66	42	b	98	62
ETX	3	03	#	35	23	C	67	43	c	99	63
EOT	4	04	$	36	24	D	68	44	d	100	64
ENQ	5	05	%	37	25	E	69	45	e	101	65
ACK	6	06	&	38	26	F	70	46	f	102	66
BEL	7	07	’	39	27	G	71	47	g	103	67
BS	8	08	(	40	28	H	72	48	h	104	68
HT	9	09	)	41	29	I	73	49	i	105	69
LF	10	0A	*	42	2A	J	74	4A	j	106	6A
VT	11	0B	+	43	2B	K	75	4B	k	107	6B
FF	12	0C	,	44	2C	L	76	4C	l	108	6C
CR	13	0D	-	45	2D	M	77	4D	m	109	6D
SO	14	0E	.	46	2E	N	78	4E	n	110	6E
SI	15	0F	/	47	2F	O	79	4F	o	111	6F
DLE	16	10	0	48	30	P	80	50	p	112	70
XON	17	11	1	49	31	Q	81	51	q	113	71
DC2	18	12	2	50	32	R	82	52	r	114	72
XOFF	19	13	3	51	33	S	83	53	s	115	73
DC4	20	14	4	52	34	T	84	54	t	116	74
NAK	21	15	5	53	35	U	85	55	u	117	75
SYN	22	16	6	54	36	V	86	56	v	118	76
ETB	23	17	7	55	37	W	87	57	w	119	77
CAN	24	18	8	56	38	X	88	58	x	120	78
EM	25	19	9	57	39	Y	89	59	y	121	79
SUB	26	1A	:	58	3A	Z	90	5A	z	122	7A
ESC	27	1B	;	59	3B	[	91	5B	{	123	7B
FS	28	1C	<	60	3C	\	92	5C	|	124	7C
GS	29	1D	=	61	3D	]	93	5D	}	125	7D
RS	30	1E	>	62	3E	^	94	5E	~	126	7E
US	31	1F	?	63	3F	_	95	5F	DEL	127	7F

Appendix C – Acronyms and Definitions

Acronym or Term	Definition
AGC	Automatic Gain Control
Cellular	800MHz radio spectrum air interface
dB	Decibel = 10 x $\log_{10}$ (P1/P2) (Power dB) Decibel = 20 x $\log_{10}$ (V1/V2) (Voltage dB)
dBm	Decibels, relative to 1 mW - Decibel(mW) = 10 x $\log_{10}$ (Pwr (mW)/1mW)
FER	Frame Error Rate – a measure of receive sensitivity
GPS	Global Positioning System—a system that uses a series of 24 geosynchronous satellites to provide navigational data
IS-95	2G radio standards targeted for voice (cdmaONE)
MHz	MegaHertz = 1e6 Hertz (Hertz = 1/second)
PCS	Personal Communication System - PCS spans the 1.9GHz radio spectrum
PDE	Position Determination Entity—the device that the mobile communicates with for assistance in acquiring a GPS location fix
response	A response from the modem that is issued prior to a result code
result code	A numeric or text code that is returned after all commands (except resets)
RF	Radio Frequency
Sensitivity (RF)	Measure of lowest power signal that the receiver can measure

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SDU Series, DIN Rail AC UPS

The SDU DIN Rail UPS combines an industry leading compact design with a wide operation temperature range and unique installation options. The SDU series provides economical protection from damaging impulses and power interruptions. These units include easy to wire screw terminations for critical devices needing battery back up such as computer based control systems.

E179213

Applications

- Programmable Logic Controllers
- Factory Automation
- Robotics
- Conveying Equipment
- Computer-based Control Systems

Features

- Lightweight, compact industrial design
- Wide operation temperature range (0°C to 50°C)
- Cold start capability
- Phone/dataline surge protection
- Software and cable included for easy installation
- Simulated sinewave output
- RS232 communication port
- USB communication port (optional)
- Form C dry contact relay (optional)
- Panel/wall mounting brackets (optional)
- Remote turn-on and shut-off capabilities
- Two year limited warranty

Certifications and Compliances

120V Models

- c UL us UL Recognized Component, UPS Equipment
  - UL 60950-1/CSA C22.2 No. 60950-1
  - Suitable for UL 508, CSA C22.2 No. 107.1 Ind. Control Equipment Applications with no derating
    - Overvoltage Cat III, Pollution Degree III

230V Models

- CE
  - EN62040-1-1

Related Products

- Portable MCR Power Conditioners
- STV Surge Protective Devices
- SDN DIN Rail Power Supplies
- STFV Plus Active Tracking® Filters

Selection Table

Capacity (VA/W)	Catalog Number	Volts, Frequency In/Out	Typical Back–up Time (minutes) *	Input/Output Connections	Approx. Ship Weight – lbs (kg)
500/300	**SDU 500**	120 Vac, 50/60 Hz	4	IP20 touch proof, screw terminals. Wire range: 10 ~ 24 AWG.	10.7 (4.70)
850/510	**SDU 850**		2		11.4 (5.00)
500/300	**SDU 500–5**	230 Vac, 50/60 Hz	4		11.5 (5.20)
850/510	**SDU 850–5**		2		11.9 (5.40)

* At full load.

SDU Accessories

Catalog Number	Description	Approx. Ship Weight – lbs (kg)
RELAYCARD–SDU	Dry contact I/O relay box, IP20 touch proof screw terminals, wire size range 12~22 AWG (IEC 2.5mm); N.O./N.C. form "C" contact. Relay contact signal for "On Battery", "Low Battery" and "UPS Shutdown".	1.0 (0.45)
UPSMON–USB	RS232 to USB adapter cable	1.0 (0.45)
SDU–PMBRK	Mounting brackets to secure UPS to wall, back of panel or enclosure.	1.0 (0.45)

Specifications

Catalog Number	SDU 500	SDU 850	SDU 500–5	SDU 850–5
Capacity (VA/Watts)	500/300	850/510	500/300	850/510
Load Power Factor	0.6			
Dimensions – inches (mm)				
Unit (H x W x D) – in. (mm)	4.88 x 11.1 x 4.55 (124.0 x 281.0 x 116.0)			
Weight – lbs (kg)	10.7 (4.70)	11.4 (5.00)	11.5 (5.20)	11.9 (5.40)
Input Parameters				
Voltage	120 V (+10%, -20%)		230 V (+/- 20%)	
Frequency	50 +/- 5 Hz or 60 Hz +/- 6 Hz (auto sensing)			
Output AC Parameters				
Voltage (Battery Mode)	Step sinewave			
	+/- 5%			
Frequency (On Battery)	50 or 60 Hz			
	+/- 0.3 Hz			
Overload Protection	UPS automatic shutdown if overload exceeds 105% of nominal at 20 seconds, 120% at 10 seconds, 130% at 3 seconds			
Short Circuit	UPS output cut off immediately			
Battery Parameters				
Battery Type	Sealed, non-spillable, maintenance-free lead acid batteries			
Transfer Time	4 - 6 ms typical			
Back–up Time * (minutes)	4.5/18	2.5/10	4.5/18	2.5/10
Recharge Time	8 hours to 90% capacity after full discharge			
Environmental				
Operating Temperature	0°C to 50°C			
Storage Temperature	-15°C to 60°C			
Relative Humidity	1% to 95%, non-condensing			
Ambient Operation	1-95% humidity non-condensing, 0-50°C up to 5,000 ft. (1500m)			
Audible Noise	< 40dBA (1 meter from surface)			
Standards				
EMC	FCC Part 15, Subpart B, Class A; EMC: EN50091-2, EN61000-3-2, EN61000-3-3, IEC60801-2, IEC60801-3, IEC60801-4, IEC61000-2-2			
Elevation	5000 ft. without derating			
Shock & Vibration	According to the International Safe Transit Association standard ISTA 2A.			
Mounting	To be mounted on DIN TS35/7.5 or TS35/15 rail system. Chassis mounting permissible via optional brackets. Unit handles normal shock and vibration of industrial use and transportation without coming off rail.			

* At full load/half load.

SOLA HD

Uninterruptible Power Systems

SDU Series
500, 850, 500-5, 850-5

Instruction Manual

While every precaution has been taken to ensure accuracy and completeness in this manual, SolaHD assumes no responsibility, and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

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1.0 Important Safety Instructions

This manual contains important safety instructions that should be followed during the installation of the Uninterruptible Power System (UPS). Please read all safety, installation, and operating instructions before attempting to install or operate the UPS. Please adhere to all warnings on the unit and in this manual during installation and operation.

The UPS is designed for Industrial or Commercial use and can be installed and operated by individuals without previous training.

1.1 Safety Precautions—Warnings

- To prevent the risk of fire or electric shock, install the UPS in a temperature and humidity controlled ventilated enclosure, free of conductive contaminants, moisture, flammable liquids, gases, and corrosive substances.

- Operate the UPS only from a properly grounded (earthed) ac supply.
- To reduce the risk of electric shock, do not remove the cover, as it has no user-serviceable parts inside. Some components are live, even when ac power is disconnected. For service, contact a qualified technician.

Although your UPS has been designed and manufactured to assure personal safety, improper use can result in electrical shock or fire. To ensure safety, please observe the following rules:

- Turn OFF UPS and disconnect the ac supply before cleaning. Do not use liquid or aerosol cleaners. A dry cloth is recommended to remove dust from the surface of your UPS.
- Do not install or operate the UPS in or near water.
- Do not place the UPS on an unstable cart, stand, or table.
- Do not place the UPS under direct sunlight or close to heat-emitting sources.
- To allow proper ventilation of the UPS, do not block or cover the top and bottom sides of the unit.
- Never block or insert any objects into the ventilation holes or other openings of the UPS. Keep all vents free of dust accumulation that could restrict airflow.

- Follow all warnings and instructions marked on the UPS. Do not attempt to service the UPS, as it has no user-serviceable parts inside. Refer all repairs to qualified service personnel.
- Do not dispose of batteries in a fire; they may explode.
- Do not open or damage the battery. Released electrolyte is harmful to the skin and eyes and may be toxic.

If your UPS demonstrates any of the following conditions, turn OFF the UPS, disconnect the ac supply and contact your local distributor, SolaHD representative or SolaHD Technical Support at 1-800-377-4384.

- Liquid has been spilled on the UPS.
- The circuit breaker opens frequently.
- The UPS does not operate in accordance with the user manual.

1.2 Conditions of Use

Your UPS provides conditioned power to connected equipment. The maximum load must not exceed that shown on UPS rating label. If uncertain, contact your distributor or SolaHD Technical Support at 1-800-377-4384.

U.S. Only: For Conditions of Acceptability in accordance with UL 508A, see “13.0 Conditions for Safe Use of SDU 500 & 850”.

2.0 Warnings Defined

⚠ DANGER **Danger:** Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations.

⚠ WARNING **Warning:** Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION **Caution:** Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

3.0 Introduction

Congratulations on your choice of the SDU Uninterruptible Power System (UPS). The SDU is a compact, “Off-Line” DIN rail mountable UPS, which provides conditioned power to sensitive electronic equipment. It supplies connected equipment with stepped approximation to sinewave power to simulate the power generated by the utility.

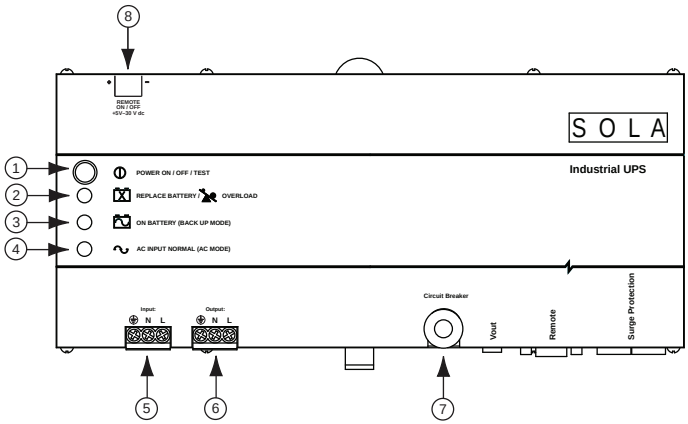
The SDU is a powerful, microprocessor-controlled UPS. Input voltage range is 80% to 110% (ideal protection for the critical connected loads). Battery charging occurs automatically when ac power is applied, no need to switch ON the UPS. When power fails, the UPS can be automatically turned OFF, as long as the connected loads are not operating to save the battery energy. The SDU also includes an automatic self-test feature to test the UPS function and battery. If the battery is no longer useful, the unit will sound an alarm and an LED indicator will illuminate.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an industrial installation. This equipment uses, generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference with radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the UPS and the receiver.
- Connect the UPS into a circuit different from that which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

4.0 System Description

4.1 Front Panel

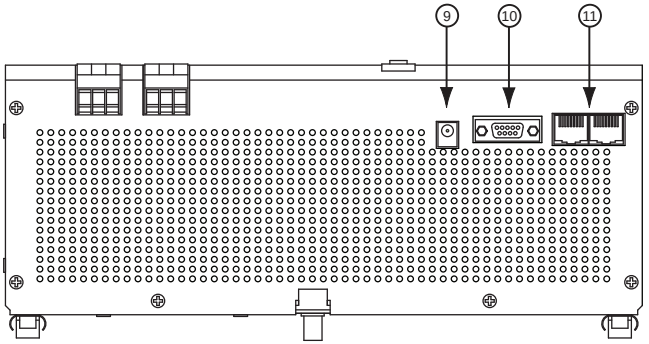


1. **Power ON/OFF/Test Button:** Press the button for more than one second to turn the UPS ON. Press the button for less than one second to activate the self-testing. Press for more than five seconds to turn OFF.
2. **Battery Warning/Overload Indicator (Red LED):** The LED flashes when the battery needs to be recharged and tested. The LED will illuminate when the unit is subjected to an overload condition. If the unit shuts down due to overload, the LED and alarm will continue for two minutes.
3. **ON Battery Indicator (Yellow LED)**: The LED illuminates when the UPS is supplying battery power to the loads.
4. **Ac Input Normal Indicator (Green LED):** The LED illuminates when the line input voltage is normal.
5. **IP20-rated Input Screw Terminals** (see table below)
6. **IP20-rated Output Screw Terminals** (see table below)

Screw	M3.0; Current rating = 30 A, Ac 300 V
Insulation Withstands Volts	Ac 2000 V min.
PCB Hole Diameter	1.8 mm, wire strip length = 8 mm
Wire Range	10–24 AWG
Screw Torque	5.5 lb.-in.

7. **Input Circuit Breaker:** Protection from ac overload and short circuit.
8. **Remote ON/OFF:** The remote switch provides the same functions as the front panel switch including ON/OFF/Test functions with Green Mode enabled or disabled.

4.2 Bottom Panel



9. **V Output:** Output terminal providing 12 V power source to the optional relay card.
10. **Remote:** RS232 communication port; DB-9 connector.
11. **Tel/Surge Protection:** Data line surge protection for phones (UL497A).

4.3 What's Included

The SDU UPS is shipped with the following items:

- User manual
- UPSMON software CD

  NOTE: Monitoring/diagnostic software is included on the UPSMON CD. The software is compatible with Windows NT and Windows 2000 (including XP operating systems).

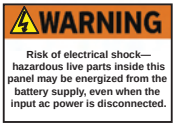
- UPSMON DB-9 serial cable
- RJ-11 cord
- Electrical shock warning label

4.4 Accessories

- **UPSMON-USB:** RS232 to USB adapter cable
- **RELAYCARD-SDU:** Dry contact relay box
- **SDU-PMBRK:** Mounting brackets to secure the UPS to the wall, back of the panel or enclosure

5.0 Installation Instructions

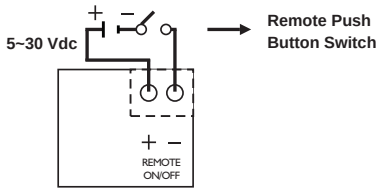
1. **Placement:** Install the UPS in a protected area with adequate airflow and free of excessive dust. Do not operate the UPS outdoors.
2. **Connect to Utility:** To power up the UPS, connect the ac input connector to the utility power.
3. **Charge the Battery:** The UPS charges its battery whenever it is connected to utility power. For best results, charge the battery for four hours during initial use.
4. **Connect the Loads:** Connect the loads to the output hardwire connector.
5. **Apply the Electrical Shock Warning Label:** Apply the electrical shock warning label to the panel, in a way that is clearly visible to the user.



6.0 Operating Instructions

1. **Output Connector:** The output connector will provide protection from surges and power failures to the critical loads.
2. **Switch ON Green Mode Enabled:** After connecting the UPS to the utility power, press the ON button until you hear the first beep, then release the button immediately. The Green Mode is enabled, i.e. if a load less than forty watts (or no load) is connected and the UPS operates in the Backup Mode. The UPS will enter into the Green Mode status after three minutes of backup time; the green light will flash every three to five seconds and after a short period of time; and the unit will enter a “power save” status by shutting down to prevent deep discharge of the battery. To reactivate the unit, power the unit OFF then ON again or reapply utility power.
3. **Switch ON Green Mode Disabled:** After connecting the UPS to the utility power, press the ON button and keep pressing it until you hear two short beeps “Bi-Bip”, then release the button immediately. The Green Mode is now disabled. Any kind of load, whether smaller than forty watts or larger, will not affect the normal operation of the UPS under Ac or Battery Mode.
4. **Switch OFF:** To switch OFF the UPS, press and hold the Power ON/OFF/Test button until the “Ac Power Normal” LED or “ON Battery” LED turns OFF.

5. **Self-test:** Use the self-test to verify both the operation of the UPS and the condition of the battery. In normal utility power, push the Power ON/OFF/Test button for less than one second; the UPS will perform a self-test. During the self-test, the UPS runs in Backup Mode. If the UPS passes the self-test, it returns to “Ac Input Normal” operation.
6. **Remote ON/OFF:** To ensure the remote ON/OFF function, connect a remote push-button switch in series with 5–30 V dc voltage source to the ON/OFF terminal as shown below.



The remote switch provides the same functions as the front panel switch including ON/OFF/Test functions with Green Mode enabled or disabled. If the Green Mode is not needed, a remote toggle switch can be used.

7.0 Battery Overload Alarms

1. **ON Battery (slow beeping):** When in ON Battery Mode, the yellow LED illuminates and the UPS sounds an audible alarm. The alarm stops when the UPS returns to Ac Input Normal operation.
2. **Low Battery (rapid beeping):** In ON Battery Mode when the battery energy runs low, the UPS beeps rapidly until the UPS shuts down from battery exhaustion or returns to Ac Input Normal operation.
3. **Overload (continuous alarm):** When the UPS is overloaded (the connected loads exceed the maximum rated capacity), the UPS sounds a continuous alarm and LED to warn of an overload condition. Reduce the load to eliminate the overload.

8.0 PIN-Out Configuration for DB9 Connector

Female Connector PIN No.	RS-232 Signal	Open Collector Signal
1	---	---
2	TX	---
3	RD	Remote shutdown*
4	DTR (+12 V)	---
5	GND	GND
6	---	Ac failure
7	RTS (-12 V)	---
8	---	Battery low
9	TX	---

DTR = Data terminal ready

RTS = Request to send

RD = Transmitted data

GND = Signal Ground

TX = Received data

*When a remote shutdown signal is applied for one second, the UPS will shut down in three minutes.

9.0 Battery Backup Times

	SDU 500, SDU 500-5	SDU 850, SDU 850-5
VA/Watts	500/300	850/510
Battery	YUASA NP7-12	YUASA REW45-12
Load Level	Backup Time (Minutes)	Backup Time (Minutes)
10%	130	80
20%	55	37
30%	36	20
40%	23	13
50%	18	10
60%	13	7
70%	10	5
80%	9	4
90%	6	3
100%	5	2.5

10.0 Troubleshooting

Problem	Probable Cause	Required Action
UPS is not ON; LED will not light	UPS is OFF or the ON/OFF/Test button was not pushed for 1+ seconds	Press the ON/OFF/Test button for more than 2 seconds
	Battery voltage is less than 10 V	Recharge the UPS for at least 4 hours. If the unit still does not start, check the input fuse.
	Other failure	Call SolaHD Technical Support
	Load is less than 20 W in Backup Mode	Normal condition
UPS is always in Backup Mode	Loose ac input power connection	Tighten the ac power connection
	Circuit breaker trips	Reset the breaker
	Line voltage too high, too low, or blackout	Normal condition
	Other failure	Call SolaHD Technical Support
Backup time is too short	Battery is not fully charged	Recharge the UPS for at least 4 hours
	Other failure	Call SolaHD Technical Support
Continuous beep & LED overload indication	Overload condition	Remove the overload
Red LED is flashing	Battery failure	Recharge the UPS for at least 8 hours. Perform UPS self-test.

⚠ CAUTION **Do not attempt to open the UPS or replace the battery. Call SolaHD Technical Support for further instructions.**

11.0 Storage

11.1 Storage Conditions

Store the UPS covered and upright in a cool, dry location, with its battery fully charged. Before storing, charge the UPS for at least four hours. Remove any accessories in the accessory slot and disconnect any cables connected to the computer interface port to avoid unnecessary draining of the battery.

11.2 Extended Storage

During extended storage in environments where the ambient temperature is -15 to +30 °C (+5 to +86 °F), charge the UPS battery every six months.

During extended storage in environments where the ambient temperature is +30 to +45 °C (+86 to +113 °F), charge the UPS battery every three months.

12.0 Specifications

Description	Catalog Number			
	SDU 500	SDU 850	SDU 500-5	SDU 850-5
INPUT				
Capacity VA/Watts	500/300	850/510	500/300	850/510
Voltage (Single Phase)	120 V + 10%, -20%		230 V +/ -20%	
Frequency	50 or 60 Hz, +/ -10% (auto-sensing)			
OUTPUT				
Voltage (on battery)	Simulated sine wave			
	120 V +/-5%		230 V +/-5%	
Frequency (on battery)	50 or 60 Hz, +/-0.5% auto-sensing			
Transfer Time	<4 milliseconds			
PROTECTION				
Unit Input	Circuit breaker for overload and short circuit protection			
Overload Protection	UPS automatic shutdown if overload exceeds 105% of nominal at 20 s, 120% at 10 s, 130% at 3 s			
Short Circuit	UPS output cut off immediately			
BATTERY				
Type	Sealed, maintenance-free, lead acid batteries			
Typical Recharge Time (to 90% of full capacity)	8 hours			
Backup Time (at full load)	4 min.	2 min.	4 min.	2 min.
ALARM				
ON Battery	Slow beeping every 4 seconds			
Battery Low	Rapid beeping every second			
Overload	Continuous beeping sound			
ENVIRONMENT				
Ambient Operation	0–95% humidity, non-condensing. 50˚C up to 10,000 ft. (3000 m).			
Audible Noise	<40 dBA (1 m from surface)			
WEIGHT & DIMENSIONS				
Net Weight, lb. (kg)	10.7 (4.7)	11.4 (5.0)	11.5 (5.2)	11.9 (5.4)
H x W x D, in. (mm)	4.88 x 11.1 x 4.55 (124 x 281 x 116)			
SAFETY/APPROVALS				
	UL 1778 C-UL Recognized* for industrial applications in accordance with UL 508A without derating. Overvoltage Category 3, Pollution Degree 3. FCC Part 15, Subpart B, Class A.		CE Marked; LVD: EN62040-1-1; EMC: EN50091-2, EN61000-3-2, EN61000-3-3, IEC801-2, IEC801-3, IEC801-4, IEC1000-2-2	

*For Conditions of Acceptability in accordance with UL 508A, see “13.0 Conditions for Safe Use of SDU 500 & 850”.

13.0 Conditions for Safe Use of SDU 500 & 850

NOTE: Applicable for U.S. only.

Considerations shall be given to the following:

1. The equipment shall be installed in compliance with the enclosure, mounting, spacing, casualty, and segregation requirements of the ultimate application.
2. The equipment has been judged on the basis of the required spacings for use in Overvoltage Category III and Pollution Degree 3 and in the Second Edition of the Standard for Uniterruptible Power Supply Equipment, UL 1778, par. 23 and table 23.1, which would cover the component itself if submitted for unrestricted listing.
3. The suitability of grounding connection shall be determined in the end-use product.
4. The equipment is provided with means for permanent mounting, the suitability of assembly shall be determined in the end-use product.
5. Equipment is considered acceptable for use in a maximum ambient of 50°C.
6. The equipment inside live parts are energized from the battery supply even when the input ac power is disconnected.
7. For CNR investigation, total harmonic distortion of 44.8% and maximum single harmonic of 33.1%.
8. The equipment was investigated under 20 amperes branch circuit in accordance with the National Electrical Code, ANSI/NFPA 70, to reduce the risk of fire, connect only to a circuit provided with 20 amperes maximum branch circuit over current protection.
9. Use No. 18 AWG, 90°C copper wire and 9 lb.-in. Torque force when connecting to terminal block.
10. Polarity Identification in UPS unit for filed wiring terminals: Provided with label adjacent to the unit supply connections. See below for details.

Input			Output		
⏚	N	L	⏚	N	L

11. The following tests were additionally conducted at specified conditions as noted below, in accordance with the Standard for Industrial Control Equipment, UL 508A, 17th Edition.

Temperature Test: Models SDU 850 and SDU 500 were mounted in an enclosure (150% of the dimensions of the device, overall 420 by 180 by 160 mm), in accordance with par. 42.6 of UL 508A. The suitability usage of industrial control equipment shall be considered in end application.

Breakdown of Components Test: Model SDU 850 had been conducted through a 30-ampere non-time-delay fuse, in accordance with par. 57.5 of UL 508A.

12. The products, Models SDU 850 and SDU 500 were evaluated based on Pollution Degree 3 and Overvoltage Category III criteria and a minimum end use ambient of 40°C, so that these devices do not have to be derated when installed within an industrial control panel.

14.0 Product Registration & Warranty Information

14.1 Product Registration

To register your product for updates and information on service and support:

- Visit the Technical Support section of our Web site at: http://www.solahd.com/support/registration.htm
- Click on the Product Registration link and fill in the form. This will register your product with SolaHD.

14.2 Warranty Information

Please see “Terms and Conditions of Sale”.

1.0 Instrucciones importantes de seguridad

Este manual contiene instrucciones importantes de seguridad que deberán seguirse durante la instalación del Sistema de Energía Eléctrica Ininterrumpible (UPS). Por favor lea este manual completamente antes de intentar instalar u operar este UPS.

Lea todas las instrucciones de seguridad, instalación y operación antes de operar el UPS. Cumpla con todas las advertencias indicadas en la unidad y en este manual. Siga todas las instrucciones de operación y deuso.

Este equipo está diseñado para uso Industrial o Comercial. Este equipo puede ser instalado y operado por personas no capacitadas previamente para hacer estas funciones.

1.1 Precauciones de seguridad—Advertencia

- Para evitar el riesgo de incendio o choque eléctrico, instale el UPS en una habitación con temperatura y humedad controladas, libre de contaminantes conductivos, humedad, líquidos inflamables, gases y sustancias corrosivas.

- Opere el UPS únicamente desde una fuente de suministro de CA debidamente conectada a tierra (unida a tierra).
- Para reducir el riesgo de choque eléctrico, no retire la cubierta, ya que la unidad no contiene piezas que el usuario puede reemplazar o reparar. Algunos de los componentes tienen energía eléctrica, aún cuando la energía de CA está desconectada. Para obtener servicio, póngase en contacto con un técnico calificado.

Aunque su UPS ha sido diseñado y fabricado para garantizar la seguridad personal del usuario, el uso indebido del mismo puede resultar en un choque eléctrico o incendio. Para garantizar su seguridad, por favor observe las siguientes normas:

- Apague el UPS y desconecte el suministro de energía de CA antes de limpiarlo. No utilice limpiadores líquidos o aerosol. Se recomienda utilizar un trapo seco para quitar el polvo de la superfi cie de su UPS.
- No instale ni opere su UPS en o cerca del agua.
- No coloque el UPS en un carro, soporte o mesa inestable.
- No coloque el UPS bajo la luz directa del sol o cerca de fuentes emisoras de calor.

- Para permitir una ventilación adecuada del UPS, no bloquee ni cubra los lados superior e inferior de la unidad.
- Nunca bloquee ni inserte ningún objeto en los orifi cios de ventilación u otras aberturas del UPS. Mantenga todas las aberturas de ventilación libre de acumulaciones de polvo que puedan restringir el fl ujo del aire.
- Siga todas las advertencias e instrucciones marcadas en el UPS. No intente darle servicio al UPS, ya que este no contiene ninguna pieza que usted pueda reparar o reemplazar. Refi era todas las reparaciones al personal de servicio técnico califi cado.
- No deseche la batería o las baterías en el fuego. La batería podría explotar.
- No abra ni dañe la batería. El electrolito derramado es peligroso para la piel y los ojos. Podría ser tóxico.

Si su UPS exhibe cualquiera de las siguientes condiciones, apague el UPS, desconecte el suministro de energía de CA y póngase en contacto con su distribuidor local, representante de SolaHD o Servicios Técnicos de SolaHD.

- Se ha derramado o vertido líquido en el UPS.
- El cortacircuito se abre frecuentemente.
- El UPS no funciona de acuerdo con el manual del usuario.

1.2 Condiciones de Uso

Su UPS le proporciona energía eléctrica acondicionada al equipo conectado. La carga máxima no deberá exceder la capacidad indicada en la etiqueta o placa del UPS. Si no está seguro, póngase en contacto con su distribuidor o SolaHD.

2.0 Definición de advertencias

⚠ PELIGRO — **Peligro:** Indica una situación de riesgo inminente que, si no se evita, causará lesiones graves o letales. Esta palabra de señal se utilizará sólo en las situaciones más extremas.

⚠ ADVERTENCIA — **Advertencia:** Indica una situación potencialmente riesgosa, que si no se evita, podría causar lesiones graves o letales.

⚠ PRECAUCIÓN — **Precaución:** Indica una situación potencialmente riesgosa, que si no se evita, podría causar lesiones leves o moderadas. También se puede utilizar para indicar prácticas poco seguras.

3.0 Introducción

Felicitaciones por su elección de un Sistema de Energía Eléctrica Ininterrumpible (UPS) de la Serie SDU Sola. Éste proporciona energía eléctrica acondicionada a los equipos electrónicos sensibles.

La Serie SDU es un UPS compacto “Fuera de línea”, montable en Riel DIN. El mismo le proporciona al equipo conectado una aproximación escalonada de alimentación eléctrica sinusoidal para simular la energía generada por la fuente pública.

La unidad SDU es un potente UPS controlado por microprocesador. La gama del voltaje de entrada es de un 80% a un 110%, una protección ideal para las cargas críticas conectadas. La recarga de la batería se realiza automáticamente cuando se conecta el suministro de energía de CA, no es necesario encender (poner en ON) el UPS. Cuando se corta la energía eléctrica, puede apagarse automáticamente el UPS si ninguna de las cargas conectadas está funcionando, para conservar la energía de la batería. La unidad SDU incluye una función de autocomprobación automática que verifi ca el funcionamiento del UPS y la batería.

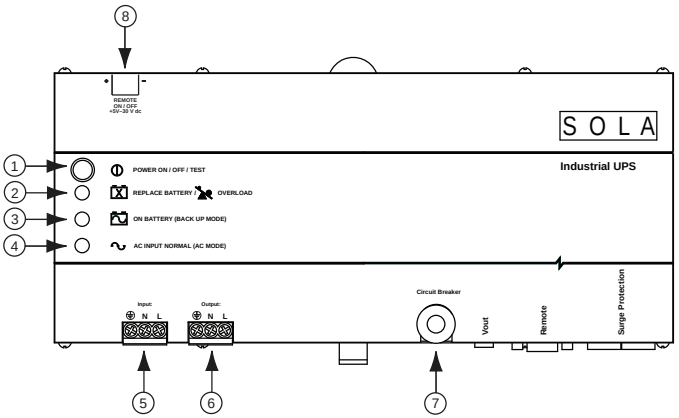
Si se detecta que la batería ya no funciona, la unidad se pone en alarma y un indicador LED se ilumina.

NOTA: Este equipo ha sido sometido a prueba y se ha determinado que cumple con los límites para un dispositivo digital de Clase A, según la parte 15 de las Normas de la FCC. Estos límites están diseñados para proporcionar una protección razonable contra las interferencias dañinas en una instalación industrial. Este equipo utiliza, genera y puede emitir energía de radiofrecuencia y, si no se instala y se utiliza de acuerdo con las instrucciones, es posible que pueda causar interferencia dañina con las comunicaciones por radio. Sin embargo, no hay ninguna garantía de que la interferencia no se producirá en una instalación en particular. Si este equipo produce interferencia dañina en la recepción de las señales de radio o televisión, lo cual puede determinarse apagando y encendiendo el equipo, el usuario debe tratar de corregir la interferencia mediante una o más de las siguientes medidas:

- Vuelva a orientar o ubicar la antena de recepción.
- Aumente la separación entre el UPS y el receptor.
- Conecte el UPS en un circuito diferente al que esté conectado el receptor.
- Consulte con su distribuidor o un técnico especializado en radio/televisión para obtener ayuda.

4.0 Descripción de sistema

4.1 Panel frontal

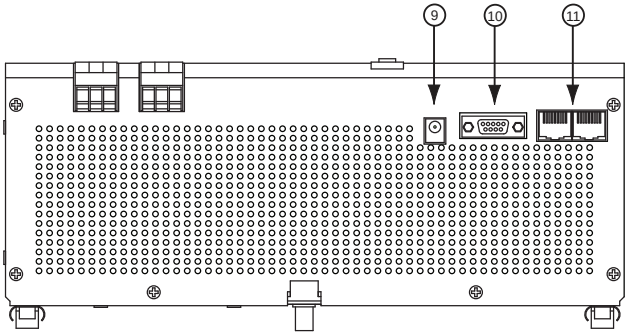


1. **Botón "POWER ON/OFF/TEST" (Encendido/Apagado/Prueba):** Presione el botón durante más de 1 segundo para encender el UPS. Presione el botón durante menos de 1 segundo para activar la autocomprobación del UPS. Presione el botón durante más de 5 segundos para apagar.
2. **Indicador (LED ROJO) "BATTERY WARNING/OVERLOAD" (Advertencia de Batería/Sobrecarga):** El LED destella cuando es necesario recargar y comprobar la batería del UPS. El LED se enciende cuando la unidad está en condición de sobrecarga. Si la unidad se apaga debido a una condición de sobrecarga, el LED y la alarma permanecerán activados durante 2 minutos.
3. **Indicador (LED AMARILLO) "ON-BATTERY" (En Batería):** El LED se enciendecuando el UPS suministra energía de la batería a las cargas.
4. **Indicador (LED VERDE) "AC INPUT NORMAL" (Entrada de CA Normal):** El LED se enciende cuando el voltaje de entrada de línea es normal.
5. Terminales de entrada con tornillos de capacidad IP20 (vea la tabla abajo)
6. Terminales de salida con tornillos de capacidad IP20 (vea la tabla abajo)

Tornillo	M3.0, capacidad de corriente = 30 Amp CA 300V
Voltaje no disruptivo del aislamiento	CA 2000 V mín.
Diámetro de agujero PCB	1.8 mm, longitud de alambre pelado = 8 mm
Gama de tamaños de alambre	10 a 24 AWG
Par torsor para los tornillos	5.5 libras - pulgada

7. **Cortacircuito de entrada:** Protección contra sobrecargas de CA y cortocircuitos.
8. **Encendido/Apagado Remoto:** El interruptor remoto proporciona las mismas funciones que el interruptor en el panel frontal, incluyendo las funciones ON/OFF/TEST con la modalidad verde habilitada o no habilitada.

4.2 Panel inferior



9. **V Out (salida de voltaje):** Terminal de salida que proporciona un suministro de energía de 12 voltios a la tarjeta opcional de relés.
10. **Remoto:** Puerto de comunicación RS-232 con conector DB9.
11. **Protección contra sobretensiones en la línea de teléfono:** Protección contra sobretensiones para línea de datos telefónica (UL497A).

4.3 Qué se incluye

El UPS SDU se envía con los siguientes artículos:

• Manual del usuario del SDU

• CD con el software UPSMON

NOTA: Junto con la unidad se suministran un CD UPSMON que incluye un software de monitoreo y diagnóstico. El programa es compatible con Windows NT y Windows 2000 (incluyendo el Protocolo XP).

• Cable serie UPSMON

• Cordón RJ-11

• Etiqueta de advertencia de descarga eléctrica

4.4 Accesorios

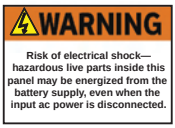
• **UPSMON-USB:** Cable de adaptación de RS232 a USB

• **RELAYCARD-SDU:** Caja de relés de contacto seco

• **SDU-PMBRK:** Soportes de montaje para sujetar el UPS en la pared, detrás de un panel o en un recinto

5.0 Instrucciones de instalación

1. **Ubicación:** Instale el UPS en una zona protegida con un fl ujo de aire adecuado y libre de polvo excesivo. No opere el UPS en el exterior.
2. **Conecte el UPS a la fuente eléctrica pública:** Acople el conector de entrada de CA a la fuente de energía eléctrica pública para energizar el UPS.
3. **Cargue la batería:** El UPS recarga su batería siempre que está conectado a la fuente de energía pública. Para obtener los mejores resultados, cargue la batería durante 4 horas en el uso inicial de la unidad.
4. **Conecte las cargas:** Acople las cargas al conector cableado de salida.
5. **Aplicar la etiqueta de advertencia de descarga eléctrica:** Aplicar la etiqueta de advertencia de descarga eléctrica al grupo de una manera que sea claramente visible para el usuario.



6.0 Instrucciones de operación

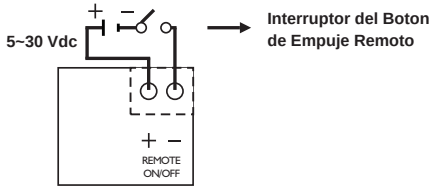
1. **Conector de salida:** El Conector de salida proporcionará protección contra sobretensiones e interrupciones del suministro eléctrico a las cargas críticas suyas.
2. **Encendido con el 'Modo verde' habilitado:** Luego de conectar el UPS (Sistema de Energía Eléctrica Ininterrumpible) al suministro de energía pública, presione el botón de encendido (ON) hasta que escuche el primer pitido después de transcurridos menos de 3 segundos, y luego suéltelo de inmediato. El modo Verde se encuentra habilitado, por ejemplo, si una carga inferior a 40 vatios (o ninguna carga) está conectada y el UPS funciona en el modo de respaldo, el UPS pasará al estado de modo verde luego de transcurridos 3 minutos del tiempo de respaldo; la luz verde destellará cada 3 a 5 segundos y tras un corto período de tiempo, la unidad pasará al modo de 'ahorro de energía' y se desactivará para impedir que la batería se descargue demasiado. Para reactivar la unidad, apague y encienda la unidad, o reconecte el suministro de energía pública al UPS y la energía se encenderá nuevamente.

3. **Encendido con el 'Modo verde' inhabilitado:** Luego de conectar el UPS (Sistema de Energía Eléctrica Ininterrumpible) al suministro de energía pública, presione el botón de encendido (ON) y continúe presionándolo hasta que escuche dos pitidos cortos; luego suéltelo de inmediato y el modo verde quedará inhabilitado. Ningún tipo de carga, ya sea menor o mayor que 40 vatios, afectará de manera alguna el funcionamiento normal del UPS bajo el modo batería o CA.

4. **Apagado:** Para apagar el UPS, presione y no suelte el botón Power ON/OFF/ Test (Encendido / Apagado /Prueba) hasta que se apague el LED "AC INPUT NORMAL" (Entrada de CA Normal) o el LED "ON BATTERY" (En Batería).

5. **Autocomprobación:** Utilice la autocomprobación para verifi car el funcionamiento del UPS y la condición de la batería.Con el suministro de energía pública, presione el botón Power ON/OFF/Test (Encendido/Apagado/Prueba) durante menos de 1 segundo y el UPS realizará la función de autocomprobación. Durante la autocomprobación, el UPS funciona en la modalidad de respaldo (en batería). Si el UPS pasa la autocomprobación, éste regresa al funcionamiento de Entrada de CA Normal ("AC INPUT NORMAL").

6. **Encendido/Apagado Remoto:** Para asegurar la función CON./DESC. alejada, conecte un interruptor de botón alejado en serie con fuente del voltaje de 5~30 VDC con el terminal con./desc. según lo demostrado en la figura siguiente.



El interruptor remoto proporciona las mismas funciones que el interruptor en el panel frontal, incluyendo las funciones ON/OFF/TEST con la modalidad verde habilitada o no habilitada. Si no necesita el modo verde, se puede usar uninterruptor de palanca.

7.0 Tiempo de autonomía de la batería (Alarma)

1. **"EN BATERÍA" (pitidos lentos):** Cuando la unidad está en la modalidad EN BATERÍA, el LED AMARILLO se enciende y el UPS emite una alarma audible. La alarma cesa cuando el UPS regresa al funcionamiento con ENTRADA DE CA NORMAL (AC INPUT NORMAL).
2. **"BATERÍA BAJA" (pitidos rápidos):** En la modalidad EN BATERÍA, cuando la carga de energía de la batería está baja, el UPS emite pitidos rápidos hasta que el UPS se apaga porque la batería ya no tiene carga o el UPS regresa al funcionamiento con ENTRADA DE CA NORMAL (AC INPUT NORMAL).
3. **"SOBRECARGA" (alarma continua):** Cuando el UPS está en condición de sobrecarga (las cargas conectadas ex-ceden la capacidad nominal máxima de la unidad), el UPS emite un sonido de alarma continuo y un LED se enciende y permanece encendido para advertir sobre la condición de sobrecarga. Disminuya la carga para eliminar la condición de sobrecarga.

8.0 Configuración de disposición de las clavijas del conector DB9

Número de clavija del conector hembra DB9	Señal RS-232	Señal de colector abierto
1	---	---
2	TX	---
3	RD	Desactivación Remota*
4	DTR (+12 V)	---
5	GND	GND
6	---	Fallo de CA
7	RTS (-12 V)	---
8	---	Batería Baja
9	TX	---

DTR = Terminal de datos listo

RTS = Petición para enviar

RD = Datos transmitidos

GND = Señal de Tierra

TX = Datos recibidos

*Cuando se aplica la señal de desactivación remota durante 1 segundo, el UPS se desactivará (o apagará) al cabo de 3 minutos.

9.0 Tiempo de reserva de la batería

	SDU 500, SDU 500-5	SDU 850, SDU 850-5
VA/Watts	500/300	850/510
Batería	YUASA NP7-12	YUASA REW45-12
Nivel de la carga	Tiempo de reserva (Minutos)	Tiempo de reserva (Minutos)
10%	130	80
20%	55	37
30%	36	20
40%	23	13
50%	18	10
60%	13	7
70%	10	5
80%	9	4
90%	6	3
100%	5	2.5

10.0 Almacenamiento

10.1 Condiciones de almacenamiento

Almacene el UPS cubierto y en posición vertical en un lugar seco y frío, con su batería plenamente cargada. Antes de almacenarlo, cargue el UPS durante 4 horas como mínimo. Retire todo accesorio de la ranura de accesorios y desconecte todo cable que esté conectado al puerto interfaz para computadora, a fi n de impedir el drenaje innecesario de la batería.

10.2 Almacenamiento prolongado

Durante los almacenamientos prolongados en los entornos donde la temperatura ambiente es de -15 a +30°C (+5 a +86°F), cargue la batería del UPS cada 6 meses.Durante los almacenamientos prolongados en los entornos donde la temperatura ambiente es de +30 +45°C (+86 +113°F), cargue la batería del UPS cada 3 meses.

11.0 Solución de problemas

Problema	Causa probable	Acción a tomar
El UPS no enciende; el LED está apagado	El UPS está apagado o no se ha presionado el botón On/Off/Test (Encendido/Apagado/Prueba) la cantidad de tiempo suficiente	Presione el botón On/Off/Test (Encendido/Apagado/Prueba) durante más de 2 segundos
	Voltaje de batería inferior a 10V	Recargue el UPS durante 4 horas como mínimo. Si la unidad no enciende, verifi que el fusible de entrada
	Otra avería	Llame a Servicios Técnicos
	Carga inferior a 20 vatios en modalidad de respaldo (en batería)	Condición normal
El UPS permanece en la modalidad de respaldo (en batería)	Conexión de entrada de energía de CA suelta o floja	Apriete la conexión de energía de CA
	El cortacircuito se dispara	Reponga el cortacircuito
	Voltaje de línea demasiado alto, demasiado bajo o se produjo un apagón	Condición normal
	Otra avería	Llame a Servicios Técnicos
Tiempo de respaldo demasiado corto	La batería no está totalmente cargada	Recargue el UPS durante 4 horas como mínimo
	Otra avería	Llame a Servicios Técnicos
Pitido continuo y se enciende el LED de indicación de sobrecarga	Condición de sobrecarga	Elimine la sobrecarga
LED rojo intermitente	Fallo de la batería	Recargue el UPS durante 8 horas como mínimo, luego realice la autocomprobación del UPS

⚠ PRECAUCIÓN **No intente abrir el UPS ni reemplazar la batería. Llame a Servicios Técnicos para obtener más explicaciones.**

12.0 Especificaciones

Descripción	Modelo			
	SDU 500	SDU 850	SDU 500-5	SDU 850-5
ENTRADA				
Capacidad VA/Vatios	500/300	850/510	500/300	850/510
Voltaje (Monofásico)	120 V + 10%, -20%		230 V +/-20%	
Frecuencia	50 ó 60Hz +/-10% (autodetección)			
SALIDA				
Voltaje (en batería)	Onda sinusoidal simulada			
	120 V +/-5%		230 V +/-5%	
Frecuencia (en batería)	50 ó 60Hz; +/-0.5% autodetección			
Tiempo de transferencia	<4 milisegundos			
PROTECCIÓN				
Entrada de la unidad	Cortacircuito para proteger contra sobrecargas y cortocircuitos			
Protección contra sobrecargas	El UPS se apaga automáticamente si la sobrecarga excede el 105% del valor nominal a 20 segundos, 120% a 10 segundos, 130% a 3 segundos			
Cortocircuito	La salida del UPS se corta automáticamente			
BATERÍA				
Tipo	Baterías selladas de plomo y ácido que no requieren mantenimiento			
Tiempo de recarga típico (hasta el 90% de plena capacidad)	8 horas			
Tiempo de autonomía en minutos a plena carga	4 min.	2 min.	4 min.	2 min.
ALARMA				
En batería	Pitidos lentos a cada 4 segundos			
Batería baja	Pitidos rápidos cada segundo			
Sobrecarga	Sonido de pitido continuo			
AMBIENTE				
Operación ambiental	0-95% de humedad sin condensación; 50°C hasta 10,000 pies (3000 m)			
Ruido audible	<40 dBA (a 1 metro de la superficie)			
PESO/DIMENSIONES				
Peso neto, lb. (kg)	10.7 (4.7)	11.4 (5.0)	11.5 (5.2)	11.9 (5.4)
Altura x Anchura x Profundidad, pulg. (mm)	4.88 x 11.1 x 4.55 (124 x 281 x 116)			
SEGURIDAD/APROBACIONES				
	Clasificación UL 1778 C-UL, reconocida para aplicaciones industriales de acuerdo con UL508 sin ninguna corrección. Categoría 3 de sobrevoltaje, grado 3 de contaminación. Parte 15, Subparte B, Clase A de la FCC.		Clasificación CE; LVD: EN62040-1-1;EMC: EN50091-2, EN61000-3-2, EN61000-3-3, IEC801-2, IEC801-3, IEC801-4, IEC1000-2-2	

13.0 Registro del producto y información sobre la garantía

13.1 Registro del producto

A fin de registrar su producto para obtener actualizaciones e información sobre servicio y apoyo:

- Visite la sección Apoyo Técnico o nuestro sitio Web en: http://www.solahd.com/support/registration.htm
- Haga clic en el enlace de Registro de Productos y complete el formulario. Así, su producto quedará registrado con SolaHD. Vous pourrez ainsi enregistrer votre produit chez SolaHD.

13.2 Información sobre la garantía

Sírvase consultar “Términos y Condiciones”.

1.0 Instructions importantes sur la sécurité

Ce manuel contient des instructions importantes sur la sécurité, qui doivent être respectées lors de l'installation de l'UPS. Veuillez lire attentivement ce manuel avant de commencer à installer ou utiliser cet UPS.

Lire toutes les instructions sur la sécurité, l'installation et le fonctionnement avant d'utiliser l'UPS. Respecter tous les avertissements indiqués sur l'appareil et dans ce manuel. Suivre toutes les instructions d'utilisation et celles destinées à l'utilisateur.

Cet équipement est conçu pour un usage industriel ou commercial. Cet équipement peut être installé et utilisé par des personnes n'ayant reçu aucune formation préalable.

1.1 Mesures de sécurité—avertissements

- Afin d'éviter les risques d'incendie ou de décharge électrique, installer l'UPS dans une enceinte dont la température et l'humidité sont contrôlées, exempte de contaminants conducteurs, d'humidité, de liquides et gaz infl ammables et de substances corrosives.

- Utiliser l'UPS seulement à partir d'une source d'alimentation en courant alternatif correctement mise à la terre.
- Afin de réduire les risques de décharge électrique, ne pas enlever le couvercle, car aucune pièce réparable par l'utilisateur ne se trouve à l'intérieur. Certains composants sont sous tension, même lorsque l'alimentation c.a est coupée. Pour obtenir du service, contacter un technicien qualifié.

Bien que l'UPS ait été conçu et fabriqué pour assurer la sécurité personnelle, une utilisation incorrecte peut entraîner une décharge électrique ou un incendie. Afin d'assurer la sécurité, observer les règles suivantes :

- Mettre l'UPS hors tension et couper l'alimentation c.a avant de le nettoyer. Ne pas utiliser de nettoyants liquides ou aérosols. On recommande d'utiliser un chiffon sec pour enlever la poussière de la surface de l'UPS.
- Ne pas installer ou utiliser l'UPS dans ou à proximité d'un plan d'eau.
- Ne pas placer l'UPS sur un chariot, un support ou une table instable.
- Ne pas placer l'UPS sous les rayons directs du soleil ou à proximité d'une source de chaleur.

- Pour assurer une ventilation adéquate de l'UPS, ne pas bloquer ou recouvrir le dessus et les côtés inférieurs de l'appareil.
- Ne jamais bloquer ou insérer un quelconque objet dans les trous de ventilation ou dans les autres ouvertures de l'UPS. Faire en sorte qu'aucune poussière susceptible de restreindre le débit d'air ne s'accumule sur aucun des évents.
- Suivre tous les avertissements et les instructions apposés sur l'UPS. Ne pas tenter de réparer l'UPS, aucune pièce réparable par l'utilisateur ne se trouve à l'intérieur. Consulter du personnel qualifi é pour effectuer des réparations.
- Ne pas jeter la ou les batteries dans un feu. La batterie pourrait exploser.
- Ne pas ouvrir ou endommager la batterie. Une fuite d'électrolyte est nocive pour la peau et les yeux. Ca peut être toxique.

Si votre UPS présente une des anomalies suivantes, mettre l'UPS hors tension, couper l'alimentation c.a. et contacter votre distributeur local, un représentant SolaHD ou les services techniques de SolaHD.

- En cas de liquide versé sur l'UPS.
- Le disjoncteur déclenche fréquemment.
- L'UPS ne fonctionne pas suivant les indications du manuel de l'utilisateur.

1.2 Conditions d'utilisation

Votre UPS fournit une l'alimentation conditionnée à l'équipement raccordé. La charge maximale ne doit pas excéder celle indiquée sur l'étiquette. En cas de doute, contacter votre distributeur ou SolaHD.

2.0 Définition des avertissements

⚠ DANGER **Danger:** Indique une situation éminemment dangereuse qui, si elle n'est pas évitée, peut causer la mort ou des blessures graves. Ce signal n'est utilisé que pour les situations les plus dangereuses.

⚠ AVERTISSEMENT **Avertissement:** Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut causer la mort ou des blessures graves.

⚠ ATTENTION **Attention:** Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut causer des blessures légères ou modérées. Elle peut aussi être utilisée pour mettre en garde contre les pratiques non sécuritaires.

3.0 Introduction

Félicitations pour avoir choisi l'UPS de Sola, série SDU. Il assure une l'alimentation conditionnée aux l'équipements électroniques sensibles.

L'UPS de la série SDU est compact, « autonome », montable sur rail DIN. Il fournit à l'équipement raccordé une approximation par étape de puissance d'ondes sinusoïdales pour simuler la puissance générée par le fournisseur d'électricité.

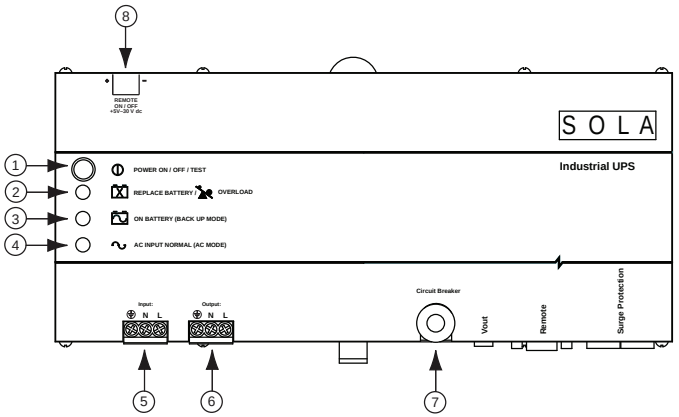
Le SDU est un UPS puissant commandé par microprocesseur. La plage de tension d'entrée se situe entre 80 % et 110 %, une protection idéale pour les charges critiques raccordées. La recharge de la batterie est automatique lorsque l'alimentation c.a. est appliquée; aucun besoin de mettre l'UPS sous tension. En cas de panne de courant, l'UPS peut être mis HORS TENSION automatiquement si aucune des charges raccordées ne fonctionne, afi n d'économiser l'énergie de la batterie. Le SDU inclut une fonction d'auto-vérifi cation du fonctionnement de l'UPS et de la batterie. Si la batterie n'est plus utile, l'appareil déclenche une alarme et la DÉL s'allume.

REMARQUE : Cet équipement a été mis à l'essai et déclaré conforme aux limites prévues pour un appareil numérique de classe A, conformément à la partie 15 du règlement de la FCC. Ces limites ont pour but d'assurer une protection raisonnable contre une interférence nuisible dans une installation résidentielle. Cet équipement utilise, génère et peut émettre de l'énergie en radiofréquence et, s'il n'est pas installé et utilisé conformé-ment aux directives, il peut causer un brouillage nuisible dans les communications radio. Cependant, il est impossible de garantir qu'aucune interférence ne se produira dans une installation particulière. Si cet équipement cause un brouillage de la réception de radio ou de télévision (que vous pouvez déterminer en éteignant puis en rallumant l'appareil), l'utilisateur est prié d'essayer d'éviter le brouillage au moyen de l'une ou de plusieurs des mesures suivantes :

- Réorienter ou déplacer l'antenne de réception.
- Éloigner davantage l'UPS du récepteur.
- Raccorder l'UPS à un circuit différent de celui du récepteur.
- Consulter le concessionnaire ou un technicien en radio / télévision qualifié pour obtenir de l'aide.

4.0 Description du système

4.1 Panneau avant

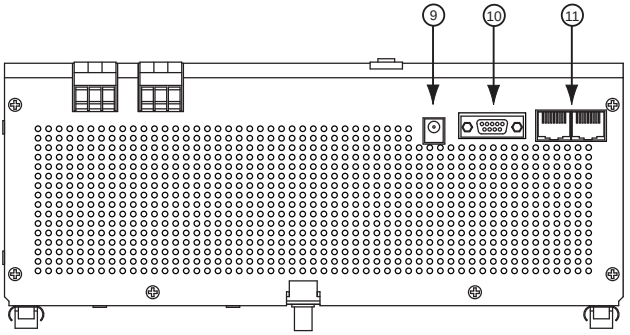


1. **Bouton « POWER ON/OFF/TEST » :** Appuyer sur le bouton pendant plus d'une (1) seconde pour mettre l'UPS sous tension. Appuyer sur le bouton pendant moins d'une seconde pour activer l'auto-vérification de l'UPS.Appuyerpendant plus de 5 secondes pour mettre hors tension.
2. **Voyant « BATTERYWARNING / OVERLOAD » (DÉL ROUGE) :** La DÉLclignote lorsque la batterie de l'UPS doit être rechargée et vérifiée. La DÉL s'allume lorsque l'appareil est en surcharge. Si l'appareil s'éteint suite à une surcharge, la DÉL et l'alarme sont activées pendant 2 minutes.
3. **Voyant « ON BATTERY » (DÉL JAUNE) :** La DÉL s'illumine lorsque l'UPS alimente les charges en courant de la batterie.
4. **Voyant «AC INPUT NORMAL » (DÉL VERTE) :** La DÉL s'allume lorsque la tension d'entrée de ligne est normale.
5. **Bornes à vis d'entrée classifiées IP-20** (voir le tableau ci-dessous)
6. **Bornes à vis de sortie classifiées IP-20** (voir le tableau ci-dessous)

Vis	M3.0, courant nominal = 30A c.a. 300 V
L'isolation résiste à la tension	c.a. 2000 V min
Diamètre du trou PCB	1,8 mm, longueur de dénudage de câble = 8 mm
Calibre du fil	10 ~ 24AWG
Couple de serrage des vis	5,5 lb - po

7. **Disjoncteur du circuit d'entrée :** Protection contre une surcharge de c.a. et des courts-circuits.
8. **Commande à distance marche/arrêt :** La commande à distance marche/arrêt offre les mêmes fonctions que L'interrupteur marche/arrêt sur le panneau.

4.2 Panneau inférieur



9. **Sortie V :** Borne de sortie fournissant une source d'alimentation de 12 V à la carte de relais en option.
10. **Distant :** Port de communication RS 232, connecteur DB9.
11. **Protection contre Téléphone/surtension :** Protection contre la surtension de ligne de données pour téléphone (UL497A).

4.3 Ce qui est inclus

L'UPS SDU est expédié avec les articles suivants :

• Manuel utilisateur du SDU

• CD delogiciel UPSMON

REMARQUE : Le logiciel de surveillance / diagnostic est inclus sur le CD UPSMON. Le programme est compatible avec Windows NT et Windows 2000, incluant le protocole XP.

• Câble série UPSMON DB-9

• Cordon RJ-11

• Etiquette indiquant Choc électrique de mise en garde

4.4 Accessoires

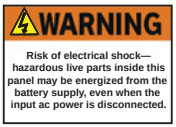
• **UPSMON-USB :** RS232 à câble adaptateur USB

• **RELAYCARD-SDU :** Boîte à relais avec contact sec

• **SDU-PMBRK :** Supports de montage pour fixer solidement l'UPS à un mur, à l'arrière d'un panneau ou dans une enceinte

5.0 Instructions d'installation

1. **Placement :** Installer l'UPS dans une zone protégée, avec une circulation d'air adéquate et exempte de poussière excessive. Ne pas utiliser l'UPS à l'extérieur.
2. **Branchement à la source d'alimentation électrique :** Brancher le connecteur d'entrée de c.a. au secteur pour mettre l'UPS sous tension.
3. **Recharge de la batterie :** L'UPS recharge sa batterie dès qu'il est branché au secteur. Pour obtenir de meilleurs résultats, recharger la batterie pendant 4 heures avant son utilisation initiale.
4. **Raccordement des charges :** Raccorder les charges au connecteur câblé de sortie.
5. **Appliquer l'étiquette indiquant la mise en garde contre le choc électrique :** Appliquer l'étiquette indiquant la mise en garde contre le choc électrique sur le panneau de façon à être clairement visible à l'utilisateur.



6.0 Instructions d'utilisation

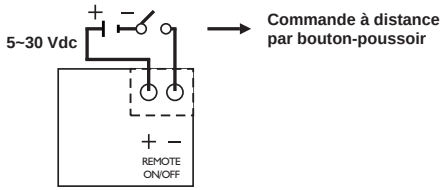
1. **Connecteur de sortie :** Le connecteur de sortie protège vos charges critiques contre les surtensions et les pannes de courant.
2. **Mise en marche avec le « Mode vert » activé :** Après avoir connecté l'UPS à l'alimentation secteur, appuyer sur le bouton de mise en marche « ON » jusqu'à ce que le premier bip se fasse entendre après moins de trois secondes, puis relâcher immédiatement le bouton. Le mode vert est activé, c.-à-d. que si une charge inférieure à 40 watts (ou aucune charge) est connectée et que l'UPS fonctionne en mode de secours; l'UPS passe en mode vert après avoir été trois minutes en mode de secours; le voyant vert clignote à toutes les trois ou cinq secondes, puis, après une brève période, passe en mode « économie d'énergie » en s'éteignant pour éviter une décharge excessive de la batterie. Pour réactiver l'appareil, le mettre hors tension puis sous tension ou remettre l'alimentation secteur vers l'appareil après que l'alimentation secteur soit revenue.

3. **Mise en marche avec le « Mode vert » désactivé :** Après avoir connecté l'UPS à l'alimentation secteur, appuyer sur le bouton de mise en marche « ON » jusqu'à ce que deux bi-bip courts se fassent entendre, puis relâcher immédiatement le bouton; le mode vert est désactivé. Toute charge, qu'elle soit inférieure à 40 watts ou plus, ne modifiera pas le fonctionnement normal de l'UPS en mode c.a. ou de batterie.

4. **Mise hors tension :** Pour mettre l'UPS hors tension, maintenir enfoncé le bouton POWER ON /OFF / TEST, jusqu'à ce que la DÉL « AC POWER NORMAL » ou « ON BATTERY » s'éteigne.

5. **Auto-vérification :** Utiliser l'auto-vérification pour contrôler le fonctionnement de l'UPS et l'état de la batterie. Si l'alimentation secteur est normale, appuyer sur le bouton POWER ON / OFF / TEST pendant moins d'une (1) seconde et l'UPS exécute une autovérification. Pendant l'auto-vérification, l'UPS fonctionne en mode de secours. Si l'UPS réussit l'auto-vérification, elle reprend son mode de fonctionnement « AC INPUT NORMAL ».

6. **Commande à distance marche/arrêt :** Pour assurer la fonction commande a distance marche/arrêt, connecter un interrupteur a bouton poussoir en série avec une source de tension continue 5~30Vdc au bornes « On/Off » comme indiqué sur la figure suivante :



La commande à distance marche/arrêt offre les mêmes fonctions que L'interrupteur marche/arrêt sur le panneau. Si le mode vert n'est pas nécessaire, un interrupteur à bascule marche/arrêt peut être utilisé au lieu de l'interrupteur à bouton poussoir.

7.0 Alarmes de la batterie de secours

1. **« ON BATTERY » (bip lent) :** Lorsqu'en mode ON BATTERY, la DÉL JAUNE s'allume et l'UPS émet une alarme audible. L'alarme arrête lorsque l'UPS retourne au mode de fonc-tionnementAC INPUT NORMAL.
2. **« LOW BATTERY » (bip rapide) :** En mode ONBATTERY,lorsque l'énergie de la batterie faiblit,l'UPS émet un bip rapide jusqu'à ce que l'UPS arrête de fonctionner en raison de l'épuisement de la batterie ou qu'il retourne au mode de fonctionnementAC INPUT NORMAL.
3. **« OVERLOAD » (alarme continue) :** Lorsque l'UPS est surchargé (les charges raccordées excèdent la capacité nominale maximale), l'UPS émet un son d'alarme continu et la DÉL indique une condition de surcharge. Réduire la charge pour éliminer la surcharge.

8.0 Configuration des broches de sortie du connecteur DB9

Connecteur UPS DB9 femelle, broche no	Signal RS-232	Signal de collecteur ouvert
1	---	---
2	TT	---
3	RD	Coupure à distance*
4	DTR (+12 V)	---
5	TERRE	TERRE
6	---	Défaillance c.a.
7	RTS (-12 V)	---
8	---	Batterie faible
9	TT	---

DTR = Terminal prêt
RTS = Demande d'émission
RD = Données transmises
TERRE = Retour commun du signal
TT = Données reçues
*Cuando se aplica la señal de desactivación remota durante 1 segundo, el UPS se desactivará (o apagará) al cabo de 3 minutos.

9.0 Temps de secours de batterie

	SDU 500, SDU 500-5	SDU 850, SDU 850-5
VA/Watts	500/300	850/510
Batterie	YUASA NP7-12	YUASA REW45-12
Niveau de charge	Temps de secours (Minutes)	Temps de secours (Minutes)
10%	130	80
20%	55	37
30%	36	20
40%	23	13
50%	18	10
60%	13	7
70%	10	5
80%	9	4
90%	6	3
100%	5	2.5

10.0 Entreposage

10.1 Conditions d'entreposage

Entreposer l'UPS en le recouvrant, en le plaçant en position verticale dans un endroit frais et sec, avec la batterie à pleine charge. Avant d'entreposer, charger l'UPS pendant au moins 4 heures. Enlever tous les accessoires de la fente aux accessoires et débrancher tous les câbles connectés au port de l'interface ordinateur, afi n d'éviter une décharge inutile de la batterie.

10.2 Entreposage de longue durée

Lors d'un entreposage prolongé dans un environnement où la température ambiante est de -15 à +30 °C (+5 à +86 °F), recharger la batterie tous les 6 mois.

Lors d'un entreposage prolongé dans un environnement où la température ambiante est de +30 à +45 °C (+86 à +113 °F), recharger la batterie tous les 3 mois.

11.0 Dépannage

Probléme	Cause Probable	Action Corrective
UPS hors tension, la DÉL ne s'allume pas	L'UPS est hors tension ou le bouton ON / OFF / TEST n'a pas été enfoncé suffi samment longtemps	Appuyer sur POWER / ON / OFF / TEST pendant plus de 2 secondes
	La tension de la batterie est inférieure à 10 V	Recharger l'UPS pendant au moins 4 heures. Si l'appareil ne se met toujours pas en marche, vérifi er le fusible d'entrée.
	Autre défaillance	Appeler les services techniques
	La charge est inférieure à 20 W en mode de secours	Condition normale
L'UPS est toujours en mode de secours	Desserrer la connexion de l'alimentation d'entrée de c.a.	Resserrer la connexion d'alimentation c.a.
	Déclenchement du disjoncteur	Réenclencher le disjoncteur
	La tension de ligne est trop élevée, trop faible ou en panne	Condition normale
	Autre défaillance	Appeler les services techniques
Temps de fonctionnement en secours trop court	La batterie n'est pas complètement chargée	Recharger l'UPS pendant au moins 4 heures
	Autre défaillance	Appeler le service technique
Bip continu et indication de DÉL de surcharge	Condition de surcharge	Éliminer la surcharge
La DÉL rouge clignote	Défaillance de la batterie	Recharger l'UPS pendant au moins 8 heures, effectuer l'auto-vérifi cation de l'UPS.

⚠ ATTENTION **Ne pas essayer d'ouvrir l'UPS ou de remplacer la batterie. Appeler les servic-es techniques pour obtenir des explications supplémentaires.**

12.0 Spécifications

Description	Modèle			
	SDU 500	SDU 850	SDU 500-5	SDU 850-5
ENTRÉE				
Capacité V A / Watts	500/300	850/510	500/300	850/510
Tension (Monophasé)	120 V + 10%, -20%		230 V +/-20%	
Fréquence	50 ou 60 Hz +/-10 % (auto-détection)			
SORTIE				
Tension (sur batterie)	Onde sinusoïdale simulée			
	120 V +/-5%		230 V +/-5%	
Fréquence (sur batterie)	50 ou 60 Hz, +/-0,5% auto-détection			
Temps de transfert	< 4 millisecondes			
PROTECTION				
Entrée de l'appareil	Disjoncteur protégeant contre les surcharges et les courts-circuits			
Protection contre les surcharges	Coupure automatique UPS si la surcharge dépasse 105 % de la charge nominale à 20 secondes, 120 % à 10 secondes, 130 % à 3 secondes			
Court-circuit	La sortie UPS est coupée immédiatement			
BATTERIE				
Type	Accumulateurs au plomb, sans entretien et hermétiques			
Temps typique de recharge (à 90 % de la pleine charge)	8 heures			
Durée en utilisation secours – minutes à pleine charge	4 min.	2 min.	4 min.	2 min.
ALARME				
Sur la batterie	Bip lent toutes les 4 secondes			
Batterie faible	Bip rapide chaque seconde			
Surcharge	Bip continu			
ENVIRONNEMENT				
Fonctionnement à température ambiante	0 à 95 % d'humidité, sans condensation50 °C jusqu'à 3000 m (10 000 pi)			
Bruit audible	< 40 dBA (1 mètre de la surface)			
POIDS / DIMENSIONS				
Poids net en kg (livres)	4,7 (10,7)	5,0 (11,4)	5,2 (11,5)	5,4 (11,9)
H x L x P, mm (po)	124 x 281 x 116 (4,88 x 11,1 x 4,55)			
SÉCURITÉ / AUTORISATIONS				
	Reconnu UL 1778 C-UL pour les applications industrielles, conformément à UL508, sans déclassement. Surtension de catégorie 3, degré de pollution : 3. FCC, partie 15, sous-partie B, classe A.		Marqué CE; LVD: EN62040-1-1;EMC: EN50091-2, EN61000-3-2, EN61000-3-3, IEC801-2, IEC801-3, IEC801-4, IEC1000-2-2	

13.0 Enregistrement du produit et information sur la garantie

13.1 Enregistrement du produit

Pour enregistrer votre produit afin de recevoir des mises à jour et de l'information sur le service et le soutien :

- Visiter la section du Soutien technique sur notre site Web au : http://www.solahd.com/support/registration.htm
- Cliquer sur le lien d'enregistrement du produit et remplir le formulaire. Vous pourrez ainsi enregistrer votre produit chez SolaHD.

13.2 Informations sur la garantie

Veuillez voir le « Termes et conditions générales de Sale » .

SOLAHD

Technical Support
U.S.: (800) 377-4384
International: (847) 268-6000
E-mail: www.solahd.com

Servicio Técnico
EE.UU. (800) 377-4384
Internacional: (847) 268-6000
Correo electrónico: www.solahd.com

Assistance technique
États-Unis: (800) 377-4384
International: (847) 268-6000
Courriel: www.solahd.com

EMERSON
Industrial Automation

Part Number: A272-080 Rev 8
May 30, 2008

Body Ported
Metal Seal/Rubber Seal
Series VQ

Thin compact design with large flow capacity

(Flip type)

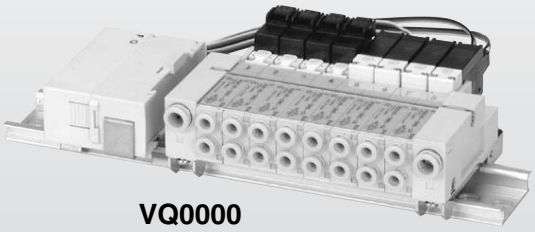
Model	Manifold pitch (mm)	Flow characteristics		Cylinder size
		Metal seal	Rubber seal	
		C [dm³/(s·bar)]	C [dm³/(s·bar)]	
VQ0000	10.5	0.50	0.59	Up to ø40
VQ1000	11	0.84	1.0	Up to ø50
VQ2000	16	2.3	2.7	Up to ø80

∗ Flow characteristics: 4/2 → 5/3 (A/B → R1/R2)

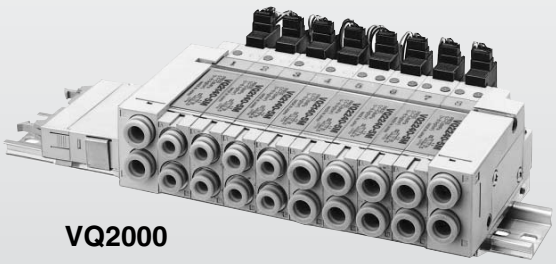
A variety of product groups meet all FA needs.

- **Flip type demonstrates space-saving effect.**
- **Cassette type enables flexible, speedy station increasing/decreasing.**

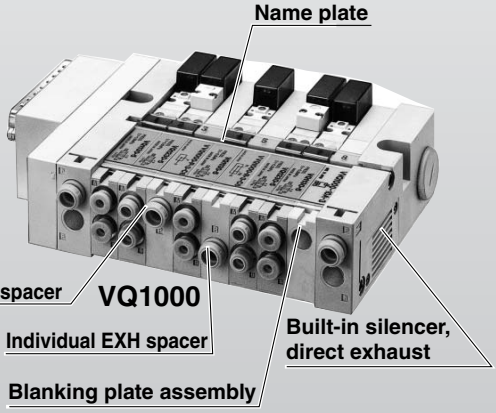
Flip type



VQ0000

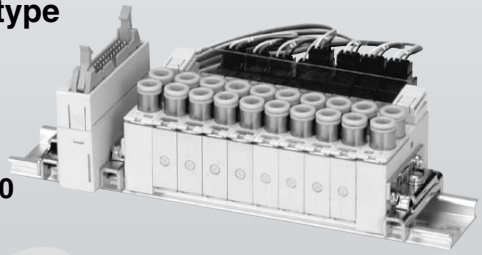


VQ2000



A variety of options

Cassette type



VQ1000

Unprecedented high speed response and long service life

(Metal seal, Single, With indicator light/surge voltage suppressor)

VQ0000	10 ms	200 million cycles
VQ1000	10 ms	
VQ2000	20 ms	

Dispersion accuracy ±2 ms

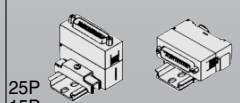
Innovative mounting methods

A valve can be changed without entirely disassembling the manifold.

Built-in One-touch fittings for easier piping.

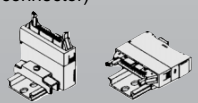
A variety of common wiring methods are standardized.

F kit (D-sub connector)



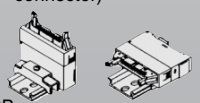
25P
15P

P kit (Flat ribbon cable connector)



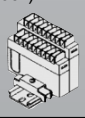
26P
20P
16P
10P

J kit (Flat ribbon cable connector)

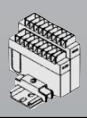


20P

T kit (Terminal block)



L kit (Lead wire)



S kit (Serial transmission unit)

Valve Specifications

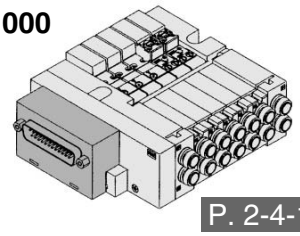
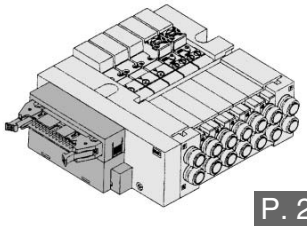
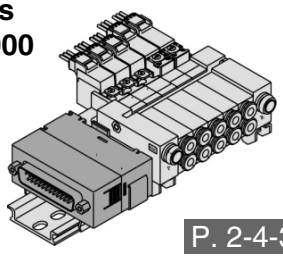
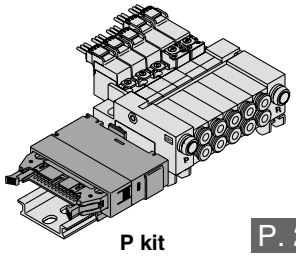
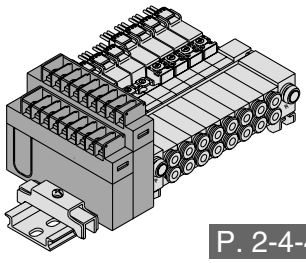
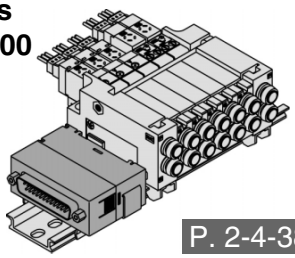
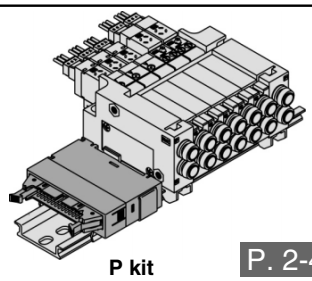
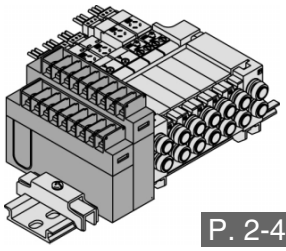
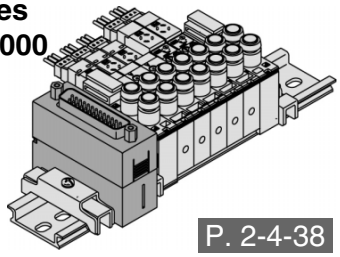
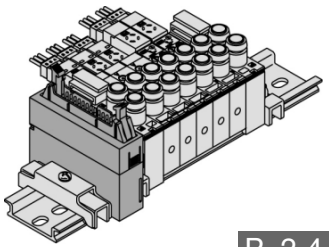
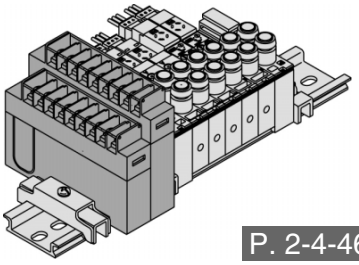
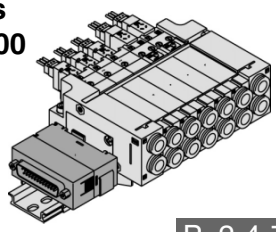
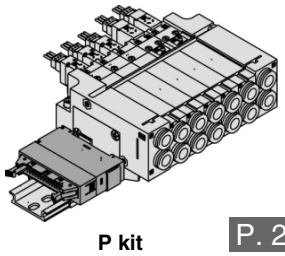
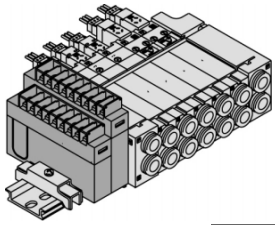
Body Ported

				Sonic conductance: C [dm³/(s·bar)] {4/2 → 5/3 (A/B → R1/R2)}		Type of actuation					Voltage			Electrical entry				Manual override		
				Double Single	3 position Closed center	Single	Double	Closed center	Exhaust center	Pressure center	12 V 24 V DC	100 V 110 V AC (50/60 Hz)	200 V 220 V AC (50/60 Hz)	Plug-in	Grommet	L plug connector	M plug connector	Push type, Tool required	Locking type	Locking type (Manual)
Plug-in	*Series VQ1000* P. 2-4-8	Rubber seal	**VQ1□30**	0.84	0.73	●	●	●	●	●	●	●	●	●				●	●	●
		Metal seal	**VQ1□31**	1.0	0.84		Latching													
				P. 2-4-10																
Plug lead	*Series VQ0000* P. 2-4-30	Rubber seal	**VQ0□40**	0.50	0.36	●	●	●	●		●	●	●		Single/ 3 position only	●	●	●	●	
		Metal seal	**VQ0□41**	0.59	0.42		Latching													
				P. 2-4-36																
	Series VQ1000 P. 2-4-30	Rubber seal	**VQ1□40**	0.84	0.73	●	●	●	●	●	●	●	●		Single/ 3 position only	●	●	●	●	●
		Metal seal	**VQ1□41**	1.0	0.84		Latching													
				P. 2-4-36																
	Series VQ2000 P. 2-4-30	Rubber seal	**VQ2□40**	2.3	—	●	●				●	●	●		Single only	●	●	●	●	●
		Metal seal	**VQ2□41**	2.7	—		Latching													
				P. 2-4-36																
Cassette	*Series VQ1000* P. 2-4-72	Rubber seal	**VQ1□70**	0.60	0.58	●	●	●	●	●	●	●	●		Single/ 3 position only	●	●	●	●	●
		Metal seal	**VQ1□71**	0.80	0.70		Latching													
				P. 2-4-74																

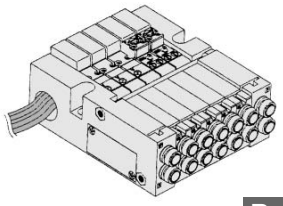
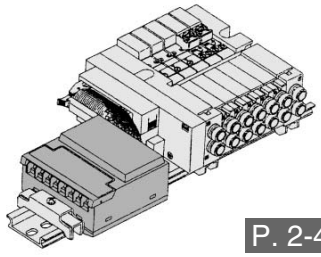
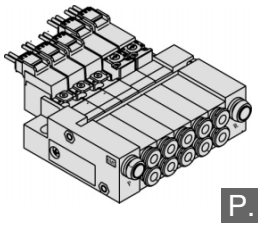
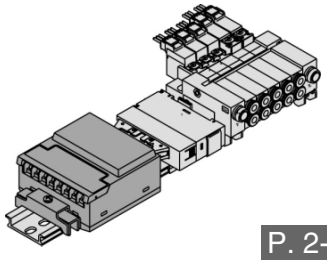
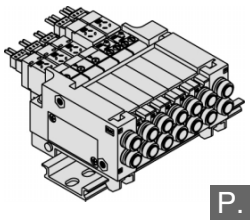
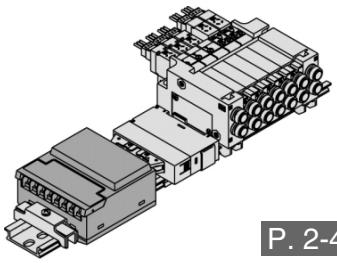
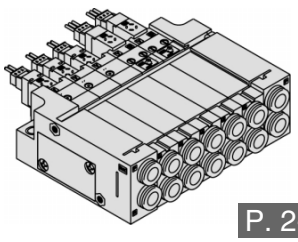
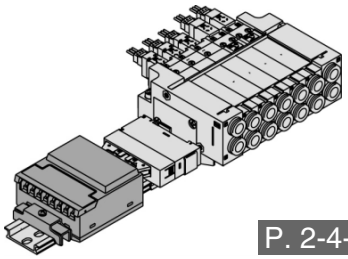
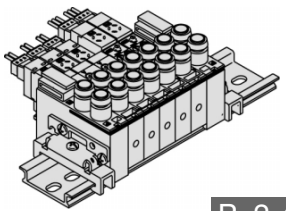
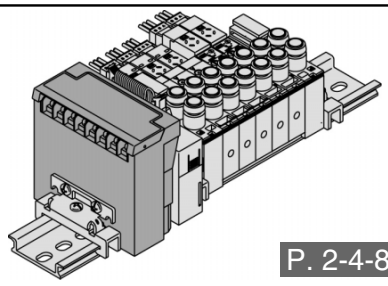
P. 2-4-92	P. 2-4-68	P. 2-4-68	P. 2-4-68	P. 2-4-28		**Option**
●	●	●	●	●	D-sub connector 15P	
●	●	●	●	●	Flat ribbon cable 10P, 16P, 20P	
●	Except S kit ●	Except S kit ●	Except S kit ●	Except S kit ●	Negative common specifications	
●	●	●	●	●	One-touch fitting Inch size	
●	Except L kit ●	Except L kit ●	Except L kit ●	Except L kit ●	For special wiring spec.	
P. 2-4-87	P. 2-4-63	P. 2-4-60	P. 2-4-59	P. 2-4-23		**Manifold Option**
	●	●	●	●	Blanking plate	
●	●	●	●	●	Individual SUP/EXH	
●	●	●	●	●	SUP/EXH passage spacer	
●	●	●	●	●	Name plate	
Standard ●	●	●	●	●	DIN rail mounting style	
	●	●	●	●	Built-in silencer	
●	●	●	●	●	Silencer for EXH port	
●					Elbow fitting for cylinder port	
●	●	●		●	Plug for cylinder port	
●	●	●	●	●	Double check block	

Series VQ/Body Ported: Variations

Manifold Variations

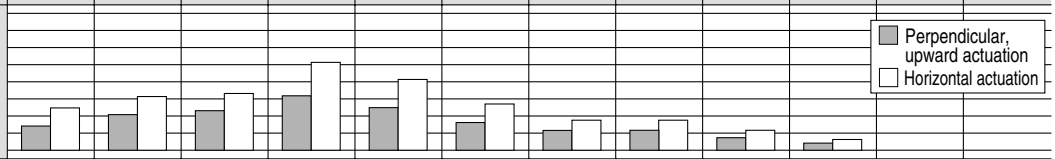
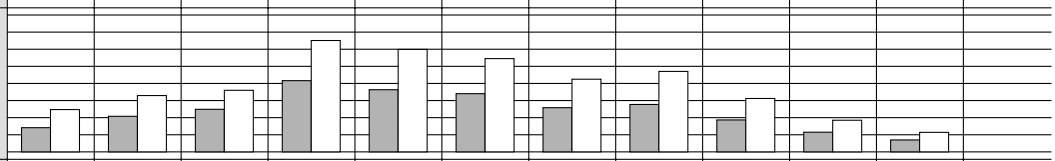
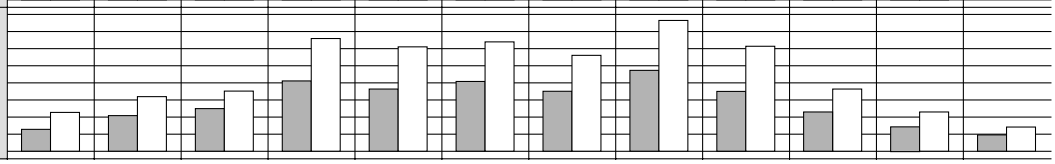
	F kit D-sub connector Conforming to MIL D-sub connector	P kit Flat ribbon cable connector (26, 20, 16, 10 pins) Conforming to MIL flat ribbon cable connector	J kit Flat ribbon cable connector (20 pins) Conforming to MIL flat. ribbon cable connector PC Wiring System compatible	T kit Terminal block Two kinds of terminal are available in accordance with the number of stations.
Plug-in	Series VQ1000  P. 2-4-12	 P/J kit P. 2-4-14		—
Plug Lead	Series VQ0000  P. 2-4-38	 P kit P. 2-4-42		 P. 2-4-46
	Series VQ1000  P. 2-4-38	 P kit P. 2-4-42		 P. 2-4-46
	Series VQ2000  P. 2-4-38	 P kit P. 2-4-42		 P. 2-4-46
Cassette	Series VQ1000  P. 2-4-76	 P kit P. 2-4-78		 P. 2-4-80

Manifold Variations

L C kit **Lead wire** Direct electrical entry type		S kit **Serial transmission unit** Enables single-wire solenoid valve-PLC operation		Port size SUP EXH port P, R	Port size Cylinder port A, B
L kit	 P. 2-4-18	 P. 2-4-20		C6 (ø6) N7 (ø1/4") <Option> Built-in silencer	C3 (ø3.2) C4 (ø4) C6 (ø6) M5 (M5 thread) N1 (ø1/8") N3 (ø5/32") N7 (ø1/4")
C kit	 P. 2-4-50	 P. 2-4-54		C6 (ø6) N7 (ø1/4") <Option> Built-in silencer	C3 (ø3.2) C4 (ø4) M5 (M5 thread) N1 (ø1/8") N3 (ø5/32")
C kit	 P. 2-4-50	 P. 2-4-54		C6 (ø6) N7 (ø1/4") <Option> Built-in silencer	C3 (ø3.2) C4 (ø4) C6 (ø6) M5 (M5 thread) N1 (ø1/8") N3 (ø5/32") N7 (ø1/4")
C kit	 P. 2-4-50	 P. 2-4-54		C8 (ø8) N9 (ø5/16") <Option> Built-in silencer	C6 (ø6) C8 (ø8) N7 (ø1/4") N9 (ø5/16")
C kit	 P. 2-4-82	 P. 2-4-84		C6 (ø6) N7 (ø1/4") <Option> Built-in silencer	C3 (ø3.2) C4 (ø4) C6 (ø6) M5 (M5 thread) N1 (ø1/8") N3 (ø5/32") N7 (ø1/4")

Cylinder Speed Chart

Use as a guide for selection.
Please confirm the actual conditions with SMC Sizing Program.

Series	Average speed (mm/s)	Bore size											
		Series CJ2 Pressure 0.5 MPa Load factor 50% Stroke 60 mm			Series CM2 Pressure 0.5 MPa Load factor 50% Stroke 300 mm				Series MB, CA1 Pressure 0.5 MPa Load factor 50% Stroke 500 mm				
		ø6	ø10	ø16	ø20	ø25	ø32	ø40	ø40	ø50	ø63	ø80	ø100
VQ0149-C4	800 700 600 500 400 300 200 100 0												
VQ014-$^{0}_{1}$C4 **VQ11$^{3}_{4}{}^{0}_{1}$-C6** **VQ214-$^{0}_{1}$C8**	800 700 600 500 400 300 200 100 0												
VQ2149-C8	800 700 600 500 400 300 200 100 0												

∗ It is when the cylinder is extending that is meter-out controlled by speed controller which is directly connected with cylinder, and its needle valve with being fully open.
∗ The average velocity of the cylinder is what the stroke is divided by the total stroke time.
∗ Load factor: ((Load weight x 9.8)/Theoretical force) x 100%

Conditions

Body ported		Series CJ2	Series CM2	Series MB, CA1
VQ0149-C4	Tube bore x Length	T0425 x 1 m		
	Speed controller	AS2001F-04		
	Silencer	AN103-X233		
VQ11$^{30}_{41}$-C6	Tube bore x Length	T0604 x 1 m		
	Speed controller	AS3001F-06		
	Silencer	AN103-X233		
VQ2149-C8	Tube bore x Length	T0806 x 1 m		
	Speed controller	AS3001F-08		
	Silencer	AN200-KM8		

Series VQ1000
Body Ported
Plug-in Unit: Flip Type

How to Order Manifold

VV5Q1 3 – 08 F S1 – N

Series VQ1000

Manifold

3	Plug-in unit/Flip

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit. (Refer to the table below.)

Kit type

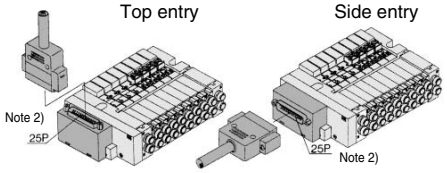
Option

Nil	None
D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S (4)	Built-in silencer, direct exhaust

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS
Note 2) All S kits are DIN rail mounting styles, so include suffix "D".
Note 3) Specify the wring specifications in the manifold specification sheet. (Except L kit)
Note 4) F, P and S kits are provided with an exhaust on one side, while L kits are with an exhaust on both sides.

Kit/Electrical entry/Cable length

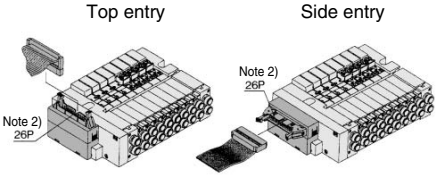
F kit (D-sub connector)



P. 2-4-12

Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

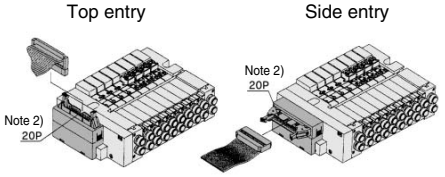
P kit (Flat ribbon cable connector)



P. 2-4-14

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

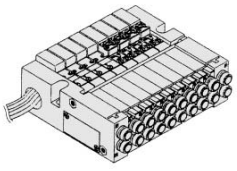
J kit (Flat ribbon cable connector)



P. 2-4-16

Connector entry direction					
Top entry		Side entry			
Kit J	U0	Kit J	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

L kit (Lead wire cable)

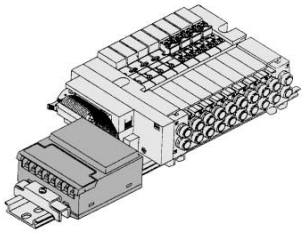


P. 2-4-18

Kit L	Lead wire entry direction		Cable length		Maximum number of stations
	Symbol	Direction	Symbol	Cable length	
	D	Entry on D side	0	With cable (0.6 m)	Max. 16 stations
			1	With cable (1.5 m)	
	U	Entry on U side	2	With cable (3.0 m)	

S kit (Serial transmission unit)

The valve is equipped with an indicator light/surge voltage suppressor, and the voltage is 24 VDC.



The dust-protected type SI unit is applicable, too. For details, please contact SMC.

P. 2-4-20

Kit S (3)			
	0	Without SI unit	Max. 16 (2) stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	H	NKE Corp.: Uni-wire H System	

Note 1) Besides the above, F and P kits with different number of pins are available. For details, refer to page 2-4-28.
Note 2) For details, refer to page 2-4-29.
Note 3) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation; Fuji Electric Co., Ltd.; OMRON Corporation.

How to Order Valves

VQ1 1 3 0 Y – 5 □ □ – C6

Series VQ1000
Type of actuation

1	2 position single
2	2 position double (Latching) Metal seal / Rubber seal
Note) 3	3 position closed center
Note) 4	3 position exhaust center
Note) 5	3 position pressure center

Note) 3 position occupies two stations.

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-29.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○(1)
H (2)	High pressure type	(1.5 W) ○	–
Y (2)	Low wattage type	(0.5 W) ○	–

Note 1) For power consumption of AC type, refer to page 2-4-10.
Note 2) Except double (latching).

Cylinder ports

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-29.

Manual override

Nil: Non-locking push type (Tool required)	B: Locking type (Tool required)	C: Locking type (Manual)

Manual override on body side / Manual override for pilot valve

Note) A manual override for pilot valve is provided to the standard model for double type. (Refer to page 2-4-26.)

Light/Surge voltage suppressor

Nil	Yes
E	None

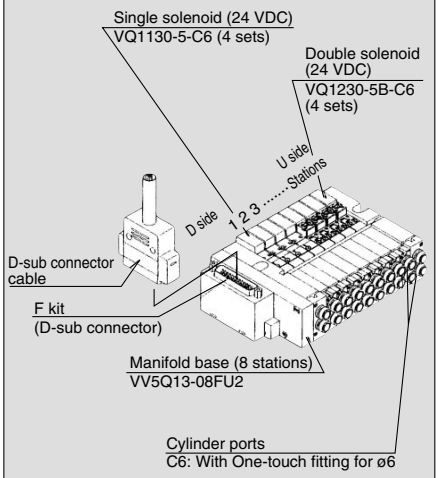
Coil voltage

1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) 200/220 VAC models are applicable to the F and L kits.

How to Order Manifold Assembly

Example



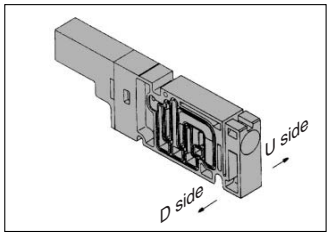
VV5Q13-08FU2 ··· 1 set (F kit 8 station manifold base no.)
∗VQ1130-5-C6 ·····4 sets (Single solenoid part no.)
∗VQ1230-5B-C6 ···4 sets (Double latching solenoid part no.)
→ The asterisk denotes the symbol for assembly.
Prefix it to the part nos. of the solenoid valve, etc.

Specify the part numbers for valves and options together beneath the manifold base part number. Besides, when the arrangement will be complicated, specify them by means of the manifold specification sheet.

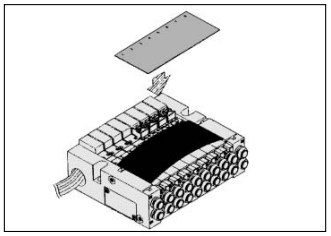
Manifold Option

P. 2-4-23

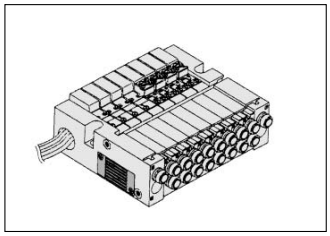
Blanking plate assembly
VVQ1000-10A-3



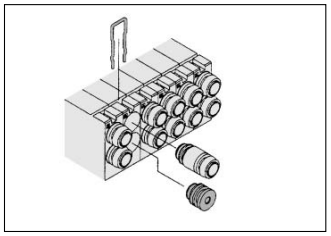
Name plate [-N3]
VQ1000-N3-Station (1 to Max. stations)



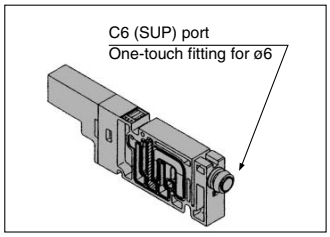
Built-in silencer, direct exhaust [-S]



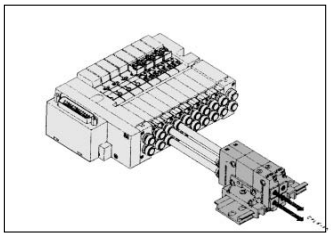
Port plug
VVQ0000-58A



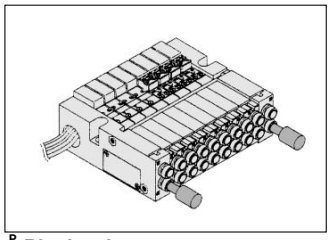
Individual SUP spacer
VVQ1000-P-3-C6



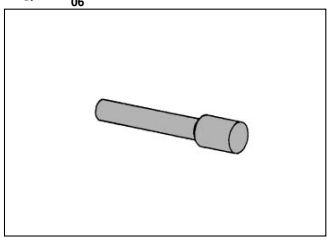
Double Check block
VQ1000-FPG-□□



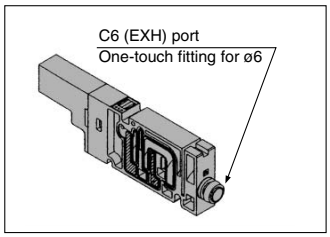
Silencer
AN103-X233



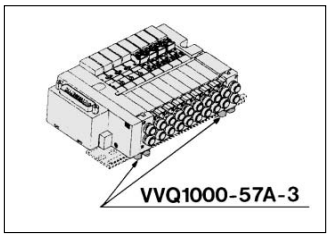
Blanking plug
KQ2P- $^{23}_{04}_{06}$



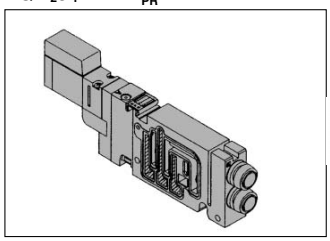
Individual EXH spacer
VVQ1000-R-3-C6



DIN rail mounting bracket [-D]
VVQ1000-57A-3



P, R, PR Block valve
VQ□ $^{1}_{2}$ 3 $^{0}_{1}$ -□ -□□ P, R, PR



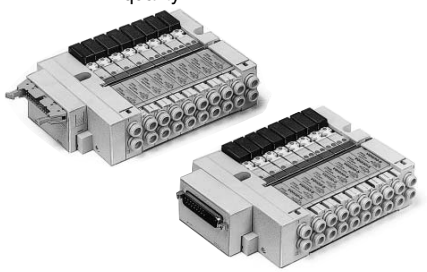
- Refer to page 2-4-27 for cylinder port fitting.
- For replacement parts, refer to page 2-4-103.

Series VQ1000
Body Ported
Plug-in Unit: Flip Type

Model

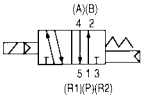
Series	Number of solenoids		Model		Flow characteristics						Response time (2)(ms)			Weight (g)
					1 → 4/2 (P → A/B)			4/2 → 5/3 (A/B → R1/R2)			Standard: 1 W H: 1.5 W	Low wattage: 0.5 W	AC	
					C [dm³/(s·bar)]	b	Cv	C [dm³/(s·bar)]	b	Cv				
VQ1000	2 position	Single	Metal seal	VQ1130	0.77	0.14	0.18	0.84	0.14	0.19	12 or less	15 or less	29 or less	57
			Rubber seal	VQ1131	0.91	0.19	0.21	1.0	0.21	0.25	15 or less	20 or less	34 or less	
		Double (Latching)	Metal seal	VQ1230	0.77	0.14	0.18	0.84	0.14	0.19	12 or less	15 or less	29 or less	
			Rubber seal	VQ1231	0.91	0.19	0.21	1.0	0.21	0.25	15 or less	20 or less	34 or less	
	3 position	Closed center	Metal seal	VQ1330	0.67	0.13	0.16	0.73	0.13	0.17	20 or less	26 or less	40 or less	105
			Rubber seal	VQ1331	0.78	0.22	0.18	0.84	0.21	0.20	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ1430	0.74	0.14	0.17	0.84	0.16	0.20	20 or less	26 or less	40 or less	
			Rubber seal	VQ1431	0.78	0.28	0.19	1.0	0.21	0.24	25 or less	33 or less	47 or less	
		Pressure center	Metal seal	VQ1530	0.74	0.14	0.17	0.82	0.16	0.20	20 or less	26 or less	40 or less	
			Rubber seal	VQ1531	0.78	0.28	0.19	0.84	0.21	0.22	25 or less	33 or less	47 or less	

Note 1) Cylinder port size C6
Note 2) As per JIS B 8375-1981 (Supply pressure: 0.5 MPa; with indicator light/surge voltage suppressor; clean air). Subject to the pressure and air quality.

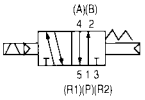


JIS Symbol

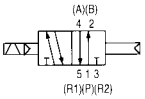
2 position single



2 position double (Latching)

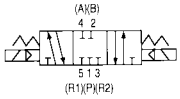


Metal seal

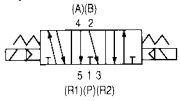


Rubber seal

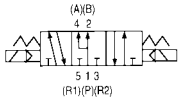
3 position closed center



3 position exhaust center



3 position pressure center



Standard Specifications

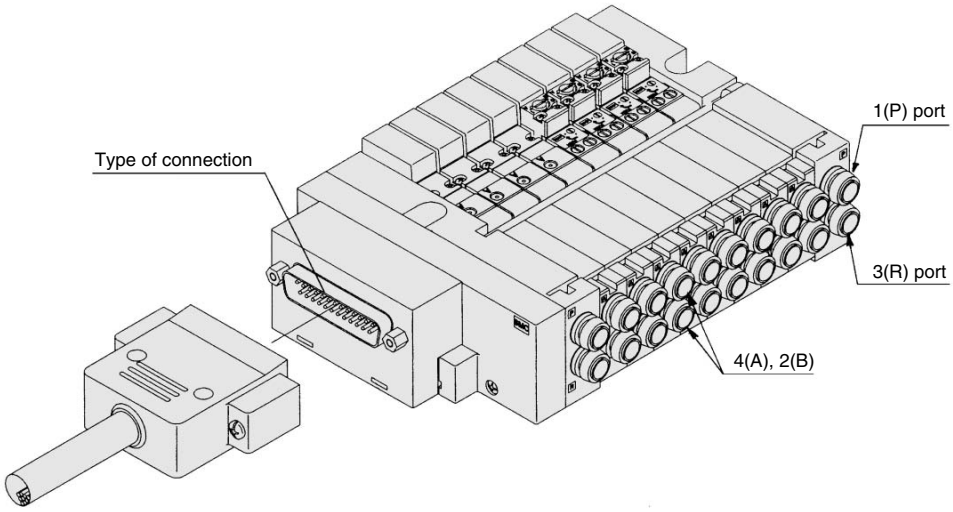
			Metal seal	Rubber seal
Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure (3)		0.7 MPa (High pressure type: 0.8 MPa) (3)	
	Minimum operating pressure	Single	0.1 MPa	0.15 MPa
		Double (Latching)	0.1 MPa	0.15 MPa
		3 position	0.1 MPa	0.2 MPa
	Ambient and fluid temperature		–10 to 50°C (1)	
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required, Manual) Option	
	Impact/Vibration resistance (2)		150/30 m/s²	
	Enclosure		Dust-protected	
Solenoid	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA)(3), 0.5 W DC (21 mA)(4)	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA)(3), 0.5 W DC (42 mA)(4)	
		100 VAC	Inrush 0.75 VA (7.5 mA), Holding 0.75 VA (7.5 mA)	
		110 VAC	Inrush 0.83 VA (7.5 mA), Holding 0.83 VA (7.5 mA)	
		200 VAC	Inrush 1.0 VA (5 mA), Holding 1.0 VA (5 mA)	
		220 VAC	Inrush 1.1 VA (5 mA), Holding 1.1 VA (5 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance····· No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance ···· No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Values in the case of high pressure type (1.5 W).
Note 4) Values in the case of low wattage (0.5 W) specifications.

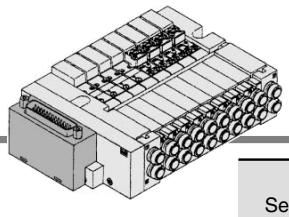
Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Applicable stations [2]	Applicable solenoid valve	5 station weight (g)
			Port location	One-touch fitting/Port size [1]				
				1(P), 3(R)	4(A), 2(B)			
VQ1000	**VV5Q13-□□□**	■ F kit—D-sub connector ■ P kit—Flat ribbon cable connector ■ J kit—Flat ribbon cable connector (20P) ■ L kit—Lead wire cable ■ S kit—Serial transmission unit	Side	C6 (ø6) (Option Built-in silencer, Direct exhaust)	C3 (ø3.2) C4 (ø4) C6 (ø6) M5 (M5 thread)	1 to 16 stations	VQ1□30 VQ1□31	424

Note 1) Inch-size One-touch fittings are also available. For details, refer to page 2-4-29.
Note 2) For details, refer to page 2-4-29.



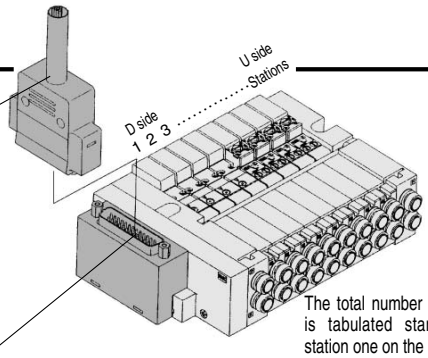
F VQ1000 Kit (D-sub connector)



Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations

- The D-sub connector reduces installation labor for electrical connections.
- Using the D-sub connector (25P), (15P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

D-sub Connector (25 pins)

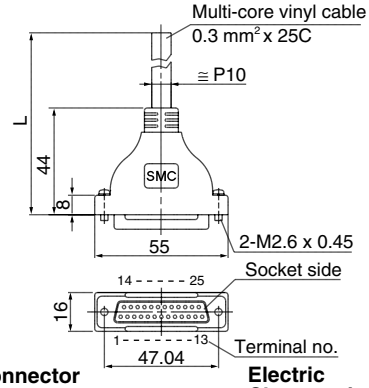


The total number of stations is tabulated starting from station one on the D side.

Cable assembly

AXT100-DS25- 015 / 030 / 050

The D-sub connector cable assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.



D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25 core x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

∗ For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Connector manufacturers' example
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Hirose Electric Co., Ltd.

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Voltage limit V, 1 min, AC	1000
Insulation resistance MΩkm, 20°C	5 or more

Note) The min. bending radius of D-sub cable assembly is 20 mm.

Wire Color by Terminal No. of D-sub Connector Cable Assembly

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

Note) Types with 15 pin are also available. For details, refer to page 2-4-29.

Electrical wiring specifications

D-sub connector assembly AXT100-DS25- 015 / 030 / 050
Wire Color

D-sub connector		Terminal no.	Polarity		Lead wire color	Dot marking
1 station	SOL.A	1	(–)	(+)	Black	None
	SOL.B	14	(–)	(+)	Yellow	Black
2 stations	SOL.A	2	(–)	(+)	Brown	None
	SOL.B	15	(–)	(+)	Pink	Black
3 stations	SOL.A	3	(–)	(+)	Red	None
	SOL.B	16	(–)	(+)	Blue	White
4 stations	SOL.A	4	(–)	(+)	Orange	None
	SOL.B	17	(–)	(+)	Purple	None
5 stations	SOL.A	5	(–)	(+)	Yellow	None
	SOL.B	18	(–)	(+)	Gray	None
6 stations	SOL.A	6	(–)	(+)	Pink	None
	SOL.B	19	(–)	(+)	Orange	Black
7 stations	SOL.A	7	(–)	(+)	Blue	None
	SOL.B	20	(–)	(+)	Red	White
8 stations	SOL.A	8	(–)	(+)	Purple	White
	SOL.B	21	(–)	(+)	Brown	White
9 stations	SOL.A	9	(–)	(+)	Gray	Black
	SOL.B	22	(–)	(+)	Pink	Red
10 stations	SOL.A	10	(–)	(+)	White	Black
	SOL.B	23	(–)	(+)	Gray	Red
11 stations	SOL.A	11	(–)	(+)	White	Red
	SOL.B	24	(–)	(+)	Black	White
12 stations	SOL.A	12	(–)	(+)	Yellow	Red
	SOL.B	25	(–)	(+)	White	None
	COM.	13	(+)	(–)	Orange	Red

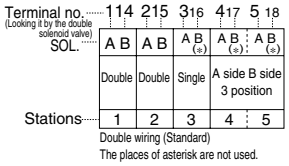
Connector terminal no.

Positive common specifications / Negative common specifications Note)

As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types.

Mixed single and double wiring is available as an option.

For details, refer to page 2-4-29.



3 position uses two stations. The A side solenoid of a 3 position valve is connected to SOL.A at the station with the smaller number in the above figure and the B side solenoid to SOL.A at the next station.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-29.)

How to Order Manifold

VV5Q1 3 – 08 F S 1 – N

Series VQ1000

Manifold

3	Plug-in unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-29.

Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Connector entry direction

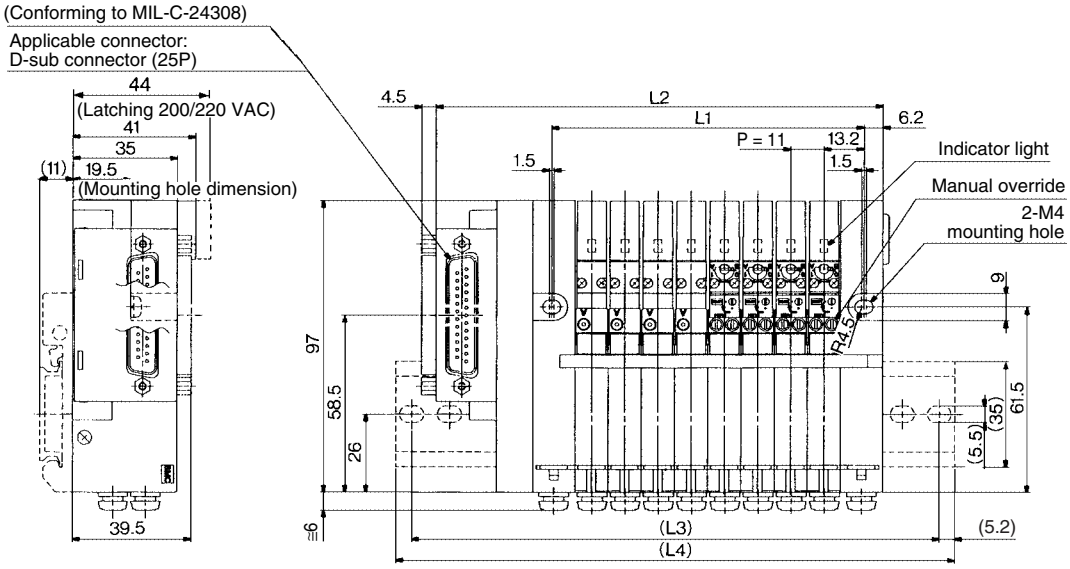
U	Top entry
S	Side entry

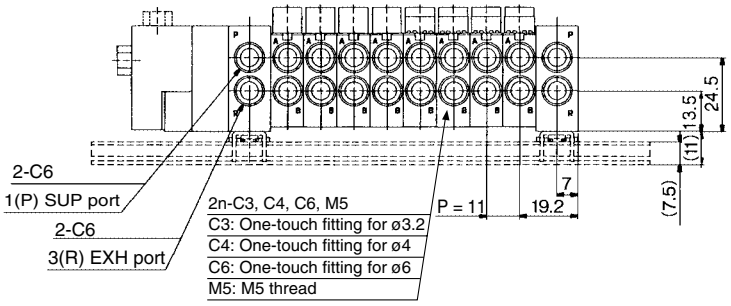
Option

Nil	None
D	DIN rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -DNS

Note 2) Specify the wiring specifications on the manifold specification sheet.





The broken lines indicate the DIN rail mounting style [-D] and the top entry connection [-FU].

Note) 3 position types need two stations.
Cylinder port is located at U side of body.

Dimensions

Formula L1 = 11n + 15.5, L2 = 11n + 60 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	71	82	93	104	115	126	137	148	159	170	181	192	203	214	225	236
(L3)	100	100	112.5	125	137.5	150	162.5	175	187.5	200	212.5	212.5	225	237.5	250	262.5
(L4)	110.5	110.5	123	135.5	148	160.5	173	185.5	198	210.5	223	223	235.5	248	260.5	273

How to Order Valves

VQ1 1 3 0 Y 5 — C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) 3 position types need two stations.

Seal

0	Metal seal
1	Rubber seal

Note) For negative common specifications, refer to "Option" on page 2-4-29.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	○ (1.0 W)	○(1)
H (2)	High pressure type	○ (1.5 W)	—
Y (2)	Low wattage type	○ (0.5 W)	—

Note 1) For power consumption of AC type, refer to page 2-4-10.

Note 2) Except double (latching).

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-29.

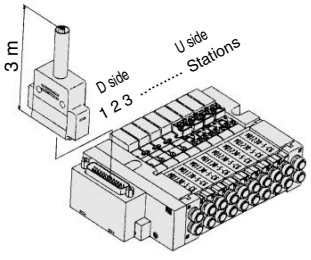
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

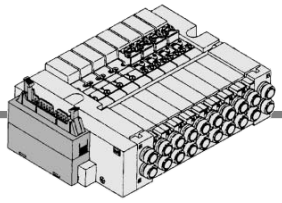
<Example>
D-sub connector kit with 3 m cable
VV5Q13-08FU2···· 1 set — Manifold base no.
∗VQ1130-5-C6····· 4 sets — Valve part no. (Stations 1 to 4)
∗VQ1230-5B-C6····4 sets — Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



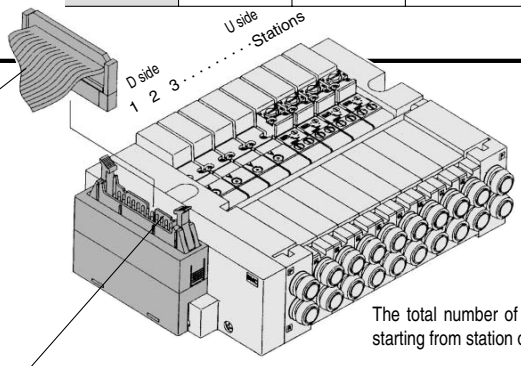
P VQ1000
Kit (Flat ribbon cable connector)



- MIL flat ribbon cable connector reduces installation labor for electrical connection.
- Using the connector for flat ribbon cable (26P), (10P, 16P, 20P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations

Flat Ribbon Cable (26 pins)

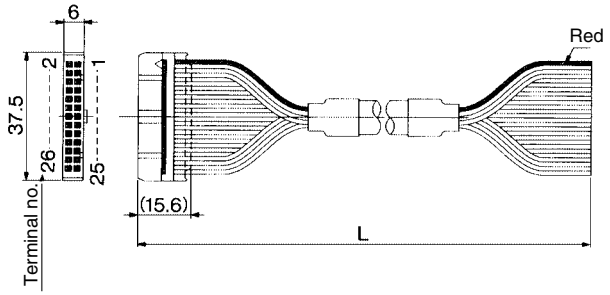


Cable assembly

The total number of stations is tabulated starting from station one on the D side.

AXT100-FC26-$\frac{1}{3}$ to

Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.



Flat Ribbon Cable Connector Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC26-1	Cable 26 core x 28AWG
3 m	AXT100-FC26-2	
5 m	AXT100-FC26-3	

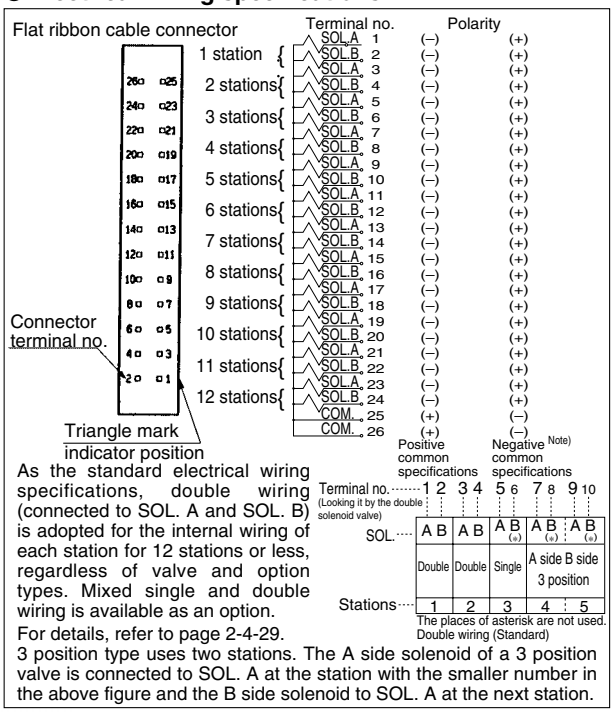
∗ For other commercial connectors, use a 26 pins type with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

- Sumitomo 3M Limited
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Oki Electric Cable Co., Ltd.

Note) Types with 10, 16, or 20 pin are also available. For details, refer to page 2-4-28.

Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option.
For details, refer to page 2-4-29.
3 position type uses two stations. The A side solenoid of a 3 position valve is connected to SOL. A at the station with the smaller number in the above figure and the B side solenoid to SOL. A at the next station.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-29.)

How to Order Manifold

VV5Q1 3 – 08 P S 1 – N

Series VQ1000

Manifold

3	Plug-in unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-29.

Connector entry direction

U	Top entry
S	Side entry

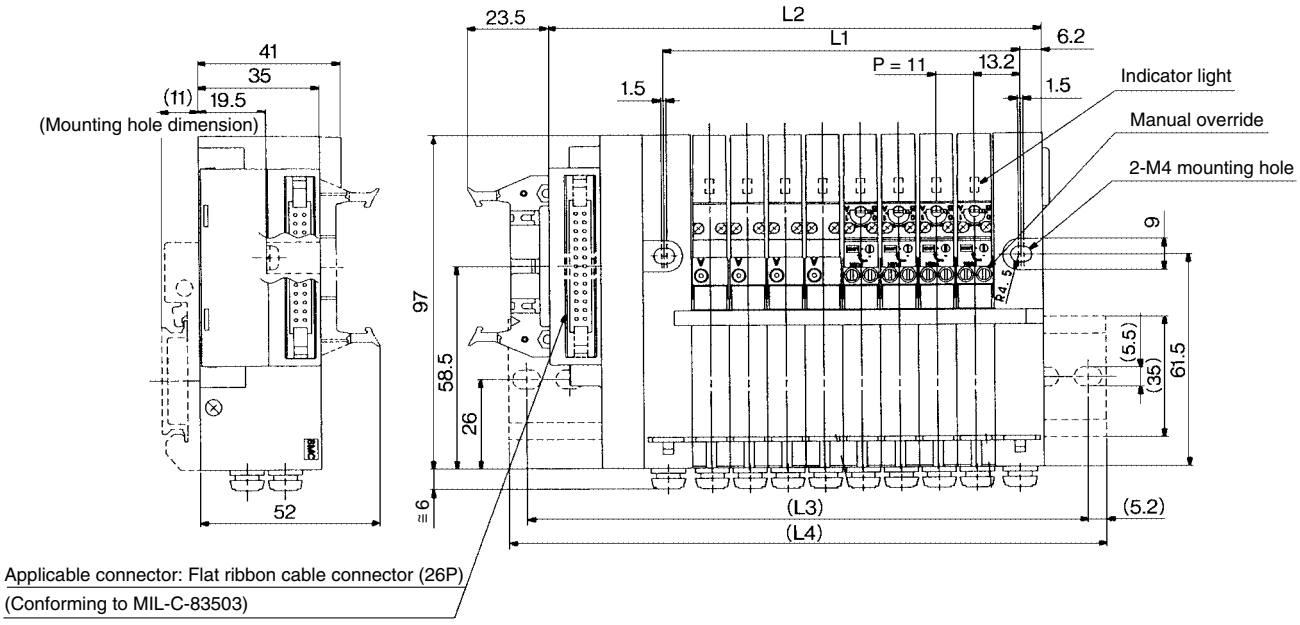
Cable (Length)

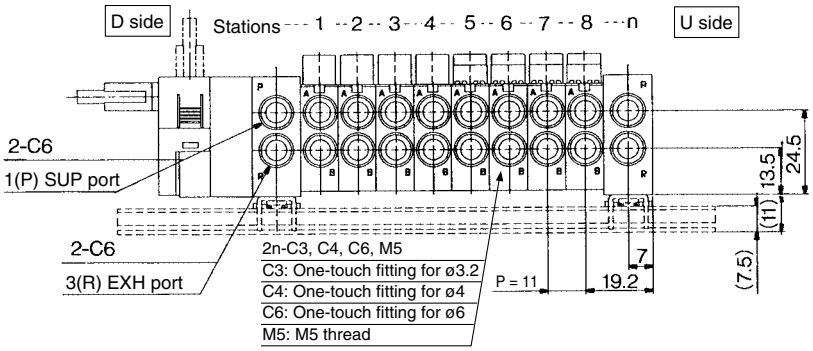
0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Option

Nil	None
D	DIN rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS
Note 2) Specify the wiring specifications on the manifold specification sheet.





The broken lines indicate the DIN rail mounting style [-D] and the top entry connection [-PU].
Note) 3 position types need two stations.
Cylinder port is located at U side of body.

Dimensions

Formula L1 = 11n + 15.5, L2 = 11n + 55 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231
(L3)	87.5	100	112.5	125	137.5	150	162.5	162.5	175	187.5	200	212.5	225	237.5	250	262.5
(L4)	98	110.5	123	135.5	148	160.5	173	173	185.5	198	210.5	223	235.5	248	260.5	273

How to Order Valves

VQ1 1 3 0 Y – 5 – C6

Series VQ1000
Type of actuation

1	2 position single
2	2 position double (Latching)
3Note)	3 position closed center
4Note)	3 position exhaust center
5Note)	3 position pressure center

Note) 3 position types need two stations.

Seal

0	Metal seal
1	Rubber seal

Note) For negative common specifications, refer to "Option" on page 2-4-29.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-10.
Note 2) Except double (latching).

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-29.

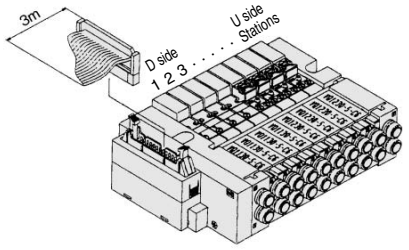
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

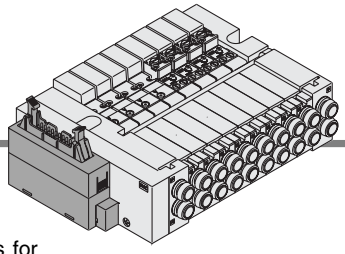
<Example>
Flat ribbon cable kit with 3 m cable
VV5Q13-08PU2···· 1 set — Manifold base no.
∗VQ1130-5-C6····· 4 sets — Valve part no. (Stations 1 to 4)
∗VQ1230-5B-C6··· 4 sets — Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



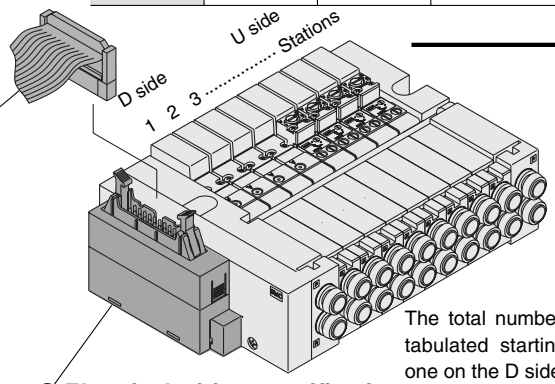
J VQ1000
Kit (Flat ribbon cable connector)



- MIL flat ribbon cable connector reduces installation labor savings for electrical connection.
- Using the connector for flat ribbon cable (20P) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations

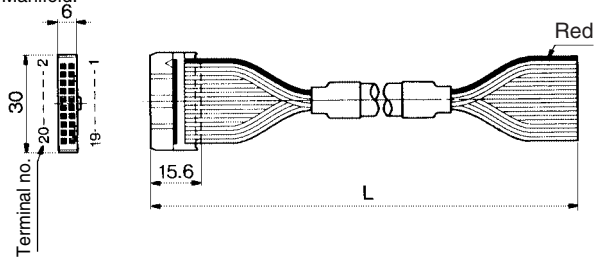
Flat Ribbon Cable (20 pins)



Cable assembly

AXT100-FC20-1 to 3

Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.



Flat Ribbon Cable Connector Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC20-1	Cable 20 core x 28AWG
3 m	AXT100-FC20-2	
5 m	AXT100-FC20-3	

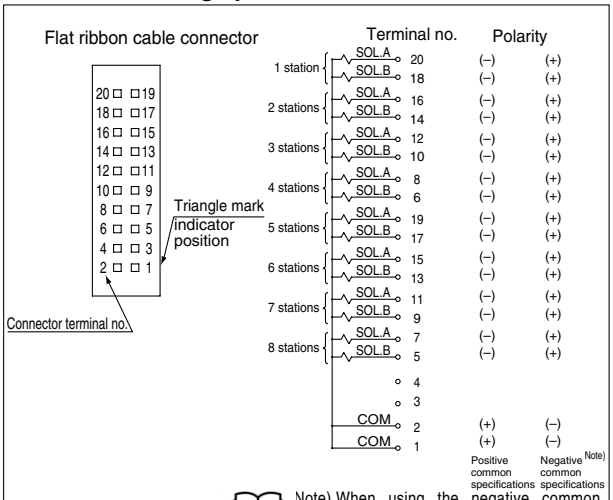
∗ For other commercial connectors, use a 20 pins with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

- Hirose Electric Co., Ltd.
- Japan Aviation Electronics Industry, Ltd.
- Oki Electric Cable Co. Ltd.
- Sumitomo 3M Limited
- J.S.T. Mfg. Co., Ltd.
- Fujitsu Limited

The total number of stations is tabulated starting from station one on the D side.

Electrical wiring specifications



Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-29.)

As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-29.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-29.)

How to Order Manifold

VV5Q1 3 – 08 J S 1 – N

Series VQ1000

Manifold

3	Plug-in unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-29.

Connector entry direction

U	Top entry
S	Side entry

Cable (Length)

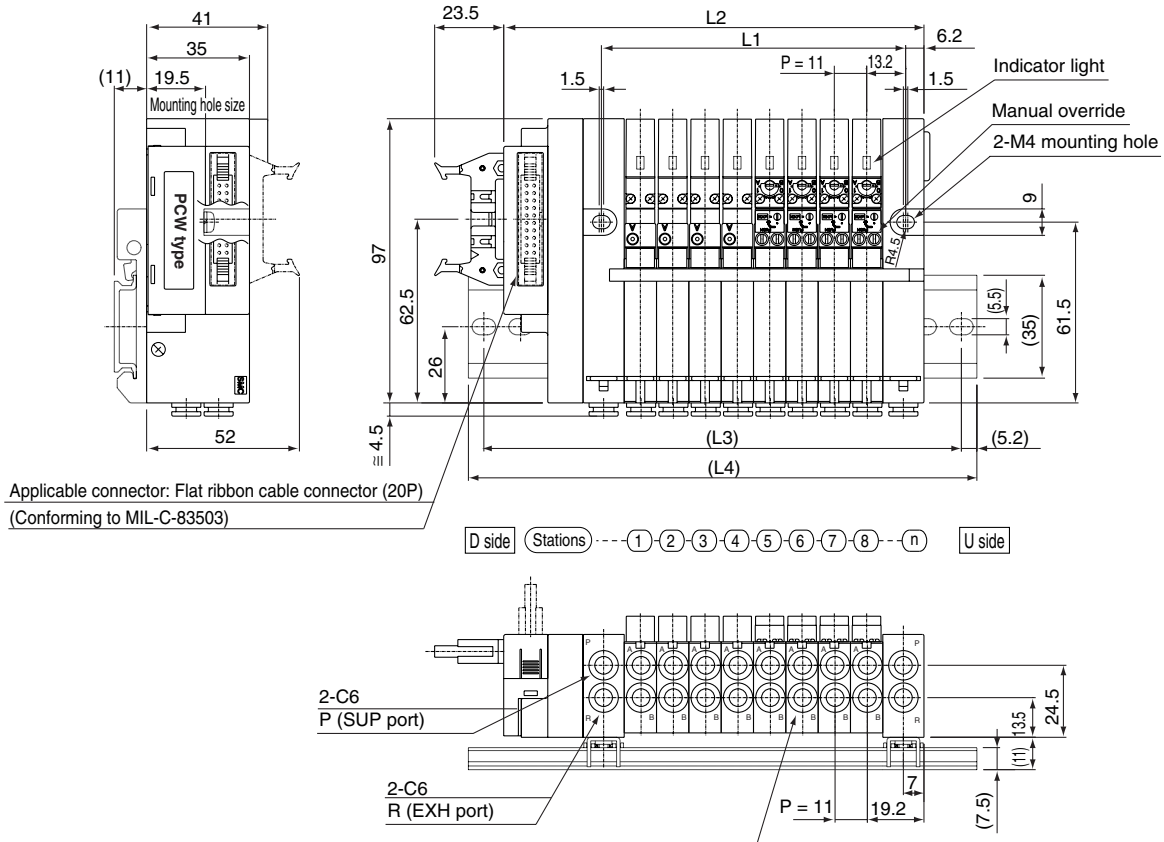
0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Option

Nil	None
D	DIN rail mounting style
K(2)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS

Note 2) Specify the wiring specifications on the manifold specification sheet.



The broken lines indicate the DIN rail mounting style [-D] and the top entry connection [-PU].

Note) 3 position types need two station.
Cylinder port is located at U side of body.

Dimensions

Formula L1 = 11n + 15.5, L2 = 11n + 55 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231
(L3)	87.5	100	112.5	125	137.5	150	162.5	162.5	175	187.5	200	212.5	225	237.5	250	262.5
(L4)	98	110.5	123	135.5	148	160.5	173	173	185.5	198	210.5	223	235.5	248	260.5	273

How to Order Valves

VQ1 1 3 0 Y 5 C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) 3 position types need two station.

Seal

0	Metal seal
1	Rubber seal

Note) For negative common specifications, refer to "Option" on page 2-4-29.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○(1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-10.
Note 2) Except double (latching).

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

For inch-size One-touch fittings, refer to "Option" on page 2-4-29.

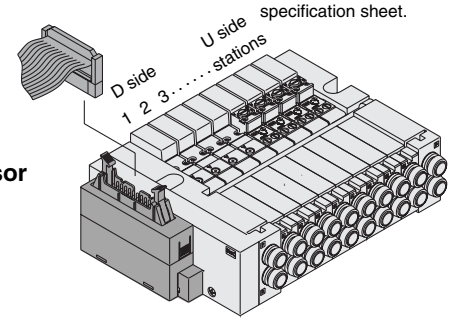
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

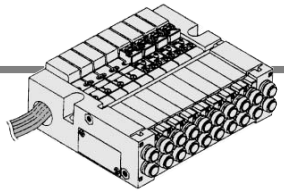
<Example>
Flat ribbon cable kit with 3 m cable
VV5Q13-08JU2···· 1 set — Manifold base no.
∗VQ1130-5-C6····· 4 sets — Valve part no. (Stations 1 to 4)
∗VQ1230-5B-C6··· 4 sets — Valve part no. (Stations 5 to 8)

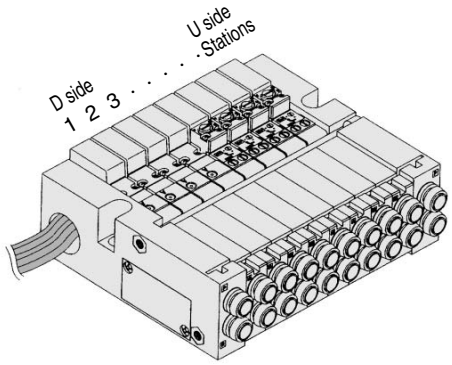
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



L VQ1000
Kit (Lead wire cable)



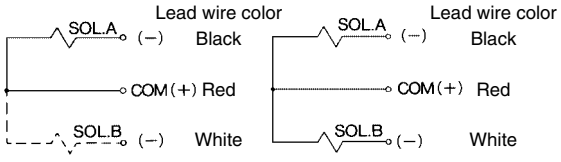


- It is the standard type which lead wire is extracted directly.
- Maximum stations are 16.

Series	Porting specifications			Applicable stations
	Port locaition	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations

● Wiring specifications: Positive COM

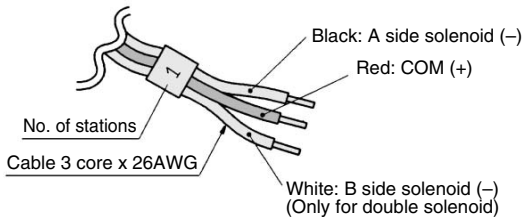
● Irrespective of the valve mounted, three lead wires are attached to each station.
The red wire is for COM connection.



3 position uses two stations. The A side solenoid of a 3 position valve is connected to SOL. A at the station with the smaller number in the above figure and the B side solenoid to SOL. A at the next station.

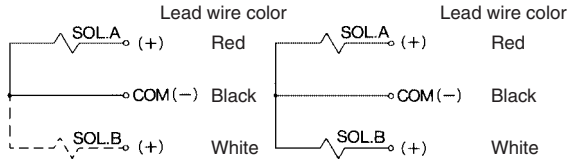
Lead wire color (Looking it by the doubl solenoid valve)	Black White	Black White	Black White	Black White	Black White
SOL.	A B	A B	A B (*)	A B (*)	A B (*)
	Double	Double	Single	A side B side 3 position	
Stations	1	2	3	4	5

The places of asterisk are not used.



● Wiring specifications: Negative COM (Option)

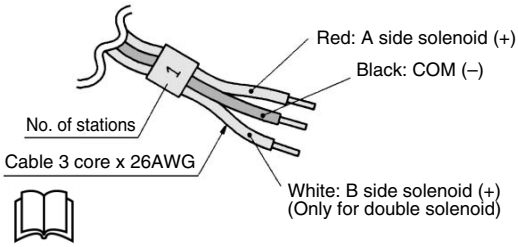
● Irrespective of the valve mounted, three lead wires are attached to each station.
The black wire is for COM connection.



3 position uses two stations. The A side solenoid of a 3 position valve is connected to SOL. A at the station with the smaller number in the above figure and the B side solenoid to SOL. A at the next station.

Lead wire color (Looking it by the double solenoid valve)	Red White	Red White	Red White	Red White	Red White
SOL.	A B	A B	A B (*)	A B (*)	A B (*)
	Double	Double	Single	A side B side 3 position	
Stations	1	2	3	4	5

The places of asterisk are not used.



Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-29.)

How to Order Manifold

VV5Q1 3 – 06 L D 1 – N

Series VQ1000

Manifold

3	Plug-in unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Lead wire entry direction

D	Entry on D side	Max. 16 stations
U	Entry on U side	

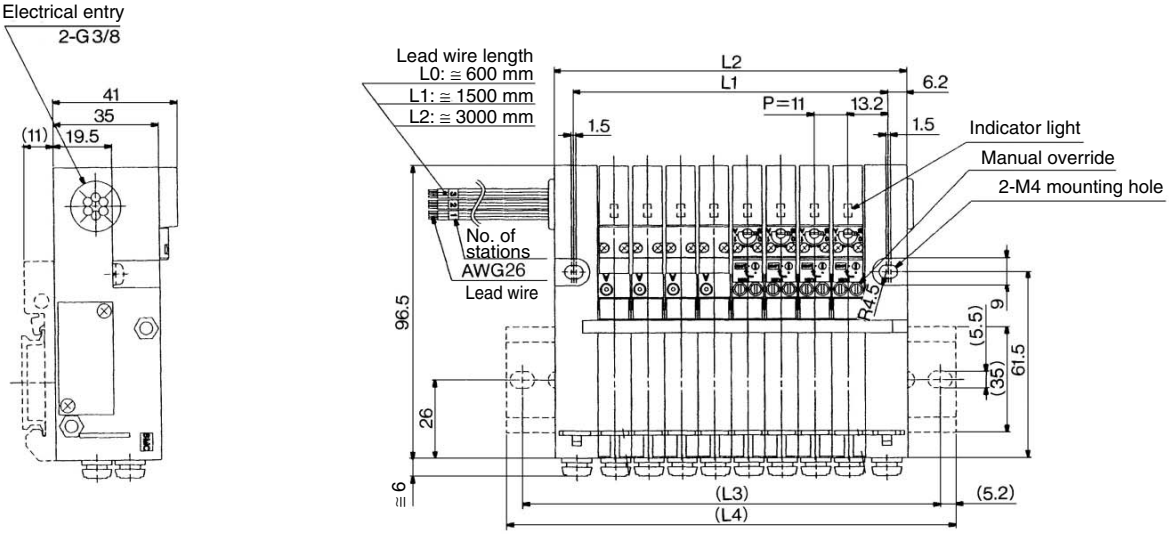
Cable (Length)

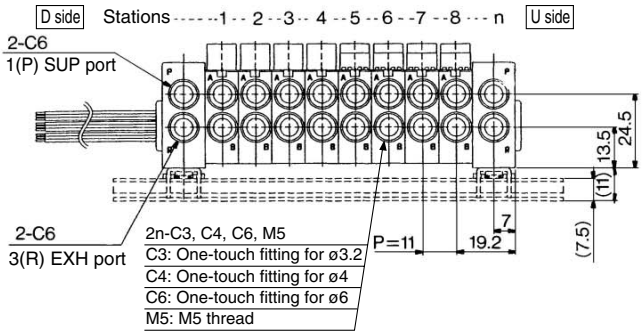
0	With cable (0.6 m)
1	With cable (1.5 m)
2	With cable (3 m)

Option

Nil	None
D	DIN rail mounting style
N	With name plate
S	Built-in silencer, direct exhaust

Note) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS





The broken lines indicate the DIN rail mounting style [-D].
The lead wire entry is on D side (LD□) in this case.

Note) 3 position types need two stations.
Cylinder port is located at U side of body.

Dimensions

Formula L1 = 11n + 15.5, L2 = 11n + 28 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	204
(L3)	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175	187.5	200	212.5	212.5	225
(L4)	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5	198	210.5	223	223	235.5

How to Order Valves

VQ1 1 3 0 Y – 5 □ □ – C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) 3 position types need two stations.

Seal

0	Metal seal
1	Rubber seal

Note) For negative common specifications, refer to "Option" on page 2-4-29.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-10.
Note 2) Except double (latching).

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-29.

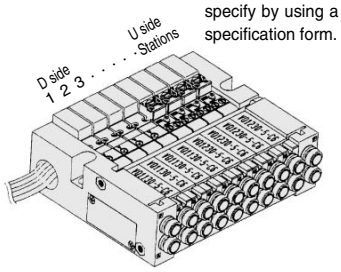
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

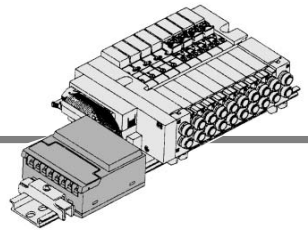
<Example>
Lead wire kit
VV5Q13-08LD2····1 set — Manifold base part no.
*VQ1230-5-C6·····4 sets — Valve part no. (Stations 1 to 4)
*VQ1230-5B-C6···4 sets — Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.
specify by using a manifold specification form.

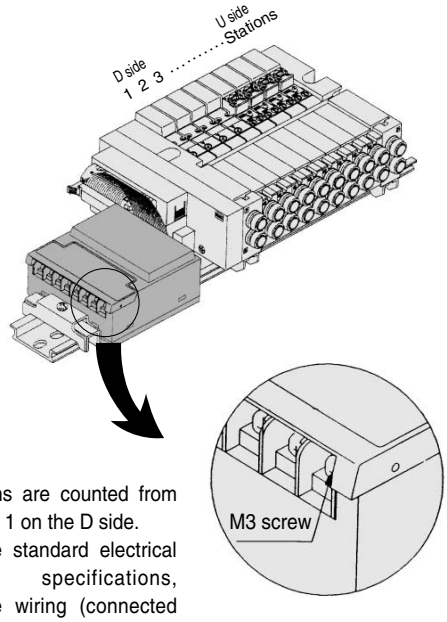


S VQ1000
Kit (Serial transmission unit)

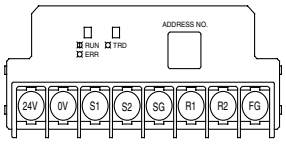
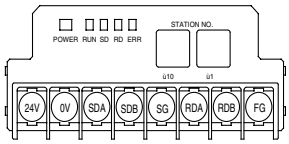


- The serial transmission system reduces wiring work, while minimizing wiring and saving space.
- The system comes in an type SA (generic for small scale systems) for equipment with a small number of I/O points, or 32 points max., type SB (applicable to Mitsubishi Electric models) for controlling 512 I/O points max., type SC (applicable to OMRON models), and type SD (applicable to SHARP models; 504 points max.).
- 16 stations max. (Specify a model with 9 to 16 stations by using the manifold specification sheet.)

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations



- Stations are counted from station 1 on the D side.
- As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-29.

	Type SA With general type SI unit (Series EX300)	Type SB Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System
Name of terminal block (LED)	 LED / Description TRD — Lighting during data reception RUN/ERR — Blinking when received data is normal; Lighting when data reception	 LED / Description POWER — Lighting when power is turned ON RUN — Lighting when data transmission with the master station is normal RD — Lighting during data reception SD — Lighting during data transmission ERR. — Lighting when reception data error occurs. Light turns off when the error is corrected.
Note	• T unit Can be connected with PLC I/O card for serial transmission. EX300-TMB1···· For models of Mitsubishi Electric Corporation EX300-TTA1····· For models of OMRON Corporation EX300-TFU1···· For models of Fuji Electric Co., Ltd. EX300-T001··· For general models ∗ Up to 32 points per unit. • No. of output points, 16 points	• Master station: PLC made by Mitsubishi Electric Corporation Series MELSEC-A AJ71PT32-S3, AJ71T32-S3 A1SJ71PT32-S3 ∗ Max. 64 stations, connected to remote I/O stations (Max. 512 points). • No. of output points, 16 points. No. of sta. occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

Item	Specifications
External power supply	24 VDC±10%
Current consumption (Internal unit)	SA, SB, SD, SFI, SH: 0.1 A/SC: 0.3 A

How to Order Manifold

VV5Q1 3 – 08 S A – D

Series VQ1000

Manifold

3	Plug-in unit/Flip

Stations

01	1 station
⋮	⋮
08 Note)	8 stations (Double)
16	16 stations (Single)

Note) For details, refer to page 2-4-29.

Model

O	Without SI unit
A	With general type SI unit (Series EX300)
B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System
C	OMRON Corp.: SYSBUS Wire System
D	SHARP Corp.: Satellite I/O Link System
F1	NKE Corp.: Uni-wire System (16 output points)
H	NKE Corp.: Uni-wire H System

Note) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation, Fuji Electric Co., Ltd.; OMRON Corporation.

∗ The dust-protected type SI unit is applicable, too. For details, please contact SMC.

Option

D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

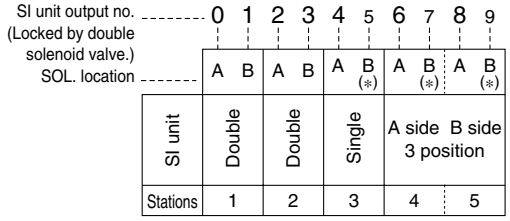
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS

Note 2) S kits are DIN rail mounting styles, so include suffix D.

Note 3) Specify the wiring specifications on the manifold specification sheet.

● SI unit output and coil numbering

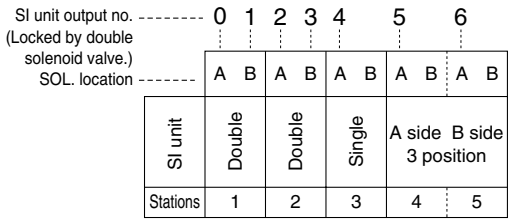
<Wiring example 1> Double wiring (Standard)

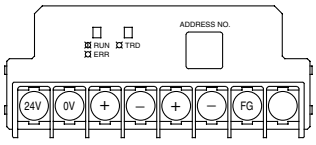
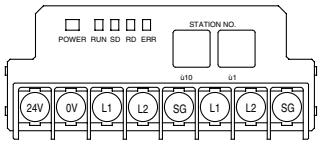


The places of asterisk are not used.

3 position uses two stations for wiring. The A side solenoid of 3 position valve is connected to A at the station with the smaller number in the above figure.

<Wiring example 2> Single/Double Mixed Wiring (Option)
Mixed wiring is available as an option.
Use the manifold specification sheet to specify.



	Type SC OMRON Corporation SYSBUS Wire System	Type SD SHARP Corporation Satellite I/O Link System
Name of terminal block (LED)	 LED: RUN — Lights when transmission is normal and PLC is in operation mode LED: T/R ERR — Blinks during data transmission/reception; ON when transmission is abnormal	 LED: POWER — ON when power supply is ON LED: RUN — Lights when power is ON and slave stations are operating normally LED: ERROR — Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit LED: R.SET HOLD — ON for master unit control input
Note	• Master station unit: OMRON PLC SYSMAC C(CV) series Types C500-RM201 and C200H-RM201 * 32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit: SHARP's PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW-31LM * Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ1 1 3 0 Y − 5 − C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) 3 position types need two stations.

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H Note)	High pressure type	(1.5 W) ○
Y Note)	Low wattage type	(0.5 W) ○

Note) Except double (latching)

Coil voltage

5	24 VDC/With indicator light/surge voltage suppressor

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-29.

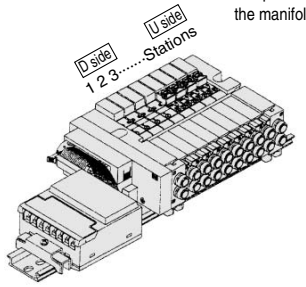
How to Order Manifold Assembly

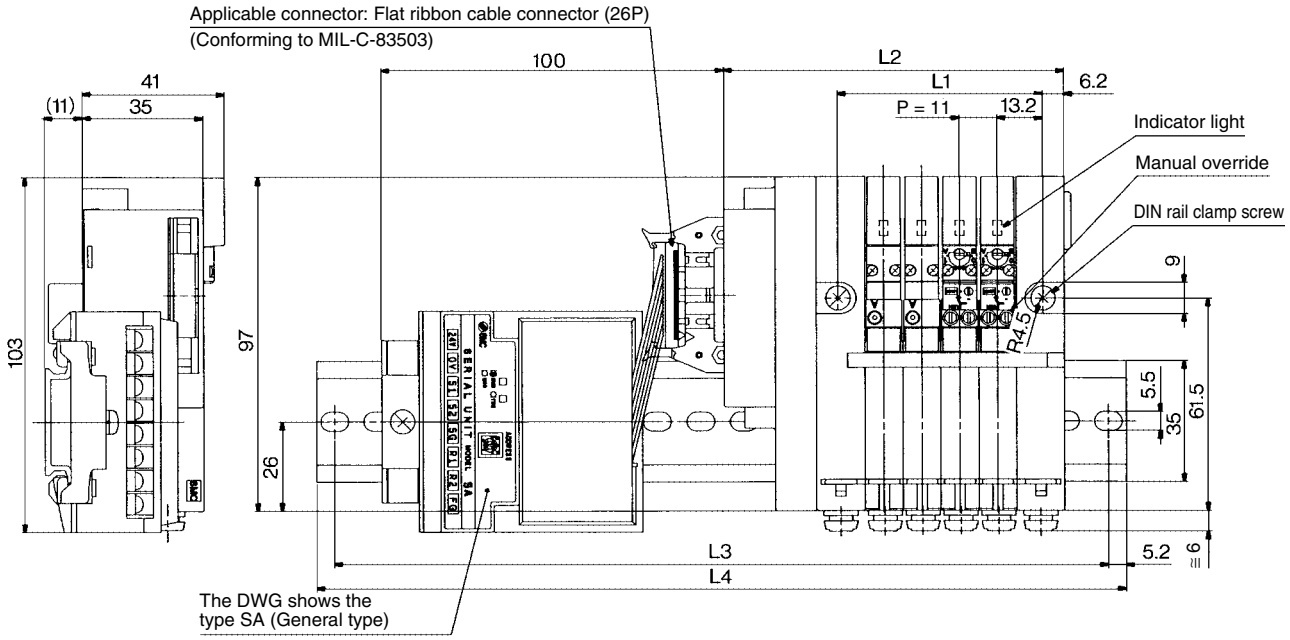
Specify the part numbers for valves and options together beneath the manifold base part number.

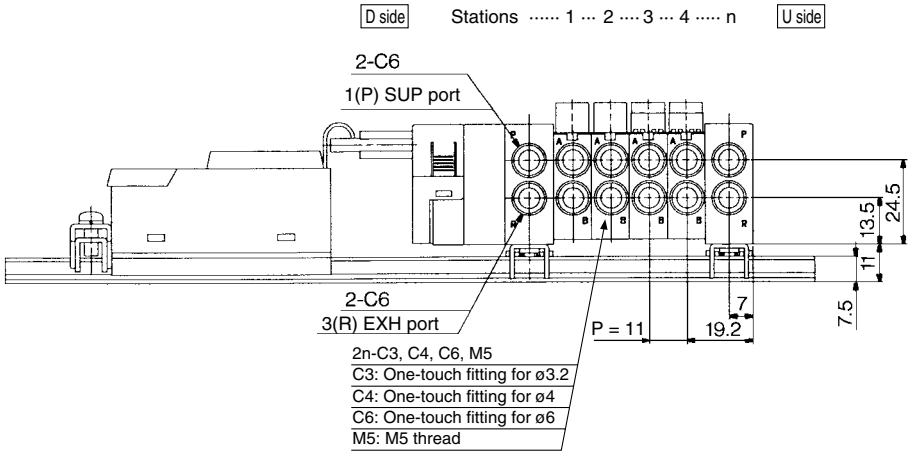
<Example>
Serial transmission kit
VV5Q13-08SA-D···1 set — Manifold base part no.
*VQ1230-5-C6·····4 sets — Valve part no. (Stations 1 to 4)
*VQ1230-5B-C6··· 4 sets — Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.







Note) 3 position types need two stations.
Cylinder port is located at U side body.

Dimensions

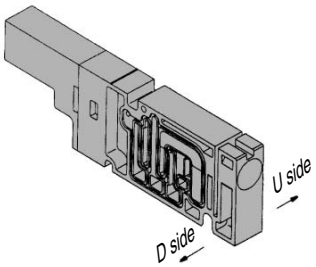
Formula L1 = 11n + 15.5, L2 = 11n + 55 n: Station (Maximum 16 stations)

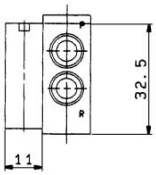
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231
L3	187.5	200	212.5	225	237.5	250	262.5	275	275	287.5	300	312.5	325	337.5	350	362.5
L4	198	210.5	223	235.5	248	260.5	273	285.5	285.5	298	310.5	323	335.5	348	360.5	373

Manifold Option Parts

Blanking plate assembly
VVQ1000-10A-3

It is used when a blanking plate is mounted to a manifold in advance for possible valve mounting, etc.

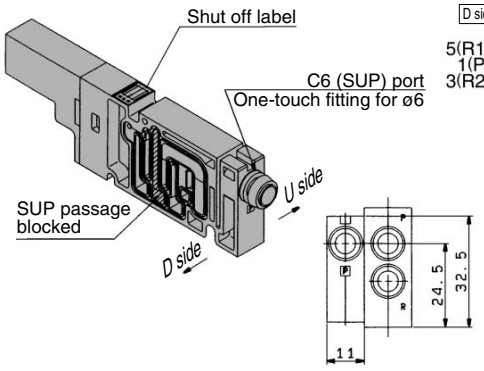


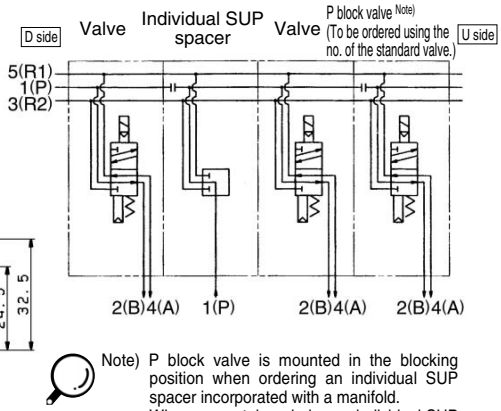


Individual SUP spacer
VVQ1000-P-3-C6

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.)
Since the SUP passage on the spacer's D side is blocked in advance, it is mounted on the D side the valves U side. (Refer to the application example.)

* Specify the spacer mounting position and SUP block plate mounting position on the manifold specification sheet.
* Electric wiring is connected to the position of the manifold station where the individual SUP spacter is mounted.



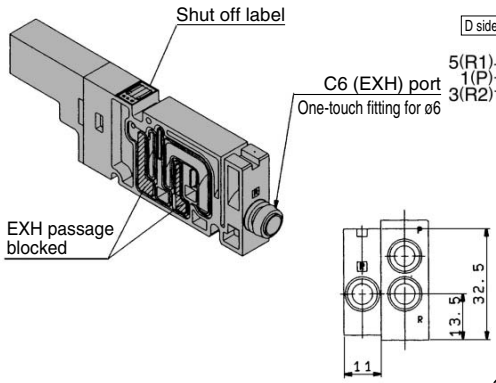


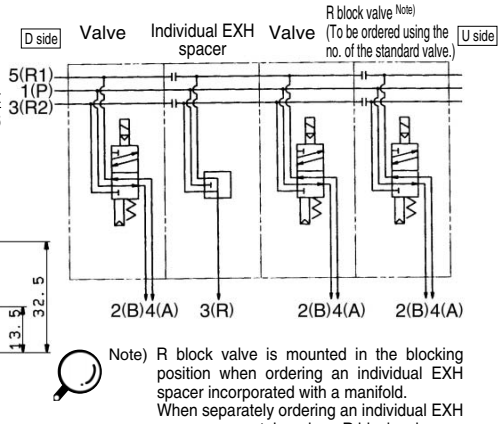
Note) P block valve is mounted in the blocking position when ordering an individual SUP spacer incorporated with a manifold.
When separately ordering an individual SUP spacer, separately order a R block valve.

Individual EXH spacer
VVQ1000-R-3-C6

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (1 station space is occupied.)
Since the EXH passage on the spacer's D side is blocked in advance, it is mounted on the D side of the valve for individual supply while blocking the valves U side. (Refer to the application example.)

* Specify the spacer mounting position and EXH block plate mounting position on the manifold specification sheet.
* Electric wiring is connected to the position of the manifold station where the individual EXH spacer is mounted.





Note) R block valve is mounted in the blocking position when ordering an individual EXH spacer incorporated with a manifold.
When separately ordering an individual EXH spacer, separately order a R block valve.

P/R/PR Block valve
VQ1$_2^1$3$_1^0$-□-□□-P/R/PR

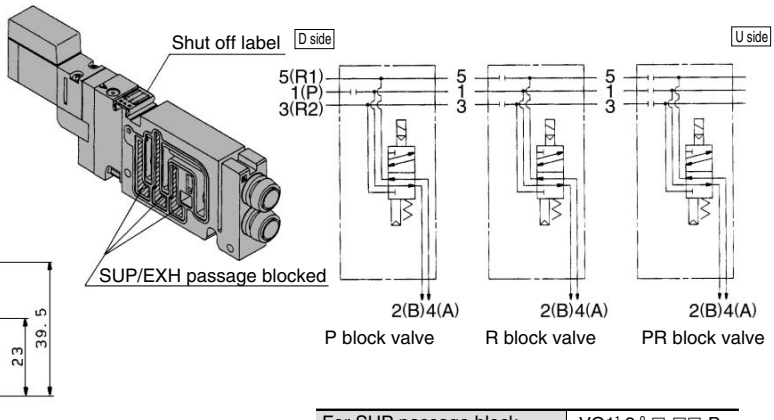
For a flip plug-in unit, block plate is built in the valve for blocking SUP and EXH passages. Since the no. is classified by the passage to be blocked, specify it by attaching the option no. to the valve no. The block valve is constructed so that D sides of SUP and EXH passages are blocked.

* Specify the number of stations on the manifold specification sheet.

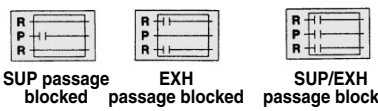
<Shut off label>

When using block plates for SUP, EXH passage, indication label for confirmation of the blocking positionfrom outside is attached. (One label for each)

* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.



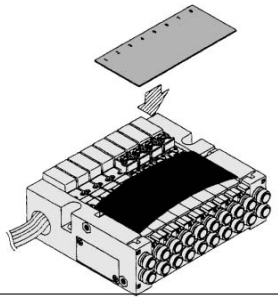
For SUP passage block	VQ1$_2^1$3$_1^0$-□-□□-P
For EXH passage block	VQ1$_2^1$3$_1^0$-□-□□-R
For SUP/EXH passage block	VQ1$_2^1$3$_1^0$-□-□□-PR

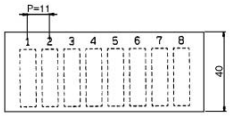


Manifold Option Parts

Name plate [-N3]
VVQ1000-N3-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.

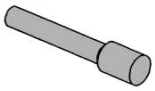


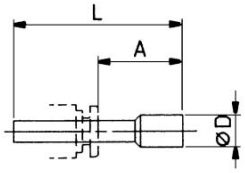


* When ordering assemblies incorporated with a manifold, add suffix N to the manifold no.

Blanking plug
KQ2P-$^{23}_{04}_{06}$

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.



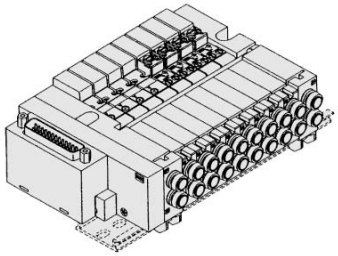


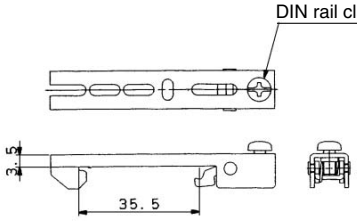
Dimensions

Applicable fittings size ød	Model	A	L	D
3.2	**KQ2P-23**	16	31.5	5
4	**KQ2P-04**	16	32	6
6	**KQ2P-06**	18	35	8

DIN rail mounting bracket
VVQ1000-57A-3

It is used for mounting a manifold on a DIN rail. The DIN rail mounted bracket is fixed to the manifold end. (The specification is the same as that for the option "-D".)
1 set of DIN rail mounting bracket is used for 1 manifold (2 DIN rail mounting brackets).



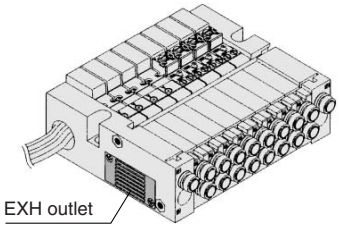


* When ordering assemblies incorporated with a manifold, add suffix -D to the manifold no.

Built-in silencer, Direct exhaust [-S]

This is an exhaust port on top of the manifold end plate. The built-in silencer exhibits an excellent noise suppression effect.
F, P and S kits are provided with single exhaust on U side.
Note) A large quantity of drainage generated in the air.

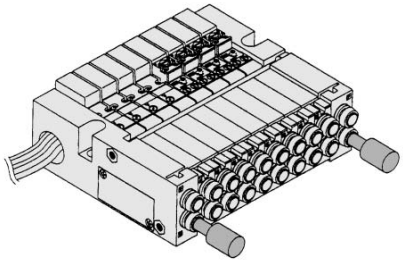
• For maintenance, refer to page 2-4-27.

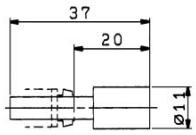


* When ordering assemblies incorporated with a manifold, add suffix -S to the manifold no.

Silencer
AN103-X233

This is inserted into the centralized type EXH port (One-touch fitting).





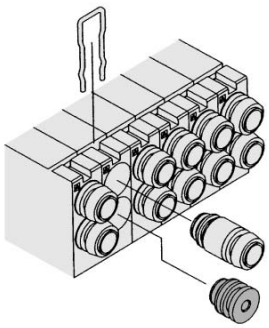
Dimensions

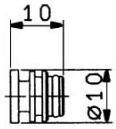
Series	Applicable fittings size ød	Model	A	L	D	Effective area (mm^2)	Noise reduction (dB)
VQ1000	6	AN103-X233	20	37	11	7	25

Port plug
VVQ0000-58A

The plug is used to block the cylinder port when using a 4 port valve as a 3 port valve.
When ordering it incorporated with a manifold, suffix A or B, the symbol of the plug port, to the valve no.

Example) **VQ1130-5L-C6-A**
A port, Plug





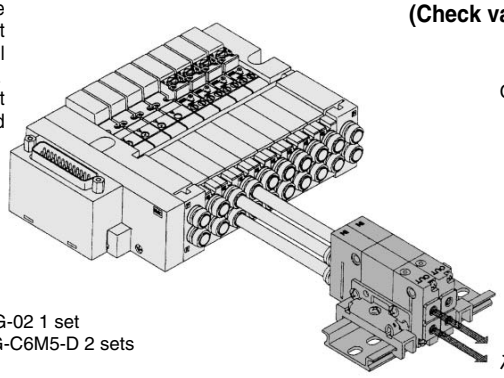
Double check block (Separated type)
VQ1000-FPG-□□

It is used on the outlet side piping to keep the cylinder in the intermediate position for a long time. Combining the double check block with a built-in pilot type double check valve and a 3 position exhaust center solenoid valve will enable the cylinder to stop in the middle or maintain its position for a long time. The combination with a two position single/double solenoid valve will permit this block to be used for preventing the dropping at the cylinder stroke end when the SUP residual pressure is released.

Specifications

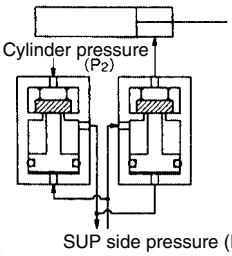
Max. operating pressure	0.8 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temperature	–5 to 50° C
Flow characteristics: C	0.60 dm³/(s·bar)
Max. operating frequency	180 CPM

Note) Based on JIS B 8375-1981 (Supply pressure: 0.5 MPa)



VVQ1000-FPG-02 1 set
∗VQ1000-FPG-C6M5-D 2 sets

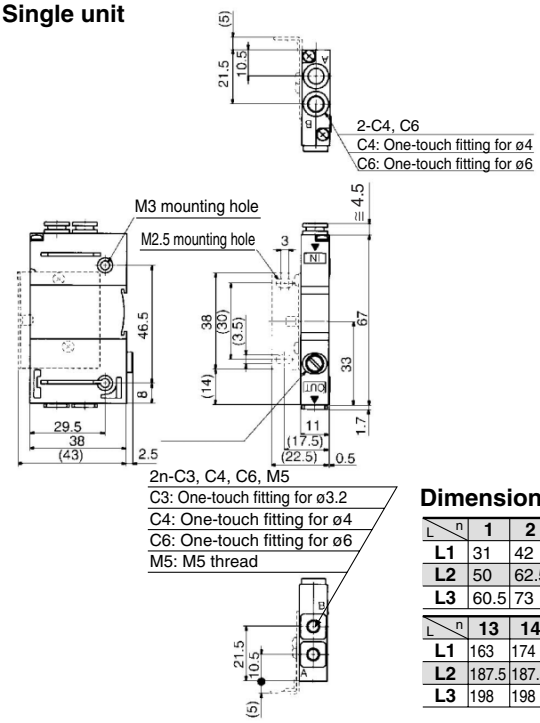
(Check valve operation principle)



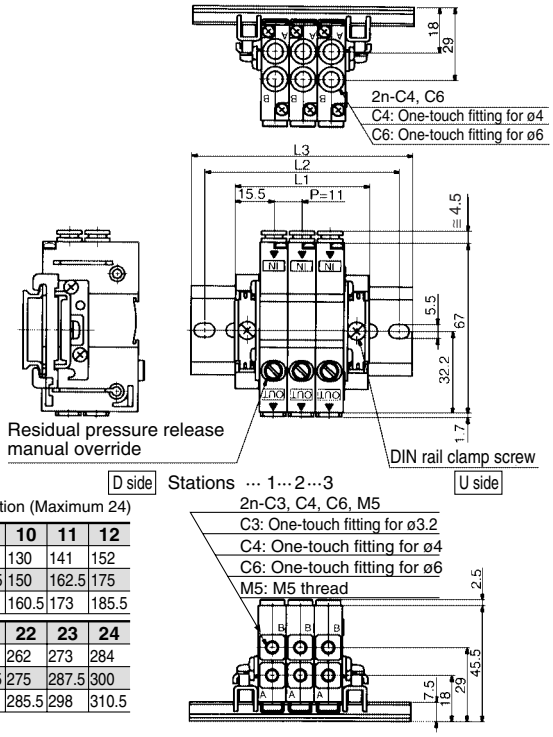
To CYL port

Dimensions

Single unit



Manifold



Dimensions

Formula L1 = 11n + 20 n: Station (Maximum 24)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	31	42	53	64	75	86	97	108	119	130	141	152
L2	50	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175
L3	60.5	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5

L \ n	13	14	15	16	17	18	19	20	21	22	23	24
L1	163	174	185	196	207	218	229	240	251	262	273	284
L2	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300
L3	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5

How to Order

Double check block

VQ1000-FPG- C4 M5 — F

IN side port size

C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

OUT side port size

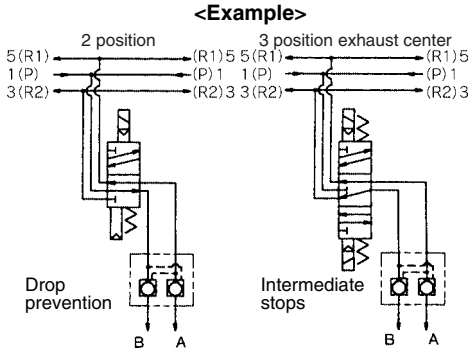
M5	M5 thread
C3	One-touch fitting for ø3.2
C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

Option

Nil	None
F	With bracket
D	DIN rail mounting style (For manifold)
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically. Example) -DN

<Example>



Manifold

VVQ1000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Example>
VVQ1000-FPG-06··6 types of manifold
∗VQ1000-FPG-C4M5-D, 3 sets
∗VQ1000-FPG-C6M5-D, 3 sets
} Double Check block

⚠ Caution

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap. Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- Combining double check block with 3 position closed center or pressure center solenoid valve will not work.
- M5 fitting assembly is attached, not incorporated into the double check block. After screwing in the M5 fittings, mount the assembly on the double check block. {Tightening torque: 0.8 to 1.2 N·m}
- If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

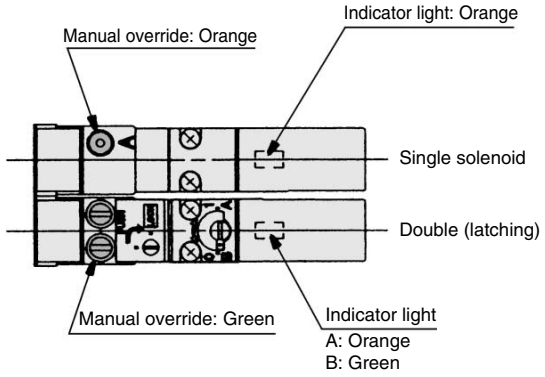
⚠Precautions

Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

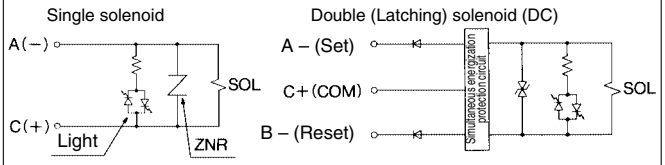
Light/Surge Voltage Suppressor

⚠Caution

The lighting positions are concentrated on one side for both single solenoid and double (latching) type. In the double (latching) type, A side and B side energization are indicated by two colors which match the colors of the manual overrides.



DC type circuit diagram



Single solenoid type | **Double (Latching)**

Note 1) • A side energization: A light (orange) illuminates.
• B side energization: B light (green) illuminates.
• Equipped with a wiring error prevention (stop diode) mechanism.
• Surge absorption (ZNR/surge absorption diode) mechanism.

Note 2) Applicable to negative COM specification models.

Note 3) In the case of double (latching), the electromagnetic valve channel is, A–(set): P → A, B → R
B–(reset): P → B, A → R

Double (Latching solenoid) Type

⚠Caution

Different from the conventional double solenoid, the double uses a latching (self-holding system) solenoid. Although the appearance is the same as the single solenoid, it is constructed so that the movable iron core in the solenoid is held in the ON position on A and B sides by instantaneous energization (20 ms or more). The usage and function is the same as the double solenoid.

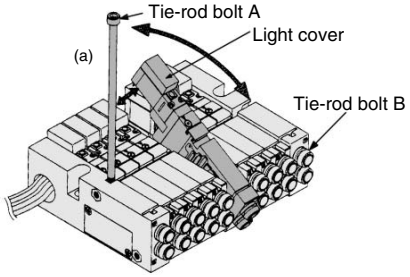
<Special Cautions for Latching Solenoid>

1. Select the circuit in which ON and OFF signals are not energized simultaneously.
2. 20 ms energization time is necessary for self-holding.
3. Avoid using the latching solenoid valves in environments where impact or collisions with the valve might occur. Also, do not use in places where strong magnetic fields are present.
4. Even though the armature in the solenoid of this valve is held on to B side, ON position (Reset), verify either A side, ON position or B side, ON position by energizing prior to use. After manual operation, the main valve will return to its original position.
5. Manual override on the pilot valve side can retain its switching position after manipulation.
6. Please contact SMC for long-term energization applications.
7. If the metal seal type goes down below the minimum operating pressure of supply air (0.1 MPa or less), the main valve will get back the home position (B side ON position). Therefore, in the event of shutting the supply air or applying the air with being A side ON position remained, cylinder may be pulsated. In the event of manipulating the supply air, the valve's switching position has to be set in the home position side (B side ON position side).

How to Mount/Remove Solenoid Valve

⚠Caution

<Procedure>



How to remove

1. Loosen tie-rod bolt B. (Two to four turns)
2. After fully loosening the tie-rod bolt, take off bold A upward as shown above.
3. Slide the valves aside to make a 1 mm clearance between the valve to betaken off and the others. As shown above, remove the whole valve while holding up the (a) side.

Mounting

Reverse the sequence of steps above to remount. Torque applied to tie-rod bolt should be 1.0 to 1.4 N·m. Tighten evenly.

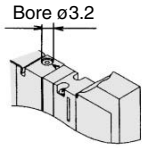
Note) Be careful not to push on the light cover while mounting/removing the valve.

Manual Override

⚠Warning

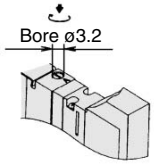
Without an electric signal for the solenoid valve the manual override is used for switching the main valve.

■ Push type (Tool required)



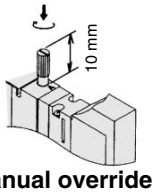
Push down on the manual override button with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

■ Locking slotted type



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it.

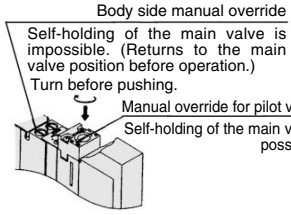
■ Locking lever type (Option)



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.

■ Manual override for double (latching) type

In the case of a double (latching) type, a manual override is provided not only on the body side but to the pilot as a standard. After manual operation, the main valve of the manual on the body side returns to the position before the manual operation, however, the pilot valve manual override maintains the change-over position.



- **If the manual override is turned by 180° clockwise and the ► mark is adjusted to A, then pushed in the direction of an arrow (⧫), it will be back to the reset condition. (passage P → A)**
- **If the manual override is turned by 180° counterclockwise and the ► mark is adjusted to B, then pushed in the direction of an arrow (⧫), it will be back to the reset condition. (passage P → B) (It is in the reset state at the time of shipment.)**

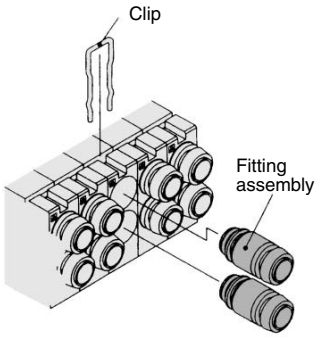
⚠Caution

Do not apply excessive torque when turning the locking type manual override. (0.1 N·m or less)

Replacement of Cylinder Port Fittings

⚠Caution

The cylinder port fittings are a cassette for easy replacement. The fittings are blocked by a clip inserted from the top of the valve.
Remove the clip with a screwdriverto remove fittings. For replacement, insert the fitting assembly until it strikes against the inside wall and then re-insert the clip to the specified position.



Applicable tubing O.D.	Fitting assemly part no.
	VQ1000
Applicable tubing ø3.2	VVQ1000-50A-C3
Applicable tubing ø4	VVQ1000-50A-C4
Applicable tubing ø6	VVQ1000-50A-C6

Purchasing order is available in units of 10 pieces.

Caution

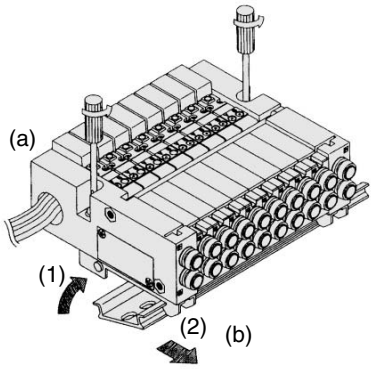
1. Use caution that O-rings must be free from scratches and dust. Otherwise, air leakage may result.
2. The tightening torque for inserting fittings to the M5 thread assembly should be 0.8 to 1.4 N·m.

Mounting/Removing from the DIN Rail

⚠Caution

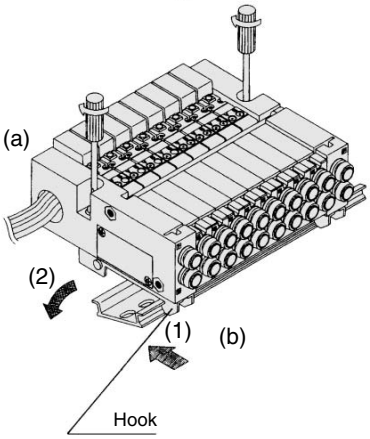
Removing

1. Loosen the clamp screw of the end plate on both sides.
2. Lift side (a) of the manifold base and side the end plate in the direction of (2) shown in the figure to remove.



Mounting

1. Hook side (b) of the manifold base on the DIN rail.
2. Press down side (a) and mount the end plate on the DIN rail. Tighten the clamp screw on side (a) of the end plate. The proper tightening torque for screws is 0.4 to 0.6 N·m.



Built-in Silencer Replacement Element

⚠Caution

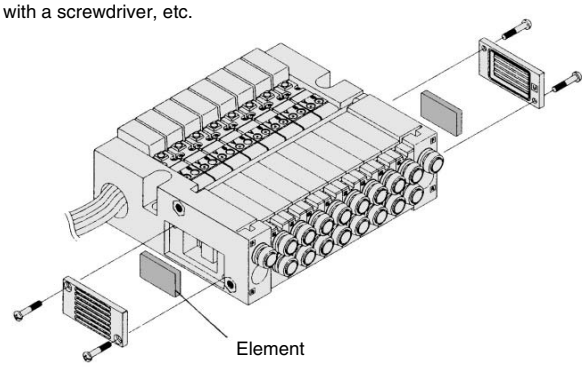
A silencer element is incorporated in the end plate on both sides of the base. A dirty and choked element may reduce cylinder speed or cause manifunction. Clean or replace the dirty element.

Element Part No.

Type	Element part no.
	VQ1000
Built-in silencer, direct exhaust (-S)	VVQ1000-82A-3

∗ The minimum order quantity is 10 pcs.

Remove the cover from the side of the end plate and remove the old element with a screwdriver, etc.



How to Calculate the Flow Rate

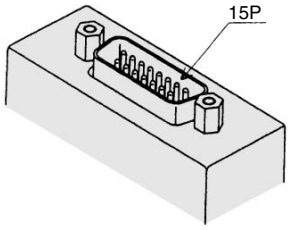
For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

Option

Different Number of Connector Pins

F and P kits with the following number of pins are available. Besides the standard number (F = 25; P = 26) select the desired number of pins and cable length from the cable assembly list. Place an order for the cable assembly separately.

F kit (D-sub connector) 15 pins



How to order manifold

VV5Q13 — 06 F SA — N

- 06 → Stations
- SA → Kit/Electrical entry
- N → Option

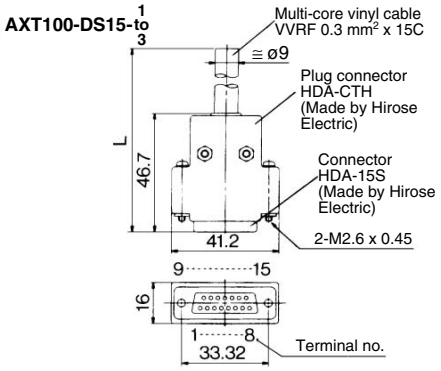
How to Order
D-sub connector, 15 pins
Connector location—Side (horizontal)
Without cable

Kit/Electrical entry

Pins \ Location	Top entry		Side entry	
15P (Max. 7 stations)	Kit F	UA	Kit F	SA

Wiring Specifications

∗ As in the case of 25-pin models (standard), terminal no. 1 is the first station SOL.A and the terminal no. 8 is COM.



Wire Color by Terminal No. of D-sub Connector Cable Assembly

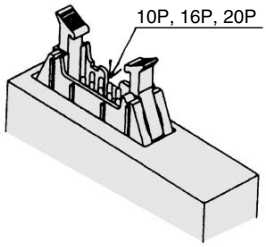
Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black

D-sub Connector Cable Assembly

Cable length (L) \ Pins	15P
1.5 m	AXT100-DS15-1
3 m	AXT100-DS15-2
5 m	AXT100-DS15-3

∗ For other commercial connectors, use a type conforming to MIL-C-24308.

P kit (Flat ribbon cable connector) 10 pins, 16 pins, 20 pins



How to order manifold

VV5Q13 — 06 P SC — N

- 06 → Stations
- SC → Kit/Electrical entry
- N → Option

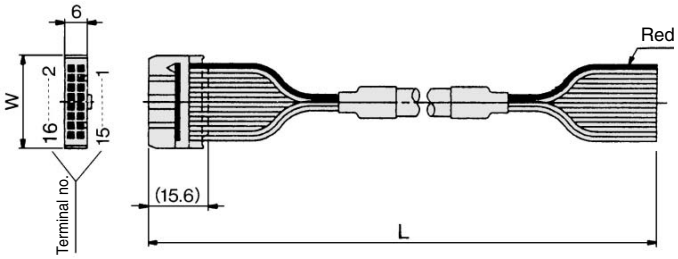
How to Order
Flat ribbon cable, 20 pins
Connector location—Side (horizontal)
Without cable

Kit/Electrical entry

Pins \ Location	Top entry		Side entry	
10P (Max. 4 stations)	Kit P	UA	Kit P	SA
16P (Max. 7 stations)		UB		SB
20P (Max. 9 stations)		UC		SC

Wiring Specifications

∗ As in the case of 26-pin models (standard), terminal no. 1 is the first station SOL.A and the last two terminal numbers are used for COM.



Flat Ribbon Cable Assembly

Cable length (L) \ Pins	10P	16P	20P
1.5 m	AXT100-FC10-1	AXT100-FC16-1	AXT100-FC20-1
3 m	AXT100-FC10-2	AXT100-FC16-2	AXT100-FC20-2
5 m	AXT100-FC10-3	AXT100-FC16-3	AXT100-FC20-3
Connector width (W)	17.2	24.8	30

∗ For other commercial connectors, use a type with strain relief that conform to MIL-C-83503.

Option

Special Wiring Specifications

In the internal wiring of F kit, P kit, and JS kit, double wiring (connected to SOL. A and SOL. B) is adopted for each station regardless of the valve and option types.
Mixed single and double wiring is available as an option.

1. How to order valves

Indicate an option symbol, -K, for the manifold no. and be sure to specify the mounting position and number of stations of the single and double wiring by means of the manifold specification sheet.

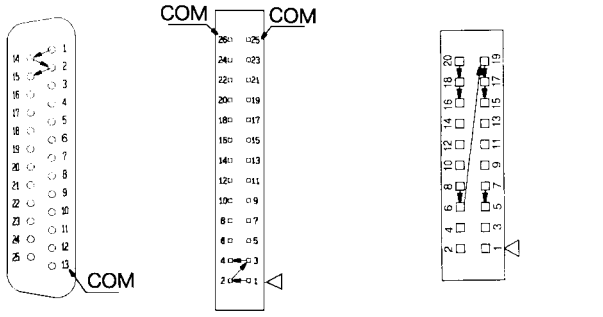
Example)

VV5Q13-09FS0-D K S

Others, option symbols: to be indicated alphabetically.

2. Wiring specifications

Connector terminal numbers are connected from solenoid station 1 on the A side in the order indicated by the arrows without shipping any terminal numbers.



F kit
D-sub connector (25P)

P kit
Flat ribbon cable connector (26P)

J kit
Flat ribbon cable connector (20P)

3. Max. number of stations

The maximum number of stations depends upon the number of solenoids. Assuming one for a single and two for a double, determine the number of stations so that the total number is not more than the maximum number given in the following table.

kit	F kit (D-sub connector)		P kit (Flat ribbon cable connector)				J kit (Flat ribbon cable connector)	S kit (Serial)
Type	F$^{U}_{S}$□ 25P	F$^{U}_{S}$A 15P	P$^{U}_{S}$□ 26P	P$^{U}_{S}$C 20P	P$^{U}_{S}$B 16P	P$^{U}_{S}$A 10P	J$^{U}_{S}$□ 20P	S□
Max. points	24 (16 stations)	14	24 (16 stations)	18 (16 stations)	14	8	16	16

Negative Common Specifications

Specify the valve model no. as shown below for negative COM specification. The manifold no. shown below is for the L kits. For other kits the standard manifold can be used. Please contact for negative COM S kit.

How to order negative COM valves

VQ1130 N − 5 − C6

Negative common specifications

How to order negative COM manifold

L kit:

VV5Q13 − 08 L N D 1 − N

Stations
Negative common specifications
Lead wire entry on D side
Cable length
Option

Inch-size One-touch Fittings

Refer to following model no. for inch-size One-touch fittings.

How to order manifold

VV5Q13 − 08FSO − DN − 00T

1(P), 3(R) port size: ø1/4

How to order valves

VQ1130 − 5 − N7

Cylinder ports

Symbol	N1	N3	N7
Applicable tube O.D. (Inch)	ø1/8"	ø5/32"	ø1/4"

DIN Rail Mounting

Each manifold can be mounted on a DIN rail.
Order it by indicating an option symbol for DIN rail mounting style, -D. In this case, a DIN rail which is approx. 30 mm longer than the manifold with the specified number of stations is attached. Besides, it is also available in the following cases.

● **When DIN rail is unnecessary (Except S kit)**

(DIN rail mounting brackets only are attached.)

Indicate the option symbol, -DO, for the manifold no.

Example)

VV5Q13-08LD1-DOS

Others, option symbols: to be indicated alphabetically.

● **When using DIN rail longer than the manifold with specified number of stations**

Clearly indicate the necessary number of stations next to the option symbol, -D, for the manifold no.

Example)

VV5Q13-08FS1-D09S

DIN rail for 9 stations
Others, option symbols: to be indicated alphabetically.

● **When changing the manifold style into a DIN rail mount**

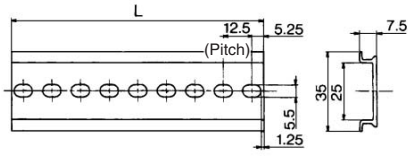
Order brackets for mounting a DIN rail. (Refer to "Option" on page 2-4-24.)

No. VVQ1000-57A-3 2 pcs. per one

● **When ordering DIN rail only**

DIN rail no.: AXT100-DR-n

∗ Refer to the DIN rail dimension table for determining the length.



L Dimension L = 12.5 x n + 10.5

No.	1	2	3	4	5	6	7	8	9	10
L dimension	23	35.5	48	60.5	73	85.5	98	110.5	123	135.5
No.	11	12	13	14	15	16	17	18	19	20
L dimension	148	160.5	173	185.5	198	210.5	223	235.5	248	260.5
No.	21	22	23	24	25	26	27	28	29	30
L dimension	273	285.5	298	310.5	323	335.5	348	360.5	373	385.5
No.	31	32	33	34	35	36	37	38	39	40
L dimension	398	410.5	423	435.5	448	460.5	473	485.5	498	510.5

Series VQ0000
Body Ported
Plug Lead Unit: Flip Type

How to Order Manifold

VV5Q 0 4 – 08 F S1 – D

Series

0	VQ0000

Manifold

4	Plug lead unit/Flip

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit. (Refer to the table below.)

Simple specials are available with SMC Simple Specials System. For details about applicable models, please contact SMC.

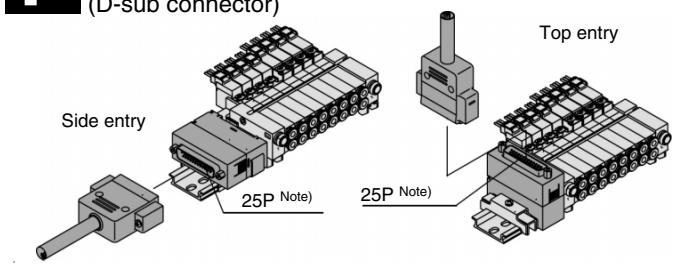
Option

Nil	None (C kit only)
D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S (4)	Built-in silencer, direct exhaust

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -DNS
Note 2) F, P, T, and S kits are DIN rail in mounting styles, so include suffix -D.
Note 3) Specify the wiring specifications on the manifold specification sheet. (Except C kit)
Note 4) F, P, T and S kits are provided with an exhaust on one side, while C kits are with an exhaust on both sides.

Kit/Electrical entry/Cable length

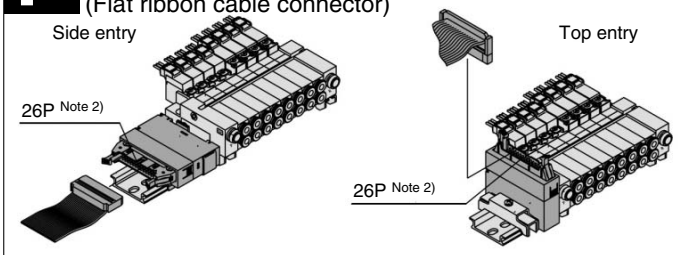
F kit (D-sub connector)



P. 2-4-38

Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

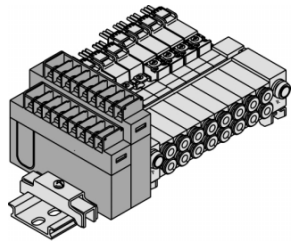
P kit (Flat ribbon cable connector)



P. 2-4-42

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

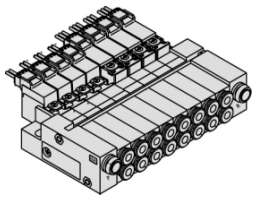
T kit (Terminal block)



P. 2-4-46

Kit T			
	1	No. of terminals: 8, 1 row	Applicable stations 1 to 8
	2	No. of terminals: 16, 2 rows	Applicable stations 5 to 16

C kit (Connector)

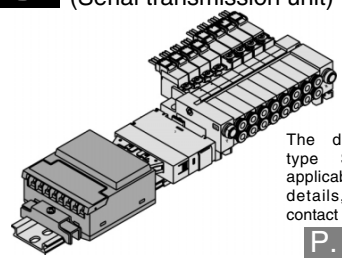


P. 2-4-50

C	Connector kit	Max. 16

S kit (Serial transmission unit)

The valve is equipped with an indicator light and surge voltage suppressor.



The dust-protected type SI unit is applicable, too. For details, please contact SMC.

P. 2-4-54

Kit S (3)			
	0	Without SI unit	(2) Max. 16 stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	H	NKE Corp.: Uni-wire H System	

Note 1) Besides the above, F and P kits with different number of pins are available. For details, refer to page 2-4-68.
Note 2) See page 2-4-69 for details.
Note 3) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation; Fuji Electric Co., Ltd.; OMRON Corporation.

How to Order Valves

VQ 0 1 4 0 Y 5 L – C4

Series

0	VQ0000

Type of actuation

1	2 position single
2	2 position double (Latching) Metal seal / Rubber seal
3 Note)	3 position closed center
4 Note)	3 position exhaust center

Note) 3 position occupies two stations.

Coil voltage

1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) The C kit is applicable to 200/220 VAC.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.
Note 2) Except double (latching).

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-69.
Note 2) Connector assembly will be required when the F, P, T, S kits add a valve. For model no., refer to "Option" on page 2-4-69.

Electrical entry

	VQ0000
G: Grommet C kit single only. Single only (Except AC.)	
L: L plug connector With lead wire	With light/ surge voltage suppressor
LO: L plug connector Without connector	With light/ surge voltage suppressor
M: M plug connector With lead wire	With light/ surge voltage suppressor
MO: M plug connector Without connector	With light/ surge voltage suppressor

Note) LO and MO valves are used for F, P, Tkits. The plug connector and lead wire are attached to the manifold.

Cylinder port

Symbol	Port size
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil: Non-locking push type (Tool required)

B: Locking type (Tool required) Available to single/3 position

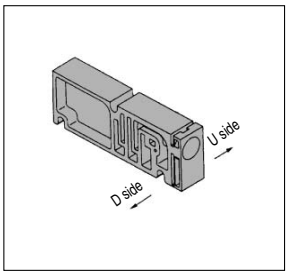
Note) Except double (latching) type is push type only though, it can keep the switching position. (Refer to page 2-4-66.)

VQC
SQ
VQ0
VQ4
VQ5
VQZ
VQD

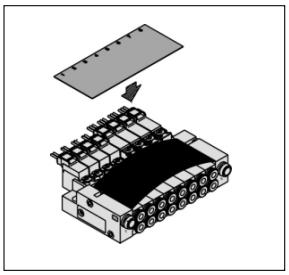
Manifold Option

P. 2-4-59

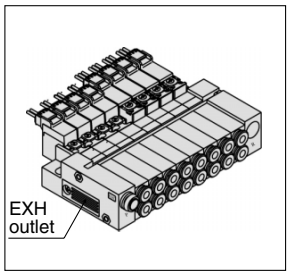
Blanking plate assembly
VVQ0000-10A-4



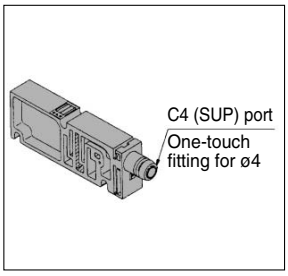
Name plate [-N4]
VVQ0000-N4-Station (1 to Max. stations)



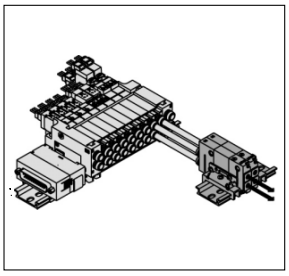
Built-in silencer, Direct exhaust [-S]



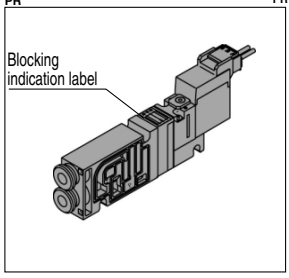
Individual SUP spacer
VVQ0000-P-4-C4



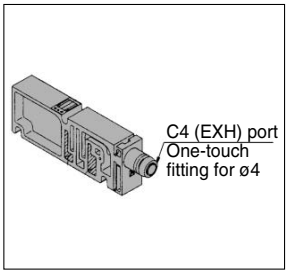
Double Check block
VQ1000-FPG-□□



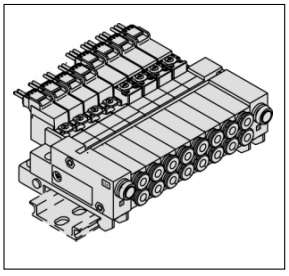
P, R, PR Block valve VQ0[1,2]4[0,1]-□-□□-P, R, PR



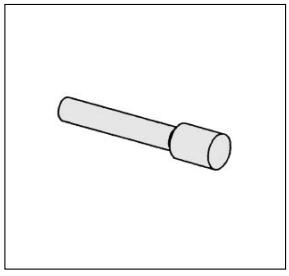
Individual EXH spacer
VVQ0000-R-4-C4



DIN rail mounting bracket
VVQ0000-57A-4

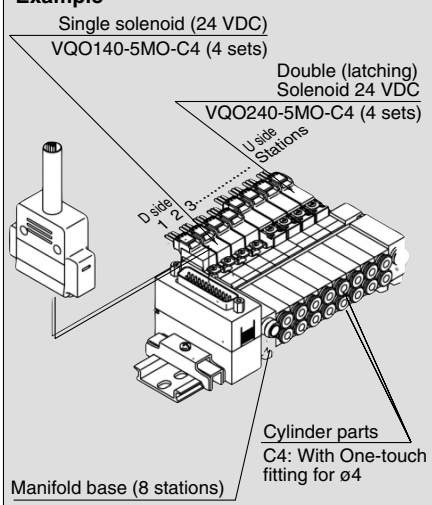


Blanking plug KQ2P-[23,04,06]



How to Order Manifold Assembly

Example



VV5Q04-08FU2-D ····· 1 set (F kit 8 station manifold base no.)
∗VQ0140-5MO-C4 ····· 4 sets (Single solenoid part no.)
∗VQ0240-5MO-C4 ····· 4 sets (Double solenoid part no.)
→ The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

Please indicate manifold base type, corresponding valve, and option parts. When entry of part numbers becomes complicated, indicate on the manifold specification sheet.

• For replacement parts, refer to page 2-4-105.

Series VQ1000

Body Ported

Plug Lead Unit: Flip Type

How to Order Manifold

VV5Q 1 4 — 08 F S1 — D

Series

1	VQ1000

Manifold

4	Plug lead unit/Flip

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit. (Refer to the table below.)

Simple specials are available with SMC Simple Specials System. For details about applicable models, please contact SMC.

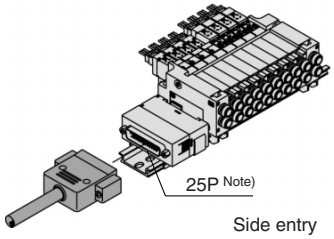
Option

Nil	None (C kit only)
D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S (4)	Built-in silencer, direct exhaust

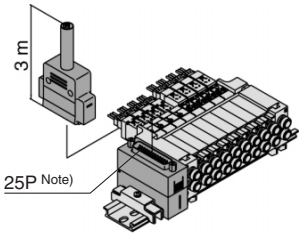
Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -DNS
Note 2) F, P, T, and S kits are DIN rail mounting styles, so include suffix -D.
Note 3) Specify the wiring specifications in the manifold specification sheet. (Except C kit)
Note 4) F, P, T and S kits are provided with an exhaust on one side, while C kits are with an exhaust on both sides.

Kit/Electrical entry/Cable length

F kit (D-sub connector)



Side entry

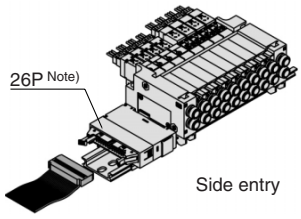


Top entry

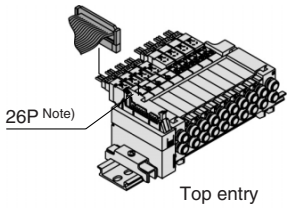
Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

P. 2-4-38

P kit (Flat ribbon cable connector)



Side entry

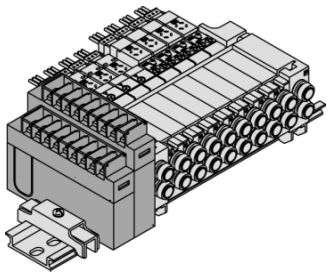


Top entry

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

P. 2-4-42

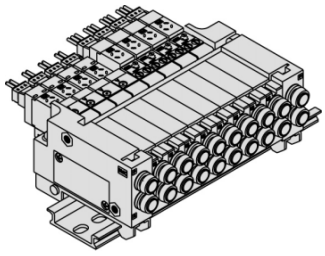
T kit (Terminal block)



P. 2-4-46

Kit T			
	1	No. of terminals: 8, 1 row	Applicable stations 1 to 8
	2	No. of terminals: 16, 2 rows	Applicable stations 5 to 16

C kit (Connector)

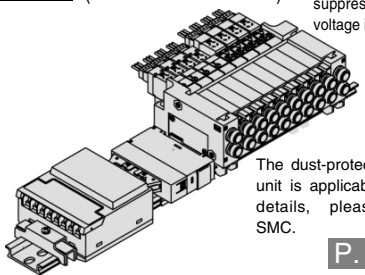


P. 2-4-50

C	Connector kit	Max. 16

S kit (Serial transmission unit)

The valve is equipped with an indicator light/surge voltage suppressor and the voltage is 24 VDC.



The dust-protected type SI unit is applicable, too. For details, please contact SMC.

P. 2-4-54

Kit S (3)			
	0	Without SI unit	Max. 16 (2) stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	H	NKE Corp.: Uni-wire H System	

Note 1) Besides the above, F and P kits with different number of pins are available. For details, refer to page 2-4-68.
Note 2) See page 2-4-69 for details.
Note 3) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation; Fuji Electric Co., Ltd.; OMRON Corporation.

How to Order Valves

VQ 1 | 1 | 4 | 0 | Y | 5 | L | | C6

Series

1	VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) L type plug connector is used for 3 position AS.

Coil voltage

1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) The C kit is applicable to 200/220 VAC.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.
Note 2) Except double (latching).

Seal

0	Metal seal
1	Rubber seal

For negative common specifications, refer to "Option" on page 2-4-69.
Connector assembly will be required when the F, P, T, S kits add a valve.
For part nos., refer to "Option" on page 2-4-69.

Electrical entry

	VQ1000
G: Grommet C kit single only. (Except AC.)	
L: L plug connector With lead wire	With light/ surge voltage suppressor
LO: L plug connector Without connector	With light/ surge voltage suppressor
M: M plug connector With lead wire	With light/ surge voltage suppressor
MO: M plug connector Without connector	With light/ surge voltage suppressor

Note) LO and MO valves are used for F, P, Tand S kits. The plug connector and lead wire are attached to the manifold.

Cylinder port

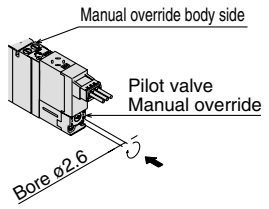
Symbol	Port size
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil: Non-locking push type (Tool required) | B: Locking type (Tool required) | C: Locking type (Manual)

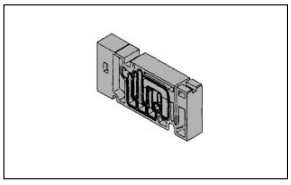
Note) A manual override for pilot valve is provided to the standard model for double type.



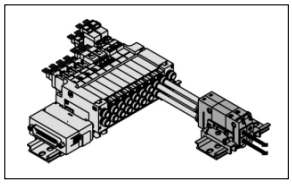
Manifold Option

P. 2-4-59

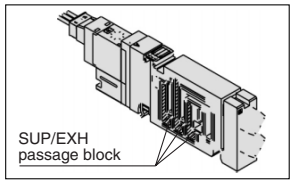
Blanking plate assembly
VVQ1000-10A-4



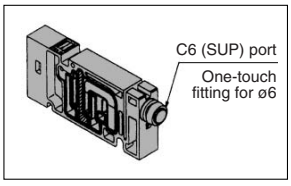
Double check block
VQ1000-FPG-□□



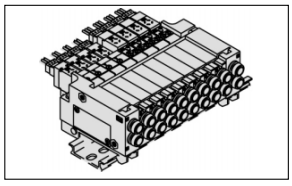
P, R, PR Block valve VQ1$^{1}_{2}$4$^{0}_{1}$-□-□□-P, R, PR



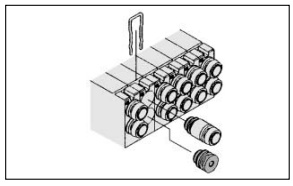
Individual SUP spacer
VVQ1000-P-4-C6



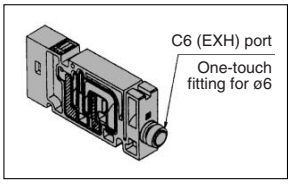
DIN rail mounting bracket
VVQ1000-57A-4



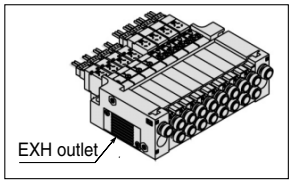
Port plug
VVQ0000-58A



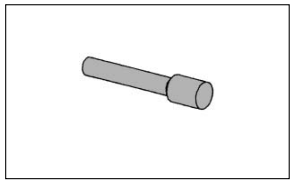
Individual EXH spacer
VVQ1000-R-4-C6



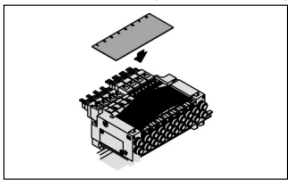
Built-in silencer, direct exhaust [-S]



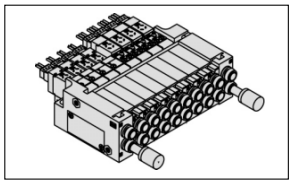
Blanking plug **KQ2P-** 23 04 06



Name plate [-N4]
VVQ1000-N4-Station (1 to Max. stations)

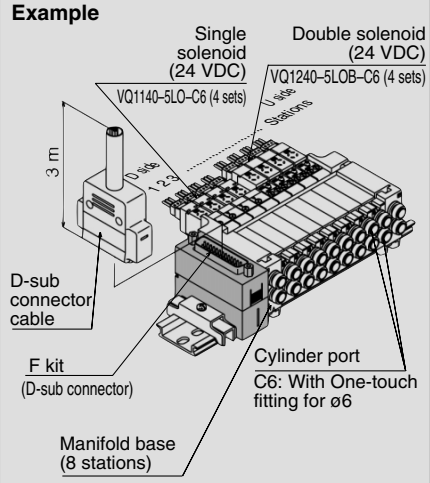


Silencer (For EXH port)
AN103-X233



How to Order Manifold Assembly

Example



VV5Q14-08FU2-D ···· 1 set (F kit 8 station manifold base no.)
∗VQ1140-5LO-C6 ···· 4 sets (Single solenoid part no.)
∗VQ1240-5LOB-C6 ···· 4 sets (Double solenoid part no.)
The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

Please indicate manifold base type, corresponding valve, and option parts. When entry of part numbers becomes complicated, indicate on the manifold specification sheet.

• For replacement parts, refer to page 2-4-107.

Series VQ2000
Body Ported
Plug Lead Unit: Flip Type

How to Order Manifold

VV5Q 2 4 — 08 F S1 — D

Series

2	VQ2000

Manifold

4	Plug lead unit/Flip

Simple specials are available with SMC Simple Specials System. For details about applicable models, please contact SMC.

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit. (Refer to the table below.)

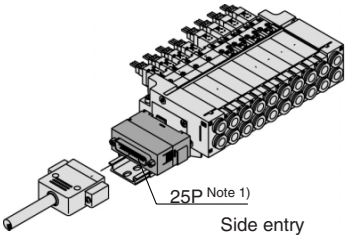
Option

Nil	None (C kit only)
D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S (4)	Built-in silencer, direct exhaust

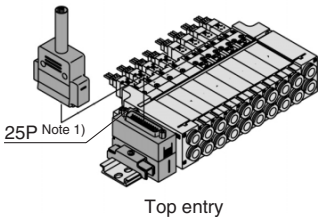
Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -DNS
Note 2) F, P, T, and S kits are of DIN rail include suffix -D
Note 3) Specify the wiring specifications in the manifold specification sheet. (Except C kit)
Note 4) F, P, T and S kits are provided with an exhaust on one side, while C kits are with an exhaust on both sides.

Kit/Electrical entry/Cable length

F kit (D-sub connector)



Side entry

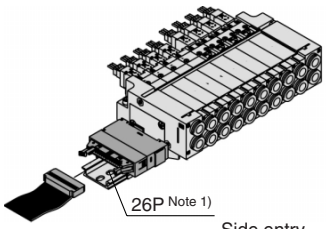


Top entry

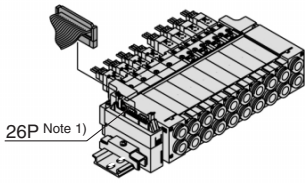
Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

P. 2-4-38

P kit (Flat ribbon cable connector)



Side entry

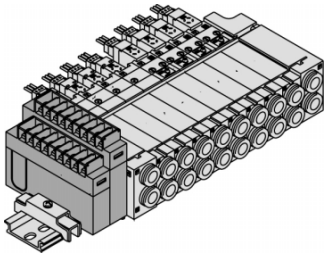


Top entry

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

P. 2-4-42

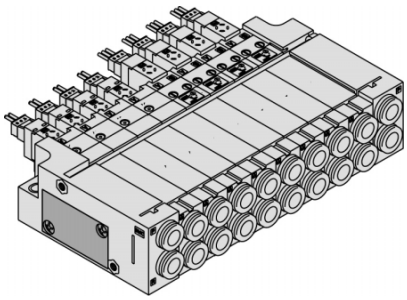
T kit (Terminal block)



P. 2-4-46

Kit T			
1	No. of terminals: 8, 1 row	Applicable stations 1 to 8	
2	No. of terminals: 16, 2 rows	Applicable stations 5 to 16	

C kit (Connector)

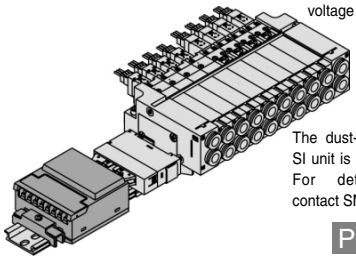


P. 2-4-50

C	Connector kit	Max. 16

S kit (Serial transmission unit)

The valve is equipped with an indicator light/surge voltage suppressor and the voltage is 24 VDC.



The dust-protected type SI unit is applicable, too. For details, please contact SMC.

P. 2-4-54

Kit S (3)			
	0	Without SI unit	(2) Max. 16 stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	H	NKE Corp.: Uni-wire H System	

Note 1) Besides the above, F and P kits with different number of pins are available. For details, refer to page 2-4-68.
Note 2) See page 2-4-69 for details.
Note 3) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation; Fuji Electric Co., Ltd.; OMRON Corporation.

How to Order Valves

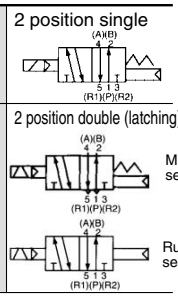
VQ 2 1 4 0 Y 5 L C6

Series

2	VQ2000

Type of actuation

1	2 position single
2	2 position double (latching)



Seal

0	Metal seal
1	Rubber seal

Coil voltage

1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) The C kits is applicable to 200/220 VAC.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.
Note 2) Except double (latching).

Note 1) For negative common specifications, refer to "Option" on page 2-4-69.
Note 2) Connector assembly will be required when the F, P, T, S kits add a valve.
For part nos., refer to "Option" on page 2-4-69.

Electrical entry

	VQ2000
G: Grommet C kit single only. (Except AC)	
L: L plug connector With lead wire	With light/ surge voltage suppressor
LO: L plug connector Without connector	With light/ surge voltage suppressor
M: M plug connector With lead wire	With light/ surge voltage suppressor
MO: M plug connector Without connector	With light/ surge voltage suppressor

Note) LO and MO valves are used for F, P, T, and S kits. The plug connector and lead wire are attached to the manifold.

Cylinder port

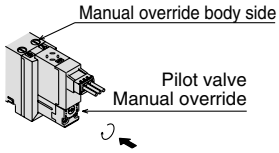
Symbol	Port size
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
C8	With One-touch fitting for ø8

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil: Non-locking push type (Tool required)	B: Locking type (Tool required)	C: Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

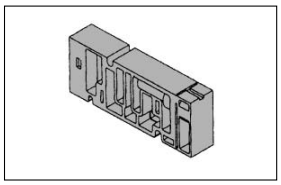


VQC
SQ
VQ0
VQ4
VQ5
VQZ
VQD

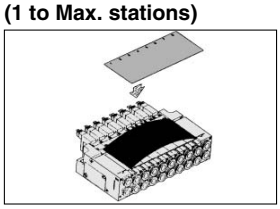
Manifold Option

P. 2-4-59

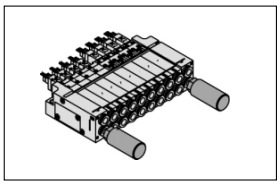
Blanking plate assembly
VVQ2000-10A-4



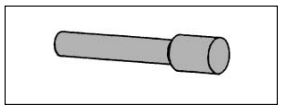
Name plate [-N4]
VVQ2000-N4-Station
(1 to Max. stations)



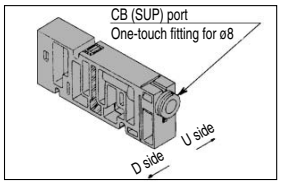
Silencer (For EXH port)
AN200-KM8



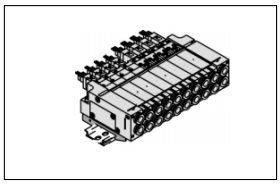
Blanking plug **KQ2P-$^{06}_{08}$**



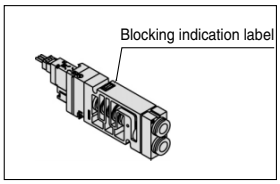
Individual SUP spacer
VVQ2000-P-4-C8



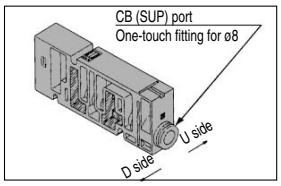
DIN rail mounting bracket
VVQ2000-57A-4



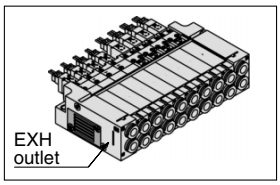
P R PR Block valve VQ2$^{1}_{2}$4$^{0}_{1}$-□-□□- P R PR



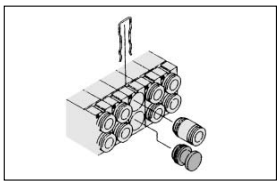
Individual EXH spacer
VVQ2000-R-4-C8



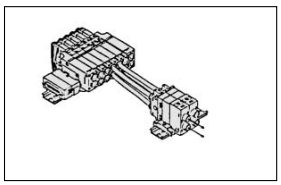
Built-in silencer,
direct exhaust [-S]



Port plug
VVQ1000-58A

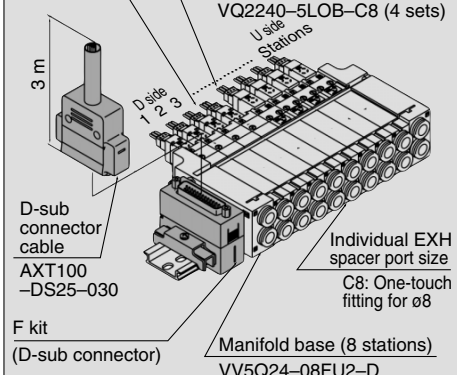


Double check block
VQ2000-FPG-□□



How to Order Manifold Assembly

Example Single solenoid (24 VDC)
VQ2140–5LO–C8 (4 sets)
Double solenoid (24 VDC)
VQ2240–5LOB–C8 (4 sets)



VV5Q24-08FU2-D ··· 1 set (F kit 8 station manifold base no.)
*VQ2140-5LO-C6 ··· 4 sets (Single solenoid part no.)
*VQ2240-5LOB-C6 ··· 4 sets (Double solenoid part no.)
The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

Please indicate manifold base type, corresponding valve, and option parts. When entry of part numbers becomes complicated, indicate on the manifold specification sheet.

• For replacement parts, refer to page 2-4-109.

Series VQ0000/1000/2000
Body Ported
Plug Lead Unit: Flip Type

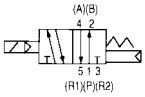
Model

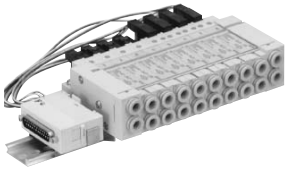
Series	Number of solenoids		Model		Flow characteristics						Response time [2] (ms)			Weight (g)
					1 → 4/2 (P → A/B)			4/2 → 5/3 (A/B → R1/R2)			Standard: 1 W H: 1.5 W	Low wattage: 0.5 W	AC	
					C [dm³/(s·bar)]	b	Cv	C [dm³/(s·bar)]	b	Cv				
VQ0000	2 position	Single	Metal seal	VQ0140	0.43	0.20	0.10	0.50	0.19	0.12	12 or less	15 or less	29 or less	57
			Rubber seal	VQ0141	0.49	0.34	0.13	0.59	0.19	0.14	15 or less	20 or less	34 or less	
		Double (Latching)	Metal seal	VQ0240	0.43	0.20	0.10	0.50	0.19	0.12	12 or less	15 or less	29 or less	
			Rubber seal	VQ0241	0.49	0.34	0.13	0.59	0.19	0.14	15 or less	20 or less	34 or less	
	3 position	Closed center	Metal seal	VQ0340	0.34	0.12	0.08	0.36	0.38	0.10	20 or less	26 or less	40 or less	105
			Rubber seal	VQ0341	0.37	0.25	0.09	0.42	0.45	0.12	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ0440	0.36	0.21	0.09	0.48	0.18	0.12	20 or less	26 or less	40 or less	
			Rubber seal	VQ0441	0.37	0.31	0.11	0.59	0.24	0.14	25 or less	33 or less	47 or less	
VQ1000	2 position	Single	Metal seal	VQ1140	0.77	0.14	0.18	0.84	0.14	0.19	12 or less	15 or less	29 or less	57
			Rubber seal	VQ1141	0.91	0.19	0.21	1.0	0.21	0.25	15 or less	20 or less	34 or less	
		Double (Latching)	Metal seal	VQ1240	0.77	0.14	0.18	0.84	0.14	0.19	12 or less	15 or less	29 or less	
			Rubber seal	VQ1241	0.91	0.19	0.21	1.0	0.21	0.25	15 or less	20 or less	34 or less	
	3 position	Closed center	Metal seal	VQ1340	0.67	0.13	0.16	0.73	0.13	0.17	20 or less	26 or less	40 or less	72
			Rubber seal	VQ1341	0.78	0.22	0.18	0.84	0.21	0.20	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ1440	0.74	0.14	0.17	0.84	0.16	0.20	20 or less	26 or less	40 or less	
			Rubber seal	VQ1441	0.78	0.28	0.19	1.0	0.21	0.24	25 or less	33 or less	47 or less	
		Pressure center	Metal seal	VQ1540	0.74	0.14	0.17	0.82	0.18	0.20	20 or less	26 or less	40 or less	
			Rubber seal	VQ1541	0.80	0.28	0.19	0.84	0.21	0.22	25 or less	33 or less	47 or less	
VQ2000	2 position	Single	Metal seal	VQ2140	2.0	0.13	0.43	2.3	0.15	0.58	22 or less	29 or less	49 or less	103
			Rubber seal	VQ2141	2.3	0.21	0.54	2.7	0.25	0.62	24 or less	31 or less	51 or less	
		Double (Latching)	Metal seal	VQ2240	2.0	0.13	0.43	2.3	0.15	0.58	22 or less	29 or less	49 or less	
			Rubber seal	VQ2241	2.3	0.21	0.54	2.7	0.25	0.62	24 or less	31 or less	51 or less	

Note 1) Cylinder port size C4: (VQ0000), C6: (VQ1000), C8: (VQ2000)
Note 2) As per JIS B 8375-1981 (Supply pressure: 0.5 MPa; with indicator ligh/surge voltage suppressor; clean air) Subject to the pressure and air quality.

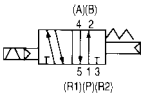
JIS Symbol

2 position single

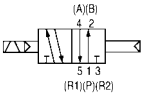




2 position double (Latching)

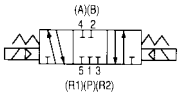


Metal seal

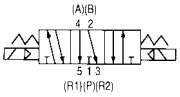


Rubber seal

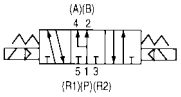
3 position closed center



3 position exhaust center



3 position pressure center



Standard Specifications

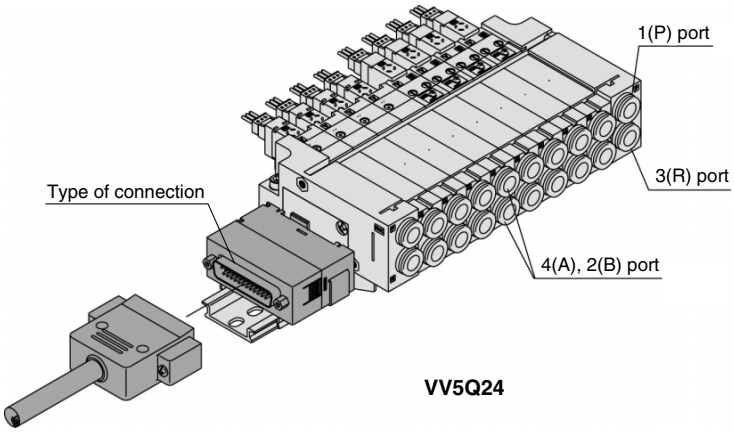
			Metal seal	Rubber seal
Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure		0.7 MPa (High pressure type: 0.8 MPa) [3]	
	Min. operating pressure	Single	0.1 MPa	0.15 MPa
		Double (Latching)	0.1 MPa	0.15 MPa
		3 position	0.15 MPa	0.2 MPa
	Ambient and fluid temperature		−10 to 50°C [1]	
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required, Manual type) Option	
	Impact resistance/Vibration resistance [2]		150/30 m/s²	
	Enclosure		Dust-protected	
Solenoid	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA) [3], 0.5 W DC (21 mA) [4]	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA) [3], 0.5 W DC (42 mA) [4]	
		100 VAC	Inrush 0.5 VA (5 mA), Holding 0.5 VA (5 mA)	
		110 VAC	Inrush 0.55 VA (5 mA), Holding 0.55 VA (5 mA)	
		200 VAC	Inrush 1.0 VA(5 mA), Holding 1.0 VA (5 mA)	
		220 VAC	Inrush 1.1 VA (5 mA), Holding 1.1 VA (5 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Values in the case of high pressure type (1.5 W) specifications.
Note 4) Values in the case of low wattage type (0.5 W) specifications.

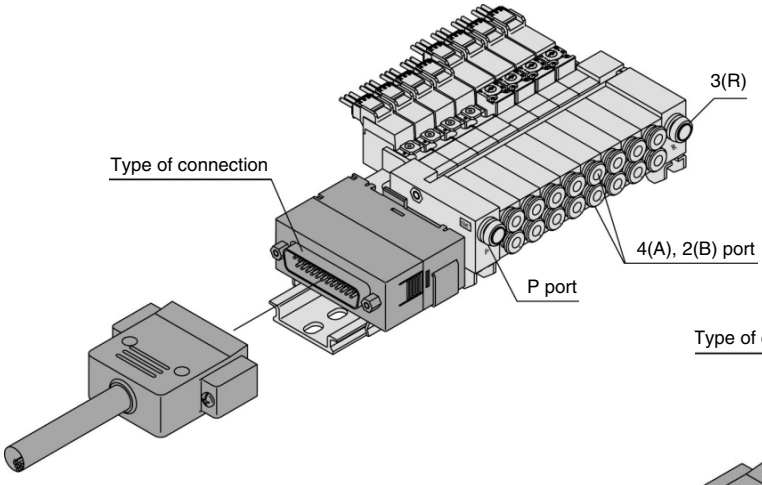
Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Applicable stations (2)	Applicable solenoid valve	5 station weight (g)
			Port location	Port size (1)				
				1(P), 3(R)	4(A), 2(B)			
VQ0000	**VV5Q04-□□□**	■ F kit–D-sub connector ■ P kit–Flat cable connector ■ T kit–Terminal block ■ C kit–Individual connector ■ S kit–Serial transmission unit	Side	C6 (ø6) Option Built-in silencer, direct exhaust	C3 (ø3.2) C4 (ø4) M5 (M5 thread)	1 to 16 stations	VQ0□40 VQ0□41	225
VQ1000	**VV5Q14-□□□**	■ F kit–D-sub connector ■ P kit–Flat cable connector ■ T kit–Terminal block ■ C kit–Individual connector ■ S kit–Serial transmission unit	Side	C6 (ø6) Option Built-in silencer, direct exhaust	C3 (ø3.2) C4 (ø4) C6 (ø6) M5 (M5 thread)		VQ1□40 VQ1□41	380
VQ2000	**VV5Q24-□□□**	■ F kit–D-sub connector ■ P kit–Flat cable connector ■ T kit–Terminal block ■ C kit–Individual connector ■ S kit–Serial transmission unit	Side	C8 (ø8) Option Built-in silencer, direct exhaust	C4 (ø4) C6 (ø6) C8 (ø8)		VQ2□40 VQ2□41	671

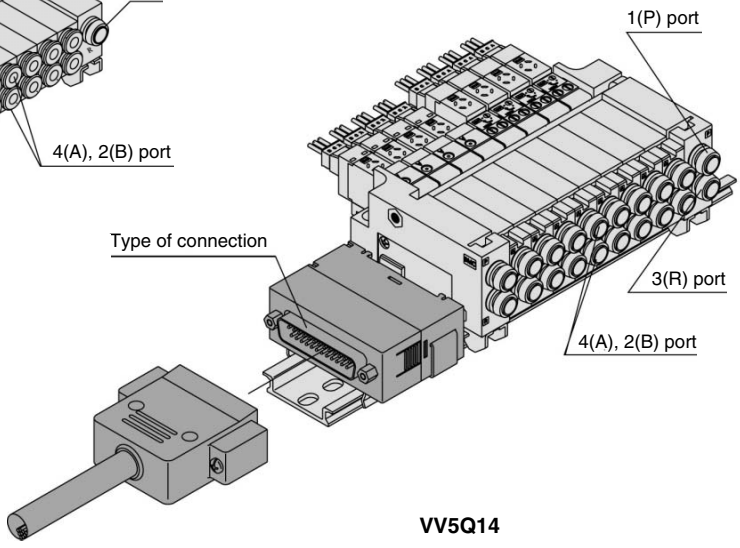
Note 1) Inch-size One-touch fittings are also available. For details, refer to page 2-4-69.
Note 2) See page 2-4-69 for details.



VV5Q24

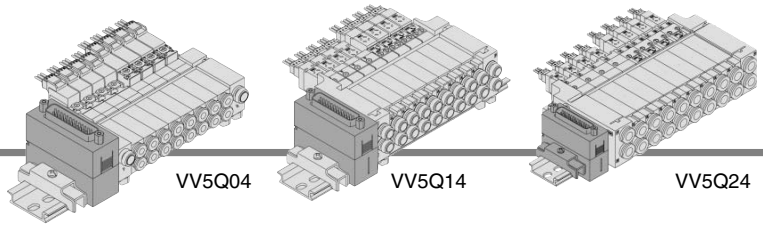


VV5Q04



VV5Q14

F VQ0000/1000/2000 Kit (D-sub connector)



- The D-sub connector reduces installation labor for electrical connections.
- Using the D-sub connector (25P), (15P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

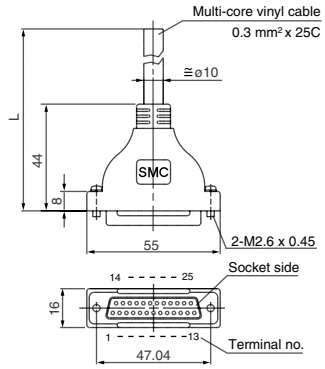
Manifold Specifications VV5Q14

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max. 16 stations
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C8	C4, C6, C8	Max. 16 stations

D-sub Connector (25 pins)

AXT100-DS25- 015 / 030 / 050

The D-sub connector cable assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.



D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25 core x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

∗ For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Connector manufacturers' example
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Insulation resistance V, 1 min, AC	1000
Insulation resistance MΩ/km, 20°C	5 or more

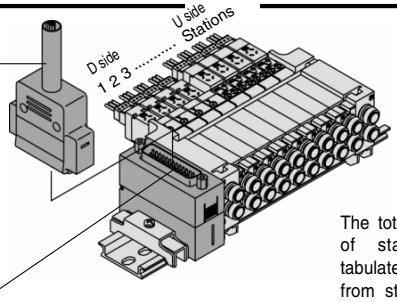
Note) The minimum bending radius of D-sub cable assembly is 20 mm.

Wire Color by Terminal No. of D-sub Connector Cable Assembly

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

Note) Types with 15 pin are also available. For details, refer to page 2-4-68.

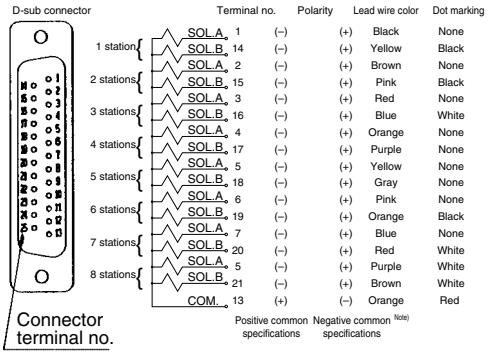
Cable assembly



The total number of stations is tabulated starting from station one on the D side.

Electrical wiring specifications

D-sub cable assembly AXT100-DS25- 015 / 030 / 050
Wire color



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-69.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-69.)

How to Order Manifold

VV5Q 1 4 – 08 F S 1 – D

Series

0	VQ0000
1	VQ1000
2	VQ2000

Manifold

4	Plug lead unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-69.

Connector entry direction

U	Top entry
S	Side entry

Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Option

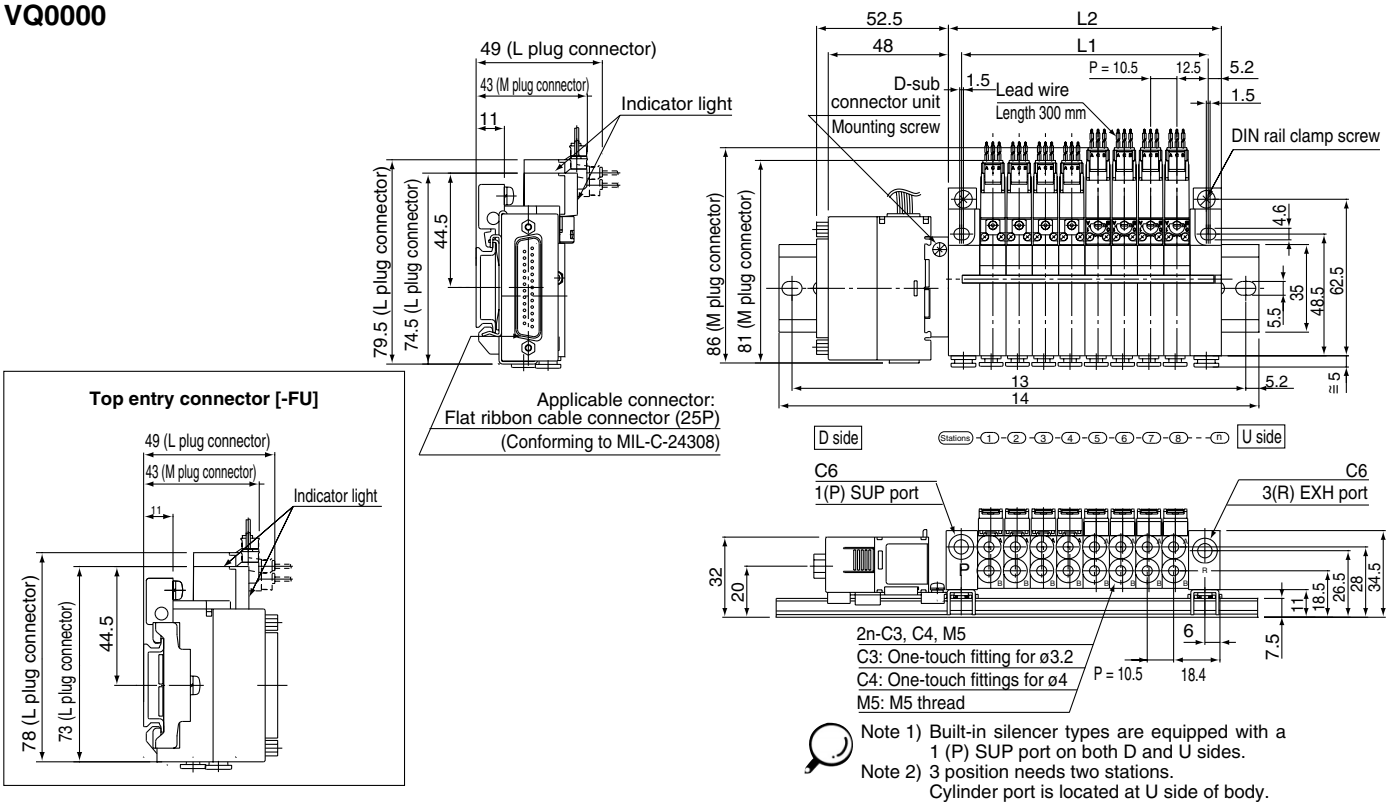
D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -DNS

Note 2) F kits are DIN rail mounting styles, include suffix -D.

Note 3) Specify the wiring specifications on the manifold specification sheet.

VQ0000



Note 1) Built-in silencer types are equipped with a 1 (P) SUP port on both D and U sides.
Note 2) 3 position needs two stations. Cylinder port is located at U side of body.

Dimensions: Side Entry Connector [-FS]

Formula L1 = 10.5n + 14.5, L2 = 10.5n + 25 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	25	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5
L2	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5	193
L3	112.5	125	137.5	150	150	162.5	175	187.5	200	212.5	212.5	225	237.5	250	262.5	275
L4	123	135.5	148	160.5	160.5	173	185.5	198	210.5	223	223	235.5	248	260.5	273	285.5

Dimensions: Top Entry Connector [-FU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	100	100	112.5	125	137.5	150	162.5	162.5	175	187.5	200	212.5	225	237.5	237.5	250
L4	110.5	110.5	123	135.5	148	160.5	173	173	185.5	198	210.5	223	235.5	248	248	260.5

How to Order Valves

VQ 1 1 4 0 Y – 5 LO [ ] – C6

Series

0	VQ0000
1	VQ1000
2	VQ2000

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.
Note 2) Except double (latching).

Type of actuation

		VQ0000	VQ1000	VQ2000
1	2 position single	●	●	●
2	2 position double (Latching)	●	●	●
3	3 position closed center	● (1)	● (2)	—
4	3 position exhaust center	● (1)	● (2)	—
5	3 position pressure center	—	● (2)	—

Note 1) (2 stations space are occupied.)
Note 2) L plug connector is used for AC.

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Cylinder port

Symbol	Port size	VQ0000	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	●	—
C4	With One-touch fitting for ø4	●	●	●
C6	With One-touch fitting for ø6	—	●	●
C8	With One-touch fitting for ø8	—	—	●
M5	M5 thread	●	●	—

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note 1) All double latching valves of VQ0000 are non-locking push type. (Refer to page 2-4-66.)
Note 2) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

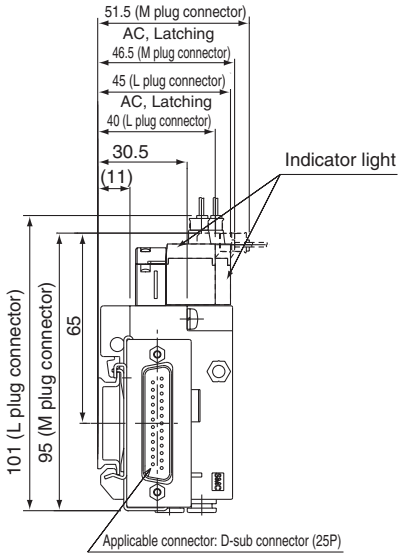
Note) Plug connector and lead wire layers are attached to the manifold.

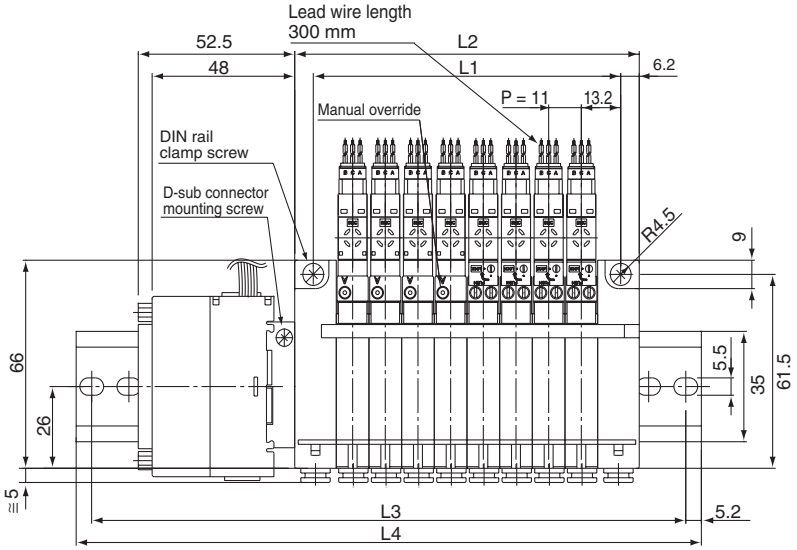
Note 1) For negative common specifications, refer to "Option" on page 2-4-69.
Note 2) Connector assembly will be required when the F kits add a valve. For part nos., refer to "Option" on page 2-4-69.

How to Order Manifold Assembly

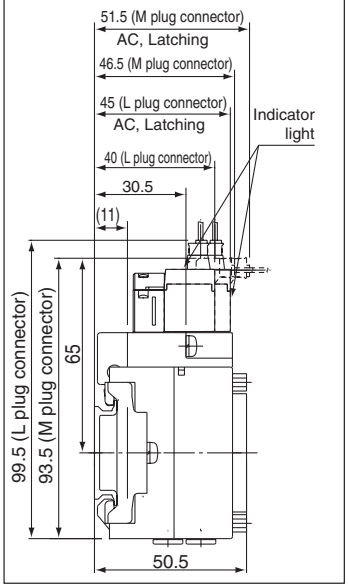
Specify the part numbers for valves and options together beneath the manifold base part number.

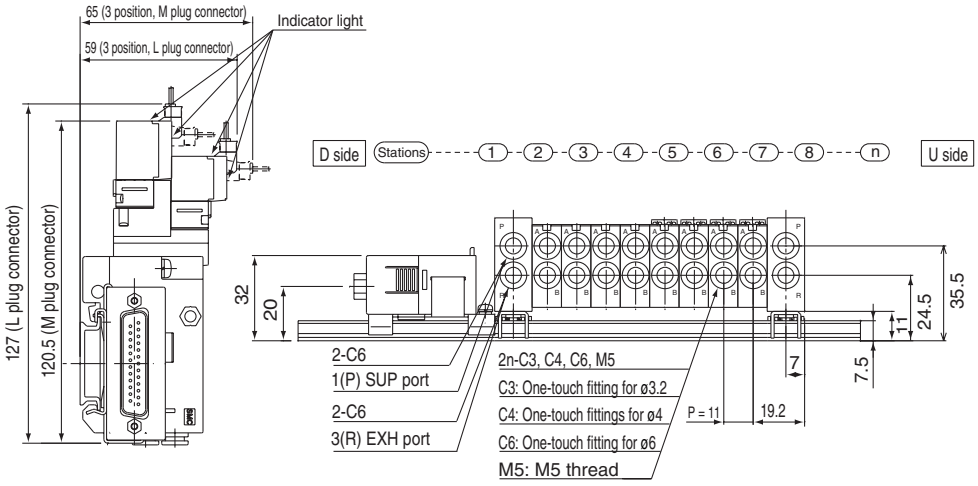
VQ1000





Top entry connector [-FU]





3 position

Dimensions: Side Entry Connector [-FS]

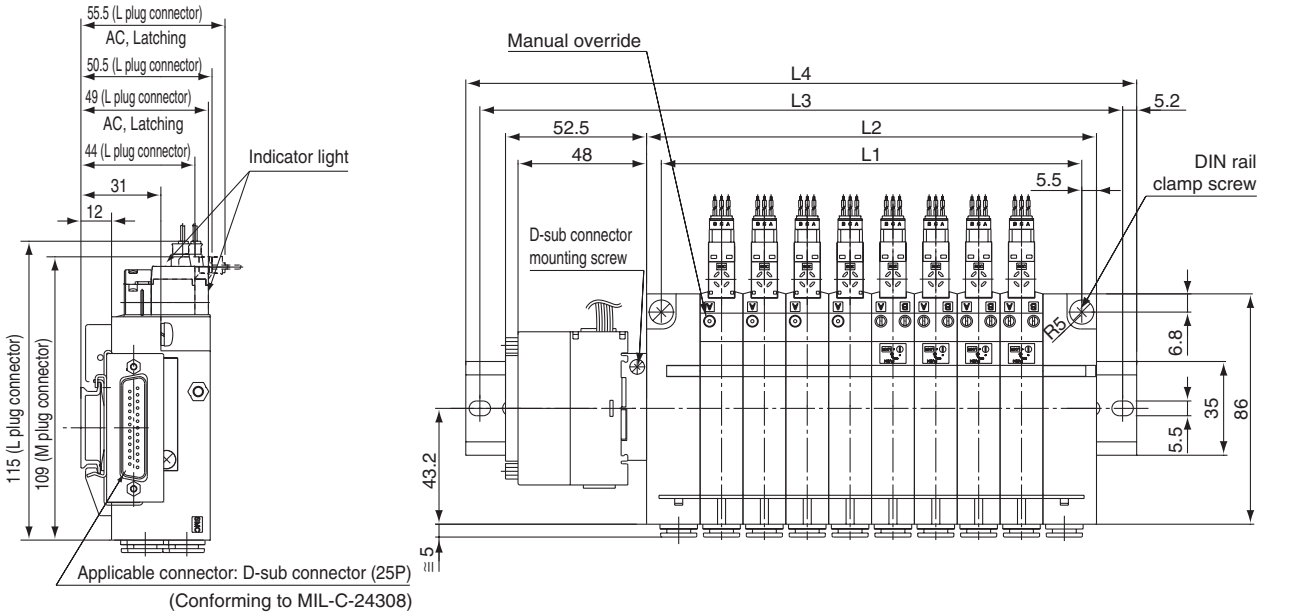
Formula $\frac{L1 = 11n + 15.5}{L2 = 11n + 28}$ n: Stations (Maximum 16 stations)

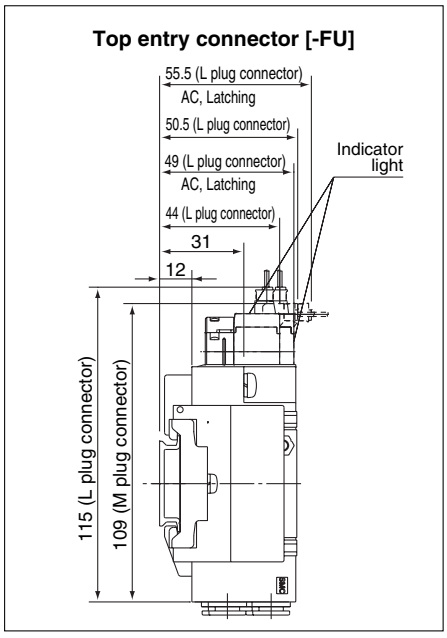
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	204
L3	112.5	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	262.5	275	287.5
L4	123	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	273	285.5	298

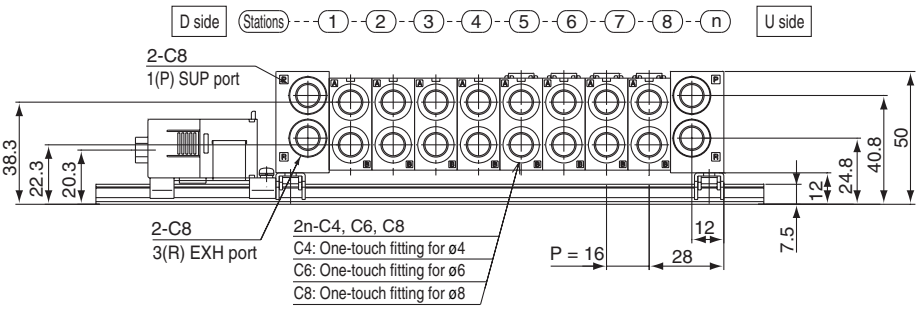
Dimensions: Top Entry Connector [-FU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	100	112.5	125	137.5	137.5	150	162.5	175	187.5	200	212.5	225	225	237.5	250	262.5
L4	110.5	123	135.5	148	148	160.5	173	185.5	198	210.5	223	235.5	235.5	248	260.5	273

VQ2000







Dimensions: Side Entry Connector [-FS]

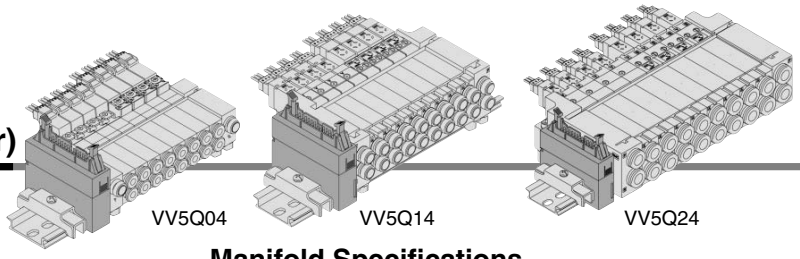
Formula L1 = 16n + 29, L2 = 16n + 40 n: Stations (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
L2	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296
L3	137.5	150	162.5	187.5	200	212.5	225	250	262.5	275	300	312.5	325	337.5	362.5	375
L4	148	160.5	173	198	210.5	223	235.5	260.5	273	285.5	310.5	323	335.5	348	373	385.5

Dimensions: Top Entry Connector [-FU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	112.5	137.5	150	162.5	175	200	212.5	225	237.5	262.5	275	287.5	312.5	325	337.5	350
L4	123	148	160.5	173	185.5	210.5	223	235.5	248	273	285.5	298	323	335.5	348	360.5

P VQ0000/1000/2000 Kit (Flat ribbon cable connector)

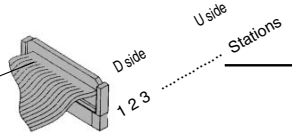


- MIL flat ribbon cable connector reduces installation labor savings for electrical connection.
- Using the connector for flat ribbon cable (26P), (10P, 16P, 20P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max. 16 stations
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C8	C4, C6, C8	Max. 16 stations

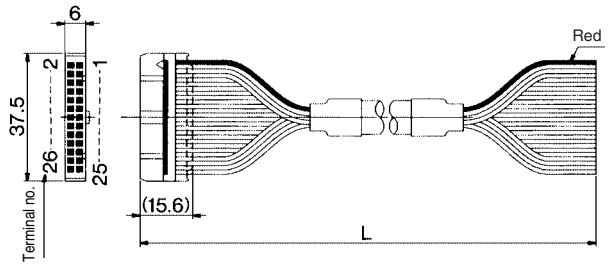
Flat Ribbon Cable (26 pins)



Cable assembly

AXT100-FC26-1 to 3

(Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.)



Flat Ribbon Cable Connector Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC26-1	Cable 26 core x 28AWG
3 m	AXT100-FC26-2	
5 m	AXT100-FC26-3	

∗ For other commercial connectors, use a 26 pins type with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

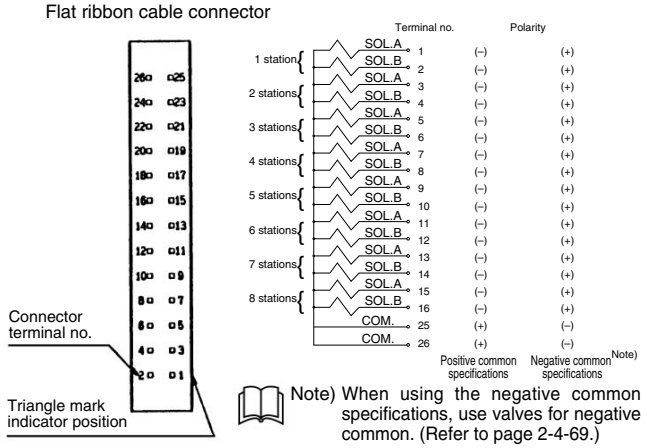
- Hirose Electric Co., Ltd.
- Sumitomo 3M Limited
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Oki Electric Cable Co., Ltd.

Note) Types with 10, 16, or 20 pin are also available. For details, refer to page 2-4-69.

VV5Q14

The total number of stations is tabulated starting from station one on the D side.

Electrical wiring specifications



Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-69.)

As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-69.

How to Order Manifold

VV5Q 1 4 – 08 P S 1 – D

Series

0	VQ0000
1	VQ1000
2	VQ2000

Manifold

4	Plug lead unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-69.

Connector entry direction

U	Top entry
S	Side entry

Cable (Length)

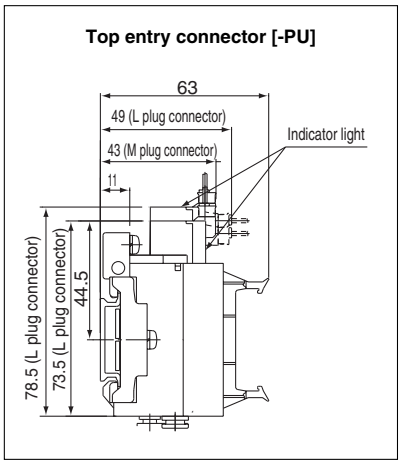
0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

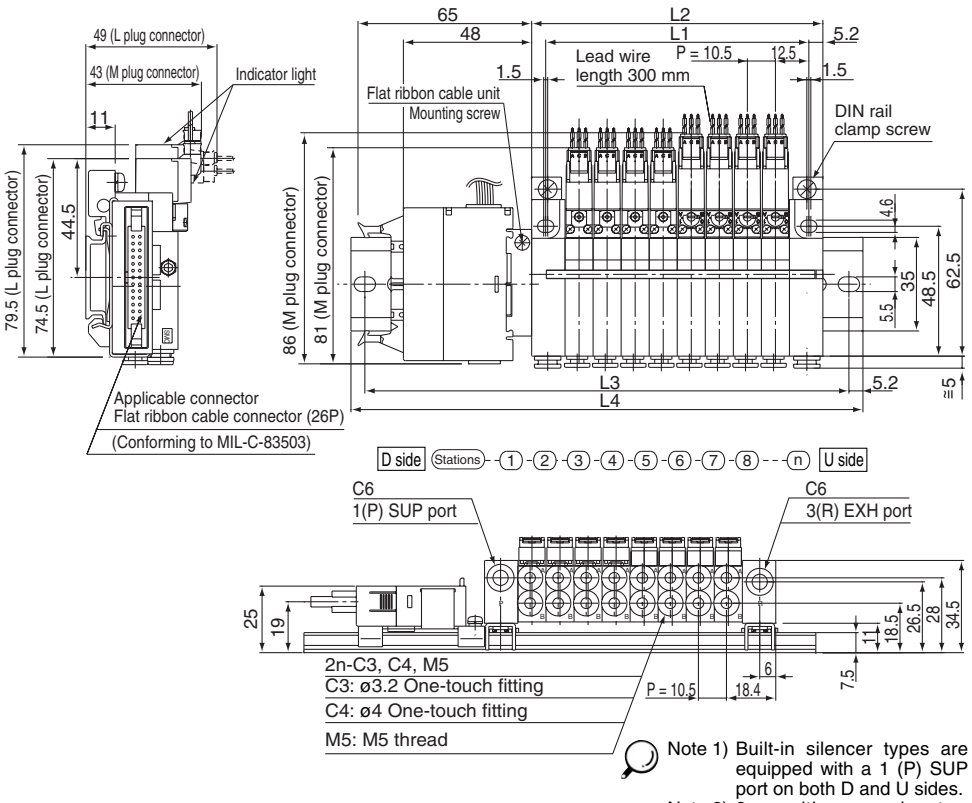
Option

D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS
Note 2) P kits are DIN rail mounting styles, so include suffix -D.
Note 3) Specify the wiring specifications on the manifold specification sheet.

VQ0000





Note 1) Built-in silencer types are equipped with a 1 (P) SUP port on both D and U sides.
Note 2) 3 position needs two stations.
Cylinder port is located at U side of body.

Dimensions: Side Entry Connector [-PS]

Formula L1 = 10.5n + 14.5 L2 = 10.5n + 25 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	25	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5
L2	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5	193
(L3)	112.5	125	137.5	150	150	162.5	175	187.5	200	212.5	212.5	225	237.5	250	262.5	275
(L4)	123	135.5	148	160.5	160.5	173	185.5	198	210.5	223	223	235.5	248	260.5	273	285.5

Dimensions: Top Entry Connector [-PU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	87.5	100	112.5	125	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250
L4	98	110.5	123	135.5	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5

How to Order Valves

VQ 1 1 4 0 Y – 5 LO [ ] – C6

Series

0	VQ0000
1	VQ1000
2	VQ2000

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.
Note 2) Except double (latching).

Type of actuation

		VQ0000	VQ1000	VQ2000
1	2 position single	●	●	●
2	2 position double (Latching)	●	●	●
3	3 position closed center	● (1)	● (2)	—
4	3 position exhaust center	● (1)	● (2)	—
5	3 position pressure center	—	● (2)	—

Note 1) (2 stations space are occupied.)
Note 2) L plug connector is used for AC.

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note 1) For negative common specifications, refer to "Option" on page 2-4-69.
Note 2) Connector assembly will be required when the P kits add a valve. For model no., refer to "Option" on page 2-4-69.

How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

Cylinder port

Symbol	Port size	VQ0000	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	●	—
C4	With One-touch fitting for ø4	●	●	●
C6	With One-touch fitting for ø6	—	●	●
C8	With One-touch fitting for ø8	—	—	●
M5	M5 thread	●	●	—

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

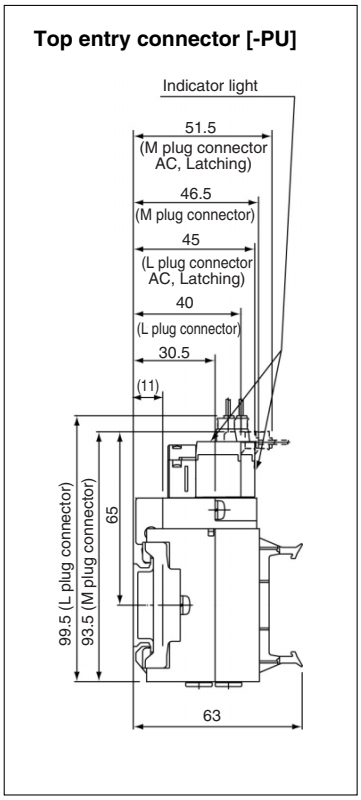
Note 1) All double latching valves of VQ0000 are non-locking push type.
Note 2) A manual override for pilot valve is provided to the standard model for double type.

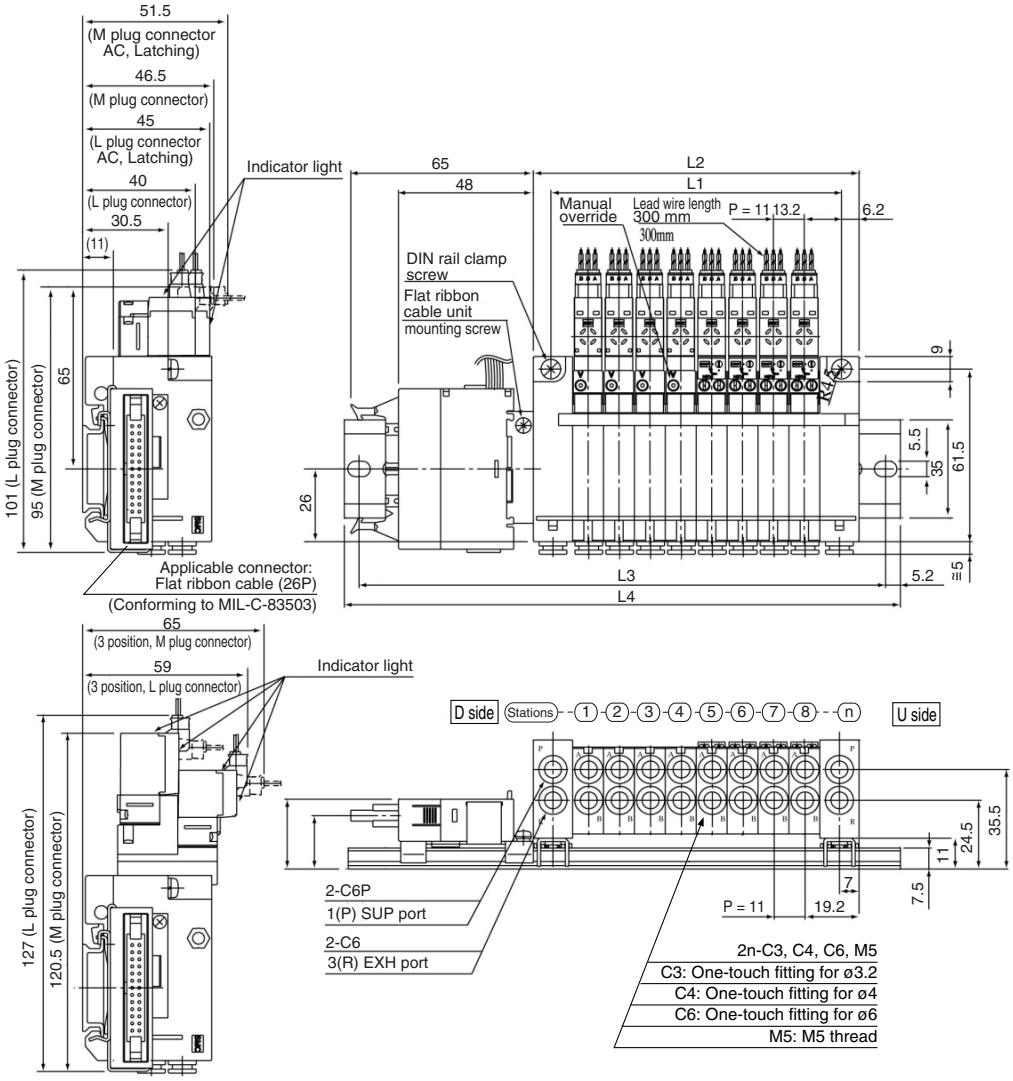
Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

Note) Plug connector and lead wire layers are attached to the manifold.

VQ1000





3 position

Dimensions: Side Entry Connector [-PS]

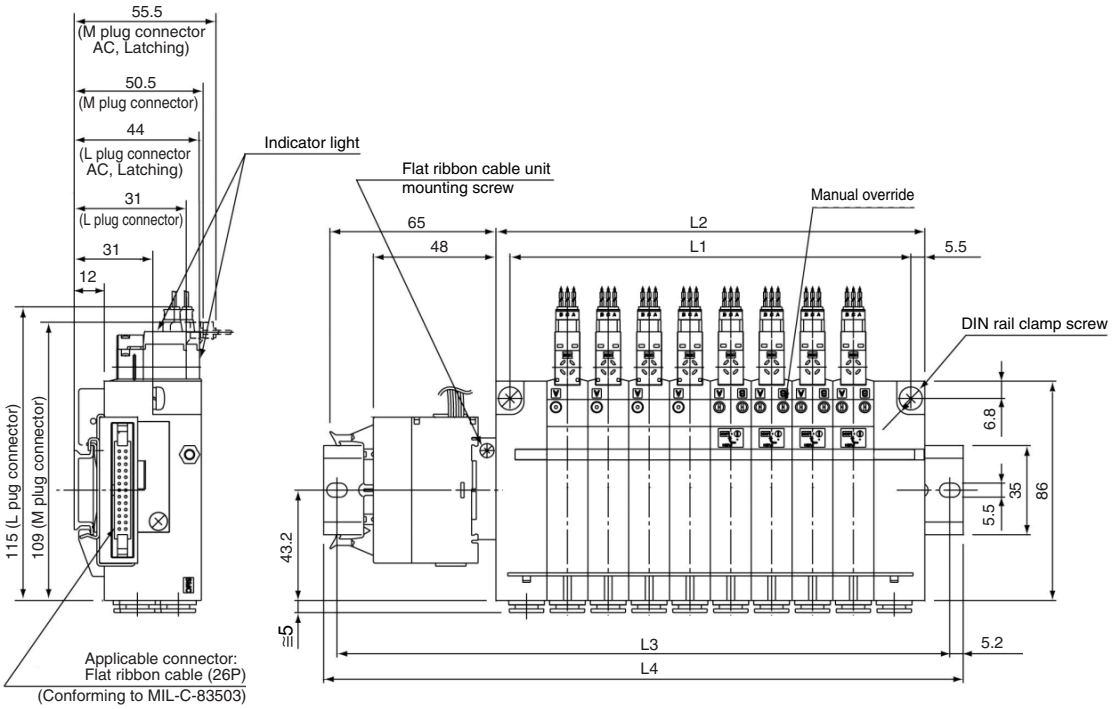
Formula L1 = 11n + 15.5, L2 = 11n + 28 n: Stations (Maximum 16 stations)

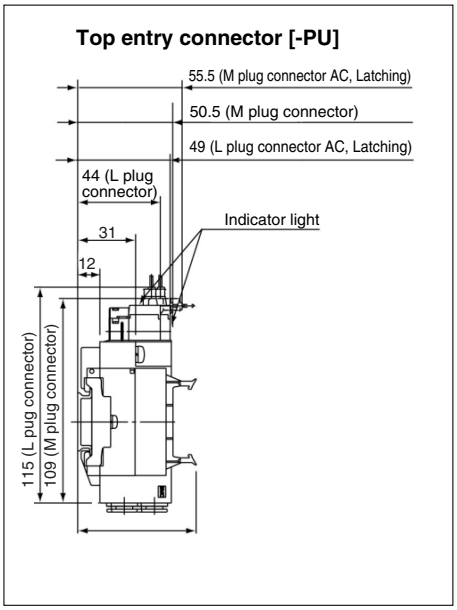
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	204
L3	112.5	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	262.5	275	287.5
L4	123	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	273	285.5	298

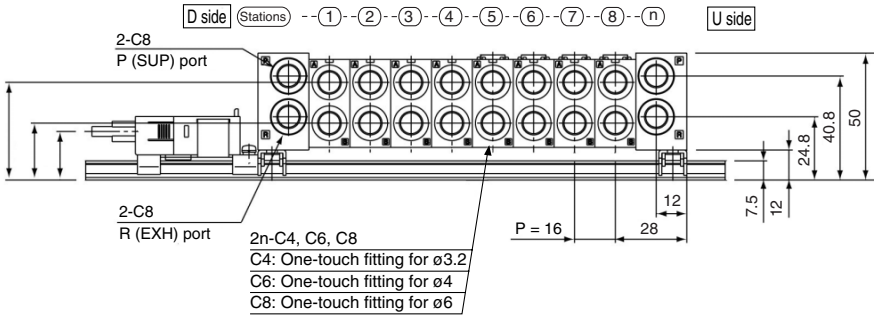
Dimensions: Top Entry Connector [-PU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	87.5	100	112.5	125	137.5	150	162.5	162.5	175	187.5	200	212.5	225	237.5	250	262.5
L4	98	110.5	123	135.5	148	160.5	173	173	185.5	198	210.5	223	235.5	248	260.5	273

VQ2000







Dimensions: Side Entry Connector [-PS]

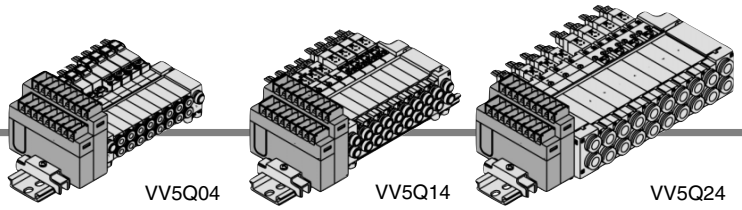
Formula L1 = 16n + 29, L2 = 16n + 40 n: Stations (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
L2	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296
L3	137.5	150	162.5	187.5	200	212.5	225	250	262.5	275	287.5	312.5	325	337.5	362.5	375
L4	148	160.5	173	198	210.5	223	235.5	260.5	273	285.5	298	323	335.5	348	373	385.5

Dimensions: Top Entry Connector [-PU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	112.5	125	137.5	162.5	175	187.5	200	225	237.5	250	262.5	287.5	300	312.5	337.5	350
L4	123	135.5	148	173	185.5	198	210.5	235.5	248	260.5	273	298	310.5	323	348	360.5

T VQ0000/1000/2000 Kit (Terminal block)

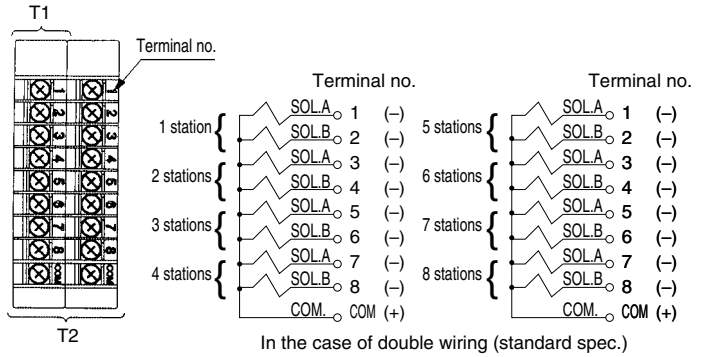


- It is a standard terminal block type.
- Two quantities of terminals can be selected in accordance with the number of stations.
  (8 terminals/16 terminals)
- Maximum stations are 16.

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max. 16 stations
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C8	C4, C6, C8	Max. 16 stations

● Electrical wiring specifications



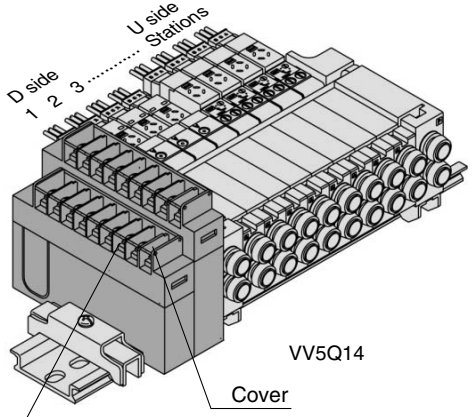
In the case of double wiring (standard spec.)
T1 (Terminal block of 1 row): 1 to 4 stations
T2 (Terminal block of 2 rows): 5 to 8 stations
T1 and T2 can be optionally chosen by adopting the combinations of single and double wiring (optional spec.), etc.

The quantity of terminal blocks used depends on the number of manifold stations.

Manifold	No. of terminals
1 to 4 stations	1 row
5 to 8 stations	2 rows

Wiring other than those above is possible. See page 2-4-69 for details.

Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. Mixed single and double wiring is available as an option.
For details, refer to page 2-4-69.



● How to connect wires to terminal block

Open the terminal block cover to connect the wires to the terminal block.
(With M3 thread)

How to Order Manifold

VV5Q 1 4 – 08 T 2 – D

Series

0	VQ0000
1	VQ1000
2	VQ2000

Manifold

4	Plug lead unit/Flip

Stations

01	1 station
⋮	⋮
16	16 stations

Note 1) For negative common specifications, refer to "Option" on page 2-4-69.
Note 2) As option, the maximum number of stations can be increased based on special wiring specifications. For details, refer to page 2-4-69.

Option

D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

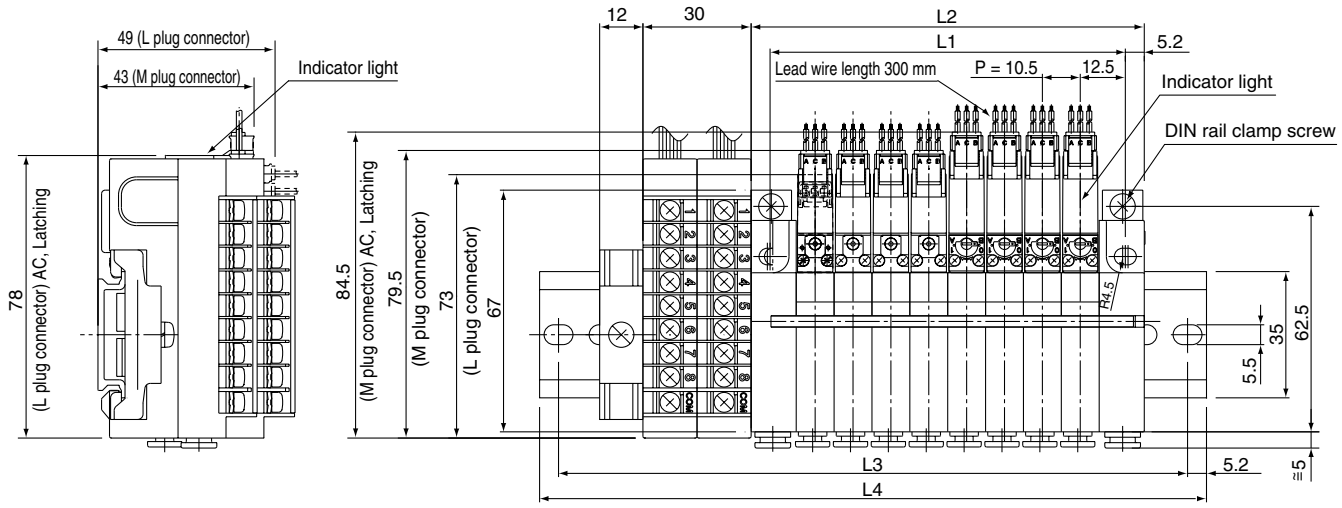
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS
Note 2) T kits are DIN rail mounted type, so include suffix -D.
Note 3) Specify the wiring specifications in the manifold specification sheet.

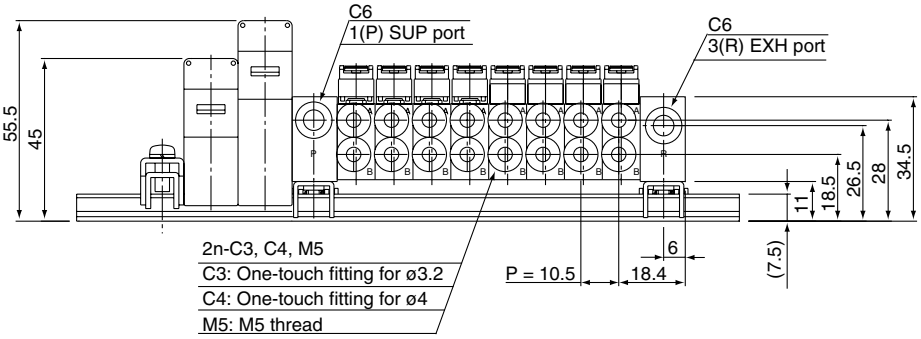
Number of terminals

1	8 terminals in 1 row	Applicable stations 1 to 4 stations (Double), 8 stations (Single)
2	16 terminals in 2 rows	Applicable stations 5 to 8 stations (Double), 16 stations (Single)

Note) The number of terminal blocks can be chosen regardless of station qty. Suffix the option symbol, K, when the wiring specification is special.

VQ0000





Note 1) Built-in silencer types are equipped with a 1 (P) SUP port on both D and U sides.
Note 2) 3 position needs two stations. Cylinder port is located at U side of body.

This drawing shows the case of VV5Q04-□T2-D□.

Dimensions

Equation L1 = 10.5n + 14.5, L2 = 10.5 n + 25 n: station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	25	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5
L2	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5	193
L3	100	112.5	125	137.5	150	150	162.5	175	187.5	200	212.5	212.5	225	237.5	250	262.5
L4	110.5	123	135.5	148	160.5	160.5	173	185.5	198	210.5	223	223	235.5	248	260.5	273

How to Order Valves

VQ 1 1 4 0 Y – 5 LO □ – C6

Series

0	VQ0000
1	VQ1000
2	VQ2000

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (1)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.
Note 2) Except double (latching).

Type of actuation

		VQ0000	VQ1000	VQ2000
1	2 position single	●	●	●
2	2 position double (Latching)	●	●	●
3	3 position closed center	● (1)	● (2)	—
4	3 position exhaust center	● (1)	● (2)	—
5	3 position pressure center	—	● (2)	—

Note 1) 2 stations space are occupied.
Note 2) L plug connector is used for AC.

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note 1) For negative common specifications, refer to "Option" on page 2-4-69.
Note 2) Connector assembly will be required when the T kits add a valve. For model no., refer to "Option" on page 2-4-69.

How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

Cylinder port

Symbol	Port size	VQ0000	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	●	—
C4	With One-touch fitting for ø4	●	●	●
C6	With One-touch fitting for ø6	—	●	●
C8	With One-touch fitting for ø8	—	—	●
M5	M5 thread	●	●	—

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

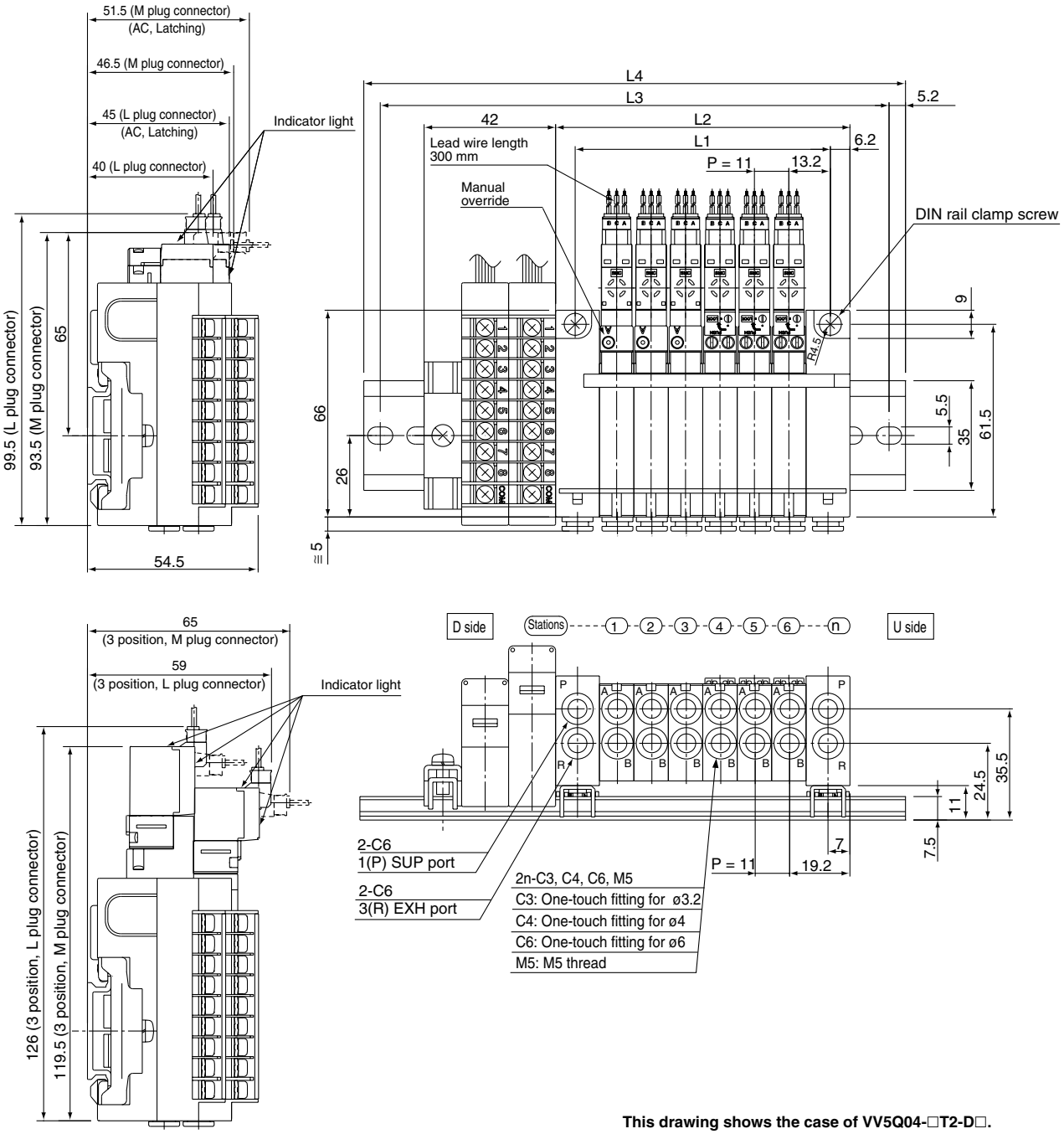
Note 1) All double latching valves of VQ0000 are non-locking push type. (Refer to page 2-4-66.)
Note 2) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

Note) Plug connector and lead wire layers are attached to the manifold.

VQ1000



This drawing shows the case of VV5Q04-□T2-D□.

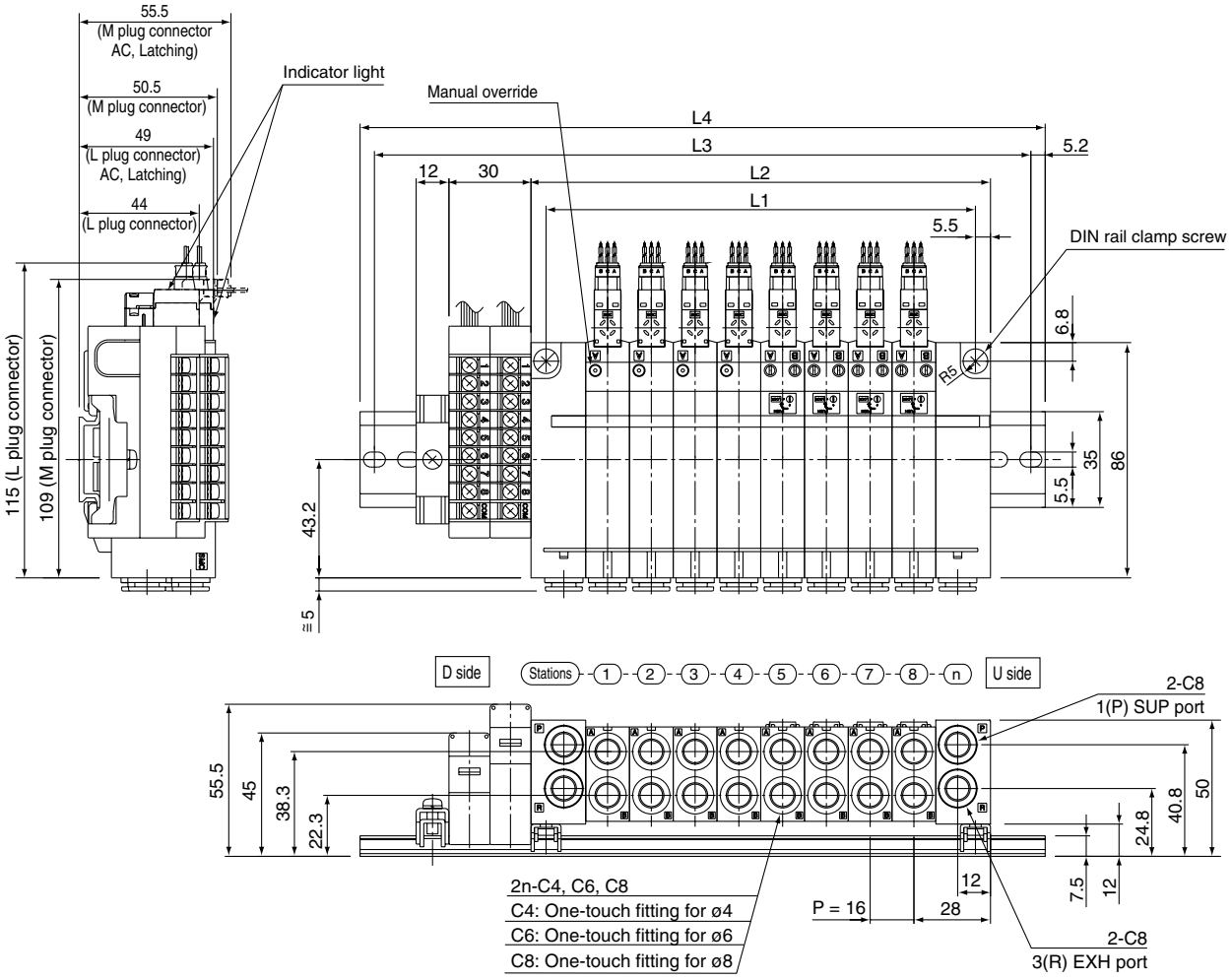
3 position

Dimensions

Formula L1 = 11n + 15.5, L2 = 11 n + 28 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	204
L3	112.5	112.5	125	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	275
L4	123	123	135.5	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	285.5

VQ2000



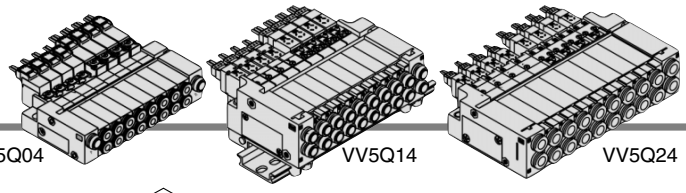
The drawing shows the case of VV5Q24-□T2.

Dimensions

Formula L1 = 16n + 29, L2 = 16n + 40 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
L2	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296
L3	125	137.5	150	175	187.5	200	225	237.5	250	262.5	287.5	300	312.5	337.5	350	362.5
L4	135.5	148	160.5	185.5	198	210.5	235.5	248	260.5	273	298	310.5	323	348	360.5	373

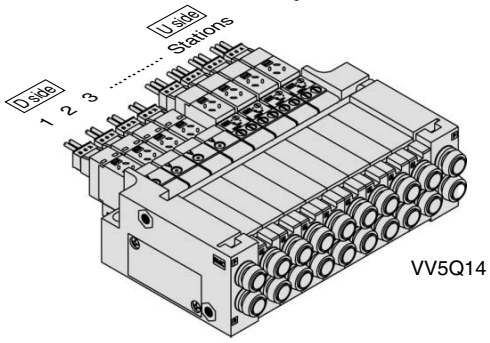
C VQ0000/1000/2000 Kit (Connector)



● Standard with lead wires connected to each valve individually.
● Maximum stations are 16.

Manifold Specifications

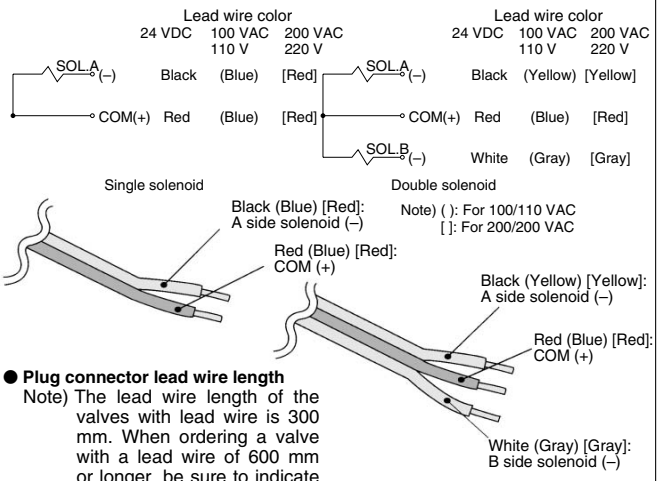
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max. 16 stations
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C8	C4, C6, C8	Max. 16 stations



VV5Q14

● Wiring specifications: Positive COM

● The lead wires are connected to the valve as shown below. Connect each to the power supply side.



● Plug connector lead wire length

Note) The lead wire length of the valves with lead wire is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1140-5LO-C6··· 3 pcs.
AXT661-14A-10 ··· 3 pcs.

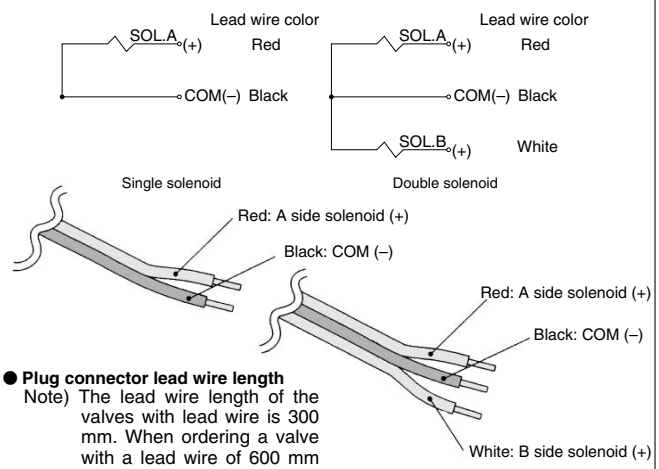
Connector Assembly Part No. (For DC)

Lead wire length	Single/3 position part no.	Double solenoid part no.
Socket only (3 pcs.)	AXT661-12A	
300 mm	AXT661-14A	AXT661-13A
600 mm	AXT661-14A-6	AXT661-13A-6
1000 mm	AXT661-14A-10	AXT661-13A-10
2000 mm	AXT661-14A-20	AXT661-13A-20
3000 mm	AXT661-14A-30	AXT661-13A-30

Note 1) 100/110 VAC for single: AXT661-31A-∗; for double: AXT661-32A-∗
200/220 VAC for single: AXT661-34A-∗; for double: AXT661-35A-∗
∗ are in accordance with the above table.
Note 2) 3 position type requires 2 sets for A side and B side.

● Wiring specifications: Negative COM (Option)

● The lead wires are connected to the valve as shown below. Connect each to the power supply side.



● Plug connector lead wire length

Note) The lead wire length of the valves with lead wire is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1140-5LO-C6···3 pcs.
AXT661-14A-10 ···3 pcs.

Connector Assembly Part No.

Lead wire length	Single/3 position part no.	Double solenoid part no.
Socket only (3 pcs.)	AXT661-12A	
300 mm	AXT661-14AN	AXT661-13AN
600 mm	AXT661-14AN-6	AXT661-13AN-6
1000 mm	AXT661-14AN-10	AXT661-13AN-10
2000 mm	AXT661-14AN-20	AXT661-13AN-20
3000 mm	AXT661-14AN-30	AXT661-13AN-30

Note 1) When using the negative common specifications, use valves for negative common.
Note 2) 3 position type requires 2 sets for A side and B side.

How to Order Manifold

VV5Q 1 4 – 08 C – N

Series

0	VQ0000
1	VQ1000
2	VQ2000

Manifold

4	Plug lead unit/Flip

Stations

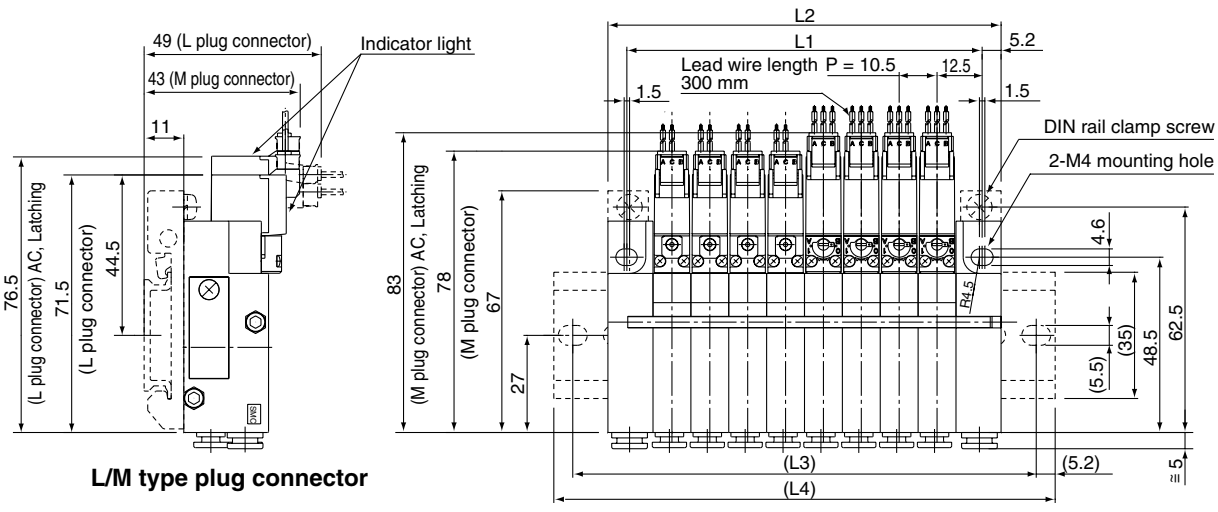
01	1 station
⋮	⋮
16	16 stations

Option

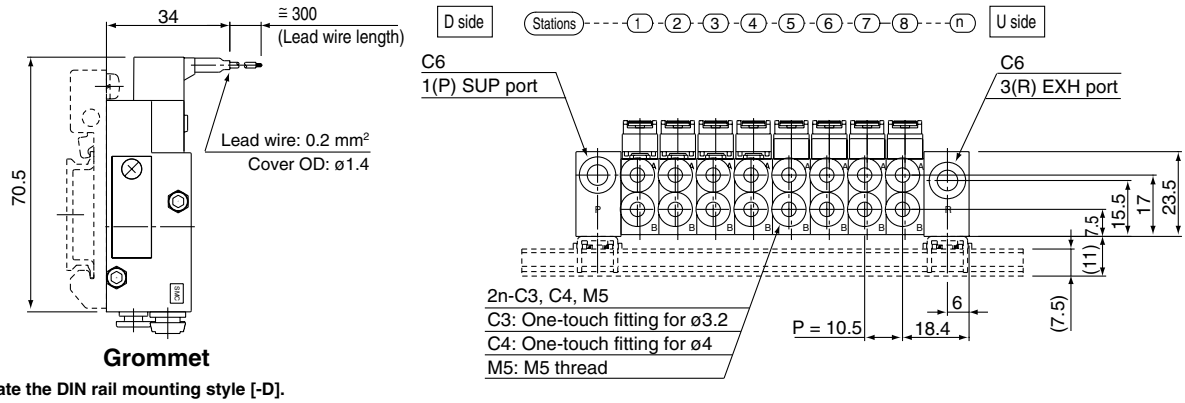
Nil	None
D	DIN rail mounting style
N	With name plate
S	Built-in silencer, direct exhaust

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS

VQ0000



L/M type plug connector



Grommet

The broken lines indicate the DIN rail mounting style [-D].

Note 1) Built-in silencer types are equipped with a 1 (P) SUP port on both D and U sides.

Note 2) 3 position needs two stations.
Cylinder port is located at U side of body.

Dimensions

Formula L1 = 10.5n + 14.5, L2 = 10.5 n + 25 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	25	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5
L2	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5	193
(L3)	62.5	75	87.5	87.5	100	112.5	125	137.5	150	150	162.5	175	187.5	200	212.5	212.5
(L4)	73	85.5	98	98	110.5	123	135.5	148	160.5	160.5	173	185.5	198	210.5	223	223

How to Order Valves

VQ 1 1 4 0 Y – 5 L [ ] – C6

Series

0	VQ0000
1	VQ1000
2	VQ2000

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-36.

Note 2) Except double (latching)

Type of actuation

		VQ0000	VQ1000	VQ2000
1	2 position single	●	●	●
2	2 position double (Latching)	●	●	●
3	3 position closed center	● (1)	● (2)	—
4	3 position exhaust center	● (1)	● (2)	—
5	3 position pressure center	—	● (2)	—

Note 1) 2 stations space are occupied.
Note 2) L plug connector is used for AC.

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note 1) For negative common specifications, refer to "Option" on page 2-4-69.

How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

Cylinder port

Symbol	Port size	VQ0000	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	●	—
C4	With One-touch fitting for ø4	●	●	●
C6	With One-touch fitting for ø6	—	●	●
C8	With One-touch fitting for ø8	—	—	●
M5	M5 thread	●	●	—

Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

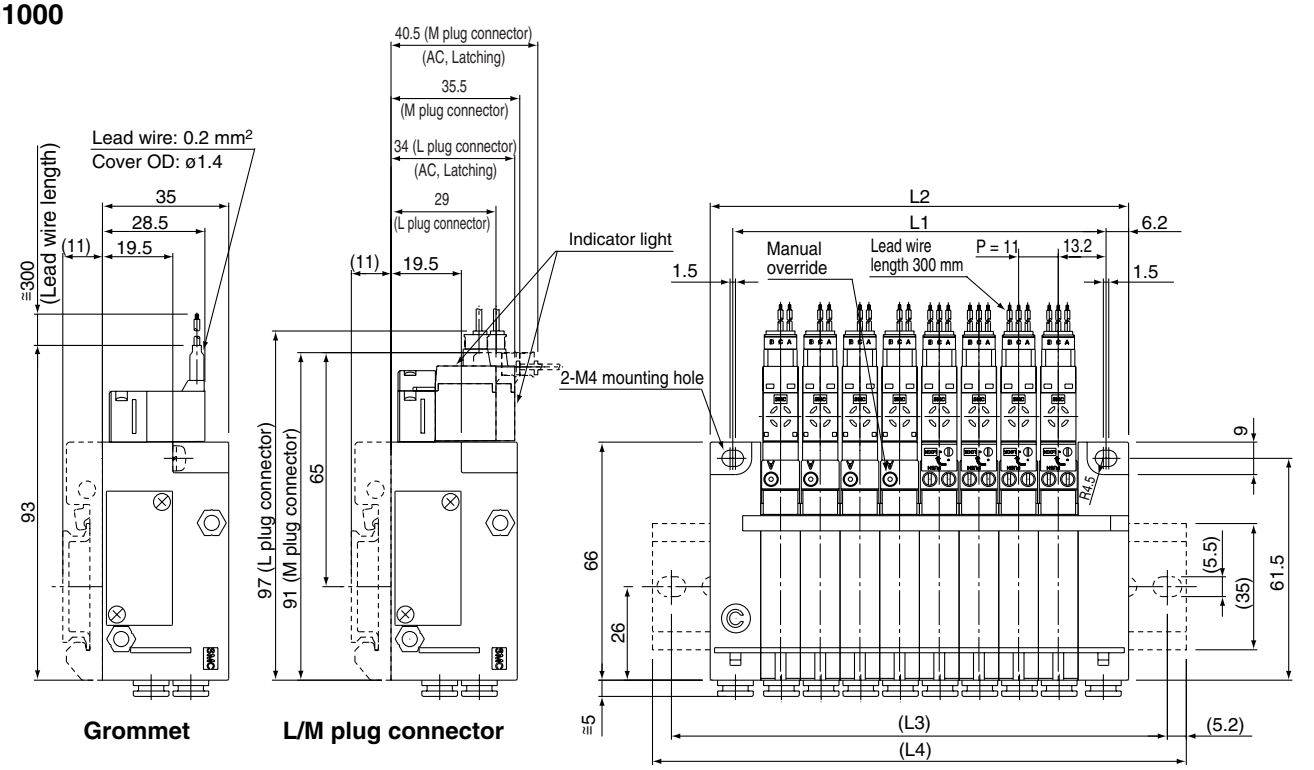
Note 1) All double latching valves of VQ0000 are non-locking push type.

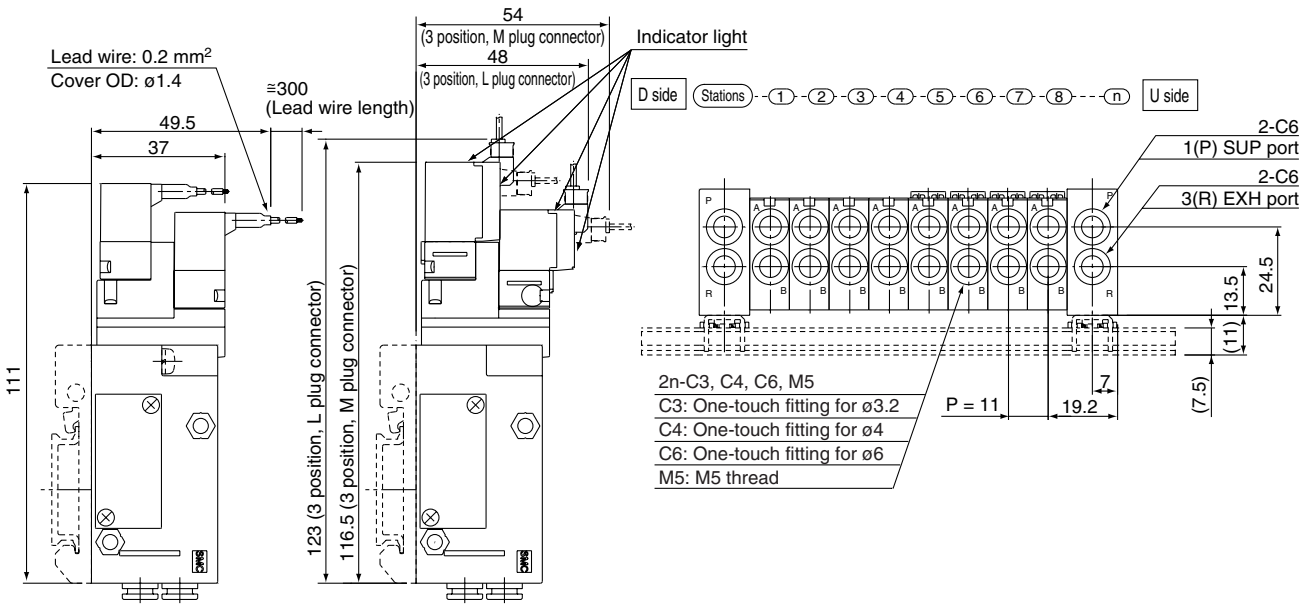
Note 2) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

G	Grommet (Except latching and 100/110 VAC type)
L	L plug connector with lead wire
LO	L plug connector without connector
M	M plug connector with lead wire
MO	M plug connector without connector

VQ1000



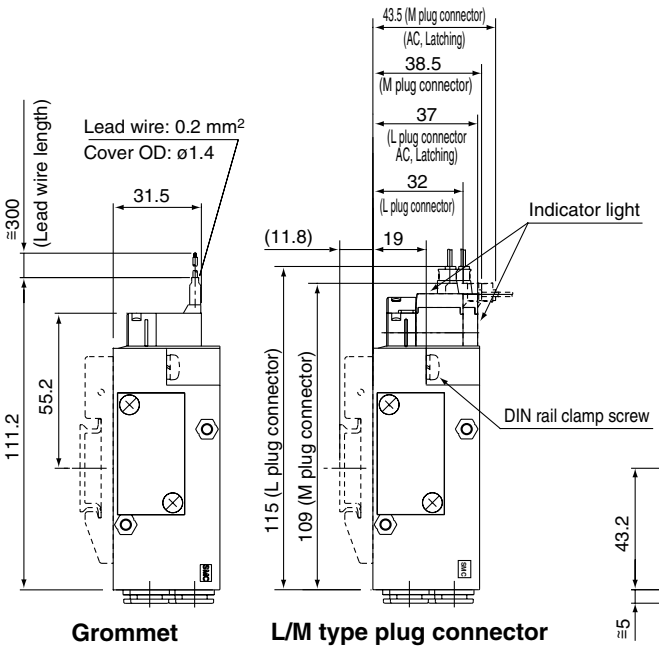


Dimensions

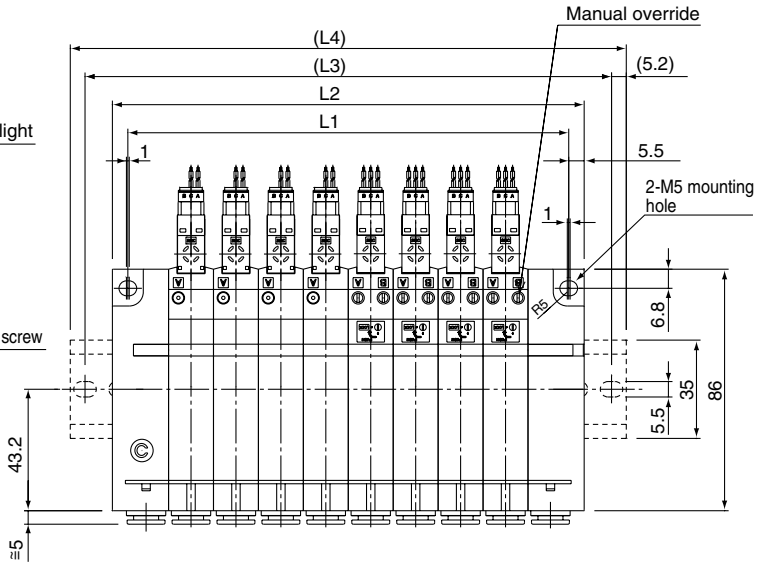
Formula L1 = 11n + 15.5, L2 = 11n + 28 n: Station (Maximum 16 stations)

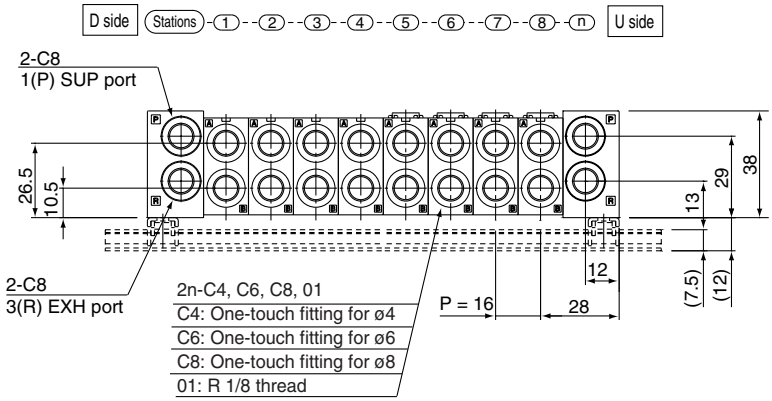
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	204
(L3)	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175	187.5	200	212.5	212.5	225
(L4)	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5	198	210.5	223	223	235.5

VQ2000



Grommet **L/M type plug connector**



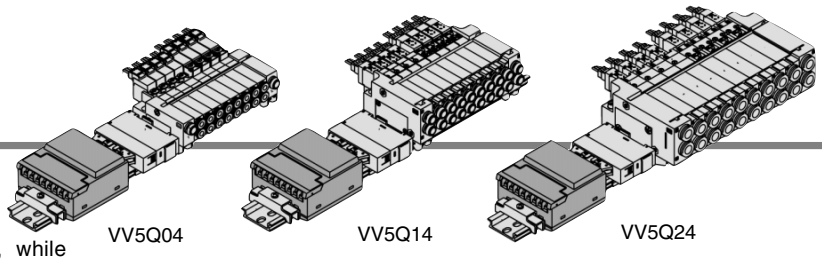


Dimensions

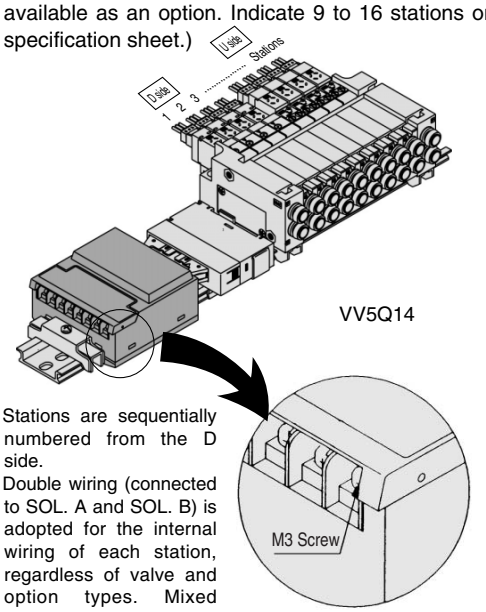
Formula L1 = 16n + 29, L2 = 16n + 40 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
L2	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296
(L3)	87.5	100	112.5	125	150	162.5	175	187.5	212.5	225	237.5	262.5	275	287.5	300	325
(L4)	98	110.5	123	135.5	160.5	173	185.5	198	223	235.5	248	273	285.5	298	310.5	335.5

S VQ0000/1000/2000 Kit (Serial transmission unit)



- The serial transmission system reduces wiring work, while minimizing wiring and saving space.
- The system comes in an type SA (generic for small scale systems) for equipment with a small number of I/O points, or 32 points max., type SB (applicable to Mitsubishi Electric models) for controlling 512 I/O points max., type SC (applicable to OMRON models), and type SD (applicable to SHARP models; 504 points max.).
- Maximum 8 stations, optional 16 stations possible. (16 stations available as an option. Indicate 9 to 16 stations on the manifold specification sheet.)

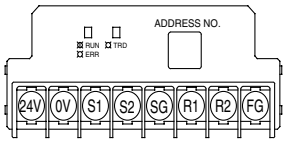
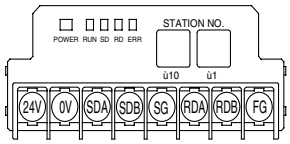


- Stations are sequentially numbered from the D side.
- Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-69.

Item	Specifications
External power supply	24 VDC±10%
Current consumption (Internal unit)	SA, SB, SD, SFI, SH: 0.1 A/SC: 0.3 A

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		P, R	A, B	
VQ0000	Side	C6	C3, C4, M5	Max. 16 stations
VQ1000	Side	C6	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C10	C4, C6, C8	Max. 16 stations

	Type SA With general type SI unit (Series EX300)	Type SB Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System
Name of terminal block (LED)	 LED / Description TRD — Lighting during data reception RUN/ERR — Blinking when received data is normal; Lighting when data reception	 LED / Description POWER — Lighting when power is turned ON RUN — Lighting when data transmission with the master station is normal RD — Lighting during data reception SD — Lighting during data transmission ERR. — Lighting when reception data error occurs. Light turns off when the error is corrected.
Note	• T unit Can be connected with PLC I/O card for serial transmission. EX300-TMB1··· For models of Mitsubishi Electric Corporation EX300-TTA1··· For models of OMRON Corporation EX300-TFU1··· For models of Fuji Electric Co., Ltd. EX300-T001··· For general models ∗Up to 32 points per unit. • No. of output points, 16 points	• Master station: PLC made by Mitsubishi Electric Corporation Series MELSEC-A AJ71PT32-S3, AJ71T32-S3 A1SJ71PT32-S3 ∗Max. 64 stations, connected to remote I/O stations (Max. 512 points). • No. of output points, 16 points. No. of sta. occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

How to Order Manifold

VV5Q 1 4 – 08 S A – D

Series

0	VQ0000
1	VQ1000
2	VQ2000

Manifold

4	Plug lead unit/Flip

Stations

01	1 station
⋮	⋮
08(Note)	8 station (Double)
16	16 stations (Single)

Note) As option, the max. number of stations can be increased based on special wiring specifications. For details, refer to page 2-4-69.

Model

0	Without SI unit
A	With general type SI unit (Series EX300)
B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System
C	OMRON Corp.: SYSBUS Wire System
D	SHARP Corp.: Satellite I/O Link System
F1	NKE Corp.: Uni-wire System (16 output points)
H	NKE Corp.: Uni-wire H System

Note) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation; Fuji Electric Co., Ltd.; OMRON Corporation.

∗ The dust-protected type SI unit is applicable, too. For details, please contact SMC.

Option

D (2)	DIN rail mounting style
K (3)	Special wiring specifications (Except double wiring)
N	With name plate
S	Built-in silencer, direct exhaust (U side only)

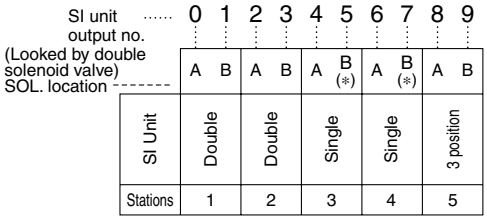
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS

Note 2) S kits are DIN rail mounting styles, so include suffix -D

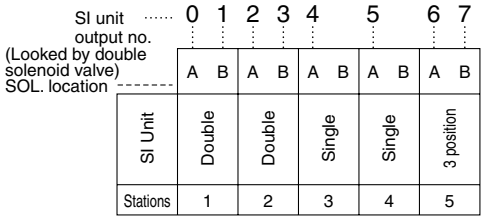
Note 3) Specify the wiring specifications in the manifold specification sheet.

● SI unit output and coil numbering

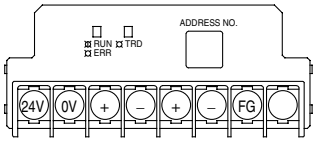
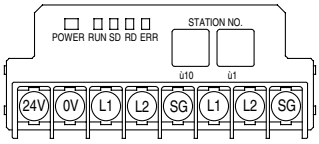
<Wiring example 1> Double wiring (Standard)



<Wiring example 2> Single/Double Mixed Wiring (Option)
Mixed wiring is available as an option.
Use the manifold specification sheet to specify.



The places of asterisk are not used.

	Type SC **OMRON Corporation** **SYSBUS Wire System**	**Type SD** **SHARP Corporation** **Satellite I/O Link System**
Name of terminal block (LED)		
	LED / Description RUN: Lights when transmission is normal and PLC is in operation mode T/R ERR: Blinks during data transmission/reception ON when transmission is abnormal.	LED / Description POWER: ON when power supply is ON RUN: Lights when power is ON and slave stations are operating normally ERROR: Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit R.SET HOLD: ON for master unit control input
Note	• Master station unit: OMRON PLC SYSMAC C(CV) series Types C500-RM201 and C200H-RM201 ∗ 32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit: SHARP's PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW-31LM ∗ Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ 1 1 4 0 Y – 5 LO □ – C6

Series

0	VQ0000
1	VQ1000
2	VQ2000

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H Note)	High pressure type	(1.5 W) ○
Y Note)	Low wattage type	(0.5 W) ○

Note) Except double (latching).

Coil voltage

5	24 VDC/With light/surge voltage suppressor

Note 1) Connector assembly will be required when the S kits add a valve.
For part nos., refer to "Option" on page 2-4-69.

Type of actuation

		VQ0000	VQ1000	VQ2000
1	2 position single	●	●	●
2	2 position double (Latching)	●	●	●
3	3 position closed center	● (1)	● (2)	—
4	3 position exhaust center	● (1)	● (2)	—
5	3 position pressure center	—	● (2)	—

Note 1) 2 stations space are occupied.
Note 2) L plug connector is used for AC.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

Note 1) Plug connector and lead wire layers are attached to the manifold.

How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

Cylinder port

Symbol	Port size	VQ0000	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	●	—
C4	With One-touch fitting for ø4	●	●	●
C6	With One-touch fitting for ø6	—	●	●
C8	With One-touch fitting for ø8	—	—	●
M5	M5 thread	●	●	—

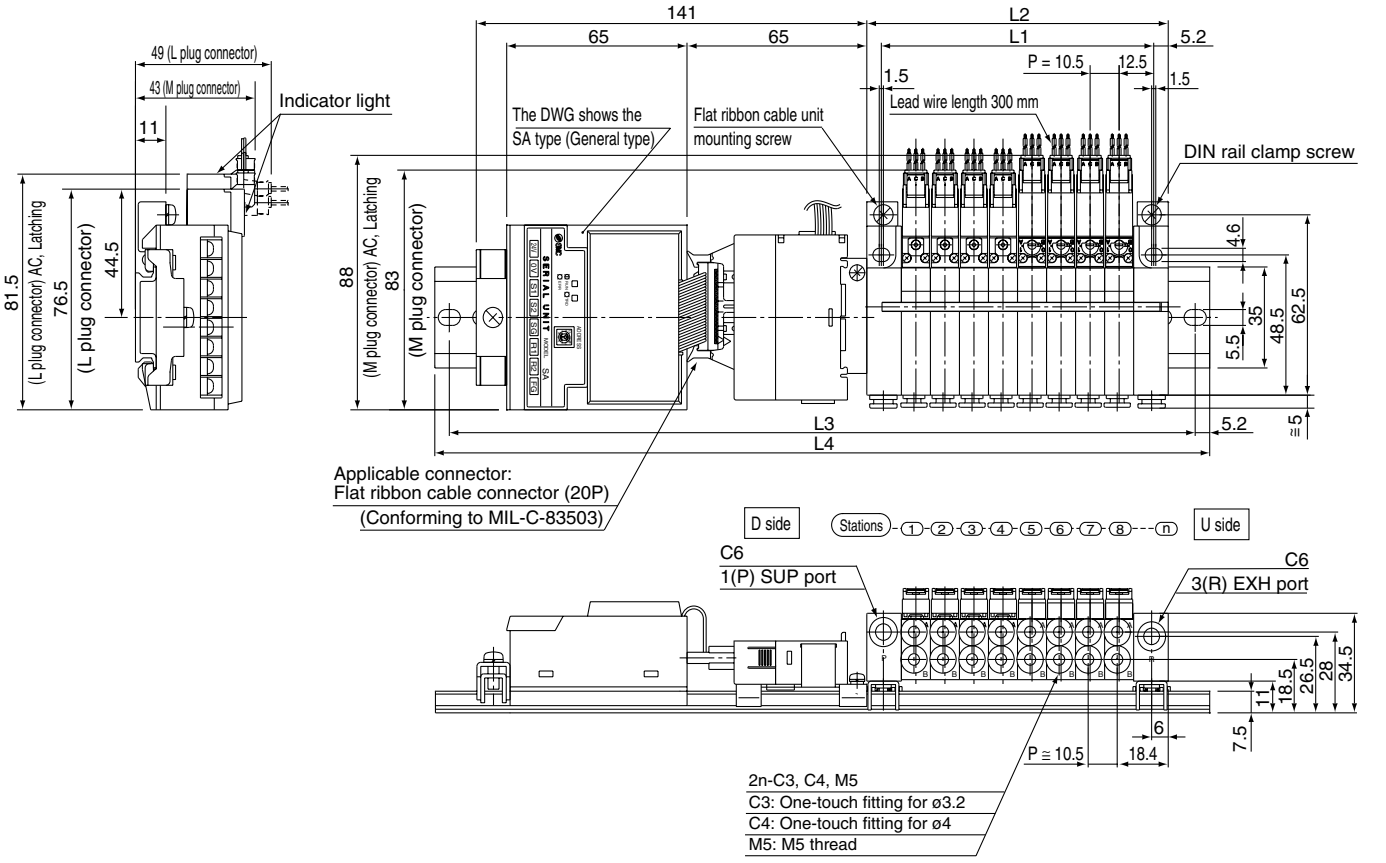
Note) For inch-size One-touch fittings, refer to "Option" on page 2-4-69.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note 1) All double latching valves of VQ0000 are non-locking push type. (Refer to page 2-4-66.)
Note 2) A manual override for pilot valve is provided to the standard model for double type.

VQ0000



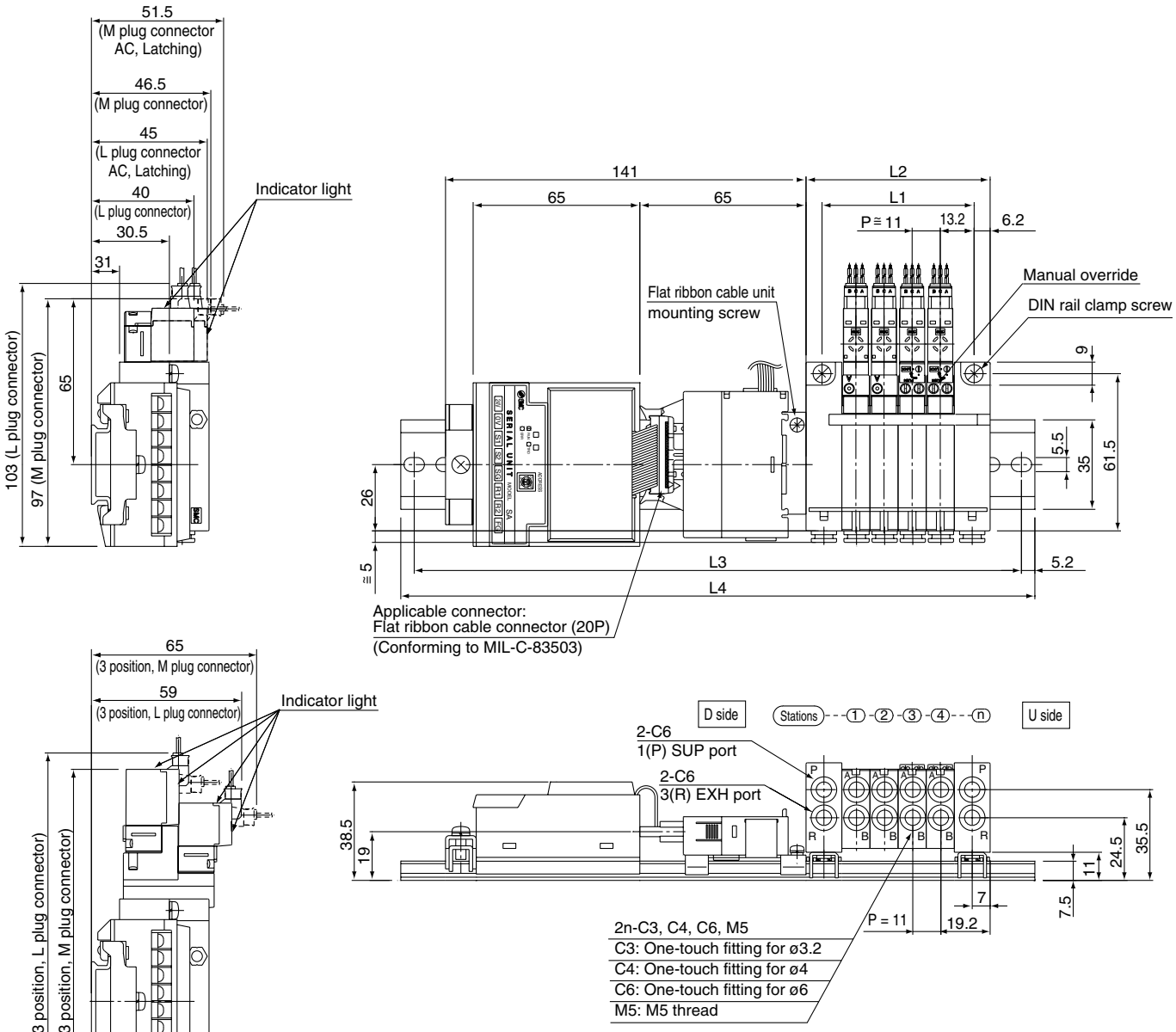
Note 1) Built-in silencer styles are equipped with a 1(P) SUP port on the both D and U sides.
Note 2) 3 position needs two stations.
Cylinder port is located U side of body.

Dimensions

Formula L1 = 10.5n + 14.5, L2 = 10.5n + 25 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	25	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5
L2	35.5	46	56.5	67	77.5	88	98.5	109	119.5	130	140.5	151	161.5	172	182.5	193
L3	200	212.5	225	237.5	250	250	262.5	275	287.5	300	312.5	312.5	325	337.5	350	362.5
L4	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5	323	323	335.5	348	360.5	373

VQ1000



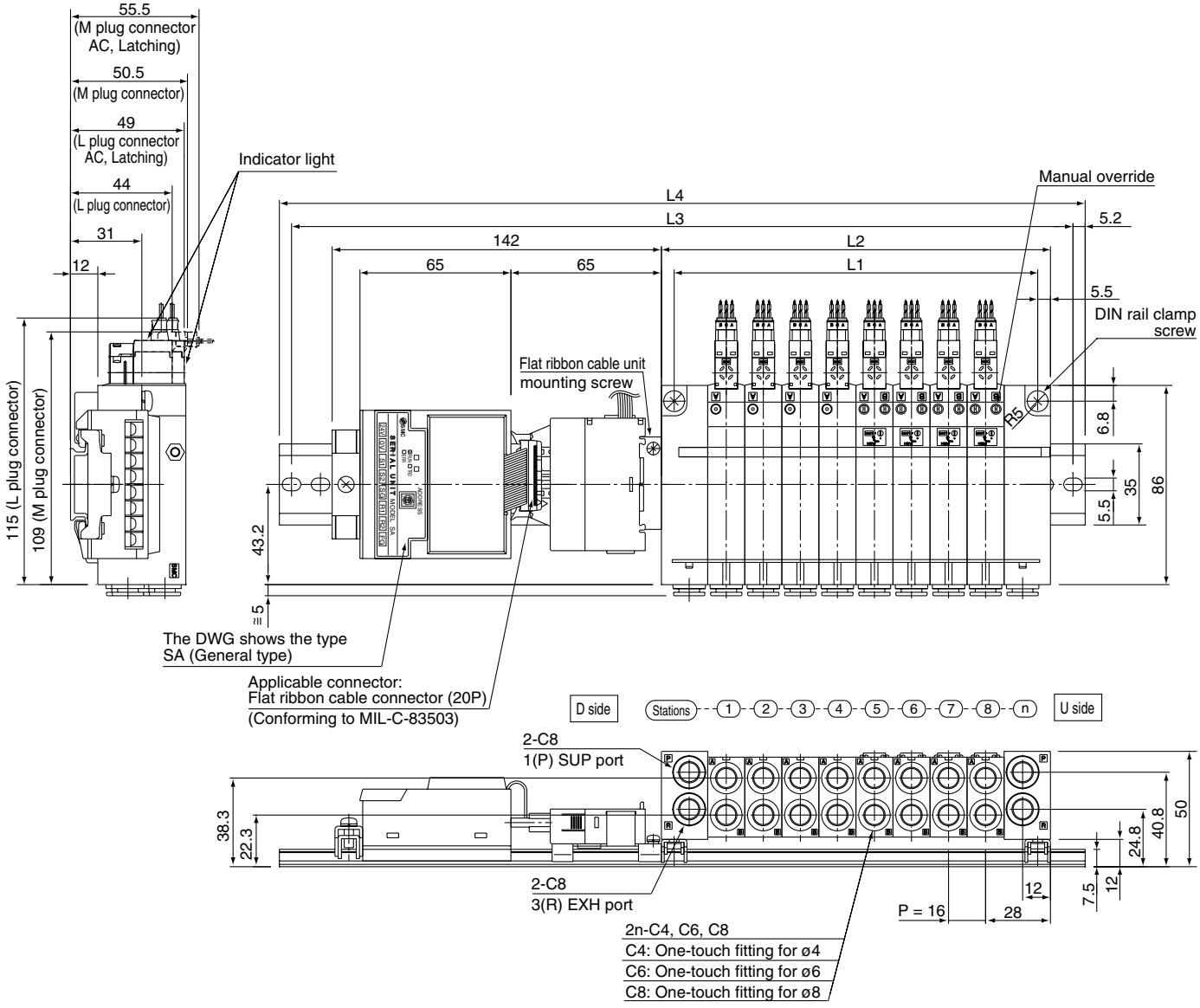
3 position

Dimensions

Formula L1 = 11n + 15.5, L2 = 11n + 28 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	26.5	37.5	48.5	59.5	70.5	81.5	92.5	103.5	114.5	125.5	136.5	147.5	158.5	169.5	180.5	191.5
L2	39	50	61	72	83	94	105	116	127	138	149	160	171	182	193	204
L3	212.5	212.5	225	237.5	250	262.5	275	287.5	300	300	312.5	325	337.5	350	362.5	375
L4	223	223	235.5	248	260.5	273	285.5	298	310.5	310.5	323	335.5	348	360.5	373	385.5

VQ 2000



Dimensions

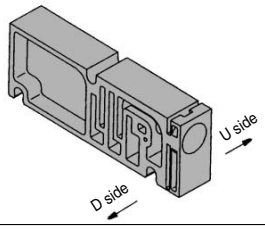
Formula L1 = 16n + 29, L2 = 16n + 40 n: Station (Maximum 16 stations)

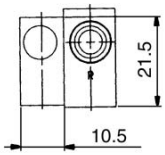
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
L2	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296
L3	225	237.5	250	275	287.5	300	325	337.5	350	362.5	387.5	400	412.5	437.5	450	462.5
L4	235.5	248	260.5	285.5	298	310.5	335.5	348	360.5	373	398	410.5	423	448	460.5	473

Manifold Option Parts for VQ0000

Blanking plate assembly
VVQ0000-10A-4

It is used when a blanking plate is mounted to a manifold in advance for possible valve mounting, etc.

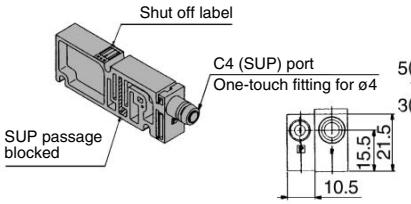




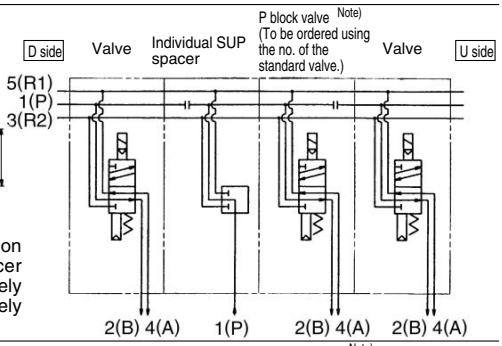
Individual SUP spacer
VVQ0000-P-4-C4

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.) Since the SUP passage on the spacer's D side is blocked in advance, it is mounted on the D side of the valve for individual supply while blocking the valve's U side. (See the application ex.)

* Specify the spacer mounting position and SUP block plate mounting position on the manifold specification sheet.



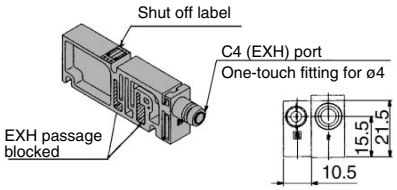
Note) P block valve is mounted in the blocking position when ordering an individual SUP spacer incorporated with a manifold. When separately ordering an individual SUP spacer, separately order a P block valve.



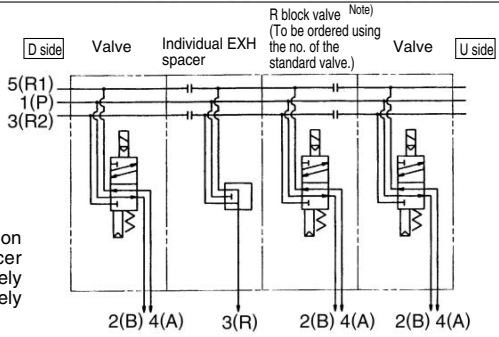
Individual EXH spacer
VVQ0000-R-4-C4

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (One station space is occupied.) Since the EXH passage on the spacer's D side is blocked in advance, it is mounted on the D side of the valve for individual supply while blocking the valve's U side. (See the application ex.)

* Specify the spacer mounting position and EXH block plate mounting position on the manifold specification sheet.



Note) R block valve is mounted in the blocking position when ordering an individual EXH spacer incorporated with a manifold. When separately ordering an individual EXH spacer, separately order a R block valve.



P/R/PR Block valve
VQ0$\frac{1}{2}$4$\frac{0}{1}$-□-□□ - P/R/PR

Valve no.

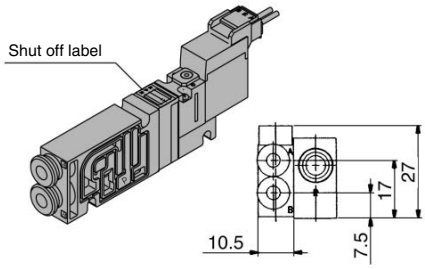
For a flip plug-in unit, block plate is built in the valve for blocking SUP and EXH passages. Since the no. is classified by the passage to be blocked, specify it by attaching the option no. to the valve no. The block valve is constructed so that U sides of SUP and EXH passages are blocked.

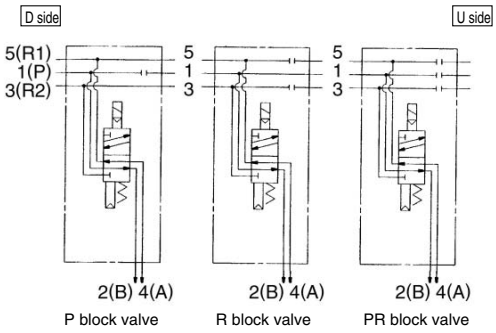
* Specify the number of stations on the manifold specification sheet.

<Shut off label>

When using block plates for SUP, EXH passage, indication label for confirmation of the blocking position from outside is attached. (One label for each)

* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.
* Caution on handling P/RP block valve
  For manifold other than C kit which is silencer built-in, there's no exhaust port on the D side end plate. Install a spacer for individual EXH on the 1st station separately.





For SUP passage block

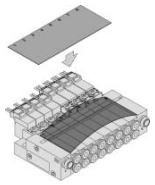
For EXH passage block

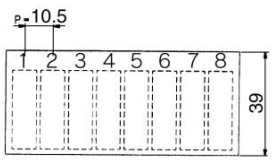
For SUP/EXH passage block

For SUP passage block	VQ0$\frac{1}{2}$4$\frac{0}{1}$-□-□□-P
For EXH passage block	VQ0$\frac{1}{2}$4$\frac{0}{1}$-□-□□-R
For SUP/EXH passage block	VQ0$\frac{1}{2}$4$\frac{0}{1}$-□-□□-PR

Name plate [-N4]
VVQ0000-N4-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.

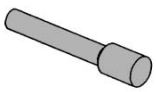


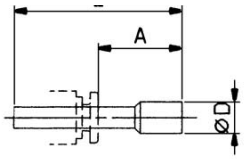


* When ordering assemblies incorporated with a manifold, suffix -N to the manifold no.

Blanking plug
KQ2P-$\frac{23}{04}$
06

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.





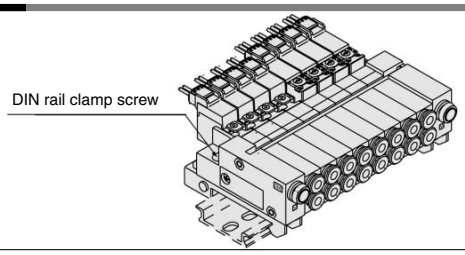
Dimensions

Applicable fittings size ød	Model	A	L	D
3.2	**KQP-23**	16	31.5	3.2
4	**KQP-04**	16	32	6
6	**KQ2P-06**	18	35	8

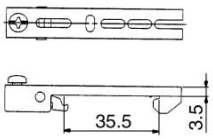
Manifold Option Parts for VQ0000

DIN rail mounting bracket
VVQ0000-57A-4

It is used for mounting a manifold on a DIN rail. The DIN rail mounted bracket is fixed to the manifold end plate.
(The specification is the same as that for the option -D.)
1 set of DIN rail mounting bracket is used for 1 manifold (2 DIN rail mounting brackets).



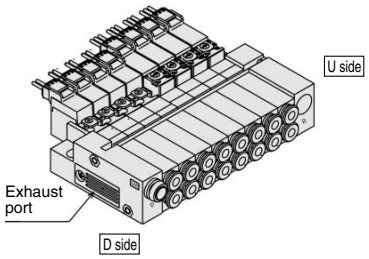
∗ When ordering assemblies incorporated with a manifold, add suffix -D to the manifold no.



Built-in silencer, Direct exhaust [-S]

This is a type with an exhaust port atop the manifold end plate. The built-in silencer exhibits an excellent noise suppression effect.
F, P, T and S kits are provided with exhaust on one side.
Note) A large quantity of drainage generated in the air source results in exhaust of air together with drainage.

• For maintenance, refer to page 2-4-67.

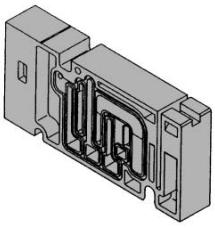


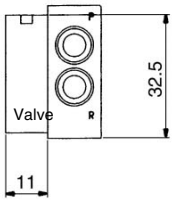
∗ When ordering assemblies incorporated with a manifold, add suffix -S to the manifold no.

Manifold Option Parts for VQ1000

Blanking plate assembly
VVQ1000-10A-4

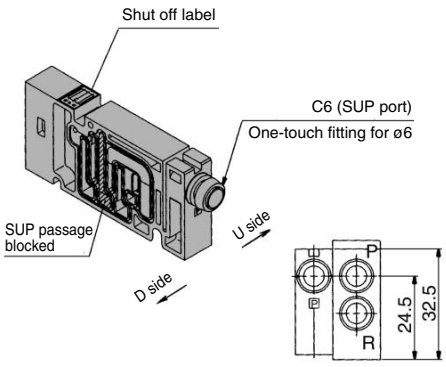
It is used when a blanking plate is mounted to a manifold in advance for possible valve mounting, etc.

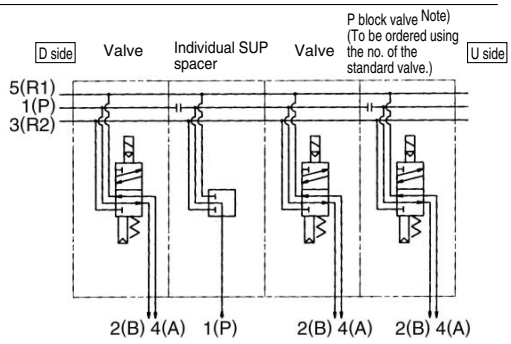




Individual SUP spacer
VVQ1000-P-4-C6

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.) Since the SUP passage on the spacer's D side is blocked in advance, it is mounted on the D side of the valve for individual supply while blocking the valve's U side. (See the application ex.)
∗ Specify the spacer mounting position and SUP block plate mounting position on the manifold specification sheet.

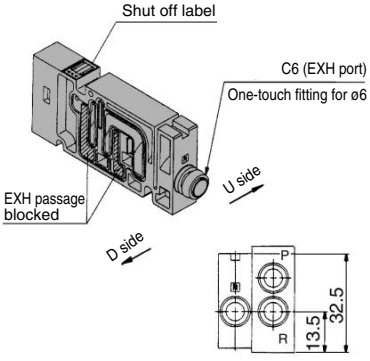


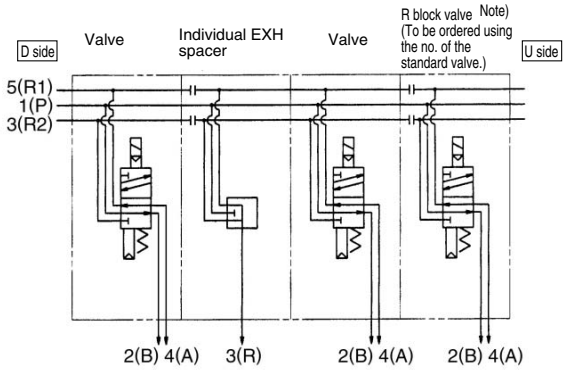


Note) P block valve is mounted in the blocking position when ordering an individual SUP spacer incorporated with a manifold.
When separately ordering an individual SUP spacer, separately order a P block valve.

Individual EXH spacer
VVQ1000-R-4-C6

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (One station space is occupied.)
Since the EXH passage on the spacer's D side is blocked in advance, it is mounted on the D side of the valve for individual supply while blocking the valve's U side. (Refer to the application example.)
∗ Specify the spacer mounting position and EXH block plate mounting position on the manifold specification sheet.
∗ When the electrical entry is F, P, T, S kit, and if you choose the option with built-in silencer, no exhaust port will be supplied on the D side end plate.
In this case, install a spacer for individual EXH on the 1st station.





Note) R block valve is mounted in the blocking position when ordering an individual EXH spacer incorporated with a manifold.
When separately ordering an individual EXH spacer, separately order an R block valve.

Manifold Option Parts for VQ1000

P/R/PR Block valve
VQ1$^{1}_{2}$4$^{0}_{1}$-□-□□-P/R/PR

Valve no.

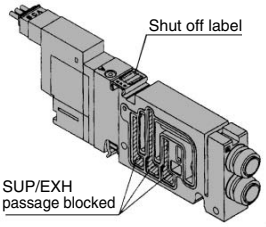
For a flip plug-in unit, block plate is built in the valve for blocking SUP and EXH passages. Since the no. is classified by the passage to be blocked, specify it by attaching the option no. to the valve no. The block valve is constructed so that D sides of SUPand EXH passages are blocked.

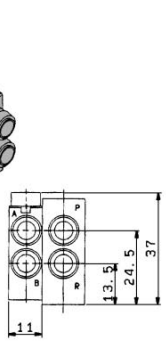
* Specify the number of stations on the manifold specification sheet.

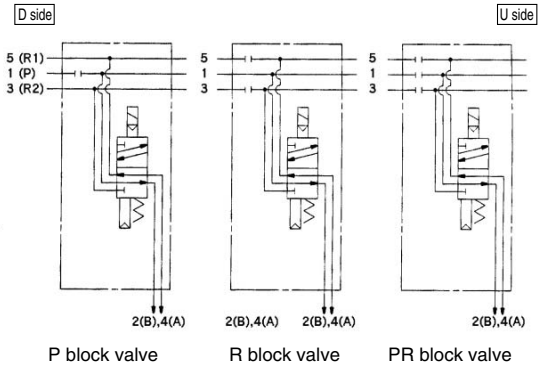
<Shut off label>

When using block plates for SUP, EXH passage, indication label for confirmation of the blocking position from outside is attached. (One label for each)

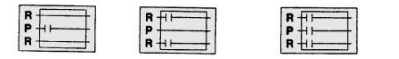
* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.
* Caution on using R/PR block valve If the electrical entry is selected for an option for built-in silencer when F, P, T, S kit, there will not be the exhaust port on the D side end plate. In this case, mount an individual EXH spacer for the 1st station.







P block valve R block valve PR block valve

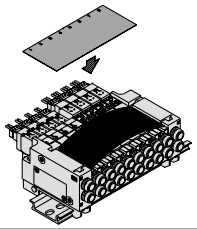


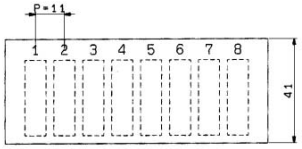
SUP passage blocked **EXH passage blocked** **SUP/EXH passage blocke**

For SUP passage block	VQ1$^{1}_{2}$4$^{0}_{1}$-□-□□-P
For EXH passage block	VQ1$^{1}_{2}$4$^{0}_{1}$-□-□□-R
For SUP/EXH passage block	VQ1$^{1}_{2}$4$^{0}_{1}$-□-□□-PR

Name plate [-N4]
VVQ1000-N4-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that Indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.

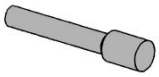


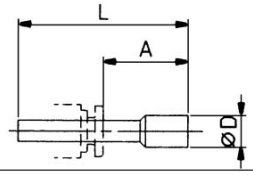


* When ordering assemblies incorporated with manifold, suffix [-N] to the manifold no.

Blanking plug
KQ2P- $^{23}_{04}_{06}$

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.



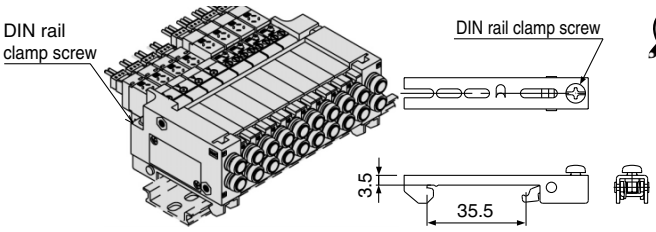


Dimensions

Applicable fittings size ød	Model	A	L	D
3.2	**KQ2P-23**	16	31.5	5
4	**KQ2P-04**	16	32	6
6	**KQ2P-06**	18	35	8

DIN rail mounting bracket
VVQ1000-57A-4

It is used for mounting a manifold on a DIN rail. The DIN rail mounted bracket is fixed to the manifold end plate. (The specification is the same as that for the option -D.)
1 set of DIN rail mounting bracket is used for 1 manifold (2 DIN rail mounting brackets).

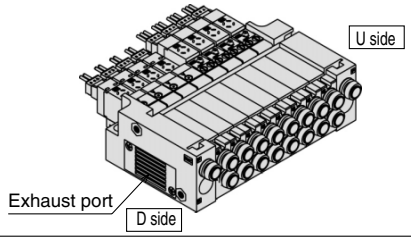


* When ordering assemblies incorporated with manifold, add suffix -D to the manifold no.

Built-in silencer, Direct exhaust [-S]

This is an exhaust port on top of the manifold end plate. The built-in silencer exhibits an excellent noise suppression effect. F, P, T and S kits are provided with exhaust on one side.
Note) A large quantity of drainage generated in the airsource results in exhaust of air together with drainage.

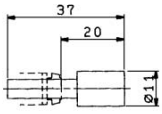
• For maintenance, refer to page 2-4-67.

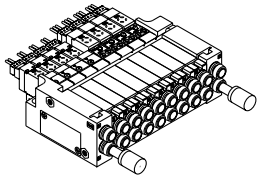


* When ordering assemblies incorporated with manifold, add suffix -S to the manifold no.

Silencer (For EXH port)

This is inserted into the centralized type EXH port (One-touch fitting).





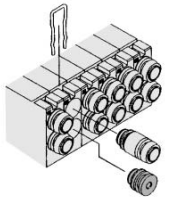
Dimensions

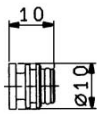
Series	Applicable fittings size ød	Model	A	L	D	Effective area (mm²)	Noise reduction (dB)
VQ1000	6	AN103-X233	20	37	11	7	25

Port plug
VVQ0000-58A

The plug is used to block the cylinder port when using a 4 port valve as a 3 port valve.
When ordering it incorporated with a manifold, suffix A or B, the symbol of the plug port, to the valve no.

Example) **VQ1140-5L-C6-A**
A port, Plug



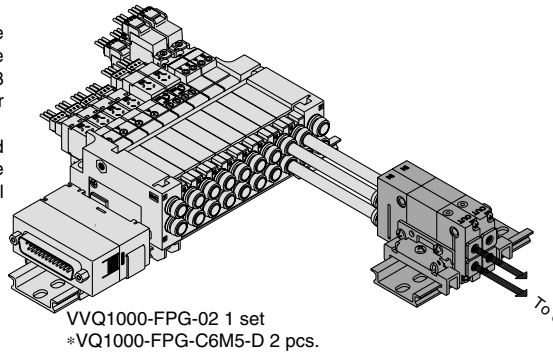


Manifold Option Parts

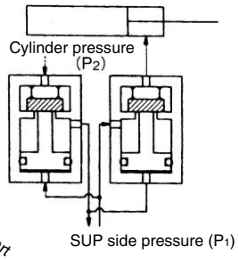
Double check block (Separated type): For VQ0000/1000

VQ1000-FPG-□□

It is used on the outlet side piping to keep the cylinder in the intermediate position for a long time. Combining the double check block with a built-in pilot type double check valve and a 3 position exhaust center solenoid valve will enable the cylinder to stop in the middle or maintain its position for a long time.
The combination with a two position single/double solenoid valve will permit this block to be used for preventing the dropping at the cylinder stroke end when the SUP residual pressure is released.



VVQ1000-FPG-02 1 set
∗VQ1000-FPG-C6M5-D 2 pcs.

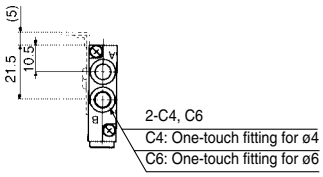


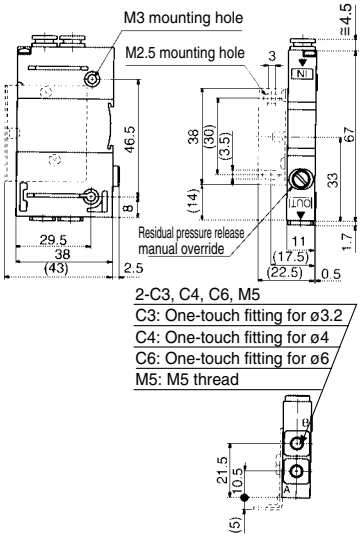
Specifications

Max. operating pressure	0.8 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temperature	–5 to 50° C
Flow characteristics: C	0.60 dm³/(s·bar)
Max. operating frequency	180 CPM

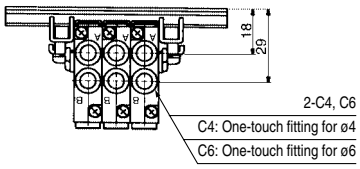
Note) Based on JIS B 8375-1981 (Supply pressure: 0.5 MPa)

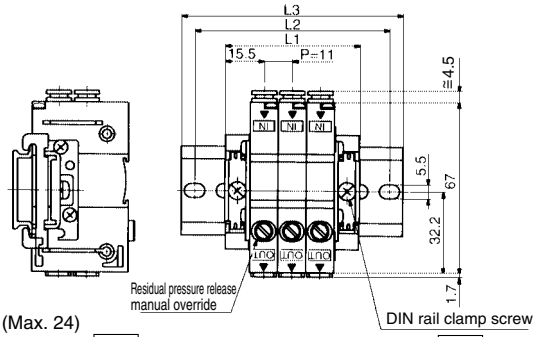
Dimensions





Manifold



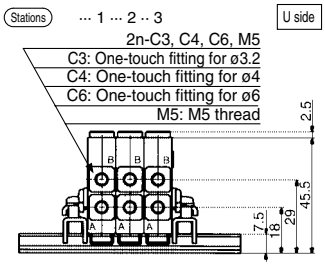


Dimensions Formula L1 = 11n + 20 n: Station (Max. 24)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	31	42	53	64	75	86	97	108	119	130	141	152
L2	50	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175
L3	60.5	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5

L \ n	13	14	15	16	17	18	19	20	21	22	23	24
L1	163	174	185	196	207	218	229	240	251	262	273	284
L2	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300
L3	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5

D side Stations ··· 1 ·· 2 ·· 3 U side



How to Order

Double check block

VQ1000-FPG- C4 M5 F

IN side port size

C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

OUT side port size

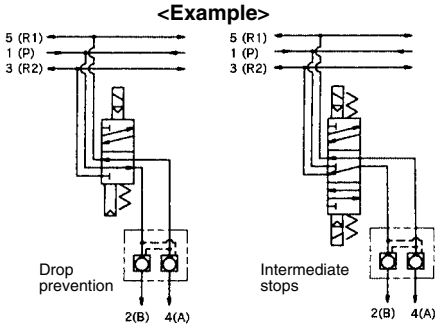
M5	M5 thread
C3	One-touch fitting for ø3.2
C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

Option

Nil	None
F	With bracket
D	DIN rail mounting style (For manifold)
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically. Example) -DN

<Example>



Manifold

VVQ1000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Example>
VVQ1000-FPG-06····6 types of manifold
∗VQ1000-FPG-C4M5-D, 3 sets
∗VQ1000-FPG-C6M5-D, 3 sets } Double check block

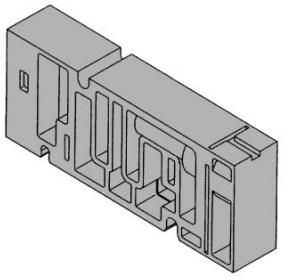
⚠ Caution

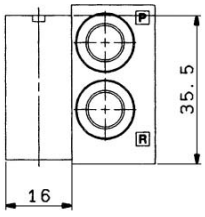
- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap. Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- Combining double check block with 3 position closed center or pressure center solenoid valve will not work.
- M5 fitting assembly is attached, not incorporated into the double check block. After screwing in the M5 fittings, mount the assembly on the double check block. {Tightening torque: 0.8 to 1.2 N·m}
- If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

Manifold Option Parts for VQ2000

Blanking plate assembly
VVQ2000-10A-4

It is used when a blanking plate is mounted to amanifold in advance for possible valve mounting, etc.

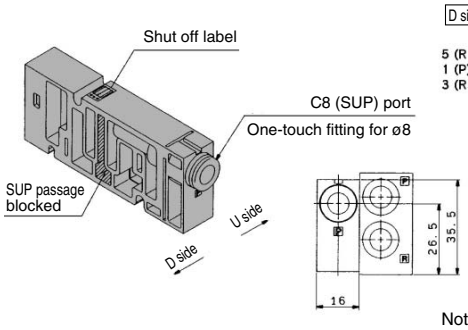


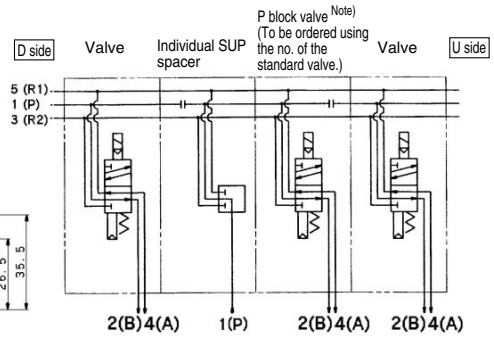


Individual SUP spacer
VVQ2000-P-4-C8

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.)
Since the SUP passage on the spacer's D side is blocked in advance, it is mounted on the D side the valves U side. (Refer to the application example.)

* Specify the spacer mounting position and SUP block plate mounting position on the manifold specification sheet.



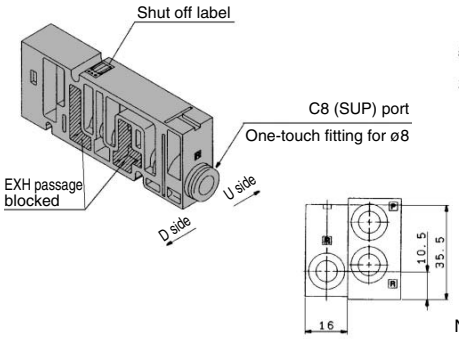


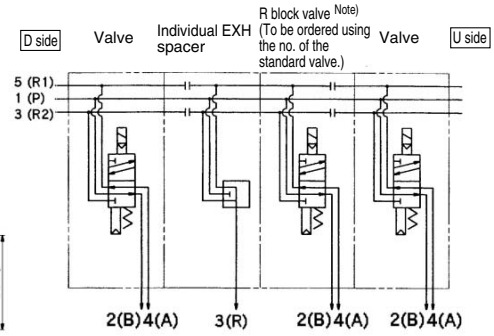
Note) P block valve is mounted in the blocking position when ordering an individual SUP spacer incorporated with a manifold. When separately ordering an individual SUP spacer, separately order a P block valve.

Individual EXH spacer
VVQ2000-R-4-C8

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (1 station space is occupied.)
Since the EXH passage on the spacer's D side is blocked in advance, it is mounted on the D side of the valve for individual supply while blocking the valves U side. (Refer to the application example.)

* Specify the spacer mounting position and EXH block plate mounting position on the manifold specification sheet.
* When the electrical entry is F, P, T, S kit, and if you choose the option with built-in silencer, no exhaust port will be supplied on the D side end plate. In this case, mount a spacer for individual EXH on the 1st station.





Note) R block valve is mounted in the blocking position when ordering an individual EXH spacer incorporated with a manifold. When separately ordering an individual EXH spacer, separately order a R block valve.

P / R / PR Block valve
VQ2 1/2 4 0/1 -□-□□- P / R / PR

Valve no.

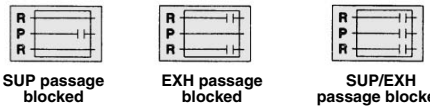
For a flip plug-in unit, block plate is built in the valve for blocking SUP and EXH passages. Since the no. is classified by the passage to be blocked, specify it by attaching the option no. to the valve no. The block valve is constructed so that U sides of SUP and EXH passages are blocked.

* Specify the number of stations on the manifold specification sheet.

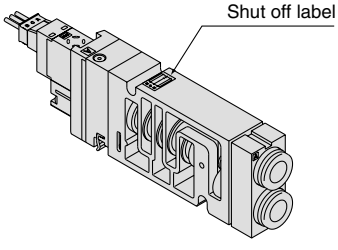
<Shut off label>

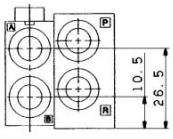
When using block plates for SUP, EXH passage, indication label for confirmation of the blocking position from outside is attached.
(One label for each)

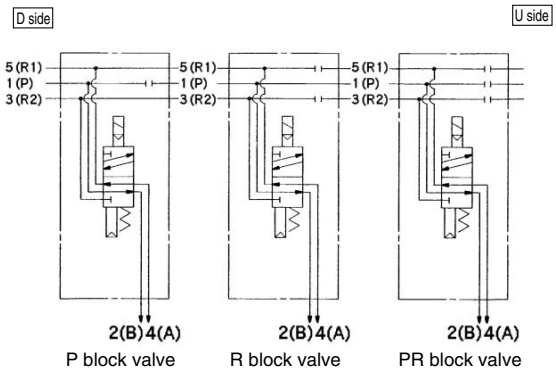
* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.
* Caution on handling P/RP block valve
  When the electrical entry is F, P, T, S kit, and if you choose the option with built-in silencer, no exhaust port will be supplied on the D side end plate. In this case, mount a spacer for individual EXH on the 1st station.



SUP passage blocked | **EXH passage blocked** | **SUP/EXH passage blocked**





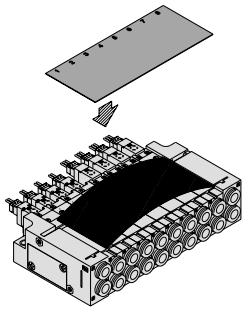


For SUP passage block	VQ2 1/2 4 0/1 -□-□□-P
For EXH passage block	VQ2 1/2 4 0/1 -□-□□-R
For SUP/EXH passage block	VQ2 1/2 4 0/1 -□-□□-PR

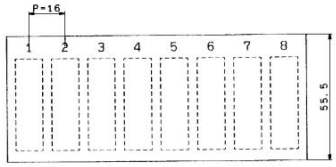
Manifold Option Parts for VQ2000

Name plate [-N4]
VVQ2000-N4-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that Indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.



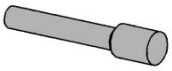
∗ When ordering assemblies incorporated with a manifold, add suffix N to the manifold no.

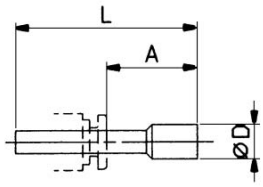


Blanking plug

KQ2P- 04 / 06 / 08

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.



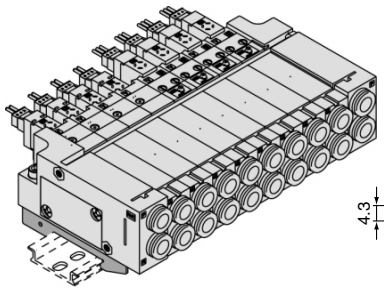


Dimensions

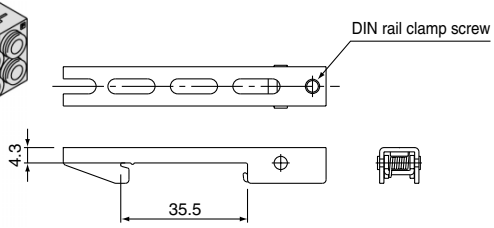
Applicable fittings size ød	Model	A	L	D
4	**KQ2P-04**	16	32	6
6	**KQ2P-06**	18	35	8
8	**KQ2P-08**	20.5	39	10

DIN rail mounting bracket
VVQ2000-57A-4

It is used for mounting a manifold on a DIN rail. The DIN rail mounting bracket is fixed to the manifold end plate. (The specification is the same as that for the option -D.)
1 set of DIN rail mounting bracket is used for 1 manifold (2 DIN rail mounting brackets).



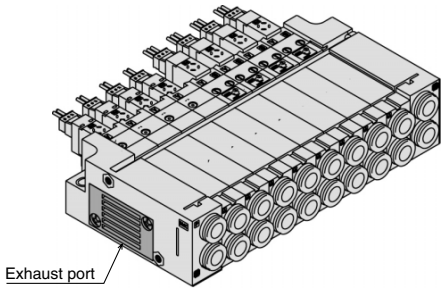
∗ When ordering assemblies incorporated with a manifold, add suffix -D to the manifold no.



Built-in silencer, Direct exhaust [-S]

This is type with an exhaust port atop the manifold endplate. The built-in silencer exhibits an excellent noise suppression effect.
F, P, T and S kits are provided with exhaust on one side.
Note) A large quantity of drainage generated in the air source results in exhaust of air together with drainage.

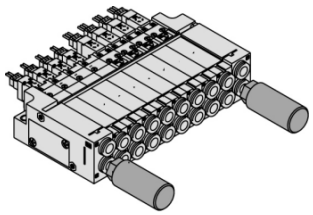
• For maintenance, refer to page 2-4-67.

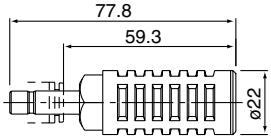


∗ When ordering assemblies incorporated with a manifold, add suffix -S to the manifold no.

Silencer (For EXH port)

This silencer is to be inserted into the EXH port (One-touch fittings) of the common exhaust.





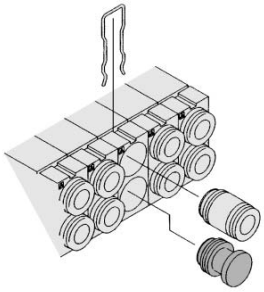
Dimensions

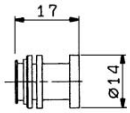
Series	Applicable fittings size ød	Model	A	L	D	Effective area (mm²)	Noise reduction (dB)
VQ2000	8	AN200-KM8	59.3	77.8	22	20	30

Port plug
VVQ1000-58A

The plug is used to block the cylinder port when usinga 4 port valve as a 3 port valve.
When ordering it incorporated with a manifold, suffix A or B, the symbol of the plug port, to the valve no.

Example) **VQ2140-5L-C8-A**
A port, Plug

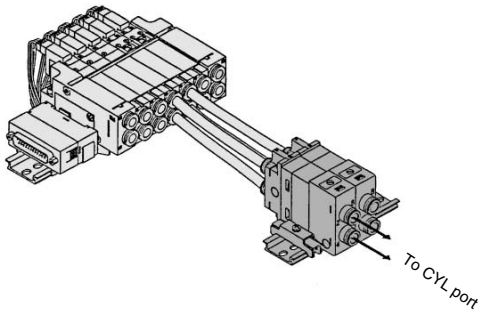




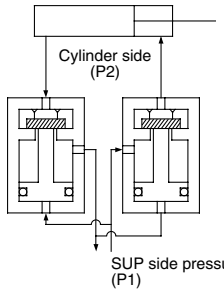
Manifold Option

Double check block (Separated type)
VQ2000-FPG-□□-□

It is used on the outlet side piping.
Combining the double check block with built-in pilot double check valve and a two-position single/double solenoid valve will prevent the dropping at the cylinder stroke end when the SUP residual pressure is released.



<Check valve operation principle>



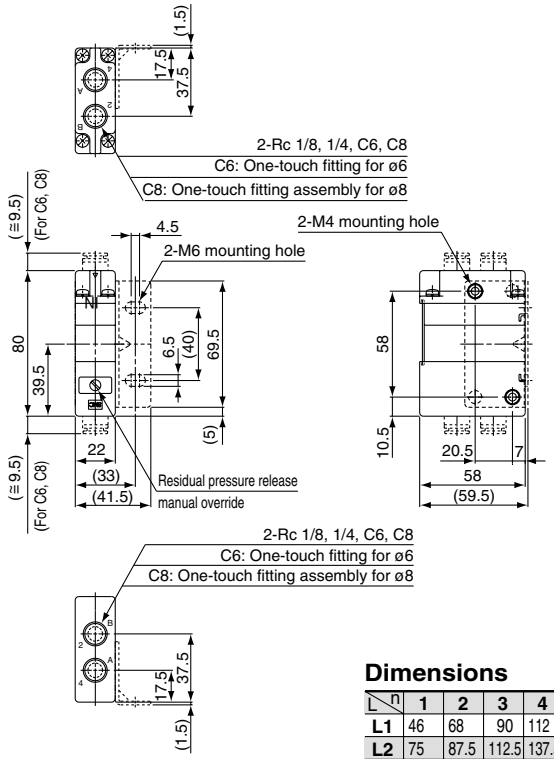
Specifications

Maximum operating pressure	0.8 MPa
Ambient and fluid temperature	0.15 MPa
Ambient and fluid temp.	–5 to 50° C
Flow characteristics: C	3.0 dm³/(s·bar)
Max. operating frequency	180 c.p.m

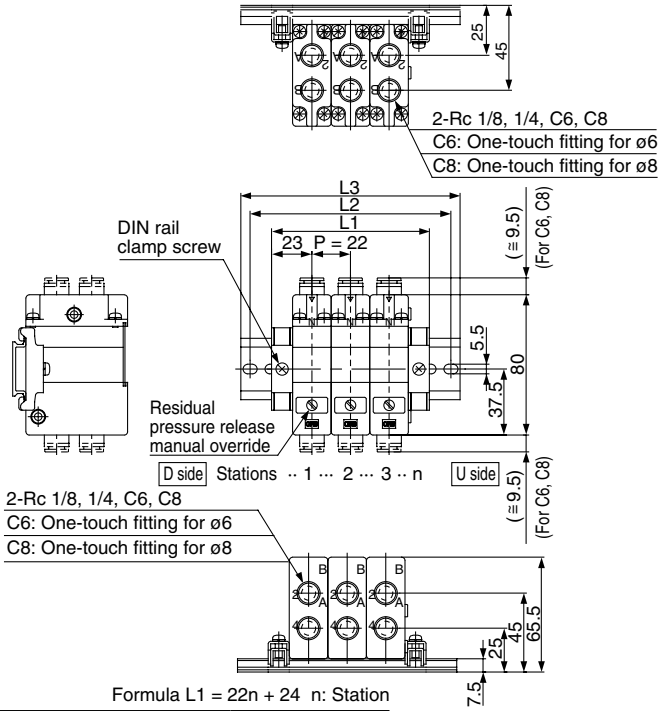
Note) Based on JIS B 8375-1981 (Supply pressure: 0.5 MPa)

Dimensions

Single unit



Manifold



Dimensions

Formula L1 = 22n + 24 n: Station

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46	68	90	112	134	156	178	200	222	244	266	288	310	332	354	376
L2	75	87.5	112.5	137.5	162.5	175	200	225	250	262.5	287.5	312.5	337.5	362.5	375	400
L3	85.5	98	123	148	173	185.5	210.5	235.5	260.5	273	298	323	348	373	385.5	410.5

How to Order

Double check block

VQ2000-FPG- 01 01 F

IN side port size

01	Rc 1/8
02	Rc 1/4
C6	One-touch fitting for ø6
C8	One-touch fitting for ø6

OUT side port size

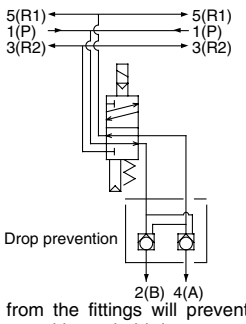
01	Rc 1/8
02	Rc 1/4
C6	One-touch fitting for ø6
C8	One-touch fitting for ø6

Option

Nil	None
D	DIN rail mounting style (For manifold)
F	With bracket
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically.
Example) -DN

<Example>



Manifold

VVQ2000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Ordering Example>
VVQ2000-FPG-06····6 stations manifold
∗VQ2000-FPG-C6C6-D: 3 sets
∗VQ2000-FPG-C8C8-D: 3 sets
} Double check block

⚠ Caution

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap.
  Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- When screwing the fittings in the double check block, proper tightening torque is as shown below:

Connection threads	Proper tightening torque (N·m)
Rc 1/8	7 to 9
Rc 1/4	12 to 14

- If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

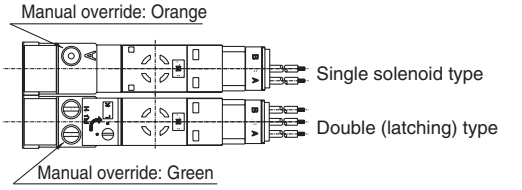
⚠ Precautions

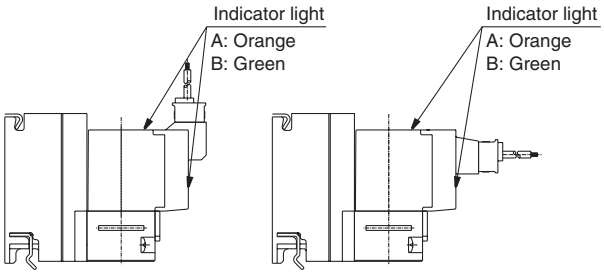
Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

Light/Surge Voltage Suppressor

⚠ Caution

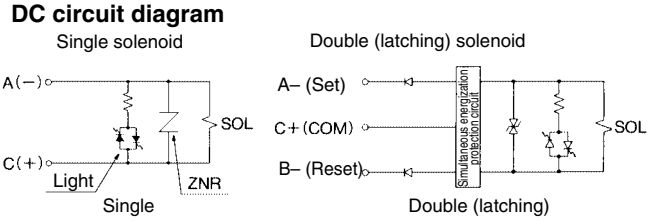
The lighting positions are concentrated on one side for both single solenoid and double (latching) type. In the double (latching) type, A side and B side energization are indicated by two colors which match the colors of the manual overrides.





M plug connector **L plug connector**

DC circuit diagram



Note 1) • A-side energization: A light (orange) illuminates.
• B-side energization: B light (green) illuminates.
• Equipped with a wiring error prevention (stop diode) mechanism and a surge absorption (ZNR/surge absorption diode) machanism.

Note 2) Applicable to negative COM specification models.

Note 3) In the case of double (latching), the electromagnetic valve channel is, A–(set): P → A, B → R, B–(reset): P → B, A → R.

Double (Latching solenoid) Type

⚠ Caution

Different from the conventional double solenoid, the double type uses a latching (self-holding system) solenoid. Although the appearance is the same as the single solenoid, it is constructed so that the movable iron core in the solenoid is held in the ON position on A and B sides by instantaneous energization (20 ms or more).

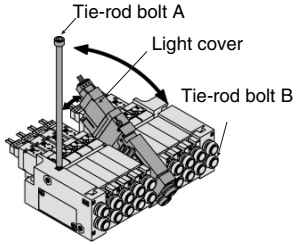
The usage and function is the same as the double solenoid.

<Special Cautions for Latching Solenoid>

1. Select the circuit in which ON and OFF signals are not energized simultaneously.
2. 20 ms energization time is necessary for self-holding.
3. Avoid using the latching solenoid valves in environments where impact or collisions with the valve might occur. Also, do not use in places where strong magnetic fields are present.
4. Even though the armature in the solenoid of this valve is held on to B side, ON position (Reset), verify either A side, ON position or B side, ON position by energizing prior to use.
5. After manual operation, the main valve will return to its original position. Manual override on the pilot valve side can retain its switching position after manipulation.
6. Please contact SMC for long-term energization applications.
7. If the metal seal type goes down below the minimum operating pressure of supply air (0.1 MPa or less), the main valve will get back the home position. (B side ON position) Therefore, in the event of shutting the supply air or applying the air with being A side ON position remained, cylinder may be pulsated. In the event of manipulating the supply air, the valve's switching position has to be set in the home position side (B side ON position side).

How to Mount/Remove Solenoid Valve

⚠ Caution



<Procedure>

How to Remove

1. Loosen tie-rod bolt B. (Two to four turns)
2. After fully loosening the tie-rod bolt, take off bolt A upward as shown above.
3. Slide the valves aside to make a 1 mm clearance between the valve to be taken off and the others. As shown above, remove the whole valve while holding up the (a) side. (Avoid rough handing of the connector.)

Mounting

Reverse the sequence of steps above to remount.

Tighten the tie-rod bolts with the tightening torque at the right table while using caution not to tighten the only one side unevenly.

Torque Applied to Tie-rod Bolt

VQ0000	0.5 to 0.7 N·m
VQ1000	1.0 to 1.4 N·m
VQ2000	1.0 to 1.4 N·m

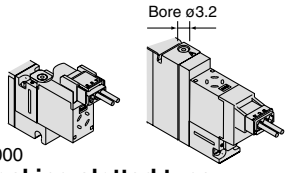
Note) Be careful not to push on the light cover while mounting/removing the valve.

Double (Latching solenoid) Type

⚠ Warning

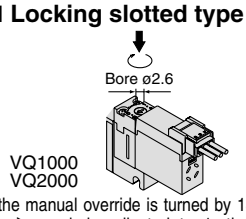
Without an electric signal for the solenoid valve the manual override is used for switching the main valve.

■ Push type (Tool required)

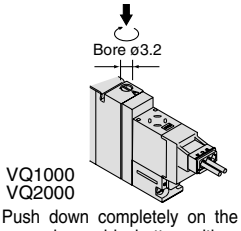


Push down on the manual override button with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

■ Locking slotted type

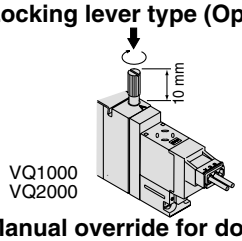


If the manual override is turned by 180° clockwise and the ▶ mark is adjusted to 1, then pushed in the direction of an arrow (↓), it will be locked in the ON state. If the manual override is turned by 180° counterclockwise and ▶ mark is adjusted to 0, locking will be released and the manual override will return.



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.

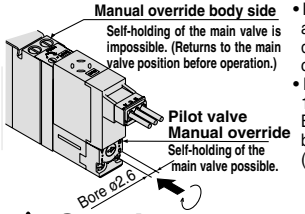
■ Locking lever type (Option)



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.

■ Manual override for double (latching) type

In the case of a double (latching) type, a manual override is provided not only on the body side but to the pilot as a standard. (VQ0000: Pilot valve only). After manual operation, the main valve of the manual on the body side returns to the position before the manual operation, however, the pilot valve manual override maintains the change-over position.



- If the manual override is turned by 180° clockwise and the ▶ mark is adjusted to A, then pushed in the direction of an arrow (⇕), it will be back to the reset condition. (passage P → A)
- If the manual override is turned by 180°counterclockwise and the ▶ mark is adjusted to B, then pushed in the direction of an arrow (⇕), it will be back to the reset condition. (passage P → B) (It is in the reset state at the time of shipment.)

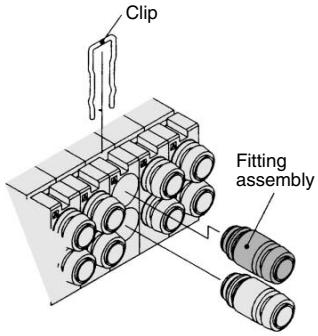
⚠ Caution

Do not apply excessive torque when turning the locking type manual override. (0.1 N·m or less)

Replacement of Cylinder Port Fittings

⚠ Caution

The cylinder port fittings are a cassette for easy replacement. (Except VQ1000)
The fittings are blocked by a clip inserted from the top of the valve. Remove the clip with a screwdriver to remove fittings. For replacement, insert the fitting assembly until it strikes against the inside wall and then re-insert the clip to the specified position.



Applicable tubing O.D	Fitting assembly part no.	
	VQ1000	**VQ2000**
Applicable tubing ø3.2	VVQ1000-50A-C3	—
Applicable tubing ø4	VVQ1000-50A-C4	VVQ1000-51A-C4
Applicable tubing ø6	VVQ1000-50A-C6	VVQ1000-51A-C6
Applicable tubing ø8	—	VVQ1000-51A-C8

Purchasing order is available in units of 10 pieces.

Caution

1. Protect O-rings from scratches and dust to prevent air leakage.
2. The tightening torque for inserting fittings to the M5 thread assembly should be 0.8 to 1.4 N·m

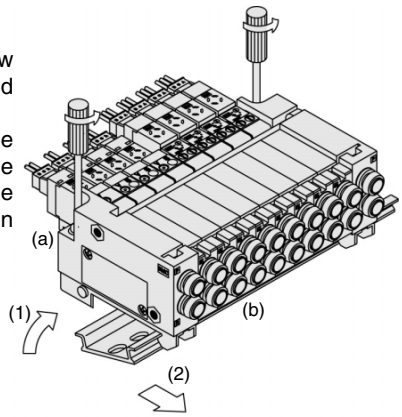
Mounting/Removing from the DIN Rail

⚠ Caution

<Procedure>

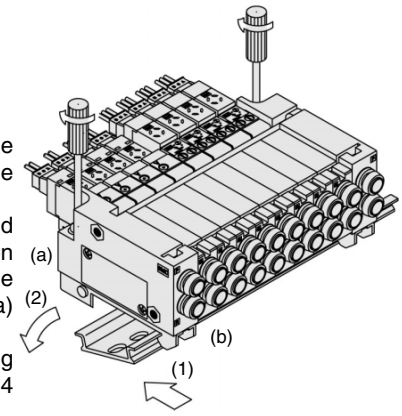
How to Remove

1. Loosen the clamp screw on side (a) of the end plate on both sides.
2. Lift side (a) of the manifold base and slide the end plate in the direction of (2) shown in the figure to remove.



Mounting

1. Hook side (b) of the manifold base on the DIN rail.
2. Press down side (a) and mount the end plate on the DIN rail. Tighten the clamp screw on side (a) of the end plate.
   The proper tightening torque for screws is 0.4 to 0.6 N·m.



How to Calculate the Flow Rate

For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

Built-in Silencer Replacement Element

⚠ Caution

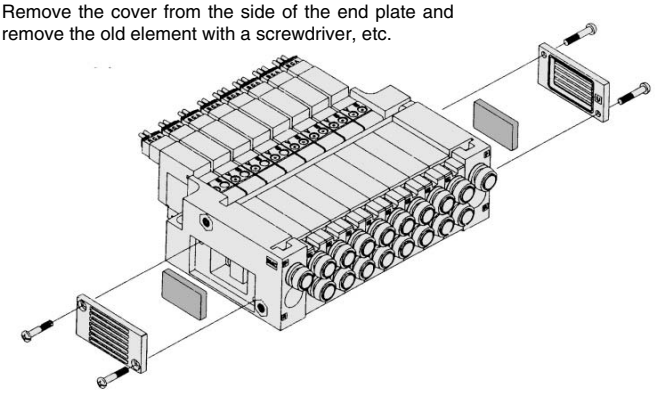
A silencer element is incorporated in the end plate on both sides of the manifold base. A dirty and choked element may reduce cylinder speed or cause malfunction. Clean or replace the dirty element.

Element Part No.

Type	Element part no.		
	VQ0000	**VQ1000**	**VQ2000**
Built-in silencer, direct exhaust (-S)	VVQ0000-82A-4	VVQ1000-82A-4	VVQ2000-82A-4

∗ The minimum order quantity is 10 pcs.

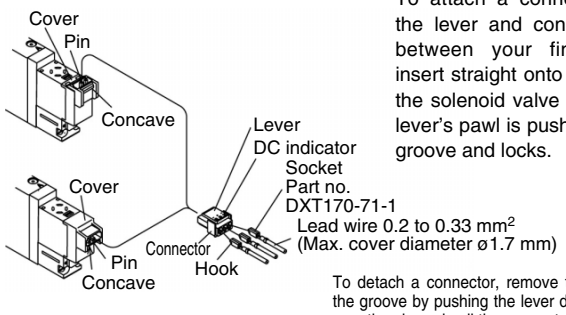
Remove the cover from the side of the end plate and remove the old element with a screwdriver, etc.



How to Use Plug Connector

⚠ Caution

Attaching and detaching connectors

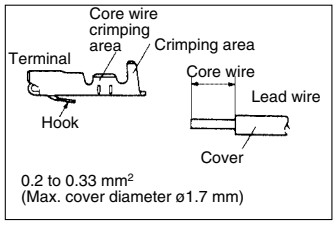


To attach a connector, hold the lever and connector unit between your fingers and insert straight onto the pins of the solenoid valve so that the lever's pawl is pushed into the groove and locks.

To detach a connector, remove the pawl from the groove by pushing the lever downward with your thumb, and pull the connector straight out.

Crimping the lead wire and socket

Peel 3.2 to 3.7 mm of the tip of lead wire, enter the core wires and press contact it by a press tool. Be careful so that the cover of lead wire does not enter into the core press contacting part.



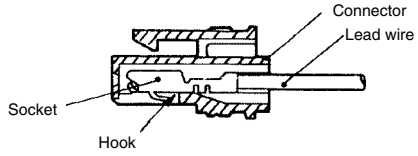
Attaching and detaching lead wires with sockets

Attaching

Insert a socket in the square hole (Indicated as +, –) of connector, push in the lead wire and lock by hanging the hook of socket to the seat of connector. (Pushing-in can open the hook and lock it automatically.) Then confirm the lock by lightly pulling on the lead wire.

Detaching

To detach a socket from a connector, pull out the lead wire while pressing the socket's hook with a stick having a thin tip (approx. 1 mm). If the socket will be used again, first spread the hook outward.

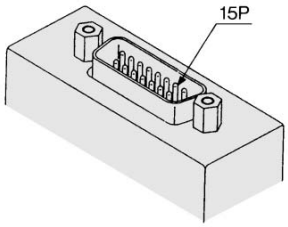


Option

Different Number of Connector Pins

F and P kits with the following number of pins are available. Besides the standard number (F = 25; P = 26) select the desired number of pins and cable length from the cable assembly list. Place an order for the cable assembly separately.

F kit (D-sub connector) 15 pins



How to order manifold

VV5Q14 — 06 F SA — D

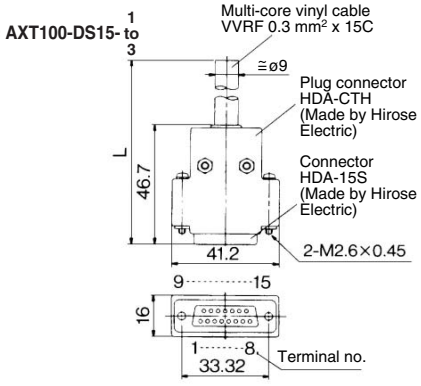
- 06 → Stations
- SA → Kit/Electrical entry
- D → Option

How to Order
D-sub connector, 15 pins
Connector location–Side (horizontal)
Without cable

Pins \ Location	Top entry		Side entry	
15P (Max. 7 stations)	Kit F	UA	Kit F	SA

Wiring specifications

∗ In the same way as the 25-pin models (standard) the terminal no. 1 is for SOL.A at the 1st station, the terminal no. 9 for SOL.B at the 1st station, and the terminal no. 8 for COM.



Wire Color by Terminal No. of D-sub Connector Cable Assembly

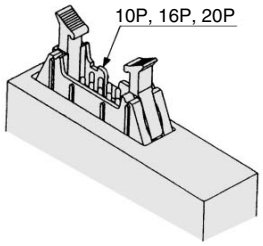
Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black

D-sub Connector Cable Assembly

Cable length (L) \ Pins	15P
1.5 m	AXT100-DS15-1
3 m	AXT100-DS15-2
5 m	AXT100-DS15-3

∗ For other commercial connectors, use a type conforming to MIL-C-24308.

P kit (Flat ribbon cable connector) 10 pins, 16 pins, 20 pins



How to order manifold

VV5Q14 — 06 P SC — D

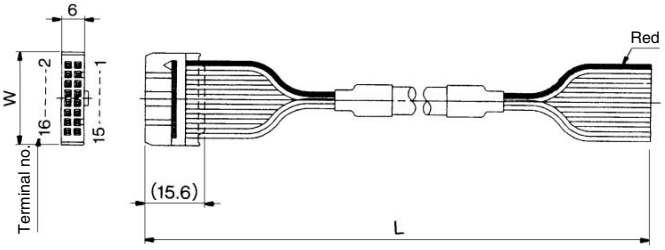
- 06 → Stations
- SC → Kit/Electrical entry
- D → Option

How to Order
Flat ribbon cable, 20 pins
Connector location–Side (Horizontal)
Without cable

Pins \ Location	Top entry		Side entry	
10P (Max. 4 stations)	Kit P	UA	Kit P	SA
16P (Max. 7 stations)		UB		SB
20P (Max. 8 stations)		UC		SC

Wiring Specifications

∗ In the same way as the 26-pin models (standard) the terminal no. 1 is for SOL.A at the 1st station, the terminal no. 2 for SOL.B at the 1st station, and two pins from the max. terminal numbers are for COM.



Flat Ribbon Cable Assembly

Cable length (L) \ Pins	10P	16P	20P
1.5 m	AXT100-FC10-1	AXT100-FC16-1	AXT100-FC20-1
3 m	AXT100-FC10-2	AXT100-FC16-2	AXT100-FC20-2
5 m	AXT100-FC10-3	AXT100-FC16-3	AXT100-FC20-3
Connector width (W)	17.2	24.8	30

∗ For other commercial connectors, use a type with strain relief conforming to MIL-C-83503.

Special Wiring Specifications

In the internal wiring of F kit, P kit, T kit and S kit, double wiring (connected to SOL. A and SOL. B) is adopted for each station regardless of the valve and option types.
Mixed single and double wiring is available as an option.

1. How to order valves

Indicate an option symbol, -K, for the manifold no. and be sure to specify the mounting position and number of stations of the single and double wiring by means of the manifold specification sheet.

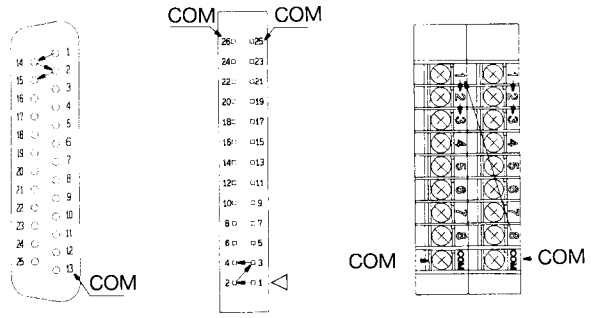
Example)

VV5Q14-09FS0-D K S

Others, option symbols: to be indicated alphabetically.

2. Wiring specifications

Connector terminal numbers are connected from solenoid station 1 on the A side in the order indicated by the arrows without skipping any terminal numbers.



F kit
D-sub connector (25P)

P kit
Flat ribbon cable connector (26P)

T kit
Terminal block (16 terminals)

3. Max. number of stations

The maximum number of stations depends upon the number of solenoids. Assuming one for a single and two for a double, determine the number of stations so that the total number is not more than the maximum number given in the following table.

kit	F kit (D-sub connector)		P kit (Flat ribbon cable connector)				T kit (Terminal block)		S kit (Serial)
Type	F⇅□ 25P	F⇅A 15P	P⇅□ 26P	P⇅C 20P	P⇅B 16P	P⇅A 10P	T1	T2	S□
Max. points	Note) 16	14	Note) 16	Note) 16	14	8	8	16	16

Note) Due to the limitation of internal wiring.

Negative Common Specifications

Specify the valve model no. as shown below for negative COM specification. The standard manifold no. can be used. Please contact SMC for negative COM S kit.

How to order negative COM valves

VQ1140 N − 5LO − C6

Negative common specifications

Inch-size One-touch Fittings

Refer to following model no. for inch-size One-touch fittings.

How to order manifold

VV5Q14 − 08FSO − DN − 00T

P, R port size

VQ0000	ø1/4"
VQ1000	ø1/4"
VQ2000	ø5/16"

How to order valves

VQ1140 − 5M − N7

Cylinder port

Symbol		N1	N3	N7	N9
Applicable tubing O.D. (Inch)		ø1/8"	ø5/32"	ø1/4"	ø5/16"
A, B port	**VQ0000**	○	○	—	—
	VQ1000	—	○	○	—
	VQ2000	—	○	○	○

Plug Connector Assembly Model

Connector assembly will be required when the F, P, T, S kits add a valve.
Specify the type of valve and connector assembly.

Connector Assembly Part No.

Specifications		Part no.
Single (2-wire)	Positive common	AXT661-14A-F
	Negative common	AXT661-14AN-F
Double (latching) (3-wire)	Positive common	AXT661-13A-F
	Negative common	AXT661-13AN-F

Note) Lead wire length: 300 mm
Note) The parts numbers above are applicable to VQ0000/1000 (2 to 16 stations) and VQ2000 (2 to 10 stations). VQ2000 (11 to 16 stations) uses AXT661-$^{13}_{14}$A(N) -F425.

Option

DIN Rail Mounting

Each manifold can be mounted on a DIN rail.
Order it by indicating an option symbol for DIN rail mounting style, -D. In this case, a DIN rail which is approx. 30 mm longer than the manifold with the specified number of stations is attached. Besides, it is also available in the following cases.

● **When DIN rail is unnecessary (C kit only.)**
(DIN rail mounting brackets only are attached.)
Indicate the option symbol, -DO, for the manifold no.

Example)

VV5Q14-08C-DOS

Others, option symbols: to be indicated alphabetically.

● **When using DIN rail longer than the manifold with specified number of stations**
Clearly indicate the necessary number of stations next to the option symbol, -D, for the manifold no.

Example)

VV5Q14-08FS1-D09S

DIN rail for 9 stations

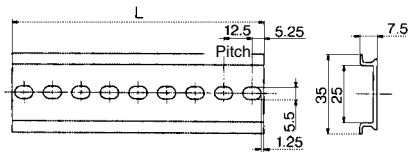
Others, option symbols: to be indicated alphabetically.

● **When changing the manifold style into a DIN rail mount**
Order brackets for mounting a DIN rail. (Refer to “Option” on pages 2-4-60, 61 and 64.)

No. VQ0000-57A4 (For VQ0000)
VQ1000-57A-4 (For VQ1000)
VQ2000-57A-4 (For VQ2000)
2 pcs. per one set

● **When ordering DIN rail only**
DIN rail no.: AXT100-DR-n

∗ Refer to the DIN rail dimension table for determining the length.



L Dimension

L = 12.5 x n + 10.5

No.	1	2	3	4	5	6	7	8	9	10
L dimension	23	35.5	48	60.5	73	85.5	98	110.5	123	135.5
No.	11	12	13	14	15	16	17	18	19	20
L dimension	148	160.5	173	185.5	198	210.5	223	235.5	248	260.5
No.	21	22	23	24	25	26	27	28	29	30
L dimension	273	285.5	298	310.5	323	335.5	348	360.5	373	385.5
No.	31	32	33	34	35	36	37	38	39	40
L dimension	398	410.5	423	435.5	448	460.5	473	485.5	498	510.5

Series VQ1000

Body Ported

Plug Lead Unit: Cassette Type

How to Order Manifold

VV5Q1 7 — 08 F U1 — D

Series VQ1000

Manifold

7	Plug lead unit/Cassette

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit. (Refer to the table below.)

Simple specials are available with SMC Simple Specials System. For details about applicable models, please contact SMC.

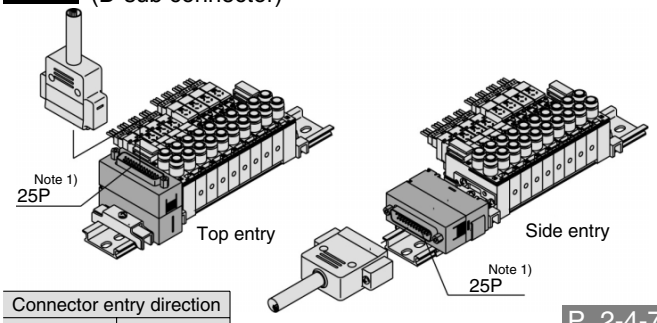
Option

D (1)	DIN rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N (3)	With name plate

Note 1) Since the manifold is all with DIN rail, and so suffix -D to the part number.
Note 2) Specify the wiring specifications on the manifold specification sheet. (Except C kit)
Note 3) Unmountable when the valve's manual override is a locking lever type.
Note 4) When two or more symbols are specified, indicate them alphabetically.

Kit/Electrical entry/Cable length

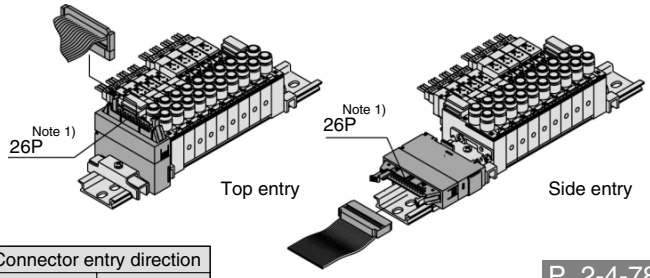
F kit (D-sub connector)



P. 2-4-76

Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 stations (2)
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

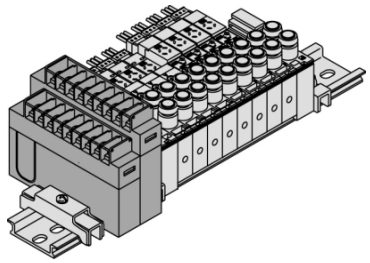
P kit (Flat ribbon cable connector)



P. 2-4-78

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 stations (2)
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

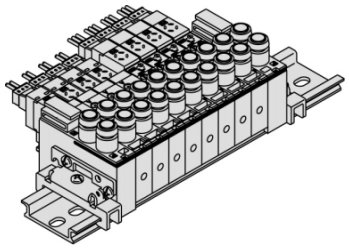
T kit (Terminal block)



P. 2-4-80

Kit T			
	1	No. of terminals: 8, 1 row	Applicable stations 1 to 8
	2	No. of terminals: 16, 2 rows	Applicable stations 5 to 16

C kit (Connector)

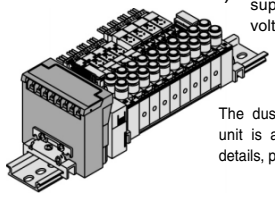


P. 2-4-82

C	Connector kit	Max. 16

S kit (Serial transmission unit)

The valve is equipped with an indicator light/surge voltage suppressor and the voltage is 24 VDC.



The dust-protected type SI unit is applicable, too. For details, please contact SMC.

P. 2-4-84

Kit S			
	0	Without SI unit	Max. 16 stations (2)
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	E	Matsushita Electric Works: MEWNET-F System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System	
	H	NKE Corp.: Uni-wire H System	
	J1	SUNX Corp.: S-LINK System (16 output points)	
	J2	SUNX Corp.: S-LINK System (8 output points)	Max. 8
	K	Fuji Electric Co.: T-LINK Mini System	Max. 16 stations
	Q	DeviceNet, CompoBus/D (OMRON Corp.)	
	R1	OMRON Corp.: CompoBus/S System (16 output points)	
	R2	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8
	V	Mitsubishi Electric Corp.: CC-LINK System	Max. 16

Note 1) Besides the above, F and P kits with different number of pins are available. For details, refer to page 2-4-92.
Note 2) See page 2-4-93 for details.

How to Order Valves

VQ 1 1 7 0 Y 5 M C6

Series VQ1000

Type of actuation

1	2 position single	
2	2 position double (Latching)	Metal seal / Rubber seal
3	3 position closed center	
4	3 position exhaust center	
5	3 position pressure center	

L type plug connector is used for 3 position AC.

Coil voltage

1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) 200/220 VAC models are applicable to the C kit.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note1) For power consumption of AC type, refer to page 2-4-74.
Note2) Except double (latching).

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-93.
Note 2) Connector assembly will be required when the F, P, T, S kits add a valve. For model no., refer to "Option" on page 2-4-93.

Manual override

Nil: Non-locking push type (Tool required)	B: Locking type (Tool required)	C: Locking type (Manual)

Manual override body side
Bore ø3.2
Pilot valve manual override

Note) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

G: Grommet (C kit only. Except double (latching) and AC.)	L: L plug connector With lead wire	LO: L plug connector Without lead wire	M: M plug connector With lead wire	MO: M plug connector Without lead wire
	With light/surge voltage suppressor	With light/surge voltage suppressor	With light/surge voltage suppressor	With light/surge voltage suppressor

Note) LO and MO valves are used for F, P, T, and S kits. Plug connector and Lead wire layers are attached to the manifold.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

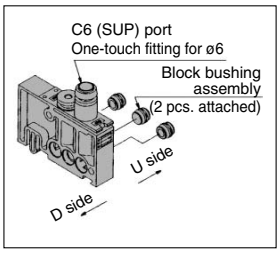
Note 1) The code is L for elbow piping for all manifold stations.
Example) L6: Elbow with One-touch fittings for ø6
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-93.

VQC
SQ
VQ0
VQ4
VQ5
VQZ
VQD

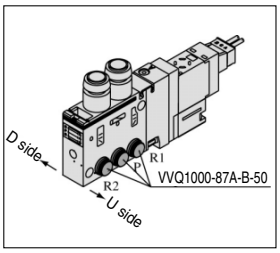
Manifold Option

P. 2-4-87

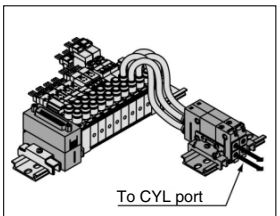
Individual SUP spacer
VVQ1000-P-7-C6



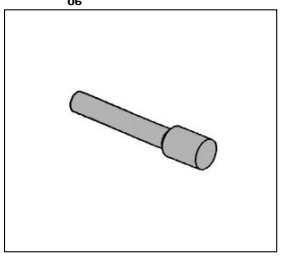
SUP/EXH block bush assembly
VVQ1000-87A-B-50



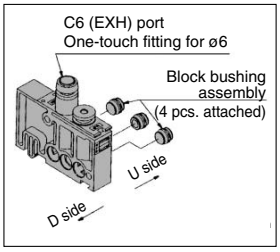
Double Check block
VQ1000-FPG-□□



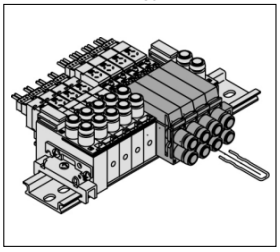
Blanking plug
KQ2P- $^{23}_{04}_{06}$



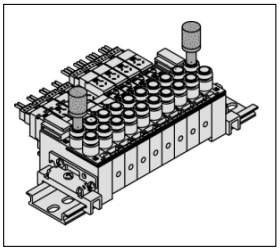
Individual EXH spacer
VVQ1000-R-7-C6



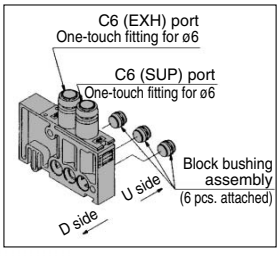
Elbow fitting assembly
VVQ1000-F7-L $^{C3}_{C4}_{C6}$



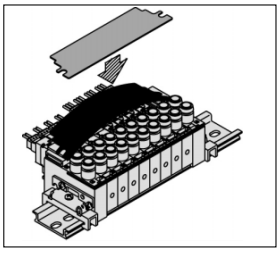
Silencer
AN103-X233



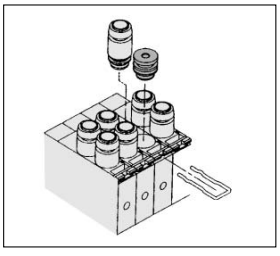
Individual SUP/EXH spacer
VVQ1000-PR-7-C6



Name plate [-N7]
VVQ1000-N7-station (1 to Max. stations)



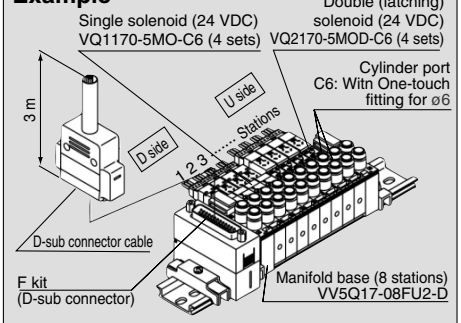
Port plug
VVQ0000-58A



• See page 2-4-91 for cylinder port fittings.
• For replacement parts, refer to page 2-4-111.

How to Order Manifold Assembly

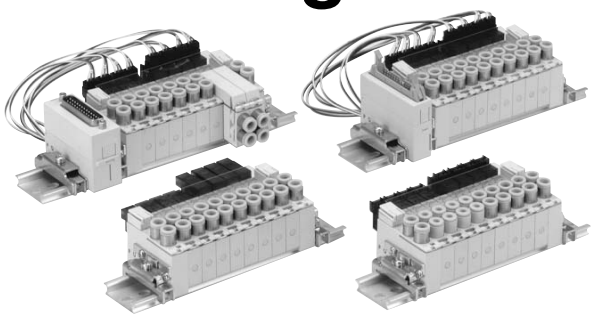
Example



VV5Q17-08FU2-D ····· 1 set (F kit 8 station manifold base no.)
*VQ1170-5MO-C6 ····· 4 sets (Single solenoid part no.)
*VQ1270-5MOB-C6 ··· 4 sets (Double latching solenoid part no.)
The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

Add the valve and option part number under the manifold base part number. In the case of complex arrangement, specify them on the manifold specification sheet.

Series VQ1000
Body Ported
Plug Lead Unit: Cassette Type



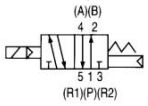
Model

Series	Number of solenoids		Model		Flow characteristics: 1 → 4/2 (P → A/B) C [dm³/(s·bar)]	b	Cv	Flow characteristics: 4/2 → 5/3 (A/B → R1/R2) C [dm³/(s·bar)]	b	Cv	Response time (2) (ms): Standard: 1 W H: 1.5 W	Response time (2) (ms): Low wattage: 0.5 W	AC	Weight (g)
VQ1000	2 position	Single	Metal seal	VQ1170	0.56	0.15	0.13	0.60	0.12	0.14	12 or less	15 or less	29 or less	67
			Rubber seal	VQ1171	0.71	0.20	0.17	0.80	0.16	0.19	15 or less	20 or less	34 or less	
		Double (Latching)	Metal seal	VQ1270	0.56	0.15	0.13	0.60	0.12	0.14	12 or less	15 or less	29 or less	
			Rubber seal	VQ1271	0.71	0.20	0.17	0.80	0.16	0.19	15 or less	20 or less	34 or less	
	3 position	Closed center	Metal seal	VQ1370	0.53	0.16	0.12	0.58	0.12	0.14	20 or less	26 or less	40 or less	82
			Rubber seal	VQ1371	0.65	0.23	0.16	0.70	0.20	0.17	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ1470	0.54	0.16	0.12	0.60	0.12	0.14	20 or less	26 or less	40 or less	
			Rubber seal	VQ1471	0.65	0.23	0.16	0.80	0.16	0.19	25 or less	33 or less	47 or less	
		Pressure center	Metal seal	VQ1570	0.54	0.16	0.12	0.58	0.12	0.14	20 or less	26 or less	40 or less	
			Rubber seal	VQ1571	0.70	0.20	0.17	0.72	0.20	0.17	25 or less	33 or less	47 or less	

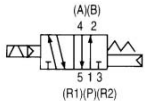
Note 1) Cylinder port size C6
Note 2) As per JIS B 8375-1981 (Supply pressure: 0.5 MPa; with indicator light/surge voltage suppressor; clean air. Subject to the pressure and air quality.)

JIS Symbol

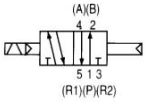
2 position single



2 position double (latching)

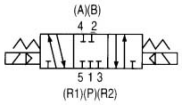


Metal seal

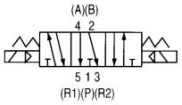


Rubber seal

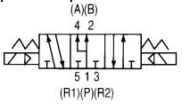
3 position closed center



3 position exhaust center



3 position pressure center



Standard Specifications

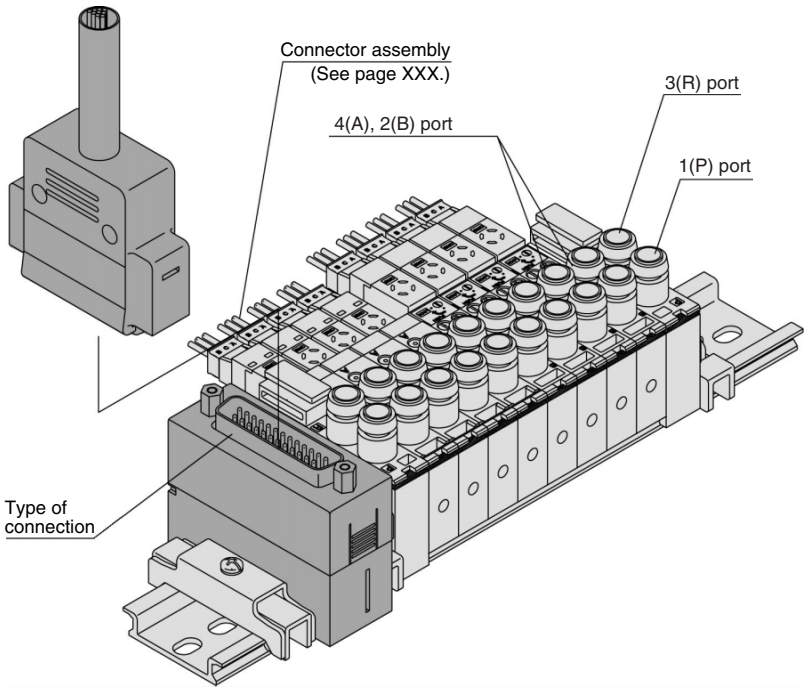
			Metal seal	Rubber seal
Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure		0.7 MPa (High pressure type: 0.8 MPa) (3)	
	Minimum operating pressure	Single	0.1 MPa	0.15 MPa
		Double (Latching)	0.1 MPa	0.15 MPa
		3 position	0.15 MPa	0.2 MPa
	Ambient and fluid temperature		10 to 50°C (1)	
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required, Manual) Option	
	Impact/Vibration resistance (2)		150/30 m/s²	
	Enclosure		Dust-protected	
Solenoid	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA) (3), 0.5 W DC (21 mA) (4)	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA) (3), 0.5 W DC (42 mA) (4)	
		100 VAC	Inrush 0.5 VA (5 mA), Holding 0.5 VA (5 mA)	
		110 VAC	Start-up 0.55 VA (5 mA), Holding 0.55 VA (7.5 mA)	
		200 VAC	Inrush 1.0 VA(5 mA), Holding 1.0 VA (5 mA)	
		220 VAC	Inrush 1.1 VA (5 mA), Holding 1.1 VA (5 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Values in the case of high pressure type (1.5 W).
Note 4) Values in the case of low wattage (0.5 W) specifications.

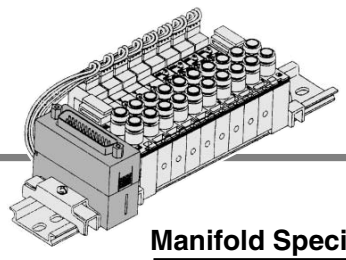
Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Applicable stations (2)	Applicable solenoid valve	5 station weight (g)
			Port location	Port size (1)				
				1(P), 3(R)	4(A), 2(B)			
VQ1000	**VV5Q17-□□□-D**	■F kit–D-sub connector ■P kit–Flat ribbon cable connector ■T kit–Terminal block ■C kit–Individual connector ■S kit–Serial transmission unit	Top	C6 (ø6)	C3 (ø3.2) C4 (ø4) C6 (ø6) M5 (M5 thread)	1 to 16 stations	VQ1□70 VQ1□71	405

Note 1) Inch-size One-touch fittings are also available. For details, refer to page 2-4-93.
Note 2) For details, refer to page 2-4-93.



F VQ1000 Kit (D-sub connector)

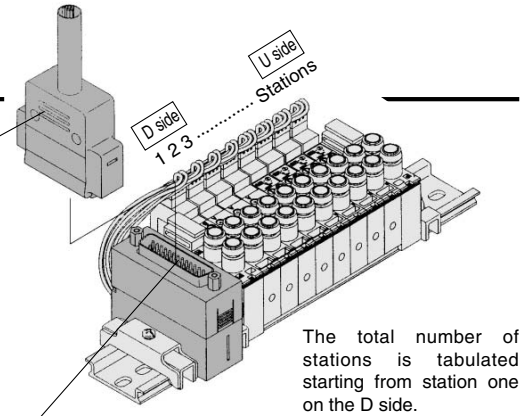


- The D-sub connector reduces installation labor for electrical connections.
- Using the D-sub connector (25P), (15P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size 1(P), 3(R)	Port size 4(A), 2(B)	
VQ1000	Top	C6	C3, C4, C6, M5	Max. 16 stations

D-sub Connector (25 pins)

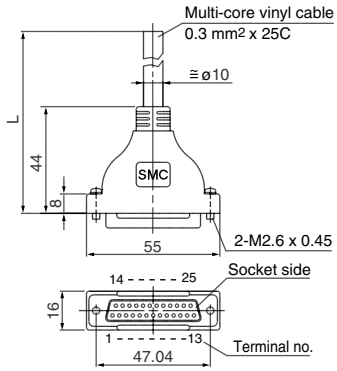


Cable assembly

The total number of stations is tabulated starting from station one on the D side.

AXT100-DS25- 015 / 030 / 050

(The D-sub connector cable assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.)



Wire Color by Terminal No. of D-sub Connector Cable Assembly

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25 core x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

∗ For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Electric Characteristics

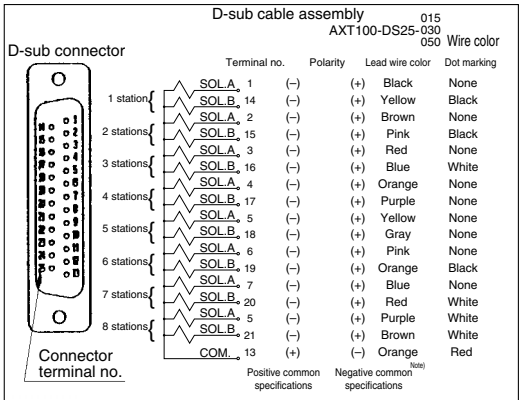
Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Insulation resistance V, 1 min, AC	1000
Insulation resistance MΩ/km, 20°C	5 or less

Note) The minimum bending radius of D-sub cable assembly is 20 mm.

Connector manufacturers' example
- Fujitsu Limited • J.S.T. Mfg. Co., Ltd.
- Japan Aviation Electronics Industry, Ltd.
- Hirose Electric Co., Ltd.

Note) Types with 15 pin are also available. Refer to page 2-4-92 for details.

Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option. For details, refer to page 2-4-93.
Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-93.)

How to Order Manifold

VV5Q1 7 – 08 F U 1 – D

Series VQ1000

Manifold

7	Plug lead unit/Cassette

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-93.

Connector entry direction

U	Top entry
S	Side entry

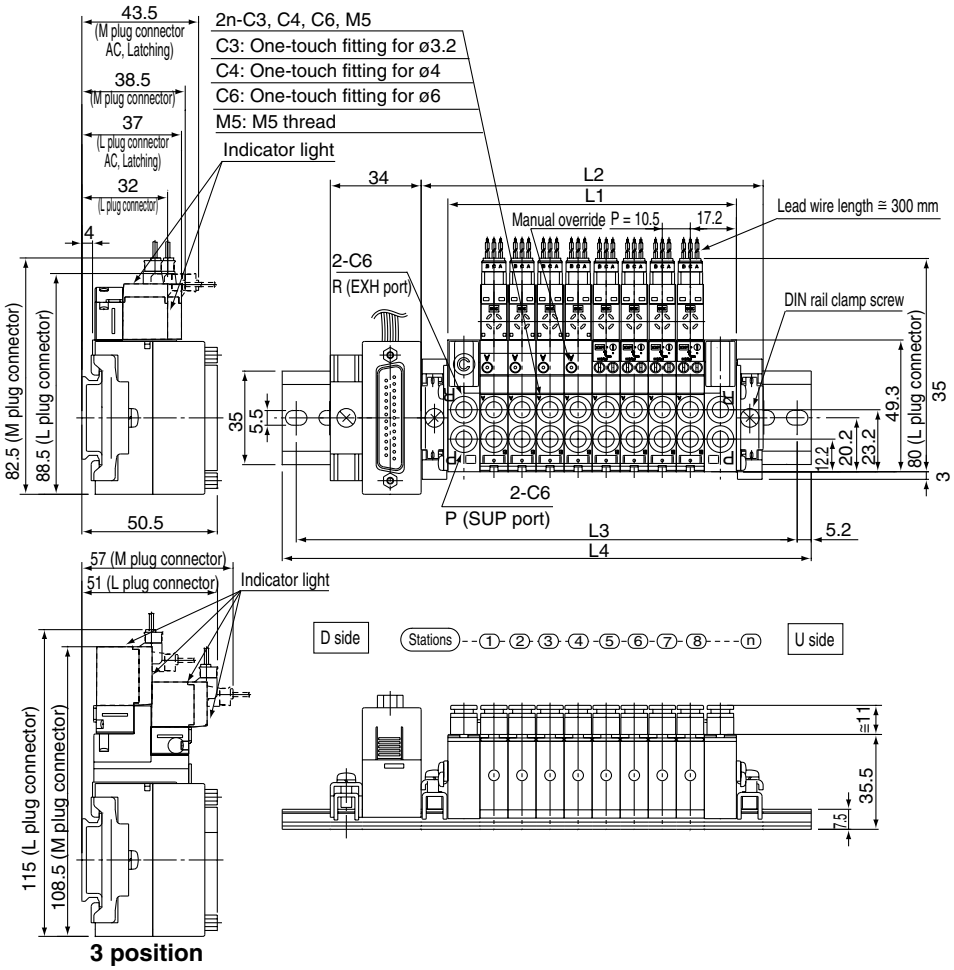
Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Option

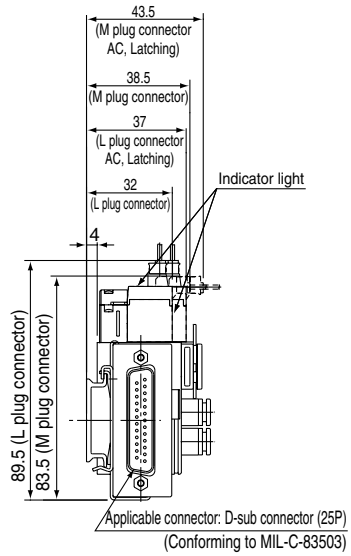
D (1)	DIN rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N (3)	With name plate

Note 1) Since the manifold is all with DIN rail, and so suffix -D to the part number.
Note 2) Specify the wiring specifications in the manifold specification sheet.
Note 3) Unmountable when the valve's manual override is a locking lever type.
Note 4) When two or more symbols are specified, indicate them alphabetically.



3 position

Side entry connector [FS]



Dimensions: Top Entry Connector [-FU]

Formula L1 = 10.5n + 24, L2 = 10.5n + 44 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	34.5	45	55.5	66	76.5	87	97.5	108	118.5	129	139.5	150	160.5	171	181.5	192
L2	54.5	65	75.5	86	96.5	107	117.5	128	138.5	149	159.5	170	180.5	191	201.5	212
L3	112.5	125	137.5	150	150	162.5	175	187.5	200	212.5	225	225	237.5	250	262.5	275
L4	123	135.5	148	160.5	160.5	173	185.5	198	210.5	223	232.5	235.5	248	260.5	273	285.5

Dimensions: Side Entry Connector [-FS]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	137.5	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	262.5	275	287.5
L4	148	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	273	285.5	298

How to Order Valves

VQ1 1 7 0 Y – 5 MO ☐ – C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note	3 position closed center
4 Note	3 position exhaust center
5 Note	3 position pressure center

Note) L type plug connector is used for 3 position AC.

Seal

0	Metal seal
1	Rubber seal

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-74.
Note 2) Except double (latching).

Note 1) For negative common specifications, refer to "Option" on page 2-4-93.
Note 2) Connector assembly will be required when the F kits add a valve. For part nos., refer to "Option" on page 2-4-93.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note1) The code is L for elbow piping for all manifold stations.
Example) L6: Elbow with One-touch fittings for ø6
Note 2) For One-touch fittings in inch sizes, refer to "Option" on page 2-4-93.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard mode for double type.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

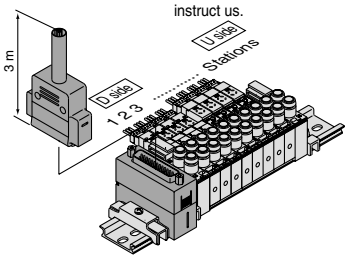
Note) Plug connector and lead wire layers are attached to the manifold.

How to Order Manifold Assembly

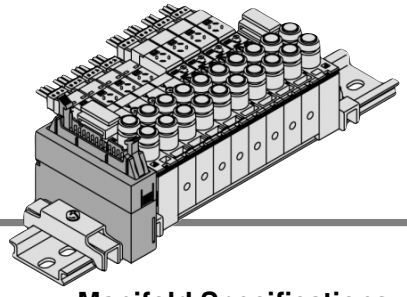
Specify the part numbers for valves and options together beneath the manifold base part number.
<Example>
D-sub connector kit with 3 m cable
VV5Q17-08FU2-D ··· 1 set Manifold base part no.
∗VQ1170-5MO-C6 ··· 4 sets Valve part no. (Stations 1 to 4)
∗VQ1270-5MOB-C6··· 4 sets Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. Besides, when the arrangement will be complicated, fill out the Manifold Specification Sheet to instruct us.



P VQ1000
Kit (Flat ribbon cable connector)

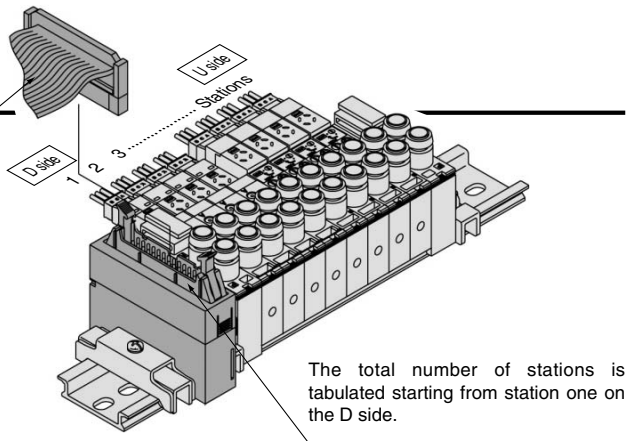


- MIL flat ribbon cable connector reduces installation labor savings for electrical connection.
- Using the connector for flat ribbon cable (26P), (10P, 16P, 20P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Top	C6	C3, C4, C6, M5	Max. 16 stations

Flat Ribbon Cable (26 pins)

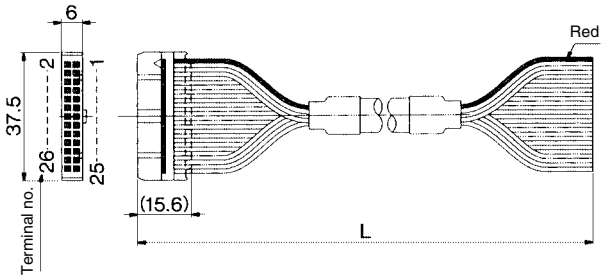


The total number of stations is tabulated starting from station one on the D side.

Cable assembly

AXT100-FC26-$\frac{1}{3}$ to

Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.



Flat Ribbon Cable Connector Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC26-1	Cable 26 core x 28AWG
3 m	AXT100-FC26-2	
5 m	AXT100-FC26-3	

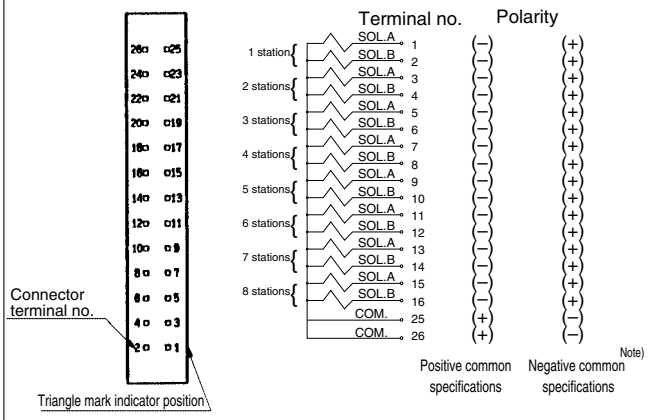
∗ For other commercial connectors, use a 26 pins type with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

- Sumitomo 3M Limited
- Fujitsu Limited
- Oki Electric Cable Co., Ltd.
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.

Note) Types with 10, 16, or 20 pin are also available. For details, refer to page 2-4-92.

Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-93.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-93.)

How to Order Manifold

VV5Q1 7 – 08 P U 1 – D

Series VQ1000

Manifold

7	Plug lead unit/Cassette

Stations

01	1 station
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-93.

Connector entry direction

U	Top entry
S	Side entry

Cable (Length)

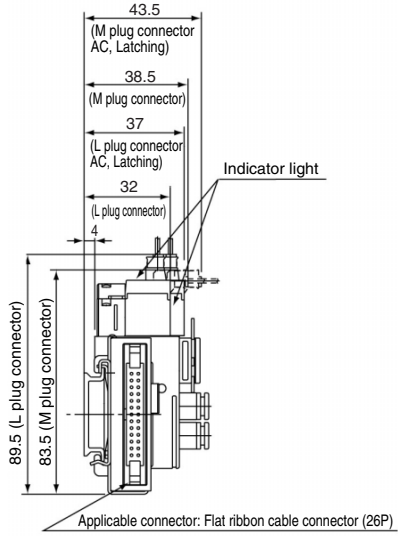
0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

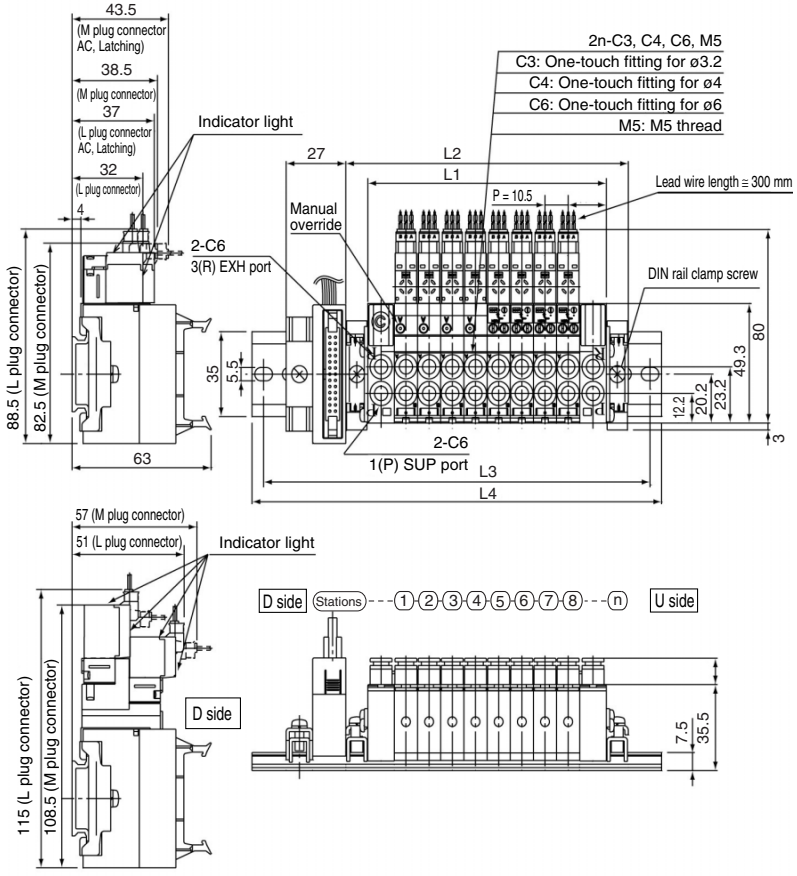
Option

D (1)	DIN rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N (3)	With name plate

Note 1) Since the manifold is all with DIN rail, and so suffix -D to the part number.
Note 2) Specify the wiring specifications on the manifold specification sheet.
Note 3) Unmountable when the valve's manual override is a locking lever type.
Note 4) When two or more symbols are specified, indicate them alphabetically.

Side entry connector [-PS]





3 position

Dimensions: Top Entry Connector [-PU] L1 = 10.5n + 24, L2 = 10.5n + 44 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	34.5	45	55.5	66	76.5	87	97.5	108	118.5	129	139.5	150	160.5	171	181.5	192
L2	54.5	65	75.5	86	96.5	107	117.5	128	138.5	149	159.5	170	180.5	191	201.5	212
L3	112.5	112.5	125	137.5	150	162.5	175	175	187.5	200	212.5	225	237.5	237.5	250	262.5
L4	123	123	135.5	148	60.5	173	185.5	185.5	198	210.5	223	235.5	248	248	260.5	273

Dimensions: Side Entry Connector [-PS]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	137.5	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	262.5	275	287.5
L4	148	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	273	285.5	298

How to Order Valves

VQ1 1 7 0 Y – 5 MO – C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) L type plug connector is used for 3 position AC.

Seal

0	Metal seal
1	Rubber seal

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-74.
Note 2) Except double (latching).

Note 1) For negative common specifications, refer to "Option" on page 2-4-93.
Note 2) Connector assembly will be required when the P kits add a valve. For model no., refer to "Option" on page 2-4-93.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

Note) Plug connector and lead wire layers are attached to the manifold.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note 1) The code is L for elbow piping for all manifold stations.
Example) L6: Elbow with One-touch fittings for ø6
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-93.

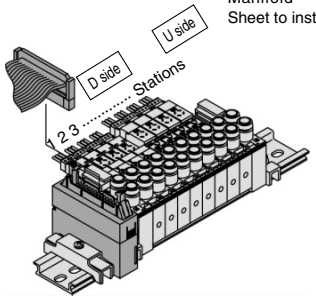
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

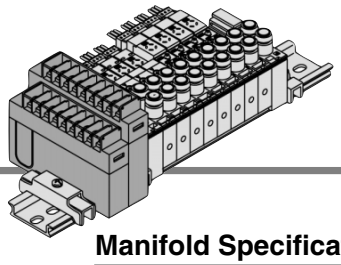
<Example>
Connector kit
VV5Q17-08PU2-D ··· 1 set –Manifold base part no.
∗VQ1170-5MO-C6 ··· 4 sets –Valve part no. (Stations 1 to 4)
∗VQ1270-5MOB-C6 ··· 4 sets –Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. Besides, when the arrangement will be complicated, fill out the Manifold Specification Sheet to instruct us.



T VQ1000 Kit (Terminal block)

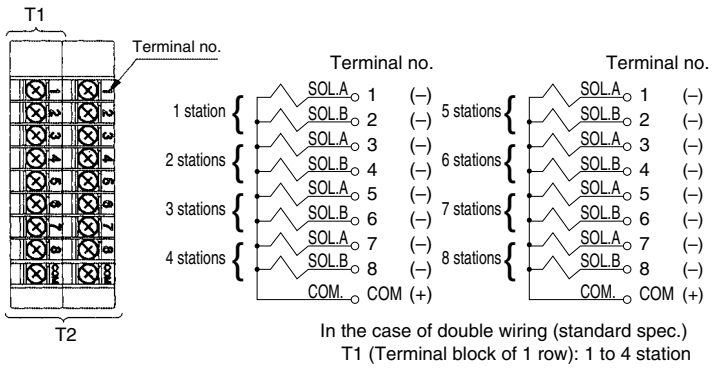


- It is a standard terminal block type.
- Two quantities of terminals can be selected in accordance with the number of stations.
  (8 terminals/16 terminals)
- Maximum stations are 16.

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P) , 3(R)	4(A), 2(B)	
VQ1000	Top	C6	C3, C4, C6, M5	Max. 16 stations

● Electrical wiring specifications



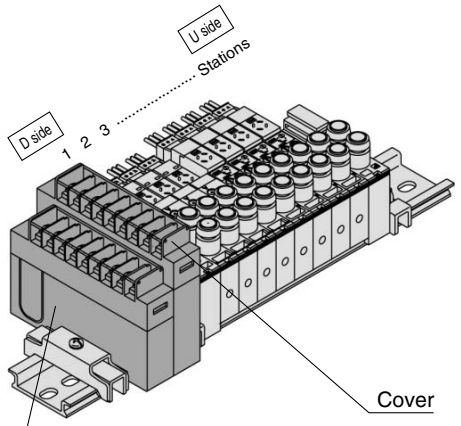
In the case of double wiring (standard spec.)
T1 (Terminal block of 1 row): 1 to 4 station
T2 (Terminal block of 2 rows): 5 to 8 stations
T1 and T2 can be optionally chosen by adopting the combinations of single and double wiring (optional spec.), etc.

The quantity of terminal blocks used depends on the number of manifold stations.

Manifold	Number of terminals
1 to 4 stations	1 row
5 to 8 stations	2 rows

Wiring other than those above is possible.
For details, refer to page 2-4-93.

Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-93.



● How to connect wires to terminal block

Open the terminal block cover to connect the wires to the terminal block.
(With M3 thread)

How to Order Manifold

VV5Q1 7 – 08 T 2 – D

Series VQ1000

Manifold

7	Plug lead unit/Cassette

Stations

01	1 station
⋮	⋮
16	16 stations

Note 1) For negative common specifications, refer to "Option" on page 2-4-93.
Note 2) For details, refer to page 2-4-93.

Number of terminals

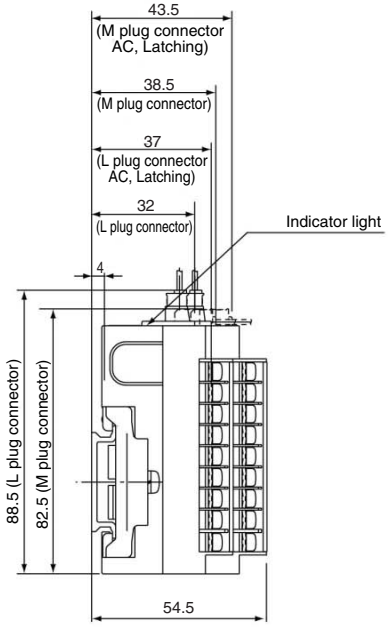
1	8 terminals in 1 row	Applicable stations 1 to 4 stations (Double)
2	16 terminals in 2 rows	Applicable stations 5 to 8 stations (Double)

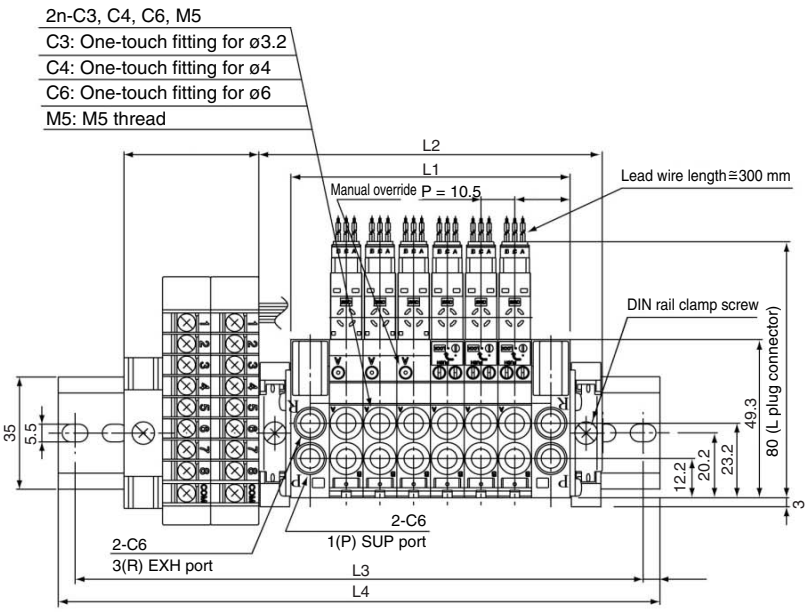
Note) The number of terminal blocks can be chosen regardless of station qty. Suffix the option symbol, K, when the wiring specification is special.

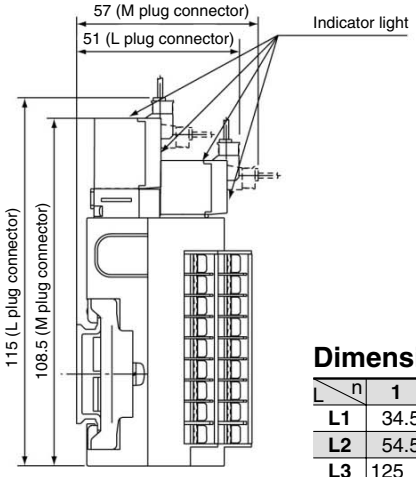
Option

D (1)	DIN rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N (3)	With name plate

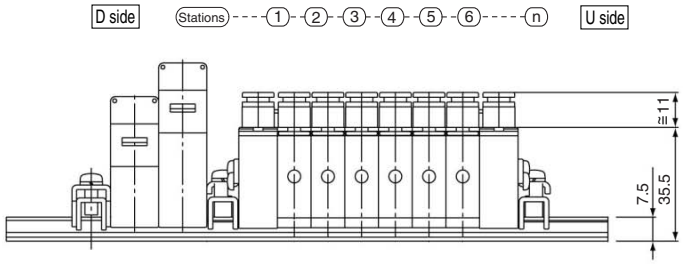
Note 1) Since the manifold is all with DIN rail, and so suffix -D to the part number.
Note 2) Specify the wiring specifications in the manifold specification sheet.
Note 3) Unmountable when the valve's manual override is a locking lever type.
Note 4) When two or more symbols are specified, indicate them alphabetically.







3 position



Dimensions

Formula L1 = 10.5n + 24, L2 = 10.5n + 44 n: Stations (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	34.5	45	55.5	66	76.5	87	97.5	108	118.5	129	139.5	150	160.5	171	181.5	192
L2	54.5	65	75.5	86	96.5	107	117.5	128	138.5	149	159.5	170	180.5	191	201.5	212
L3	125	137.5	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	275	275
L4	135.5	148	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	285.5	285.5

How to Order Valves

VQ1 1 7 0 Y 5 MO C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note 1) L type plug connector is used for 3 position AC.

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note 1) For power consumption of AC type, refer to page 2-4-74.
Note 2) Except double (latching).

Note 1) For negative common specifications, refer to "Option" on page 2-4-93.
Note 2) Connector assembly will be required when the T kits add a valve. For model no., refer to "Option" on page 2-4-93.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note 1) The code is L for elbow piping for all manifold stations.
Example) L6: Elbow with One-touch fittings for ø6
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-93.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

Note) Plug connector and lead wire layers are attached to the manifold.

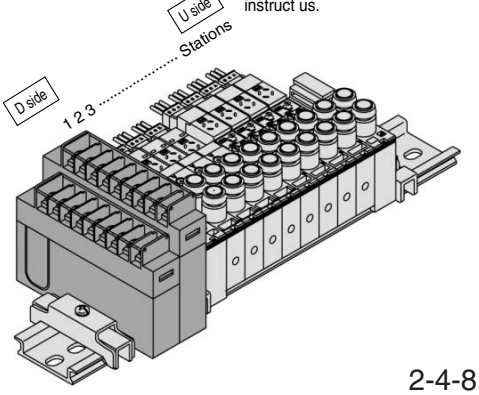
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

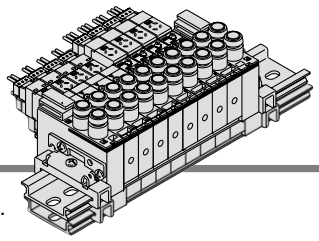
<Example>
Connector kit
VV5Q17-08T2-D ·····1 set–Manifold base part no.
*VQ1170-5MO-C6 ····4 sets–Valve part no. (Stations 1 to 4)
*VQ1270-5MOB-C6 ···4 sets–Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

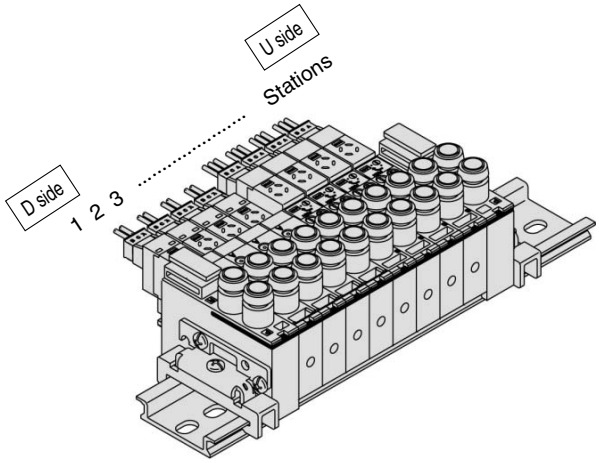
Enter in order starting from the first station on the D side. Besides, when the arrangement will be complicated, fill out the Manifold Specification Sheet to instruct us.



C VQ1000 Kit (Connector)



- Standard with lead wires connected to each valve individually.
- Maximum stations are 16.

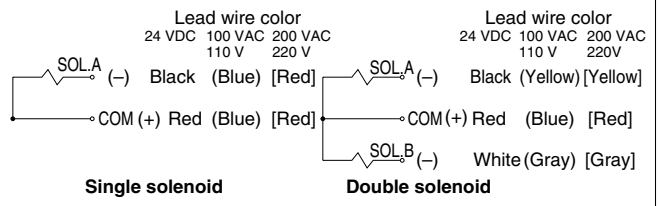


Manifold Specifications

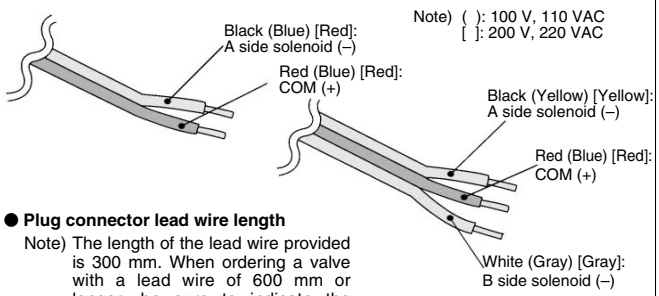
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Top	C6	C3, C4, C6, M5	Max. 16 stations

● Wiring specifications: Positive COM

● The lead wires are connected to the valve as shown below. Connect each to the power supply side.



Single solenoid **Double solenoid**



● Plug connector lead wire length

Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1170-5LO-C6····3 pcs.
AXT661-14A-10 ····3 pcs.

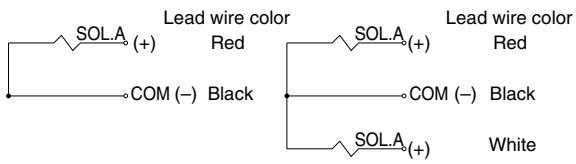
Connector Assembly Part No. (For DC)

Lead wire length	Single/3 position part no.	Double solenoid part no.
Socket only (3 pcs.)	AXT661-12A	
300A	AXT661-14A	AXT661-13A
600A	AXT661-14A-6	AXT661-13A-6
1000A	AXT661-14A-10	AXT661-13A-10
2000A	AXT661-14A-20	AXT661-13A-20
3000A	AXT661-14A-30	AXT661-13A-30

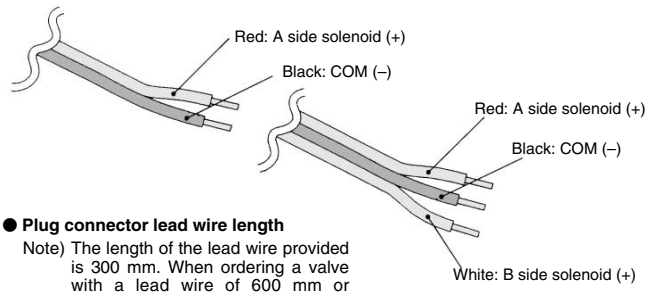
Note 1) 100/110 VAC for single: AXT661-31A-∗; for double: AXT661-32A-∗
200/220 VAC for single: AXT661-34A-∗; for double: AXT661-35A-∗
∗ are in accordance with the above table.
Note 2) 3 position type requires 2 sets for A side and B side.

● Wiring specifications: Negative COM (Option)

● The lead wires are connected to the valve as shown below. Connect each to the power supply side.



Single solenoid **Double solenoid**



● Plug connector lead wire length

Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1170N-5LO-C6····3 pcs.
AXT661-14AN-10 ····3 pcs.

Connector Assembly Part No. (For DC)

Lead wire length	Single/3 position part no.	Double solenoid part no.
Socket only (3 pcs.)	AXT661-12A	
300A	AXT661-14AN	AXT661-13AN
600A	AXT661-14AN-6	AXT661-13AN-6
1000A	AXT661-14AN-10	AXT661-13AN-10
2000A	AXT661-14AN-20	AXT661-13AN-20
3000A	AXT661-14AN-30	AXT661-13AN-30

Note 1) When using the negative common specifications, use valves for negative common.
Note 2) 3 position type requires 2 sets for A side and B side.

How to Order Manifold

VV5Q1 7 – 08 C – D

Series VQ1000

Manifold

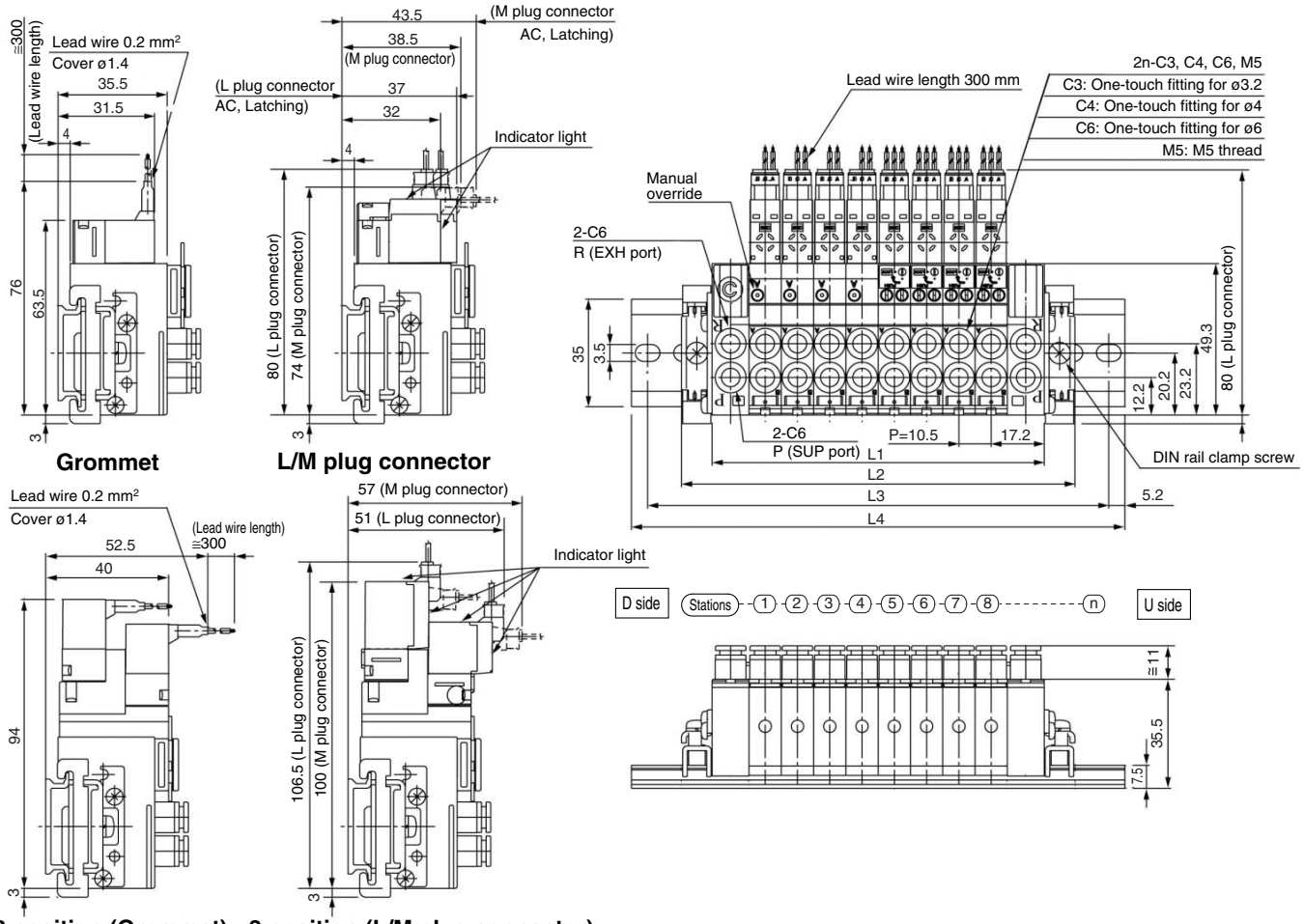
Stations

01	1 station
⋮	⋮
16	16 stations

Option

D (1)	DIN rail mounting style
N (2)	With name plate

Note 1) Manifolds are a DIN rail mounting style, and so suffix -D should be indicated.
Note 2) Unmountable when the valve's manual override is a locking lever type.
Note 3) When both options are specified, indicate as DN.



Dimensions

Formula L1 = 10.5n + 24, L2 = 10.5n + 44 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	34.5	45	55.5	66	76.5	87	97.5	108	118.5	129	139.5	150	160.5	171	181.5	192
L2	54.5	65	75.5	86	96.5	107	117.5	128	138.5	149	159.5	170	180.5	191	201.5	212
L3	75	87.5	100	112.5	125	137.5	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5
L4	85.5	98	110.5	123	135.5	148	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248

How to Order Valves

VQ1 1 7 0 Y – 5 M ☐ – C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note	3 position closed center
4 Note	3 position exhaust center
5 Note	3 position pressure center

Note) L type plug connector is used for 3 position AC.

Seal

0	Metal seal
1	Rubber seal

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
Y (3)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-74.
Note 2) Except double (latching).

Note 1) For negative common specifications, refer to "Option" on page 2-4-93.

Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note 1) The code is L for elbow piping for all manifold stations.
Note 2) Example) L6: Elbow with One-touch fittings for ø6
For inch-size One-touch fittings, refer to "Option" on page 2-4-93.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

G	Grommet (Except double (latching) and AC)
L	L plug connector with lead wire
LO	L plug connector without connector
M	M plug connector with lead wire
MO	M plug connector without connector

How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

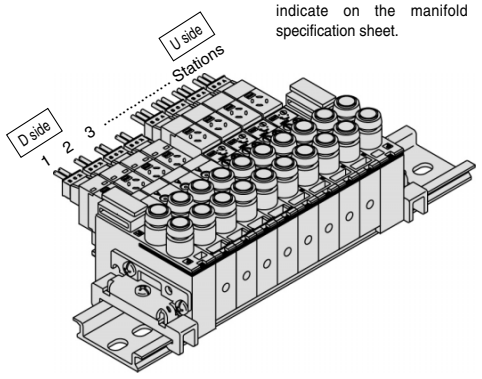
<Example>

Connector kit with 3 m cable

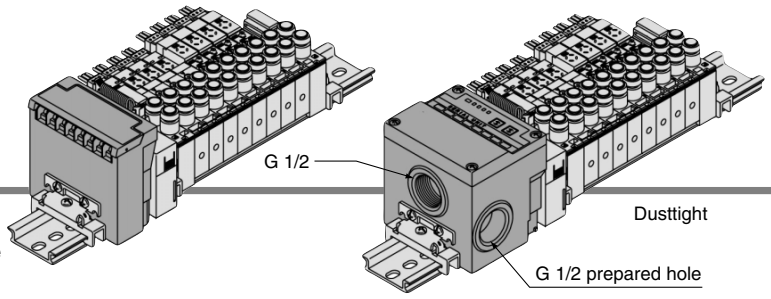
VV5Q17-08C-D ···1 set—Manifold base part no.
*VQ1170-5M-C6 ···4 sets—Valve part no. (Stations 1 to 4)
*VQ1270-5MB-C6 ···4 sets—Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate on the manifold specification sheet.



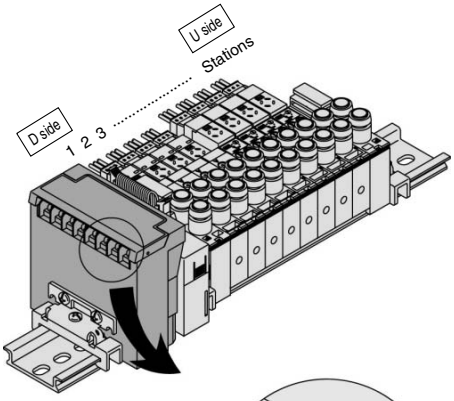
S VQ1000
Kit (Serial transmission unit)



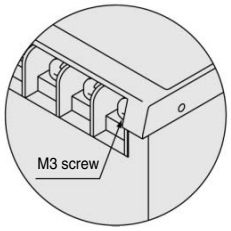
- The serial transmission system reduces wiring work, while minimizing wiring and saving space.
- The system comes in an type SA (generic for small scale systems) for equipment with a small number of I/O points, or 32 points max., type SB (applicable to Mitsubishi Electric models) for controlling 512 I/O points max., type SC (applicable to OMRON models), and type SD (applicable to SHARP models; 504 points max.).
- 16 stations max. (Specify a model with more than 8 stations by using a manifold specification sheet.)

Manifold Specifications

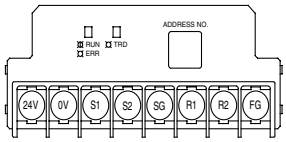
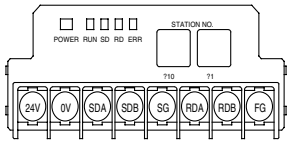
Series	Porting specifications			Applicable stations
	Port locaition	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Top	C6	C3, C4, C6, M5	Max. 16 stations



- Stations are counted from station 1 on the D side.
- As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-93.



Item	Specifications
External power supply	24 VDC +10%, –5%
Current consumption (Internal unit)	SA, SB, SD, SE, SF, SG, SH, SJ, SK, SQ, SV, SR: 0.1 A, SC: 0.3 A

Name of terminal block (LED)	**Type SA** **With general type SI unit (Series EX300)**	**Type SB** **Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System**
		
	LED / Description TRD: Lighting during data reception RUN/ERR: Blinking when received data is normal; Lighting when data reception	LED / Description POWER: Lighting when power is turned ON RUN: Lighting when data transmission with the master station is normal RD: Lighting during data reception SD: Lighting during data transmission ERR.: Lighting when reception data error occurs. Light turns off when the error is corrected.
Note	• T unit Can be connected with PLC I/O card for serial transmission. EX300-TMB1 ···For models of Mitsubishi Electric Corporation EX300-TTA1 ···For models of OMRON Corporation EX300-TFU1 ···For models of Fuji Electric Co., Ltd. EX300-TOO1 ···For general models ∗ Up to 32 points per unit. • No. of output points, 16 points	• Master station: PLC made by Mitsubishi Electric Corporation Series MELSEC-A AJ71PT32-S3, AJ71T32-S3 A1SJ71PT32-S3 ∗ Max. 64 stations, connected to remote I/O stations (Max. 512 points). • No. of output points, 16 points. No. of sta. occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

How to Order Manifold

VV5Q1 7 – 08 S A – D – XP

Dust-protected type (-XP)
Suffix "-XP" for the dust-protected SI units. (Except SE and SQ)

Series VQ1000

Manifold

7	Plug lead unit/Cassette

Stations

01	1 station
⋮	⋮
08	8 station (Double)
16 Note)	16 stations (Single)

Note) As an option, the maximum number of stations can be increased based on special wiring specifications. For details, refer to page 2-4-93.

Model

O	Without SI unit	Max. 16 stations
A	With general type SI unit (Series EX300)	
B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
C	OMRON Corp.: SYSBUS Wire System	
D	SHARP Corp.: Satellite I/O Link System	
E	Matsushita Electric Works: MEWNET-F System	
F1	NKE Corp.: Uni-wire System (16 output points)	
G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System	
H	NKE Corp.: Uni-wire H System	
J1	SUNX Corp.: S-LINK System (16 output points)	
J2	SUNX Corp.: S-LINK System (8 output points)	Max. 8
K	Fuji Electric Co.: T-LINK Mini System	Max. 16 stations
Q	DeviceNet, CompoBus/D (OMRON Corp.)	
R1	OMRON Corp.: CompoBus/S System (16 output points)	
R2	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8
V	Mitsubishi Electric Corp.: CC-LINK System	Max. 16

• For the general purpose type, a transmission unit is required on the CPU side.

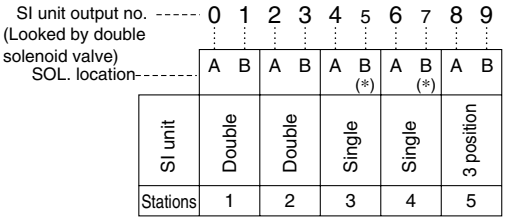
Option

D (1)	DIM rail mounting style
K (2)	Special wiring specifications (Except double wiring)
N (3)	With name plate

Note 1) Since the manifold is all with DIN rail, and so suffix -D to the part number.
Note 2) Specify the wiring specifications in the manifold specification sheet.
Note 3) Unmountable when the valve's manual override is a locking lever type.
Note 4) When two or more symbols are specified, indicate them alphabetically.

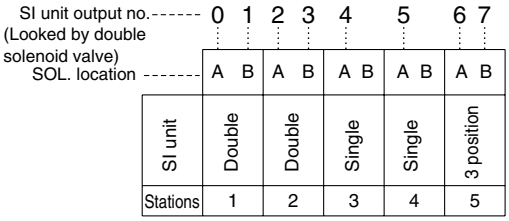
● SI unit output and coil numbering

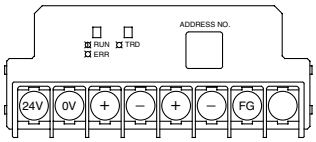
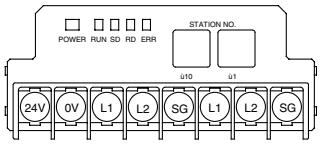
<Wiring example 1> Double wiring (Standard)



The places of asterisk are not used.

<Wiring example 2> Single/Double mixed wiring (Option)
Mixed wiring is available as an option.
Use the manifold specification sheet to specify.



	Type SC OMRON Corporation SYSBUS Wire System	Type SD SHARP Corporation Satellite I/O Link System
Name of terminal block (LED)	 LED / Description RUN: Lights when transmission is normal and PLC is in operation mode T/R ERR: Blinks during data transmission/reception; ON when transmission is abnormal	 LED / Description POWER: ON when power supply is ON RUN: Lights when power is ON and slave stations are operating normally ERROR: Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit R.SET HOLD: ON for master unit control input
Note	• Master station unit: OMRON PLC SYSMAC C(CV) series Types C500-RM201 and C200H-RM201 ∗ 32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit: SHARP's PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW-31LM ∗ Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ1 1 7 0 Y − 5 MO □ − C6

Series VQ1000

Type of actuation

1	2 position single
2	2 position double (Latching)
3 Note)	3 position closed center
4 Note)	3 position exhaust center
5 Note)	3 position pressure center

Note) L type plug connector is used for 3 position AC.

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H Note)	High pressure type	(1.5 W) ○
Y Note)	Low wattage type	(0.5 W) ○

Note) Except double (latching).

Coil voltage

5	24 VDC, With indicator light and surge voltage suppressor

Note) Connector assembly will be required when the S kits add a valve. For model no., refer to "Option" on page 2-4-93.

Cylinder ports

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

Note 1) The code is L for elbow piping for all manifold stations.
Example) L6: Elbow with One-touch fittings for ø6
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-93.

Manual override

Nil	Non-locking push type (Tool required)
B Note)	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

Electrical entry

LO	L plug connector without connector
MO	M plug connector without connector

Note) Plug connector and lead wire layers are attached to the manifold.

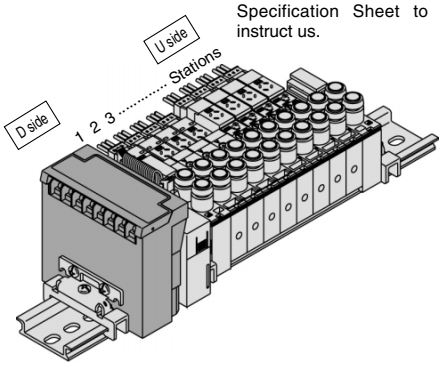
How to Order Manifold Assembly

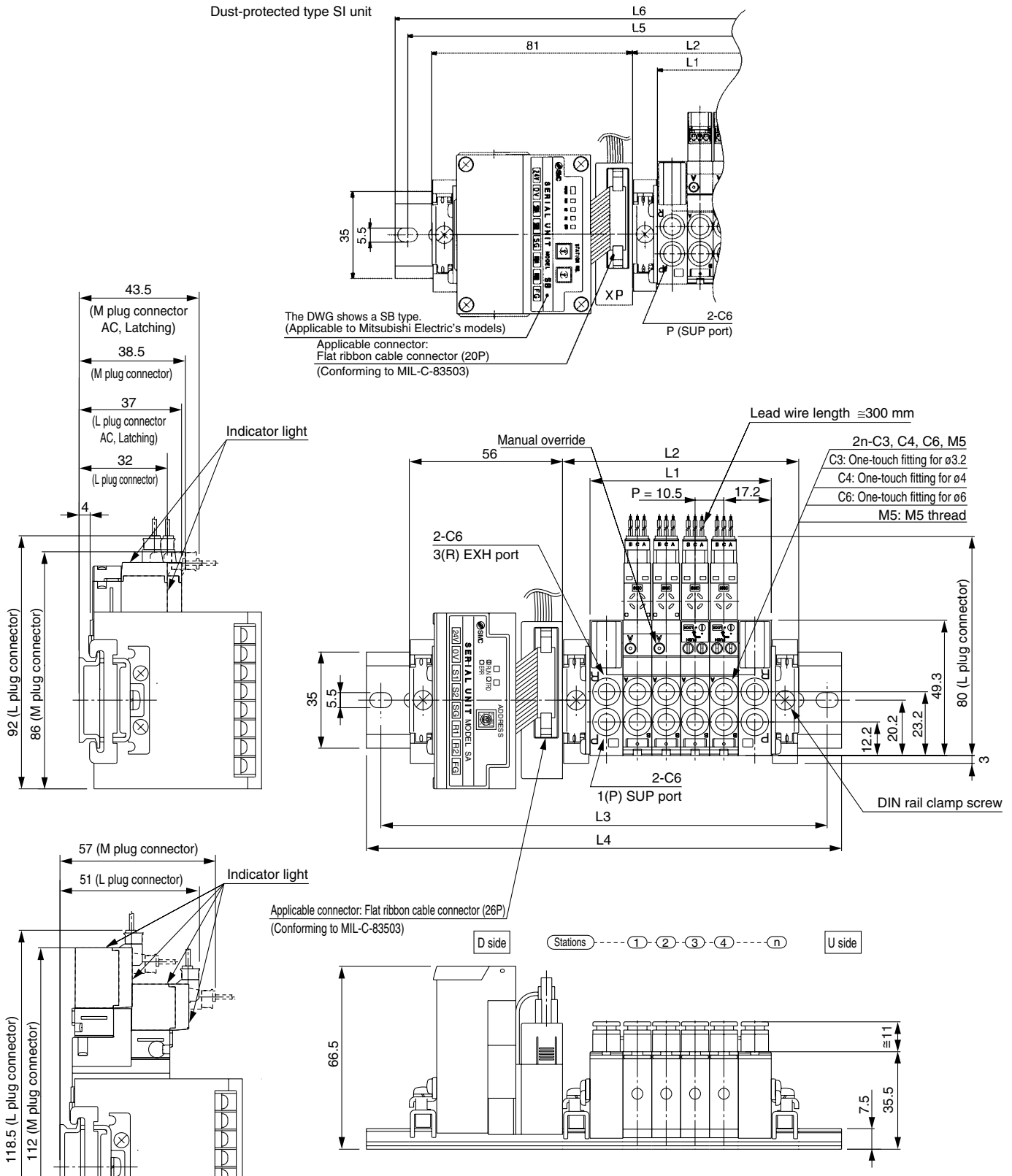
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Serial transmission unit kit
VV5Q17-08SA-D ··· 1 set–Manifold base part no.
∗VQ1170-5MO-C6 ··· 4 sets–Valve part no. (Stations 1 to 4)
∗VQ1270-5MOB-C6 ··· 4 sets–Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. Besides, when the arrangement will be complicated, fill out the Manifold Specification Sheet to instruct us.





3 position

Dust-protected type SI unit: L5 = L3 + 25, L6 = L4 + 25

Dimensions

Formula L1 = 10.5n + 24, L2 = 10.5n + 44 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	34.5	45	55.5	66	76.5	87	97.5	108	118.5	129	139.5	150	160.5	171	181.5	192
L2	54.5	65	75.5	86	96.5	107	117.5	128	138.5	149	159.5	170	180.5	191	201.5	212
L3	137.5	150	162.5	162.5	175	187.5	200	212.5	225	237.5	237.5	250	262.5	275	287.5	300
L4	148	160.5	173	173	185.5	198	210.5	223	235.5	248	248	260.5	273	285.5	298	310.5

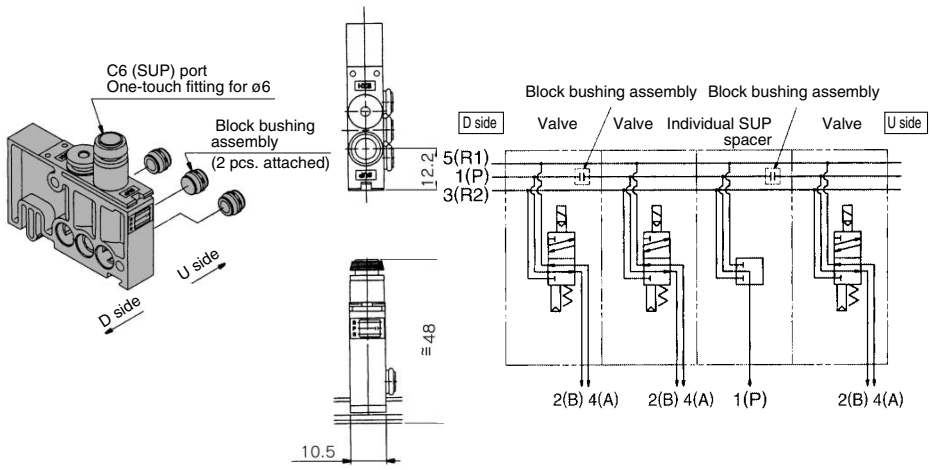
Manifolds with SI unit for Matsushita Electric Works' MEWNET FP and Rockwell Automation's model are the same with L5 and L6 dimensions of dust-protected type SI unit.

Manifold Option Parts

Individual SUP spacer
VVQ1000-P-7-C6

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.) Block both sides of the station, for which the supply pressure from the individual SUP spacer is used, with SUP block plates. (See the application ex.)

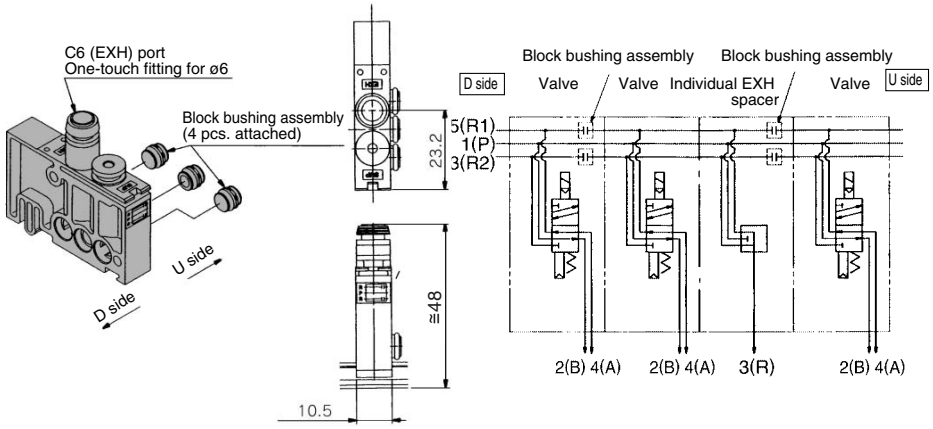
* Specify the spacer mounting position and SUP block plate mounting position on the manifold specification sheet. The block plate are used in two places for one set. (Two SUP block plates for blocking SUP station are attached to the individual SUP spacer.)
* The spacer's specification can be changed (from an individual SUP spacer to an individual EXH spacer) by changing the coupling of the fittings and bushing.



Individual EXH spacer
VVQ1000-R-7-C6

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (One station space is occupied.)
Block both sides of the individual valve EXH station.

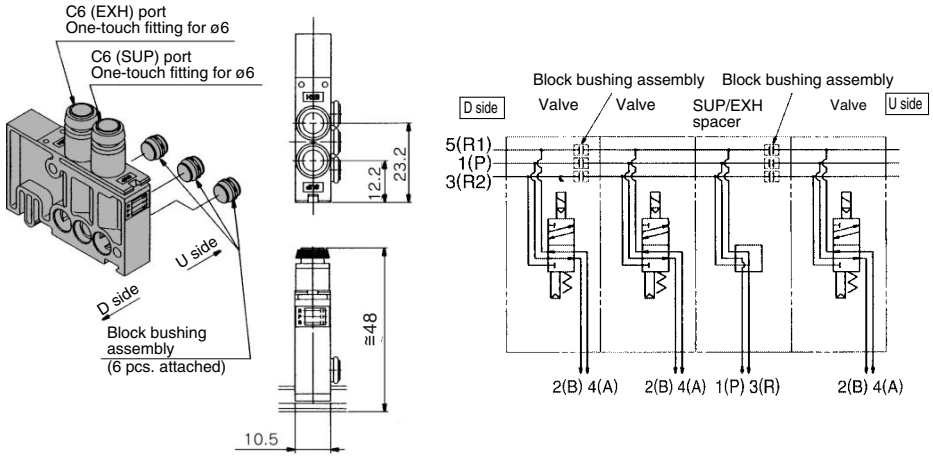
* Specify the spacer mounting position and EXH block plate mounting position on the manifold specification sheet. The block plate are used in two places for one set. (Four EXH block plates for blocking EXH station are attached to the individual EXH spacer.)
* The spacer's specification can be changed (from an individual EXH spacer to an individual SUP spacer) by changing the coupling of the fittings and bushing.



Individual SUP/EXH spacer
VVQ1000-PR-7-C6

This spacer has both functions of the above individual SUP and EXH spacers. (Refer to the application example.)

* Specify the spacer mounting position and SUP/EXH block plate mounting position on the manifold specification sheet. The blockplates are used in two places for one set.
  (A SUP/EXH block plates for blocking SUP/EXH station are attached to the individual SUP/EXH spacer.)
* When using the spacer not for individual SUP/EXH but for improving the ability to supply/exhaust air, it is unnecessary to block the SUP/EXH passage. In this case, place an order via VVQ1000-PRA-7-C6.
* The spacer's specification can be changed by changing the coupling of the fittings and bushing.



Manifold Option Parts

SUP EXH Block bushing assembly
VVQ1000-87A-B-50

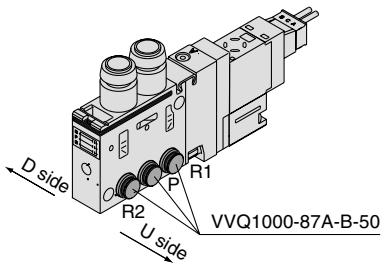
<For SUP>
When one manifold is to be used for different, high and low pressures, this block bushing assembly is used between the stations under a different pressure. The block assembly is mounted on the U side of the valve's SUP passage.

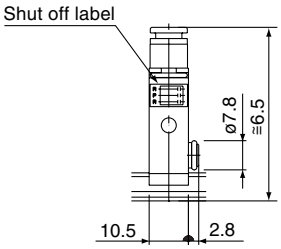
* Specify the number stations on the manifold specification sheet.

<For EXH>
When a valve exhaust affects other stations due to the circuit configuration, this block bushing assembly is used between the stations whose EXH passages are to be separated each other. Since the block bushing assembly is mounted on the U side of the valve's R1 and R2 passages, two assemblies are necessary for one station.

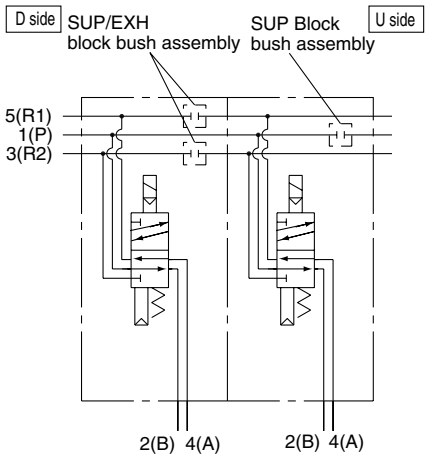
* Specify the number stations on the manifold specification sheet.

<Shut off label>
When using block bushing assembly for SUP, EXH passage, indication label for confirmation of the blocking position from outside is attached. (One label for each)





* Can be included in manifold model no.



<Example>

* When ordering a block bush incorporated with the manifold, a block indication label is attached to the manifold.

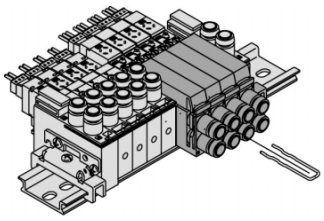
SUP passage blocked

EXH passage blocked

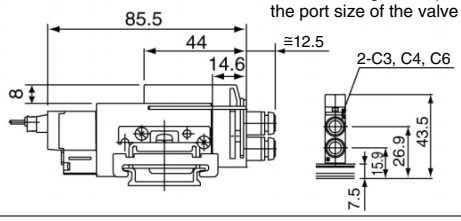
SUP/EXH passage blocked

Elbow fitting assembly
VVQ1000-F7-L (C3, C4, C6)

It is used in a side-valve-port application.



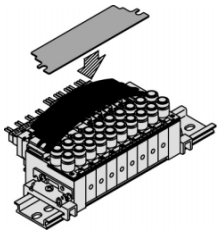
* When ordering it incorporated with a valve, the port size of the valve no. is L□.



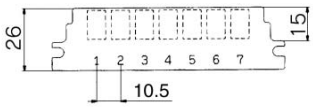
Name plate [-N7]
VVQ1000-N7-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.
Open the face plate seating when the manual override is operating.

* It is not applicable to locking manual override.

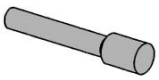


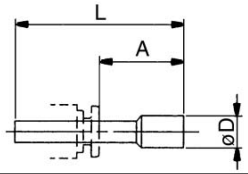
* When ordering assemblies incorporated with a manifold, suffix -N to the manifold no.



Blanking plug
KQ2P-$^{23}_{04}_{06}$

Used for unused cylinder port, SUP and EXH port. Purchasing order is available in units of 10 pieces.



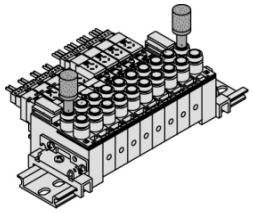


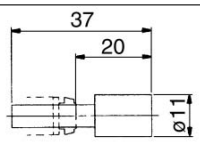
Dimensions

Applicable fittings size ød	Model	A	L	D
3.2	**KQ2P-23**	16	31.5	5
4	**KQ2P-04**	16	32	6
6	**KQ2P-06**	18	35	8

Silencer
AN103-X233

This silencer is to be inserted into the EXH port (One-touch fittings) of the common exhaust type.





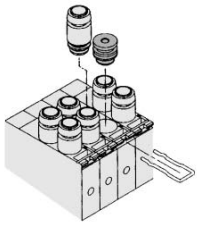
Dimensions

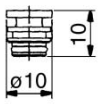
Series	Applicable fittings size ød	Model	A	L	D	Effective area (mm²)	Noise reduction (dB)
VQ1000	6	AN103-X233	20	37	11	7	25

Port plug
VVQ0000-58A

The plug is used to block the cylinder port when using a 4 port valve as a 3 port valve.
When ordering it incorporated with a manifold, suffix A or B, the symbol of the plug port, to the valve no.

Example) **VQ1170-5L-C6-A**
A port, Plug





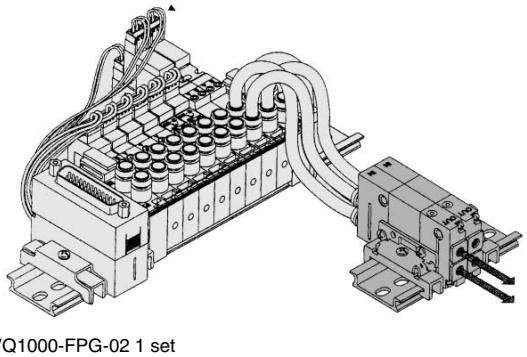
Double check block (Separated type)
VQ1000-FPG-□□

It is used on the outlet side piping to keep the cylinder in the intermediate position for a long time. Combining the double check block with a built-in pilot type double check valve and a 3 position exhaust center solenoid valve will enable the cylinder to stop in the middle or maintain its position for a long time.
The combination with a two position single/double solenoid valve will permit this block to be used for preventing the dropping at the cylinder stroke end when the SUP residual pressure is released.

Specifications

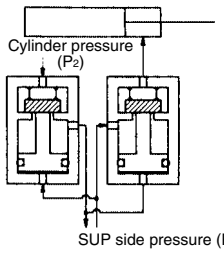
Max. operating pressure	0.8 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temperature	–5 to 50°C
Flow characteristics: C	0.60 dm³/(s·bar)
Max. operating frequency	180 CPM

Note) Based on JIS B 8375-1981 (Supply pressure: 0.5 MPa)



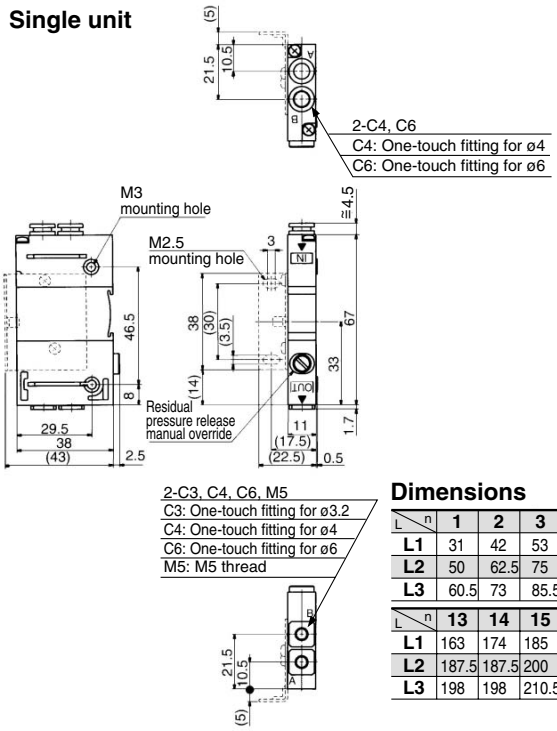
VVQ1000-FPG-02 1 set
∗ VQ1000-FPG-C6M5-D 2 pcs.

(Check valve operation principle)

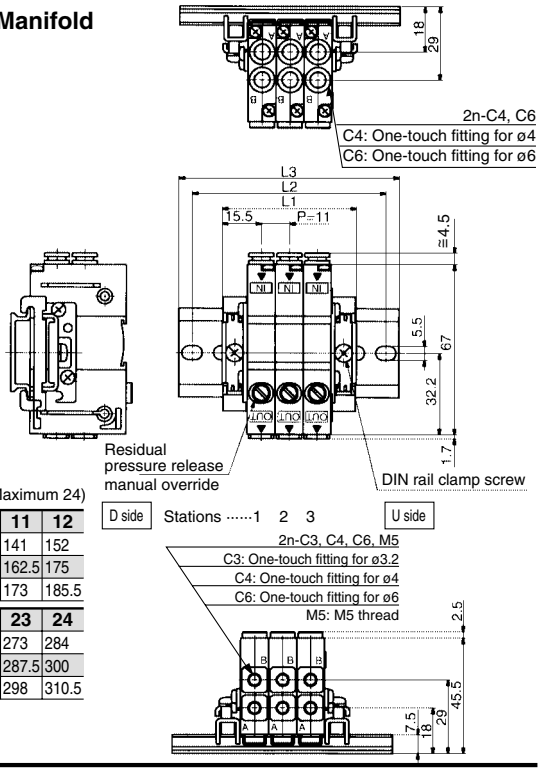


Dimensions

Single unit



Manifold



Dimensions

Formula L1 = 11n + 20 n: Station (Maximum 24)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	31	42	53	64	75	86	97	108	119	130	141	152
L2	50	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175
L3	60.5	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5

L \ n	13	14	15	16	17	18	19	20	21	22	23	24
L1	163	174	185	196	207	218	229	240	251	262	273	284
L2	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300
L3	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5

How to Order

Double check block

VQ1000-FPG- C4 M5 — F

IN side port size

C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

OUT side port size

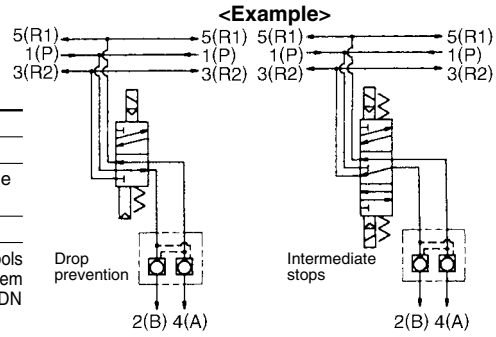
M5	M5 thread
C3	One-touch fitting for ø3.2
C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

Option

Nil	None
F	With bracket
D	DIN rail mounting style (For manifold)
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically. Example) -DN

<Example>



Manifold

VVQ1000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Example>
VVQ1000-FPG-06··6 types of manifold
∗VQ1000-FPG-C4M5-D, 3 sets
∗VQ1000-FPG-C6M5-D, 3 sets } Double Check block

Bracket Assembly

Part no.	Tightening torque
VQ1000-FPG-FB	0.22 to 0.25 N·m

⚠ Caution

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap.
- Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- Combining double check block with 3 position closed center or pressure center solenoid valve will not work. M5 fitting assembly is attached, not incorporated into the double check block.
- After screwing in the M5 fittings, mount the assembly on the double check block. {Tightening torque: 0.8 to 1.2 N·m} If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

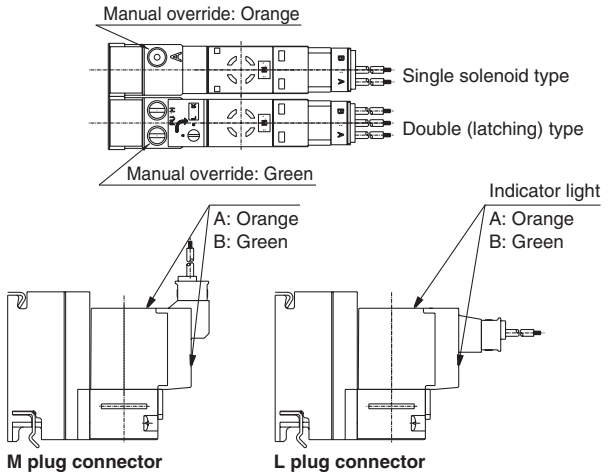
⚠ Precautions

Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

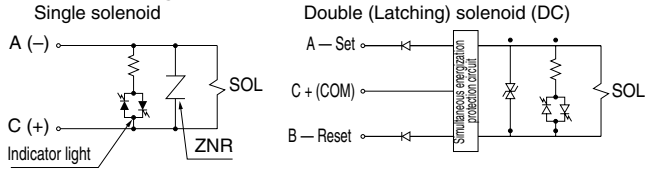
Light/Surge Voltage Suppressor

⚠ Caution

The standard model is equipped with an indicator light and surge voltage suppressor. The lighting positions are concentrated on one side for both single solenoid type and double (latching) type. In the double (latching) type, A side and B side energization are indicated by two colors which match the colors of the manual overrides.



DC circuit diagram



Single solenoid type | **Double (Latching)**

Note 1) • A-side energization: A light (orange) illuminates.
• B-side energization: B light (green) illuminates.
• Equipped with a wiring error prevention (stop diode) mechanism.
• Surge absorption (ZNR/surge absorption diode) mechanism.

Note 2) Applicable to negative COM specification models.

Note 3) In the case of double (latching), the electromagnetic valve channel is, A–(set):
P → A, B → R
B–(reset): P → B, A → R

Double (Latching solenoid) Type

⚠ Caution

Different from the conventional double solenoid, the double type uses a latching (self-holding system) solenoid. Although the appearance is the same as the single solenoid, it is constructed so that the movable iron core in the solenoid is held in the ON position on A and B sides by instantaneous energization (20 ms or more). The usage and function is the same as the double solenoid type.

<Special Cautions for Latching Solenoid>

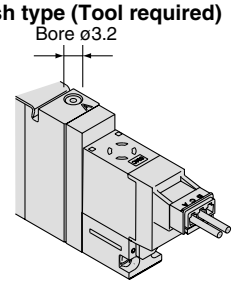
1. Select the circuit in which ON and OFF signals are not energized simultaneously.
2. 20 ms energization time is necessary for self-holding.
3. Avoid using the latching solenoid valves in environments where impact or collisions with the valve might occur.
Also, do not use in places where strong magnetic fields are present.
4. Even though the armature in the solenoid of this valve is held on to B side, ON position (Reset), verify either A side, ON position or B side, ON position by energizing prior to use.
After manual operation, the main valve will return to its original position.
5. Manual override on the pilot valve side can retain its switching position after manipulation.
6. Please contact SMC for long-term energization applications.
7. In the case of metal seal type, if the supply air goes down below the minimum operating pressure (0.1 MPa or less), the main valve will be back to the home position (B side ON position). Therefore, when the supply air is shut off or applied while leaving A side ON position, cylinder may be pulsated. The valve's switching position when the supply air is operated should be installed on the home position side (B side ON position).

Manual Override

⚠ Warning

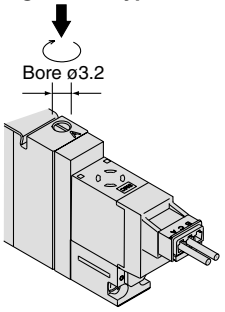
Without an electric signal for the solenoid valve the manual override is used for switching the main valve.

■ Push type (Tool required)



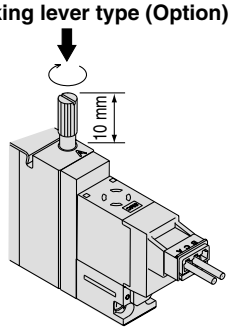
Push down on the manual override button with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

■ Locking slotted type



Push down on the manual override button with a small screwdriver until it stops. While down, turn clockwise by 90° to lock it. Turn it counterclockwise to release it.

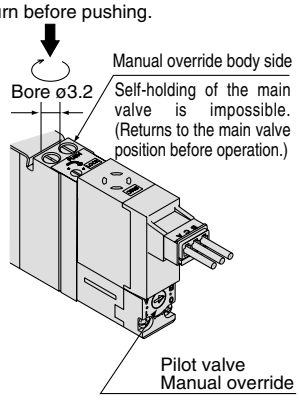
■ Locking lever type (Option)



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.

■ Manual override for double (latching) type

In case of a double (latching) type, a manual override is provided not only on the body side but to the pilot as a standard specification.
After manual operation, the main valve of the manual override on the body side returns to the position before the manual operation, however, the pilot valve manual override maintains the change-over position.



Self-holding of the main valve possible.

- If the manual override is turned by 180° clockwise and the ▶ mark is adjusted to A, then pushed in the direction of an arrow (⇳), it will be back to the reset condition. (passage P → A)
- If the manual override is turned by 180° counterclockwise and the ▶ mark is adjusted to B, then pushed in the direction of an arrow (⇳), it will be back to the reset condition. (passage P → B) (It is in the reset state at the time of shipment.)

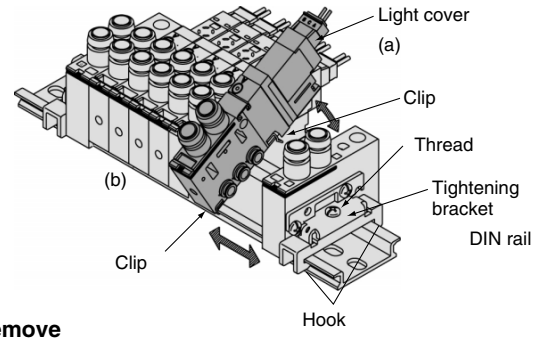
⚠ Caution

Do not apply excessive torque when turning the locking type manual override. (0.1 N·m or less)

How to Mount/Remove Solenoid Valve

⚠ Caution

<Procedure>



How to Remove

1. Loosen the clamp screw on one side.
2. Slightly slide a part the valve stations on both sides of the station to be removed.
3. Pull up side (a) of the valve station and remove it from the DIN rail.

How to mount

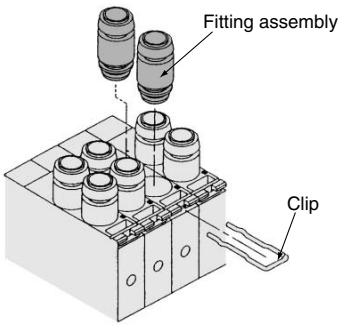
1. Take procedures 1 and 2 above to make an open space in the position for mounting a new valve station.
2. Diagonally insert the clip on the side (b) of the valve station to the DIN rail.
3. Press down on the valve station and insert the clip on the side (a) of the valve station to the DIN rail.
4. Slide the valve stations together so that there is no clearance between them. Position the clamp screw and tighten. (Proper tightening torque: 0.7 to 1.0 N·m)

Note) **Be careful to keep O-ring or gallery dust free since dirt may cause air leakage.**
Be sure both hooks of the bracket are fixed to the DIN rail.
Use caution not to apply force on the light cover when mounting or dismounting the valve.

Replacement of Cylinder Port Fittings

⚠ Caution

The cylinder port fittings are a cassette for easy replacement. The fittings are blocked by a clip inserted from the side of the valve. Remove the clip with a screwdriver and remove fittings. For replacement, insert the fitting assembly until it strikes against the inside wall and then reinsert the clip to the specified position.



Applicable tubing O.D	Fitting assembly part no.
Applicable tubing ø3.2	VVQ1000-50A-C3
Applicable tubing ø4	VVQ1000-50A-C4
Applicable tubing ø6	VVQ1000-50A-C6

∗ Purchasing order is available in units of 10 pieces.

⚠ Caution

1. Protect O-rings from scratches and dust to prevent air leakage.
2. The tightening torque for inserting fittings to the M5 thread ass'y should be 0.8 to 1.4 N·m.

How to Use Plug Connector

⚠ Caution

For details, refer to page 2-4-67.

How to Calculate the Flow Rate

⚠ Caution

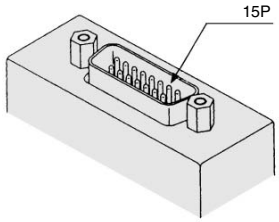
For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

Option

Different Number of Connector Pins

F and P kits with the following number of pins are available besides the standard number (F = 25; P = 26). Select the desired number of pins and cable length from the cable assembly list. Place an order for the cable assembly separately.

F kit (D-sub connector) 15 pins



How to order manifold

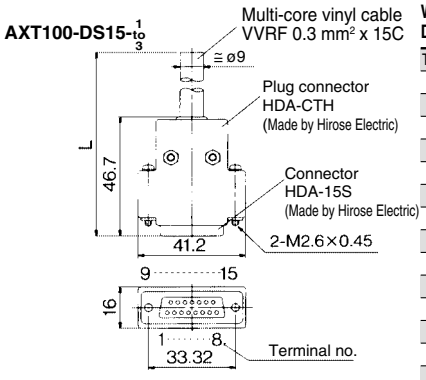
VV5Q17 — 06 F SA — D

- 06: Stations
- F: Kit/Electrical entry
- SA: How to Order — D-sub connector, 15 pins; Connector location–Side (horizontal); Without cable
- D: Option

Pins \ Location	Top entry		Side entry	
15 pins (Max. 14 stations)	Kit F	UA	Kit F	SA

Wiring Specifications

Like 25-pin models (standard), terminal no. 1 will be the 1st station SOL.A, and terminal no. 9 for the 1st station SOL.B. Then COM will be the terminal no. 8.



Wire Color by Terminal No. of D-sub Connector Cable Assembly

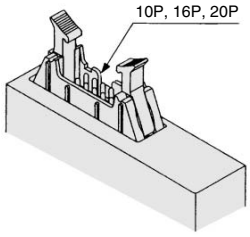
Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black

D-sub Connector Cable Assembly

Cable length (L) \ Pins	15P
1.5 m	AXT100-DS15-1
3 m	AXT100-DS15-2
5 m	AXT100-DS15-3

∗ For other commercial connectors, use a type conforming to MIL-C-24308.

P kit (Flat ribbon cable connector) 10 pins, 16 pins, 20 pins



How to order manifold

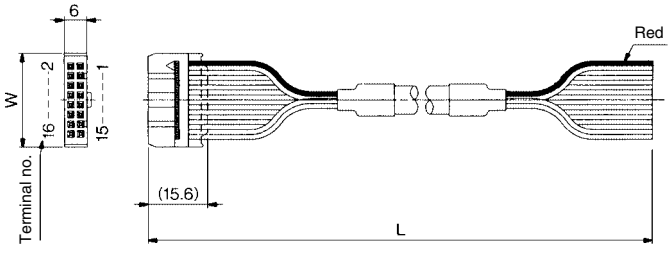
VV5Q17 — 06 P SC — D

- 06: Stations
- P: Kit/Electrical entry
- SC: How to Order — Flat ribbon cable, 20 pins; Connector location–Side (Horizontal); Without cable
- D: Option

Pins \ Location	Top entry		Side entry	
10 pins (Max. 8 stations)	Kit P	UA	Kit P	SA
16 pins (Max.14 stations)		UB		SB
20 pins (Max.16 stations)		UC		SC

Wiring Specifications

Similarly to 26-pin models (standard), the terminal no. 1 will be allocated to SOL.A of the 1st. station, and terminal no. 2 for SOL.B of the 1st. station. COM occupies 2 pins from the maximum no. of terminal.



Flat Ribbon Cable Assembly

Cable length (L) \ Pins	10P	16P	20P
1.5 m	AXT100-FC10-1	AXT100-FC16-1	AXT100-FC20-1
3 m	AXT100-FC10-2	AXT100-FC16-2	AXT100-FC20-2
5 m	AXT100-FC10-3	AXT100-FC16-3	AXT100-FC20-3
Connector width (W)	17.2	24.8	30

∗ For other commercial connectors, use a type with strain relief conforming to MIL-C-83503.

Special Wiring Specifications

In the internal wiring of F kit, P kit, J kit, G kit, T kit and S kit, double wiring (connected to SOL. A and SOL. B) is adopted for each station regardless of the valve and option types.
Mixed single and double wiring is available as an option.

1. How to order valves

Indicate an option symbol, -K, for the manifold no. and be sure to specify the mounting position and number of stations of the single and double wiring by means of the manifold specification sheet.

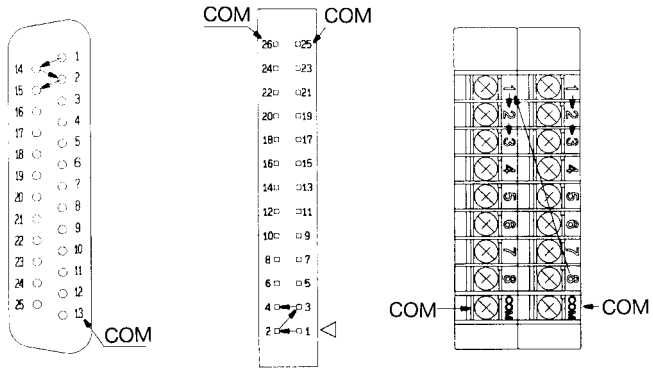
Example)

VV5Q17-09FU0-D K S

Others, option symbols: to be indicated alphabetically.

2. Wiring specifications

Connector terminal numbers are connected from solenoid station 1 on the A side in the order indicated by the arrows without shipping any terminal numbers.



F kit
D-sub connector (25P)

P kit
Flat ribbon cable connector (26P)

T kit
Terminal block (16 terminals)

3. Max. number of stations

The maximum number of stations depends upon the number of solenoids. Assuming one for a single and two for a double, determine the number of stations so that the total number is not more than the maximum number given in the following table.

kit	F kit (D-sub connector)		P kit (Flat ribbon cable connector)				T kit (Terminal block)		S kit (Serial)
Type	F S U □ 25P	F S U A 15P	P S U □ 26P	P S U C 20P	P S U B 16P	P S U A 10P	T1	T2	S□
Max. points	16 Note)	14	16 Note)	16 Note)	14	8	8	16	16

Note) Due to the limitation of internal wiring.

Negative Common Specifications

Specify the valve model no. as shown below for negative COM specification. The standard manifold no. can be used. Please contact SMC for negative COM S kit.

How to order negative COM valves

VQ1170 N − 5MO − C6

Negative common specifications

Inch-size One-touch Fittings

Refer to following model no. for inch-size One-touch fittings.

How to order manifold

VV5Q17 − 08FSO − DN − 00T

1(P), 3(R) port size ø1/4"

How to order valves

VQ1170 − 5M − N7

Cylinder port

Symbol	N1	N3	N7
Applicable tube O.D. (Inch)	ø1/8"	ø5/32"	ø1/4"

Plug Connector Assembly Model

Connector assembly will be required when the F, P, T, S kits add a valve.
Specify the valve and connector assembly.

Connector Assembly Part No.

Specifications		Part no.
Single (2-wire)	Positive common	AXT661-14A-F
	Negative common	AXT661-14AN-F
Double (latching) (3-wire)	Positive common	AXT661-13A-F
	Negative common	AXT661-13AN-F

Note) Lead wire length: 300 mm

DIN Rail Mounting

Each manifold can be mounted on a DIN rail.
Order it by indicating an option symbol for DIN rail mounting style, -D. In this case, a DIN rail which is approx. 30 mm longer than the manifold with the specified number of stations is attached. Besides, it is also available in the following cases.

● **When using DIN rail longer than the manifold with specified number of stations**
Clearly indicate the necessary number of stations next to the option symbol, -D, for the manifold no.

Example)

VV5Q17-08FU1-D09S

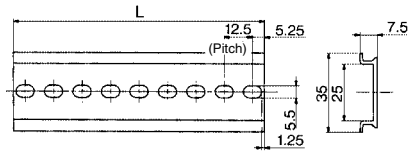
DIN rail for 9 stations

Others, option symbols: to be indicated alphabetically.

● **When ordering DIN rail only**

DIN rail no.: AXT100-DR-n

∗ Refer to the DIN rail dimension table for determining the length.

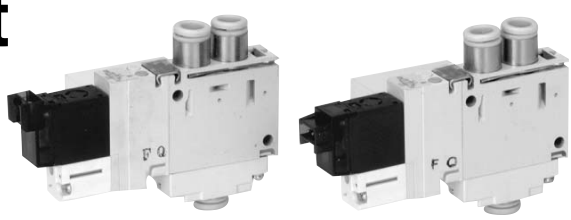


L Dimension L = 12.5 x n + 10.5

No.	1	2	3	4	5	6	7	8	9	10
L dimension	23	35.5	48	60.5	73	85.5	98	110.5	123	135.5
No.	11	12	13	14	15	16	17	18	19	20
L dimension	148	160.5	173	185.5	198	210.5	223	235.5	248	260.5
No.	21	22	23	24	25	26	27	28	29	30
L dimension	273	285.5	298	310.5	323	335.5	348	360.5	373	385.5
No.	31	32	33	34	35	36	37	38	39	40
L dimension	398	410.5	423	435.5	448	460.5	473	485.5	498	510.5

Series VQ
Single Unit

For individual use of a single valve.



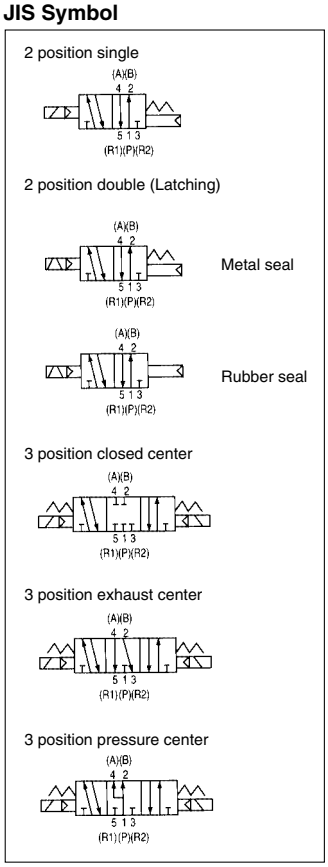
VQ1000

Model

Series		Number of solenoids		Model		Flow characteristics: 1 → 4/2 (P → A/B) C [dm³/(s·bar)]	b	Cv	Flow characteristics: 4/2 → 5/3 (A/B → R1/R2) C [dm³/(s·bar)]	b	Cv	Response time (ms) (2) Standard: 1 W H: 1.5 W	Low wattage: 0.5 W	AC	Weight (g)
Body ported	**VQ1000** Cassette Plug lead	2 position	Single	Metal seal	**VQ1160**	0.56	0.15	0.13	0.60	0.12	0.14	12 or less	15 or less	29 or less	50
				Rubber seal	**VQ1161**	0.71	0.20	0.17	0.80	0.16	0.19	15 or less	20 or less	34 or less	
			Double (Latching)	Metal seal	**VQ1260**	0.56	0.15	0.13	0.60	0.12	0.14	12 or less	15 or less	29 or less	
				Rubber seal	**VQ1261**	0.71	0.20	0.17	0.80	0.16	0.19	15 or less	20 or less	34 or less	
		3 position	Closed center	Metal seal	**VQ1360**	0.53	0.16	0.12	0.58	0.12	014	20 or less	26 or less	40 or less	65
				Rubber seal	**VQ1361**	0.65	0.23	0.16	0.70	0.20	0.17	25 or less	33 or less	47 or less	
			Exhaust center	Metal seal	**VQ1460**	0.54	0.16	0.12	0.60	0.12	014	20 or less	26 or less	40 or less	
				Rubber seal	**VQ1461**	0.65	0.23	0.16	0.80	0.16	0.19	25 or less	33 or less	47 or less	
			Pressure center	Metal seal	**VQ1560**	0.54	0.16	0.12	0.58	0.12	0.14	20 or less	26 or less	40 or less	
				Rubber seal	**VQ1561**	0.70	0.20	0.17	0.72	0.20	0.17	25 or less	33 or less	47 or less	

Note 1) Cylinder port size C6 (VQ1000)
Note 2) As per JIS B 8375-1981 (Supply pressure: 0.5 MPa; with indicator light/surge voltage suppressor; clean air. Subject to the pressure and air quality.)

JIS Symbol



Standard Specifications

Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure		0.7 MPa (High pressure type: 0.8 MPa)	
	Min. operating pressure	Single	0.1 MPa	0.15 MPa
		Double (Latching)	0.1 MPa	0.15 MPa
		3 position	0.15 MPa	0.2 MPa
	Ambient and fluid temperature		–10 to 50°C (1)	
	Lubrication		Not required	
	Manual override (2)		Push type/Locking type (Tool required, Manual type) Option	
	Impact/Vibration resistance		150/30 m/s²	
	Enclosure		Dust tight	
Solenoid	Coil rated voltage		12 , 24 VDC, 100 , 110 , 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA) (3) , 0.5 W DC (21 mA) (4)	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA) (3), 0.5 W DC (42 mA) (4)	
		100 VAC	Inrush 0.5 VA (5 mA), Holding 0.5 VA (5 mA)	
		110 VAC	Inrush 0.55 VA (5 mA), Holding 0.55 VA (5 mA)	
		200 VAC	Inrush 1.0 VA (5 mA), Holding 1.0 VA (5 mA)	
		220 VAC	Inrush 1.1 VA (5 mA), Holding 1.1 VA (5 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Values in the case of high pressure type (1.5 W) specifications.
Note 4) Values in the case of low wattage type (0.5 W) specifications.

How to Order Valves

VQ1 [1] 6 [0] [Y] – [5] [L] [ ] – [C6]

Series VQ1000

Symbol

1	2 position single
2	2 position double (Latching)
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ (1)
H (2)	High pressure type	(1.5 W) ○	—
N	Negative common type	○	—
Y (2)	Low wattage type	(0.5 W) ○	—

Note 1) For power consumption of AC type, refer to page 2-4-94.
Note 2) Except double (latching).
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil rated voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Electrical entry

G	Grommet (Except double (latching) and AC)
L	L plug connector with lead wire
LO	L plug connector without connector
M	M plug connector with lead wire
MO	M plug connector without connector

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) A manual override for pilot valve is provided to the standard model for double type.

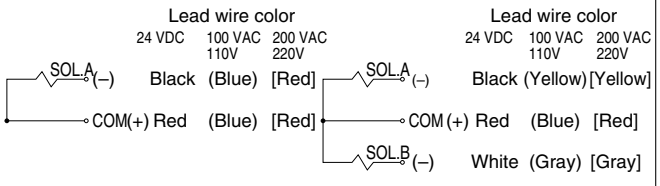
Sub-plate SUP, Cylinder port

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

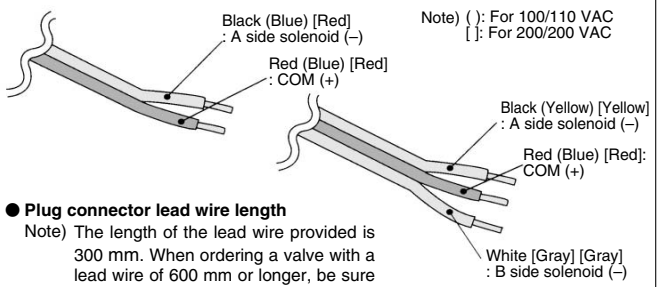
Note 1) For inch-size One-touch fittings, refer to "Option" on page 2-4-93.
Note 2) EXH port is a direct exhaust (with built-in silencer).

Wiring Specifications: Positive COM

● **The lead wires are connected to the valve as shown below. Connect each to the power supply side.**



Single solenoid **Double solenoid**



● **Plug connector lead wire length**

Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1160-5LO-C6·····3 pcs.
AXT661-14A-10·····3 pcs.

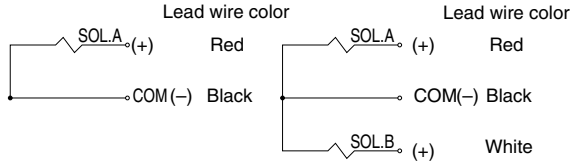
Connector Assembly Part No. (For DC)

Lead wire length	Single/3 position part no.	Double solenoid part no.
Socket only (3 pcs.)	AXT661-12A	
300 mm	AXT661-14A	AXT661-13A
600 mm	AXT661-14A-6	AXT661-13A-6
1000 mm	AXT661-14A-10	AXT661-13A-10
2000 mm	AXT661-14A-20	AXT661-13A-20
3000 mm	AXT661-14A-30	AXT661-13A-30

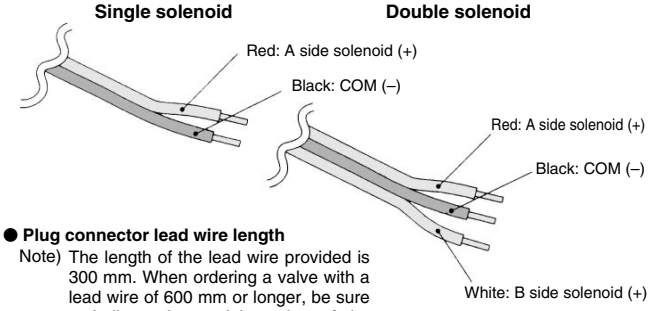
Note 1) 100/110 VAC for single: AXT661-31A-∗; for double: AXT661-32A-∗
200/220 VAC for single: AXT661-34A-∗; for double: AXT661-35A-∗
∗ are in accordance with the above table.
Note 2) 3 position type requires 2 sets for A side and B side.

Wiring Specifications: Negative COM (Option)

● **The lead wires are connected to the valve as shown below. Connect each to the power supply side.**



Single solenoid **Double solenoid**



● **Plug connector lead wire length**

Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1160N-5LO-C6····3 pcs.
AXT661-14AN-10·····3 pcs.

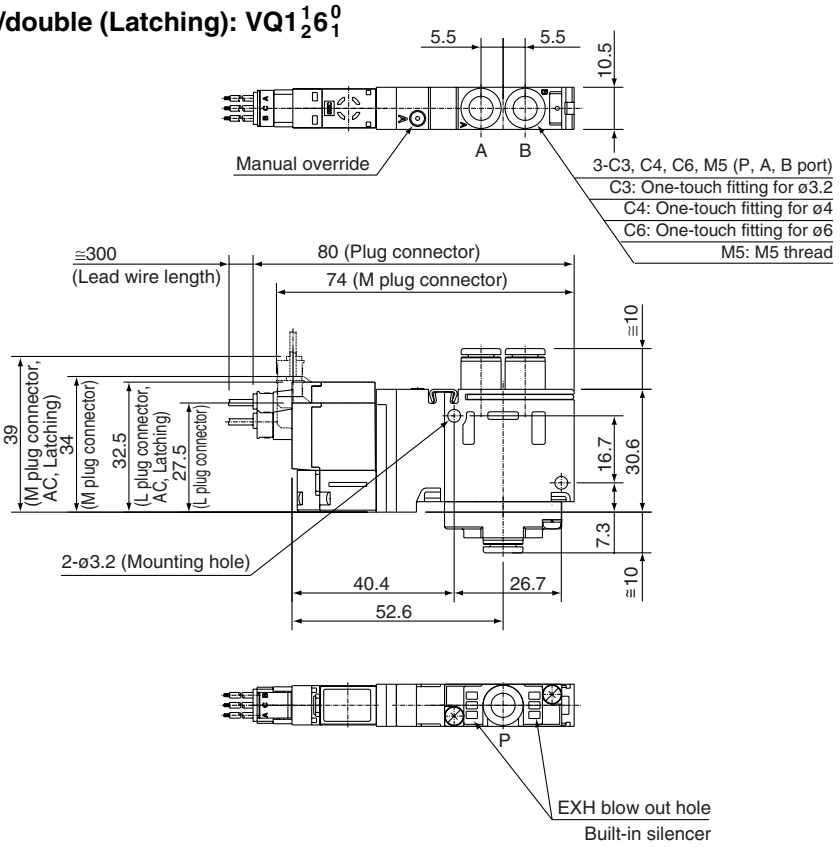
Connector Assembly Part No.

Lead wire length	Single/3 position part no.	Double solenoid part no.
Socket only (3 pcs.)	AXT661-12A	
300 mm	AXT661-14AN	AXT661-13AN
600 mm	AXT661-14AN-6	AXT661-13AN-6
1000 mm	AXT661-14AN-10	AXT661-13AN-10
2000 mm	AXT661-14AN-20	AXT661-13AN-20
3000 mm	AXT661-14AN-30	AXT661-13AN-30

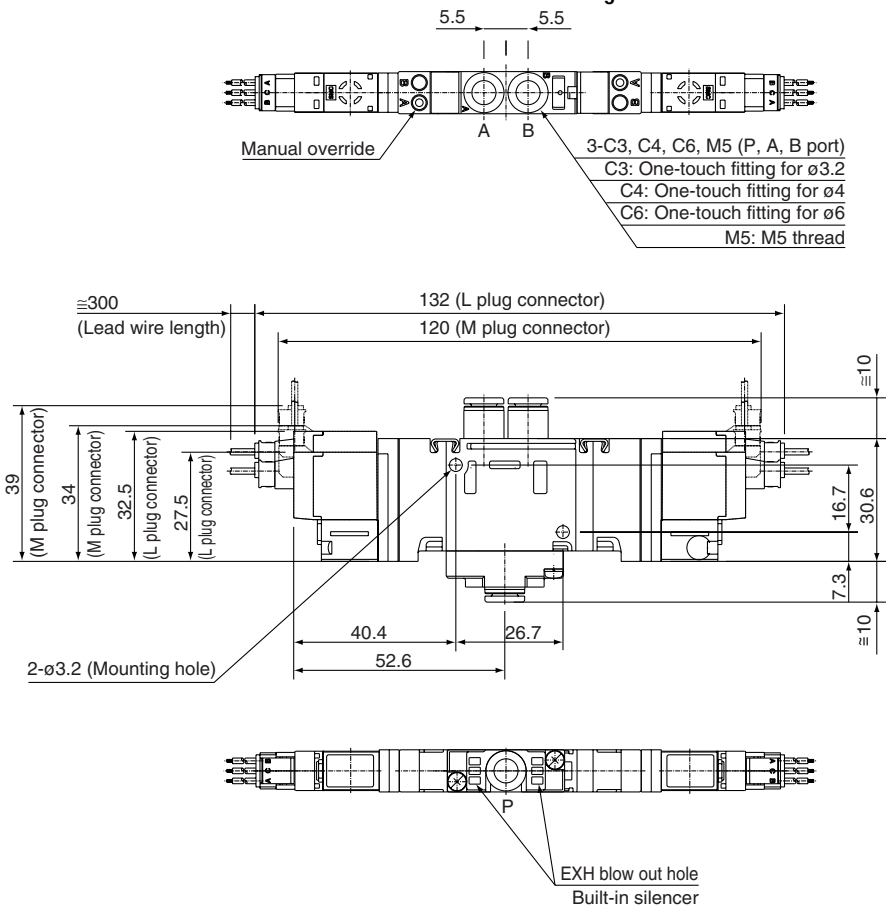
Note 1) When using the negative common specifications, use valves for negative common.
Note 2) 3 position type requires 2 sets for A side and B side.

Dimensions

2 position single/double (Latching): VQ1$^{1}_{2}$6$^{0}_{1}$



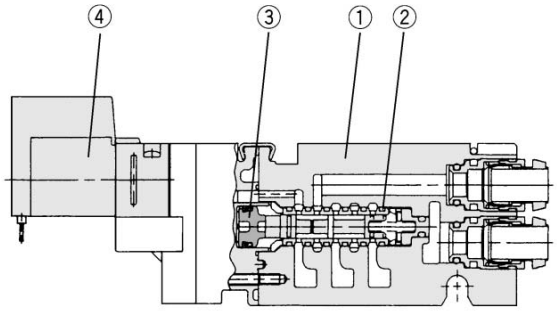
3 position closed center/exhaust center/pressure center: VQ1$^{3}_{5}$6$^{0}_{1}$

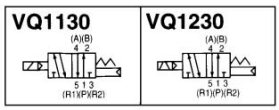


Construction
Main Parts, Replacement Parts

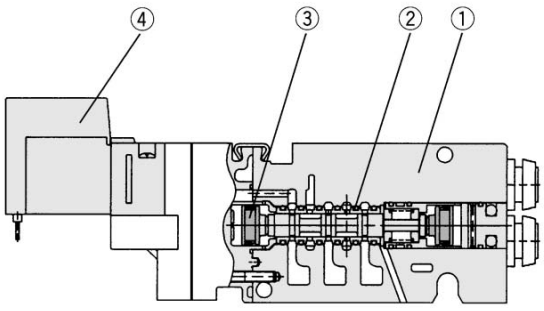
Construction: VQ1000/Plug-in Unit, Flip Type

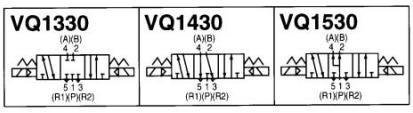
Metal seal
Single/Double (Latching)





3 position





Component Parts

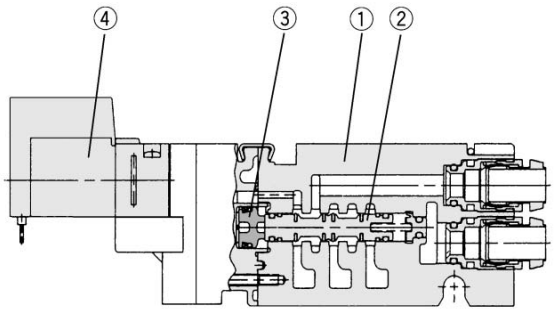
No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

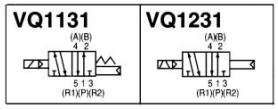
④ Pilot valve assembly

Single/3 position	VQ111(H/Y)-□F (Note) Voltage: 1 to 6	
Double (Latching)	VQ110L-□F Voltage: 1 to 6	

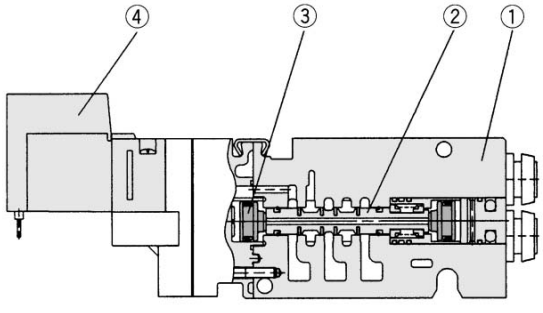
Note) (H): 1.5 W, (Y): 0.5 W

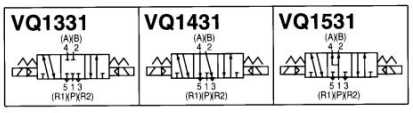
Rubber seal
Single/Double (Latching)





3 position





Component Parts

No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

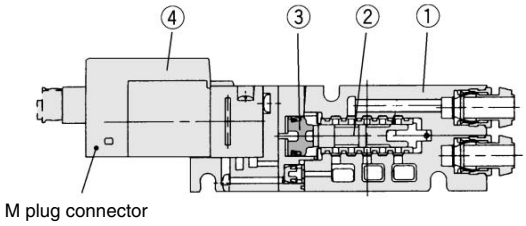
④ Pilot valve assembly

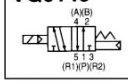
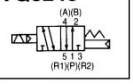
Single/3 position	VQ111(H/Y)-□F (Note) Voltage: 1 to 6	
Double (Latching)	VQ110L-□F Voltage: 1 to 6	

Note) (H): 1.5 W, (Y): 0.5 W

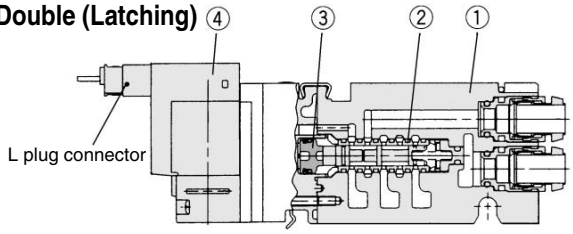
Construction: VQ0000, 1000, 2000/Plug Lead Unit, Flip Type

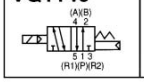
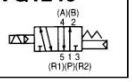
Metal seal
VQ0000



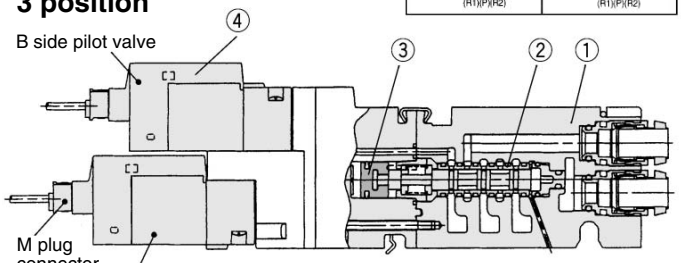
VQ0140	VQ0240
	

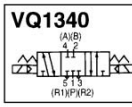
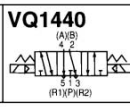
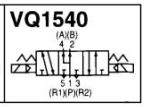
VQ1000
Single/Double (Latching)



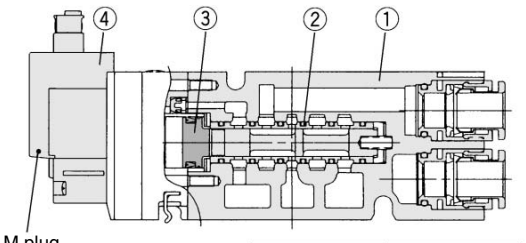
VQ1140	VQ1240
	

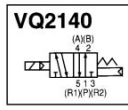
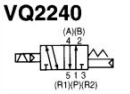
3 position



VQ1340	VQ1440	VQ1540
		

VQ2000



VQ2140	VQ2240
	

Component Parts

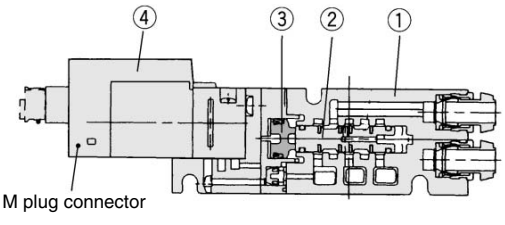
No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

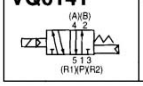
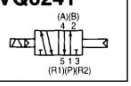
④ Pilot valve assembly

Single 3 position (VQ1000)	VQ111 (H)/(Y) - (Note) □ L/M/G - 2/3 (VQ0000/VQ1000/VQ2000) Voltage: 1 to 6 0: VQ0000 1: VQ1000, VQ2000	
Double (Latching)	VQ110L - □ L/M - 2/3 (VQ0000/VQ1000/VQ2000) Voltage: 1 to 6	
3 position (VQ1000)	VQ111 (H)/(Y) - (Note) □ L/M/G - X18 {A side (Bottom side)/Nil {B side (Top side)} Voltage: 1 to 6	The direction of the L and M connectors of a pilot valve is opposite to that of the single and double type.

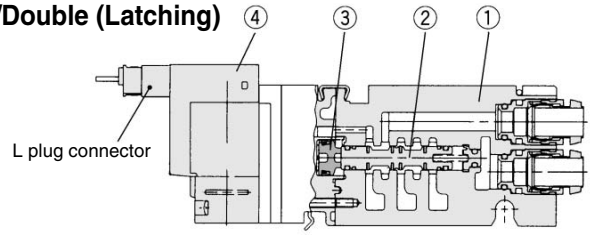
Note 1) (H): 1.5 W, (Y): 0.5 W, G type: DC only

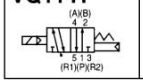
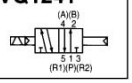
Rubber seal
VQ0000



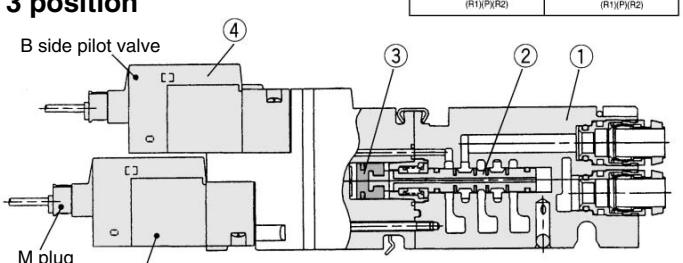
VQ0141	VQ0241
	

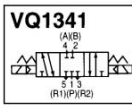
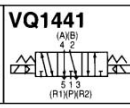
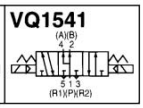
VQ1000
Single/Double (Latching)



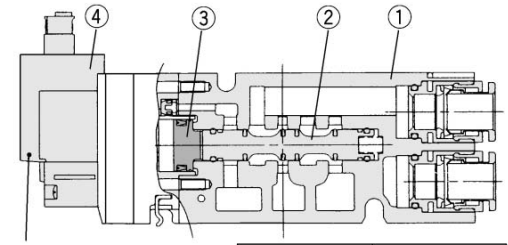
VQ1141	VQ1241
	

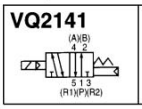
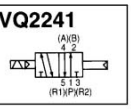
3 position



VQ1341	VQ1441	VQ1541
		

VQ2000



VQ2141	VQ2241
	

Component Parts

No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

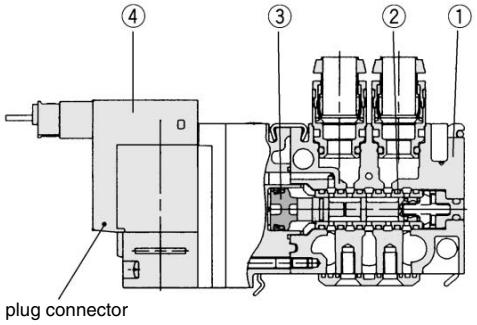
④ Pilot valve assembly

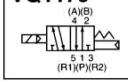
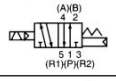
Single 3 position (VQ1000)	VQ111 (H)/(Y) - (Note) □ L/M/G - 2/3 (VQ0000/VQ1000/VQ2000) Voltage: 1 to 6 0: VQ0000 1: VQ1000, VQ2000	
Double (Latching)	VQ110L - □ L/M - 2/3 (VQ0000/VQ1000/VQ2000) Voltage: 1 to 6	
3 position (VQ1000)	VQ111 (H)/(Y) - (Note) □ L/M/G - X18 {A side (Bottom side)/Nil {B side (Top side)} Voltage: 1 to 6	The direction of the L and M connectors of a pilot valve is opposite to that of the single and double type.

Note 1) (H): 1.5 W, (Y): 0.5 W, G type: DC only

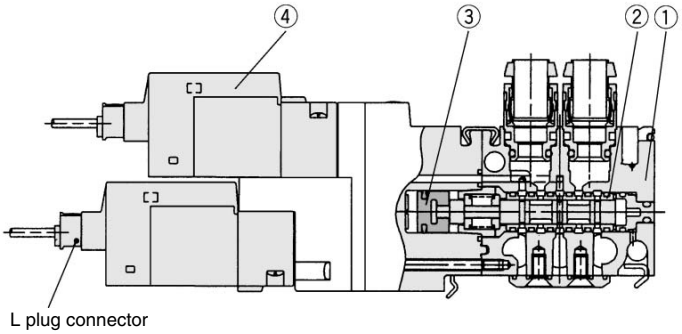
Construction: VQ1000/Plug Lead Unit, Cassette Type

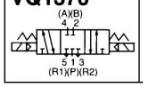
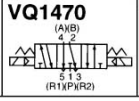
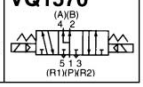
Metal seal
Single/Double (Latching)



VQ1170	VQ1270
	

3 position



VQ1370	VQ1470	VQ1570
		

Component Parts

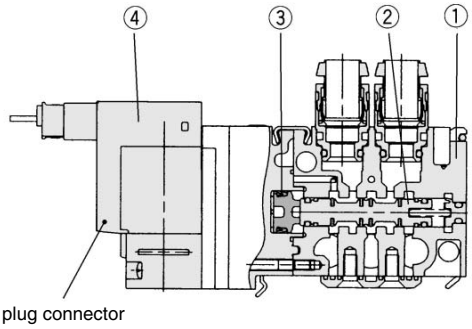
No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

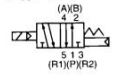
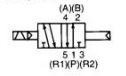
④ Pilot valve assembly

Single	Note) VQ111(H)(Y)-□L/M/G-2 Voltage: 1 to 6	
Double (Latching)	VQ110L-□L/M-2 Voltage: 1 to 6	
3 position	Note) VQ111(H)(Y)-□L/M/G-X18 {A side (Bottom side)} Nil {B side (Top side)} Voltage: 1 to 6	The direction of the L and Mconnectors of a pilot valve is opposite to that of the single and double type.

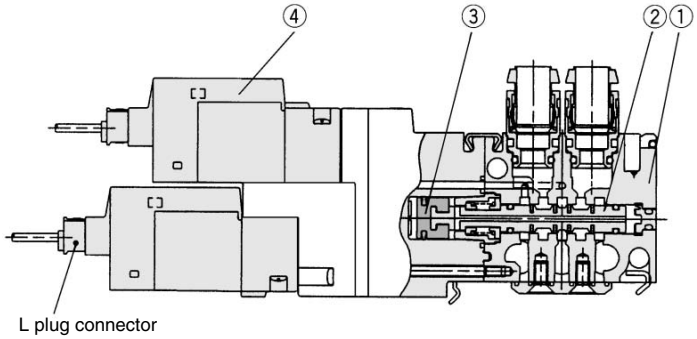
Note 1) (H): 1.5 W, (Y): 0.5 W, G type: DC only

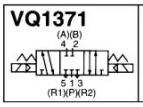
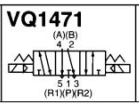
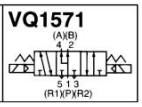
Rubber seal
Single/Double (Latching)



VQ1171	VQ1271
	

3 position



VQ1371	VQ1471	VQ1571
		

Component Parts

No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

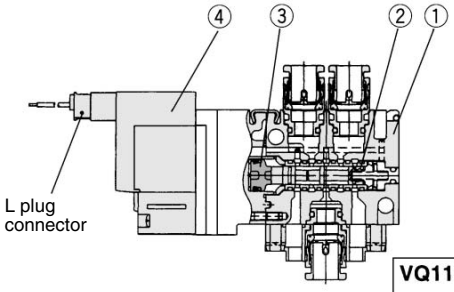
④ Pilot valve assembly

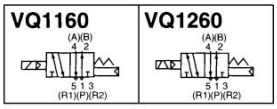
Single	Note) VQ111(H)(Y)-□L/M/G-2 Voltage: 1 to 6	
Double (Latching)	VQ110L-□L/M-2 Voltage: 1 to 6	
3 position	Note) VQ111(H)(Y)-□L/M/G-X18 {A side (Bottom side)} Nil {B side (Top side)} Voltage: 1 to 6	The direction of the L and Mconnectors of a pilot valve is opposite to that of the single and double type.

Note 1) (H): 1.5 W, (Y): 0.5 W, G type: DC only

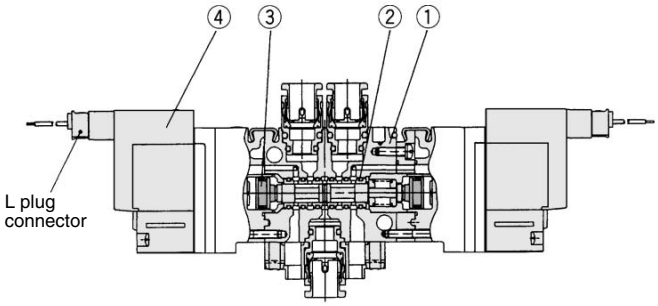
Construction: VQ1000/Single Unit

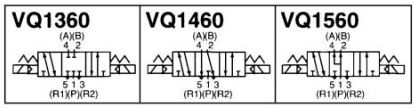
Metal seal
Single/Double (Latching)





3 position





Component Parts

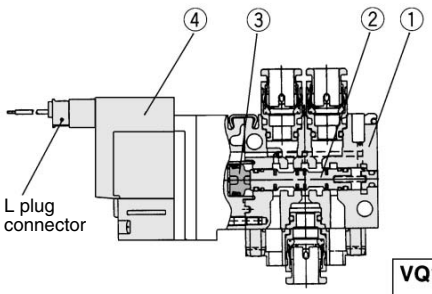
No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

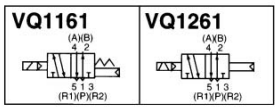
④ Pilot valve assembly

Single/3 position	Note) VQ111(H)(Y)-□LMG-2 Voltage: 1 to 6	
Double (Latching)	VQ110L-□LM-2 Voltage: 1 to 6	

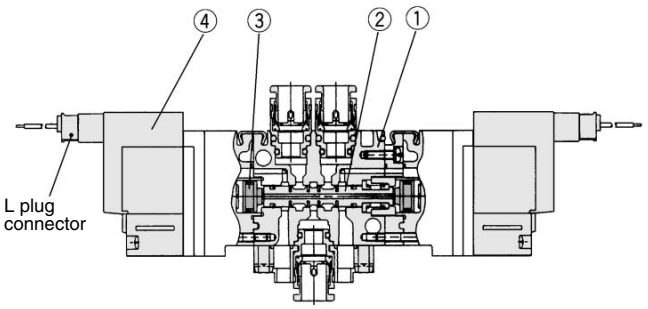
Note 1) (H): 1.5 W, (Y): 0.5 W, G type: DC only

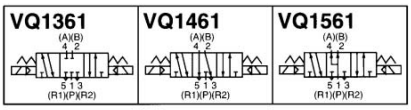
Rubber seal
Single/Double (Latching)





3 position





Component Parts

No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

④ Pilot valve assembly

Single/3 position	Note) VQ111(H)(Y)-□LMG-2 Voltage: 1 to 6	
Double (Latching)	VQ110L-□LM-2 Voltage: 1 to 6	

Note 1) (H): 1.5 W, (Y): 0.5 W, G type: DC only

Exploded View of Manifold

VQ1000 (VV5Q13)/Plug-in Unit, Flip Type

(F, P, J, L, S kit)

∗ For how to increase the stations, refer to the instruction manual.

	Housing assembly and SI unit	U side end plate assembly	Valve and junction box assembly	D side end plate assembly	Station increase parts
S kit	Note 1) ② ①				
P/J kit	② PS (Side entry)				
F kit	③ PS (Side entry)	④	⑦ ⑨ ⑧ ⑩	⑥ ⑨ ⑩	⑫ ⑪
L kit		⑤			

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-1-PU20) of ① SI unit and ② P kit (20 pins).

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①(1)	(SA kit)	EX330-S001	General type SI unit (Series EX300)
	(SB kit)	EX130-SMB1	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX130-STA1	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX130-SSH1	SI unit for Satellite I/O Link System (SHARP Corporation)
	(SF1 kit)	EX130-SUW1	SI unit for 16 point Uni-wire System (NKE Corporation)
	(SH kit)	EX130-SUH1	SI unit for 16 point Uni-wire H System (NKE Corporation)
②	P_S^U kit	AXT100-1-P_S^U□ (2)	Flat cable housing assembly □ = Number of pins: 26, 20, 16, 10
	J_S^U kit	AXT100-1-J_S^U20 (2)	Flat cable housing assembly
③	F_S^U kit	AXT100-1-F_S^U□ (2)	D-sub connector housing assembly □ = Number of pins: 25, 15

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-1-PU20) of ① SI unit and ② P kit (20 pins). Place an order for AXT-100-1-PS20 separately.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.

<D Side End Plate Assembly>

④⑤ D side end plate assembly no.

VVQ1000-3A-3-□-□

- **Option**
  - **Nil**: Common exhaust
  - **S:** Built-in silencer, direct exhaust (1)
- **Electrical entry**
  - **F**: For F kit
  - **P**: For P kit
  - **J**: For J kit
  - **L**: For L kit
  - **S**: For S kit

Note 1) Applicable for L kit only
Note 2) The housing assembly and SI unit of F/P/J/S kit are not included. Separately place an order for ①, ②, and ③.
Note 3) The ⑩'s fitting assembly is included.

<U Side End Plate Assembly No.>

⑥ U side end plate assembly no.

VVQ1000-2A-3-□

- **Option**
  - **Nil**: Common exhaust
  - **S:** Built-in silencer, direct exhaust

Note) The ⑩'s fitting assembly is included.

<Junction Box Assembly>

⑦ Junction box assembly no.

VVQ1000-1A-3-□

- **Electrical entry**
  - F1: For F kit
  - P1: P, G, T, S kit for 1 to 12 stations/Double wiring
  - P2: G, S kit for 13 to 16 stations/Double wiring
  - P3: G, S kit for 1 to 16 stations/Single wiring
  - L0□: L0 kit Note)
  - L1□: L1 kit Note)
  - L2□: L2 kit Note)

  } □: Stations (1 to 16)

Note) Lead wire assembly for extensions is attached.

<Replacement Parts>

No.	Part no.	Description	Material	Number
⑧	VVQ1000-80A-3-2	Seal	HNBR	12
⑨	VVQ1000-80A-4	Clip	Stainless steel	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Fittings Assembly>

⑩ Fittings assembly part no.

VVQ1000-50A-□

- **Port size**
  - **C3**: Applicable tubing ø3.2
  - **C4**: Applicable tubing ø4
  - **C6**: Applicable tubing ø6 (1)

Note 1) Standard SUP/EXH port is C6.
Note 2) Purchasing order is available in units of 10 pieces.

<Station Increase Parts>

∗ The station can be increased up to 2 stations.

No.(3)	Part no.	Description	Material	Number(1)
⑪	VVQ1000-105A-3-□ (2)	Tie-rod bolt	Carbon steel	2
⑫		Junction cover	Stainless steel	1

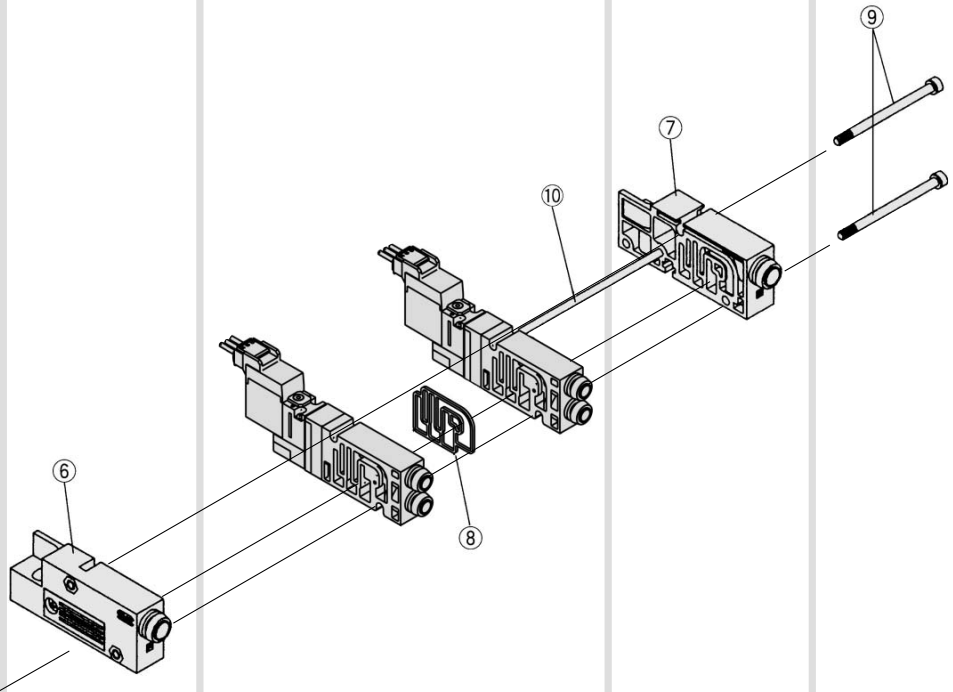
Note 1) Each number of replacement parts are included in one set.
Note 2) □: Number of stations (01 to 16)
Note 3) ⑪ and ⑫ are in one set.

VQ0000 (VV5Q04)/Plug Lead Unit, Flip Type

(F, P, T, S kit)

∗ For how to increase the stations, refer to the instruction manual.

	Housing assembly and SI unit (3)	U side end plate assembly	Valve	D side end plate assembly	Station increase parts
S kit	Connector assembly Note 2) Note 1) Note 4)				
P kit	Connector assembly Note 2) Note 4) PS (Side entry)				
F kit	Connector assembly Note 2) Note 4) FS (Side entry)				
T kit	Connector assembly Note 2) Note 4)				



Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PU20) of ① SI unit and ② P kit (20 pins).
Note 2) Since no connector assembly is included, order it separately. (Refer to page 2-4-69.)
Note 3) A housing assembly is not used for a C kit.
Note 4) A DIN rail clamping bracket is attached to each.

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①[1]	(SA kit)	EX330-S001	General type SI unit (Series EX300)
	(SB kit)	EX130-SMB1	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX130-STA1	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX130-SSH1	SI unit for Satellite I/O Link System (SHARP Corporation)
	SF1 kit	EX130-SUW1	SI unit for 16 point Uni-wire System (NKE Corporation)
	SH kit	EX130-SUH1	SI unit for 16 point Uni-wire H System (NKE Corporation)
②	P_S^U kit	AXT100-2-P_S^U□[2]	Flat ribbon cable housing assembly □ = Number of pins: 26, 20, 16, 10
③	F_S^U kit	AXT100-2-F_S^U□[2]	D-sub connector housing assembly □ = Number of pins: 25, 15
④[3]	T kit	AXT100-2-TB1	Terminal block assembly (8 terminals)
⑤[3]	T kit	AXT100-2-TB2	Terminal block assembly (8 terminals)

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins). Place an order for AXT100-2-PS20 separately.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.
Note 3) In the case of standard specifications and double wiring, ④ is for 1 to 4 stations and ⑤ is for 5 to 8 stations.

Since no connector assembly is included, order it separately. (Refer to page 2-4-69.)

<D Side End Plate Assembly>

⑥ D side end plate assembly no.

VVQ0000-3A-4-□

Option
S: Built-in silencer, direct exhaust
P: Exclusively for SUP

The end plate style is subject to the kit. The combination as standard is as follows.

Kit	Part no.	U side end plate assembly	D side end plateassembly
F, P, S kit	Common exhaust type	VVQ0000-3A-4-P	VVQ0000-2A-4-R
	Built-in silencer, direct exhaust	VVQ0000-3A-4-P	VVQ0000-2A-4-S
C kit	Common exhaust type	VVQ0000-3A-4-P	VVQ0000-2A-4-R
	Built-in silencer, direct exhaust	VVQ0000-3A-4-S	VVQ0000-2A-4-S

<U Side End Plate Assembly No.>

⑦ U side end plate assembly no.

VVQ0000-2A-4-□

Option
S: Built-in silencer, direct exhaust
R: Exclusively for EXH (Common exhaust type)

<Replacement Parts>

No.	Part no.	Description	Material	Number
⑧	VVQ0000-80A-4-2	Seal	HNBR	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Station Increase Parts>

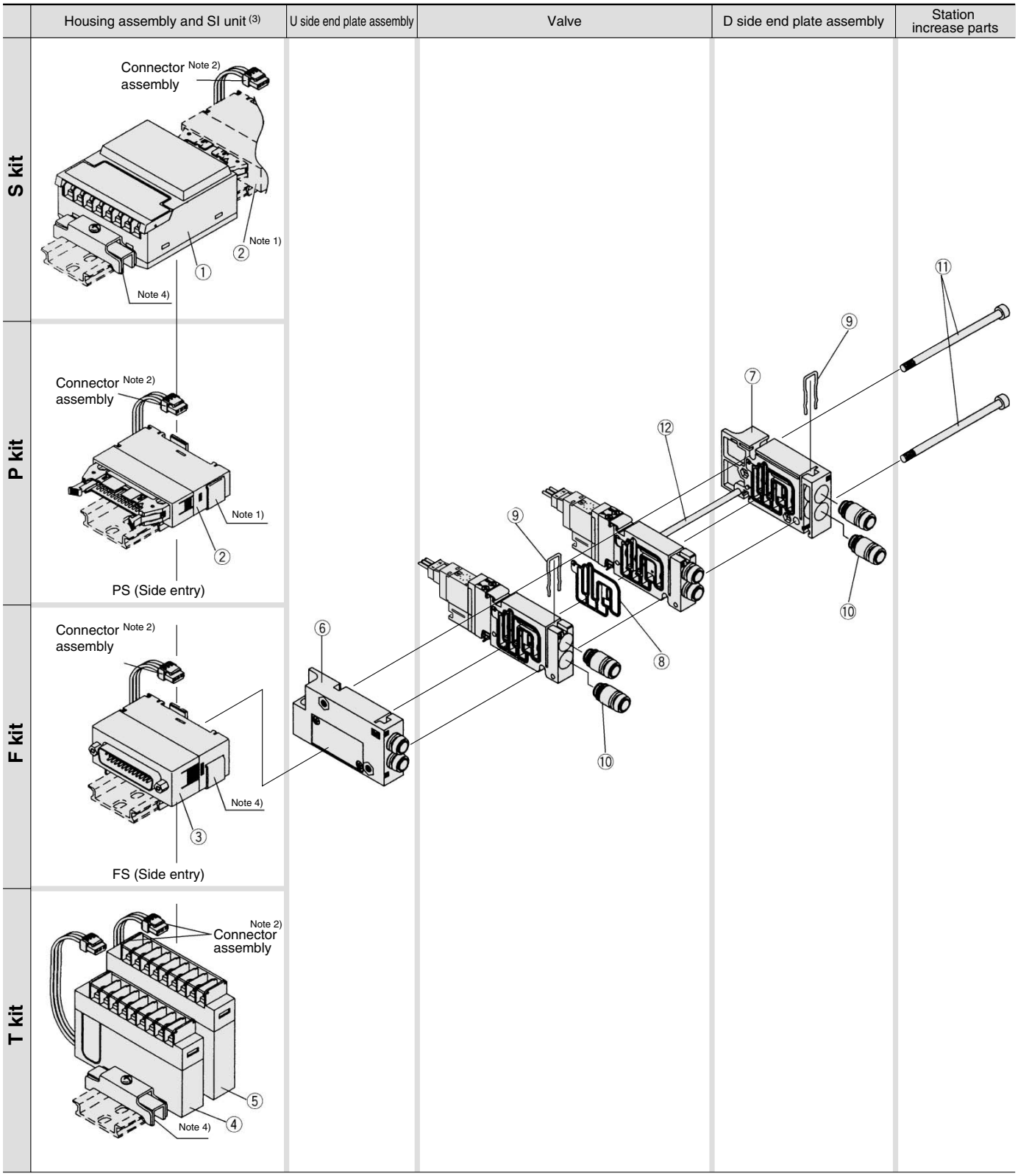
No.[3]	Part no.	Description	Material	Number[1]
⑨	VVQ0000-105A-4-□[2]	Tie-rod bolt	Carbon steel	2
⑩		Guide rod	Stainless steel	1

Note 1) Each number of replacement parts are included in one set.
Note 2) □: Number of stations (01 to 16)
Note 3) ⑨ and ⑩ are in one set.

VQ1000 (VV5Q14)/Plug Lead Unit, Flip Type

(F, P, T, S kit)

∗ For how to increase the stations, refer to the instruction manual.



Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PU20) of ① SI unit and ② P kit (20 pins).
Note 2) Since no connector asswmbly is included, order it separately. (Refer to page 2-4-69.)
Note 3) A housing assembly is not used for a C kit.
Note 4) A DIN rail clamping bracket is attached to each.

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①[1]	(SA kit)	EX330-S001	General type SI unit (Series EX300)
	(SB kit)	EX130-SMB1	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX130-STA1	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX130-SSH1	SI unit for Satellite I/O Link System (SHARP Corporation)
	(SF1 kit)	EX130-SUW1	SI unit for 16 point Uni-wire System (NKE Corporation)
	(SH kit)	EX130-SUH1	SI unit for 16 point Uni-wire H System (NKE Corporation)
②	P^{U}_{S} kit	AXT100-2-P^{U}_{S} □ [2]	Flat ribbon cable housing assembly □ = Number of pins: 26, 20, 16, 10
③	F^{U}_{S} kit	AXT100-2-F^{U}_{S} □ [2]	D-sub connector housing assembly □ = Number of pins: 25, 15
④[3]	T kit	AXT100-2-TB1	Terminal block assembly (8 terminals)
⑤[3]	T kit	AXT100-2-TB2	Terminal block assembly (8 terminals)

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins). Place an order for AXT100-2-PS20 separately.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.
Note 3) Since no connector assembly is included, order it separately. (Refer to page 2-4-69.)
Note 4) In the case of standard specifications and double wiring, ④ is for 1 to 4 stations and ⑤ is for 5 to 8 stations.

<D Side End Plate Assembly>

⑥ D side end plate assembly no.

VVQ1000-3A-4-□

Option
Nil: Common exhaust
S: Built-in silencer, direct exhaust (Applicable for C kit only)

Note) The ⑩'s fitting assembly is included.

<U Side End PlateAssembly No.>

⑦ U side end plate assembly no.

VVQ1000-2A-4-□

Option
Nil: Common exhaust
S: Built-in silencer, direct exhaust

Note) The ⑩'s fitting assembly is included.

<Replacement Parts>

No.	Part no.	Description	Material	Number
⑧	VVQ1000-80A-3-2	Seal	HNBR	12
⑨	VVQ1000-80A-4	Clip	Stainless steel	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Fittings Assembly>

⑩ Fittings assembly part no.

VVQ1000-50A-□

Port size
C3: Applicable tubing ø3.2
C4: Applicable tubing ø4
C6: Applicable tubing ø6 [1]

Note 1) Standard SUP/EXH port is C6.
Note 2) Purchasing order is available in units of 10 pieces.

<Station Increase Parts>

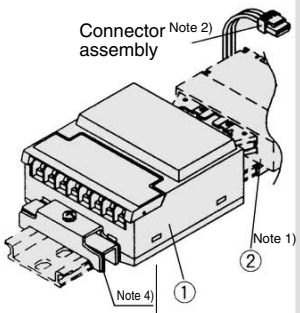
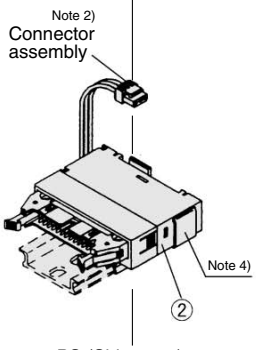
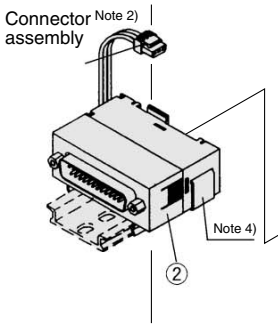
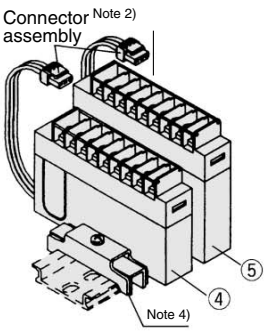
No. [3]	Part no.	Description	Material	Number [1]
⑪	VVQ1000-105A-4-□ [2]	Tie-rod bolt	Carbon steel	2
⑫		Guide rod	Stainless steel	1

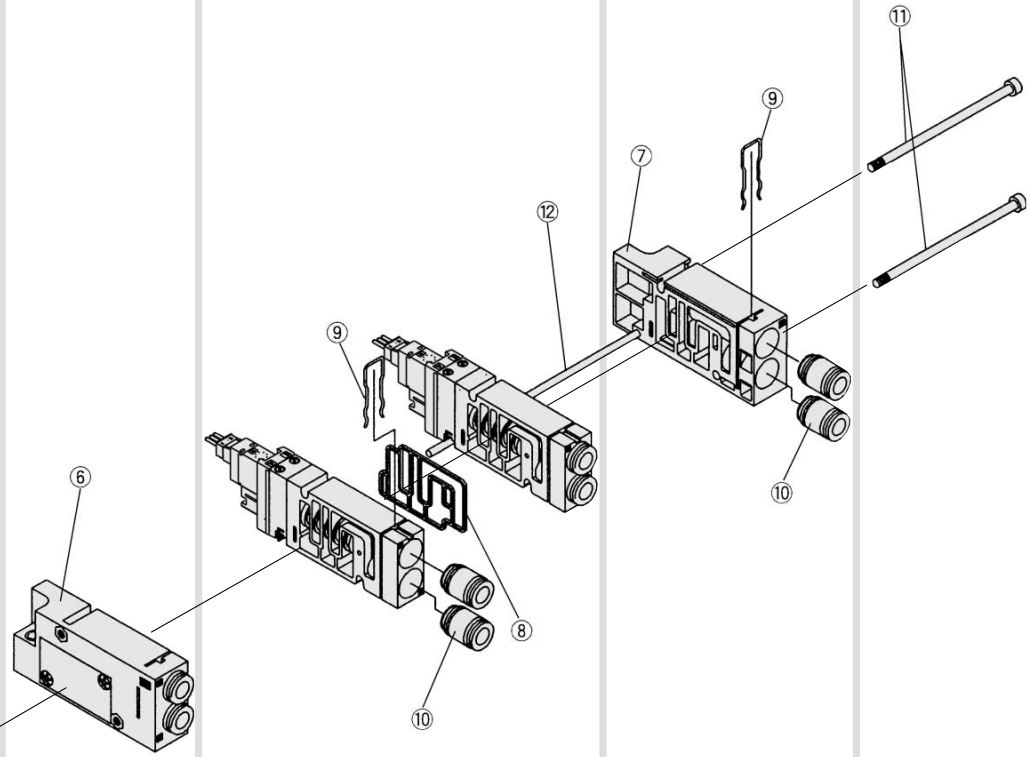
Note 1) Each number of replacement parts are included in one set.
Note 2) □: Number of stations (01 to 16)
Note 3) ⑪ and ⑫ are in one set.

VQ2000 (VV5Q24)/Plug Lead Unit, Flip Type

(F, P, T, S kit)

∗ For how to increase the stations, refer to the instruction manual.

	Housing assembly and SI unit (3)	U side end plate assembly	Valve	D side end plate assembly	Station increase parts
S kit					
P kit	 PS (Side entry)				
F kit	 FS (Side entry)				
T kit					



Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PU20) of ① SI unit and ② P kit (20 pins).
Note 2) Since no connector assembly is included, order it separately. (Refer to page 2-4-69.)
Note 3) A housing assembly is not used for a C kit.
Note 4) A DIN rail clamping bracket is attached to each.

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①(1)	(SA kit)	EX330-S001	General type SI unit (Series EX300)
	(SB kit)	EX130-SMB1	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX130-STA1	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX130-SSH1	SI unit for Satellite I/O Link System (SHARP Corporation)
	SF1 kit	EX130-SUW1	SI unit for 16 point Uni-wire System (NKE Corporation)
	SH kit	EX130-SUH1	SI unit for 16 point Uni-wire H System (NKE Corporation)
②	P^U_S kit	AXT100-2-P^U_S□ (2)	Flat ribbon cable housing assembly □ = Number of pins: 26, 20, 16, 10
③	F^U_S kit	AXT100-2-F^U_S□ (2)	D-sub connector housing assembly □ = Number of pins: 25, 15
④(3)	T kit	AXT100-2-TB1	Terminal block assembly (8 terminals)
⑤(3)	T kit	AXT100-2-TB2	Terminal block assembly (8 terminals)

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins). Place an order for AXT100-2-PS20 separately.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.
Note 3) Since no connector assembly is included, order it separately. (Refer to page 2-4-93.)
Note 4) In the case of standard specifications and double wiring, ④ is for 1 to 4 stations and ⑤ is for 5 to 8 stations.

<D Side End Plate Assembly>

⑥ D side end plate assembly no.

VVQ2000-3A-4-□

Option
Nil: Common exhaust
S: Built-in silencer, direct exhaust
(Applicable for C kit only)

Note) The ⑩'s fitting assembly is included.

<U Side End Plate Assembly No.>

⑦ U side end plate assembly no.

VVQ2000-2A-4-□

Option
Nil: Common exhaust
S: Built-in silencer, direct exhaust

Note) The ⑩'s fitting assembly is included.

<Replacement Parts>

No.	Part no.	Description	Material	Number
⑧	VVQ2000-80A-3-2	Seal	HNBR	12
⑨	VVQ2000-80A-3-4	Clip	Stainless steel	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Fittings Assembly>

⑩ Fittings assembly part no.

VVQ1000-51A-□

Port size
C4: Applicable tubing ø4
C6: Applicable tubing ø6
C8: Applicable tubing ø8 (1)

Note 1) Standard SUP/EXH port is C8.
Note 2) Purchasing order is available in units of 10 pieces.

<Station Increase Parts>

No. (3)	Part no.	Description	Material	Number (1)
⑪	VVQ2000-105A-4-□ (2)	Tie-rod bolt	Carbon steel	2
⑫		Guide rod	Stainless steel	1

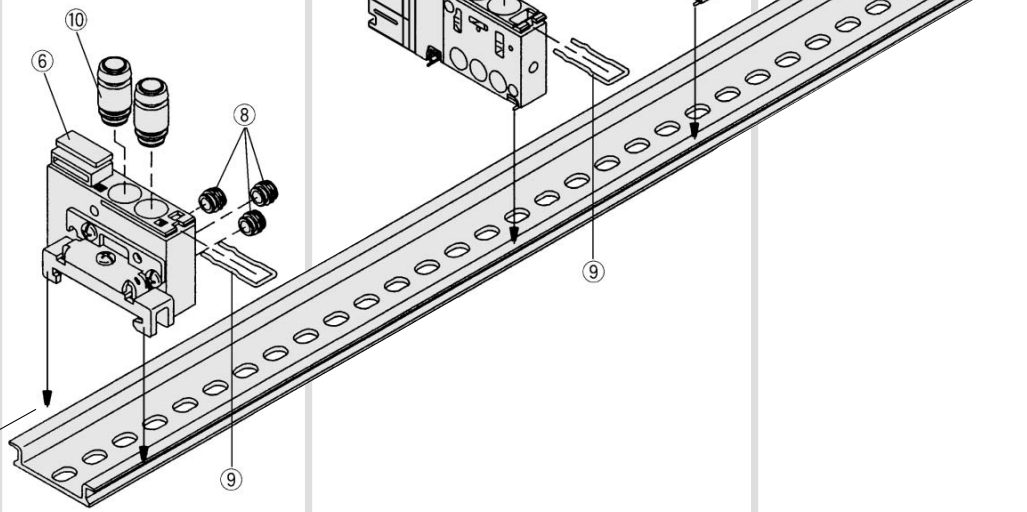
Note 1) Each number of replacement parts are included in one set.
Note 2) □: Number of stations (01 to 16)
Note 3) ⑪ and ⑫ are in one set.

VQ1000 (VV5Q17)/Plug Lead Unit, Cassette Type

(F, P, T, S kit)

∗ For how to increase the stations, refer to the instruction manual.

	Housing assembly and SI unit (3)	U side end plate assemblyy	Valve	D side end plate assembly
S kit	Connector assembly Note 2), ①, Note 4), Note 1), ②			
P kit	Note 2) Connector assembly, ②, Note 4) PU (Side entry)			
F kit	Note 2) Connector assembly, ③, Note 4) FU (Side entry)			
T kit	Note 4), ④, ⑤			



Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PU20) of ① SI unit and ② P kit (20 pins).
Note 2) Since no connector assembly is included, order it separately. (Refer to page 2-4-93.)
Note 3) A housing assembly is not used for a C kit.
Note 4) A DIN rail clamping bracket is attached to each.

<Housing Assemnly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
	(SA kit)	EX321-S001(-XP)	General type SI unit (Series EX300)
	(SB kit)	EX121-SMB1(-XP)	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX121-STA1(-XP)	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX121-SSH1(-XP)	SI unit for Satellite I/O Link System (SHARP Corporation)
	(SE kit)	EX121-SPA1	SI unit for MEWNET-F System (Matsushita Electric Works Ltd.)
	(SF1kit)	EX121-SUW1(-XP)	SI unit for 16 point Uni-wire System (NKE Corporation)
	(SG kit)	EX121-SAB1(-XP)	SI unit for Allen Bradley Remote I/O (RIO) System (Rockwell Automation, Inc.)
① (1)	(SH kit)	EX121-SUH1(-XP)	SI unit for 16 point Uni-wire H System (NKE Corporation)
	(SJ1 kit)	EX121-SSL1(-XP)	SI unit for 16 point S-LINK System (SUNX Corporation)
	(SJ2 kit)	EX121-SSL2(-XP)	SI unit for 8 point S-LINK System (SUNX Corporation)
	(SK kit)	EX121-SFU1(-XP)	SI unit for T-LINK Mini System (Fuji Electric Co.,Ltd.)
	(SQ kit)	EX121-SDN1	SI unit for DeviceNet, CompoBus/D (OMRON Corporation)
	(SR1 kit)	EX121-SCS1(-XP)	SI unit for 16 point CompoBus/S System (OMRON Corporation)
	(SR2 kit)	EX121-SCS2(-XP)	SI unit for 8 point CompoBus/S System (OMRON Corporation)
	(SV kit)	EX121-SMJ1(-XP)	Mitsubishi Electric Corporation: CC-LINK System
②	P^{U}_{S} kit	AXT100-2-P^{U}_{S}□ (2)	Flat ribbon cable housing assembly □ = Number of pins: 26, 20, 16, 10
③	F^{U}_{S} kit	AXT100-2-F^{U}_{S}□ (2)	D-sub connector housing assembly □ = Number of pins: 25, 15
④ (3)	T kit	AXT100-2-TA1	Terminal block assembly (8 terminals)
⑤ (3)	T kit	AXT100-2-TA2	Terminal block assembly (8 terminals)

Note 1) A S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins). Place an order for AXT100-2-PS20 separately. Suffix -XP for dustproof type SI unit.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.
Note 3) Since no connector assembly is included, order it separately. (Refer to page 2-4-93.)
Note 4) In the case of standard specifications and double wiring, ④ is for 1 to 4 stations and ⑤ is for 5 to 8 stations.

<D Side End Plate Assembly>

⑥ D side end plate assembly no.

VVQ1000-3A-7

Note) The ⑩'s fitting assembly is included.

<U Side End Plate Assembly No.>

⑦ U side end plate assembly no.

VVQ1000-2A-7

Note) The ⑩'s fitting assembly is included.

<Replacement Parts>

No.	Part no.	Description	Material	Number
⑧	VVQ1000-80A-7-2	Bushing assembly		3
⑨	VVQ1000-80A-7-4	Clip	Stainless steel	12

<Fittings Assembly>

⑩ Fittings assembly part no.

VVQ1000-50A-□

Port size
C3: Applicable tubing ø3.2
C4: Applicable tubing ø4
C6: Applicable tubing ø6 (1)

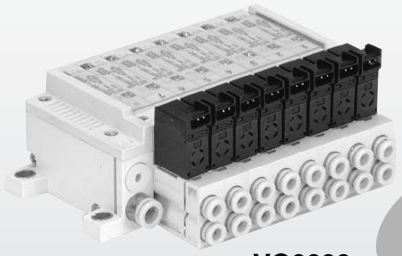
Note 1) Standard SUP/EXH port is C6.
Note 2) Purchasing order is available in units of 10 pieces.

Base Mounted
Metal Seal/Rubber Seal
Series VQ

Space-saving profile

All pilot valves are compactly mounted on one side. The space-saving design of mounting all fittings on one side permits mounting in three directions.

Space-saving ····· 45% less
Capacity-saving ····· 50% less



VQ0000 (VV5Q05)

Unprecedented high speed response and long service life

(Metal seal, single, with indicator light/surge voltage suppressor)

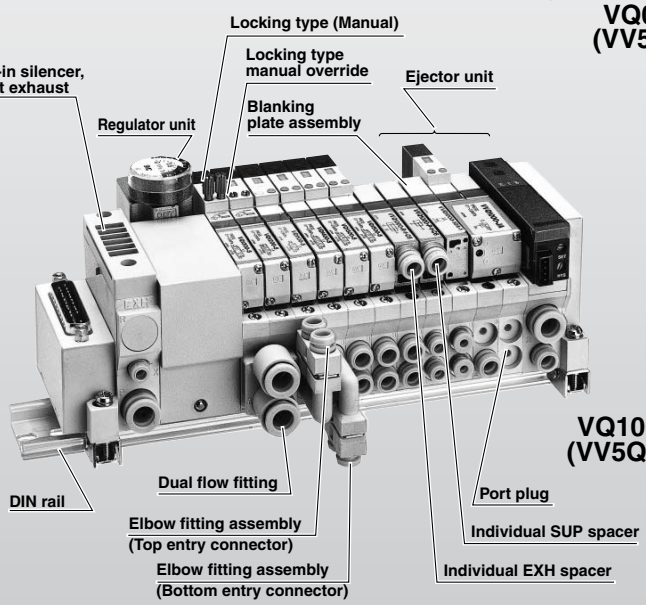
VQ0000	10 ms	200 million cycles
VQ1000	10 ms	
VQ2000	20 ms	

Dispersion accuracy ±2 ms

Thin compact design with large flow capacity

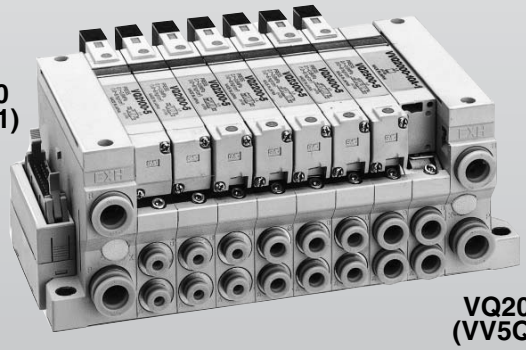
Model	Manifold pitch (mm)	Flow characteristics		Cylinder size
		Metal seal	Rubber seal	
		C [dm³/(s·bar)]	C [dm³/(s·bar)]	
VQ0000	10.7	0.44	0.53	Up to ø40
VQ1000	10.5	0.72	1.0	Up to ø50
VQ2000	16	2.6	3.2	Up to ø80

∗ Flow characteristics: 4/2 → 5/3 (A/B → R1/R2)



∗ The photo does not show an actual use example.

A variety of options



VQ1000 (VV5Q11)

VQ2000 (VV5Q21)

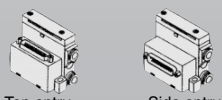
Innovative mounting methods

The non-bias, one-clamp structure permits easy valve replacement. (Plug-in unit)

Built-in One-touch fittings for easy piping.

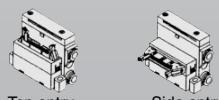
A variety of common wiring methods are standardized.

F kit (D-sub connector)
Number of pins: 15, 25



Top entry Side entry

P kit (Flat ribbon cable connector)
Number of pins: 10, 16, 20, 26

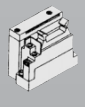


Top entry Side entry

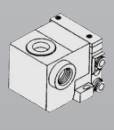
J kit (Flat ribbon cable connector)
Number of pins: 20
(PC Wiring System compliant)

Top entry Side entry

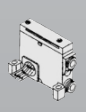
G kit (Flat ribbon cable with terminal block)
Number of pins: 20



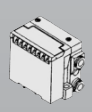
T kit (Terminal box)



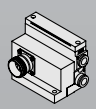
L kit (Lead wire)



S kit (Serial transmission unit)



M kit (Multi-connector kit)



(VQ2000 only)

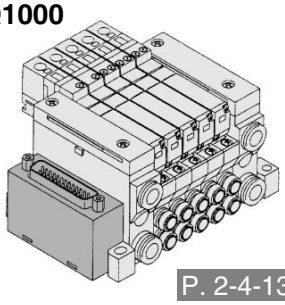
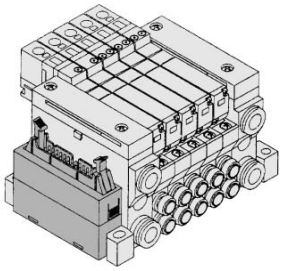
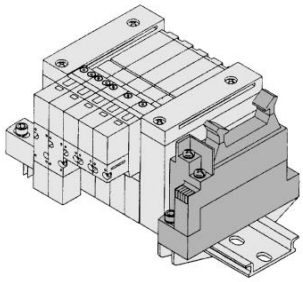
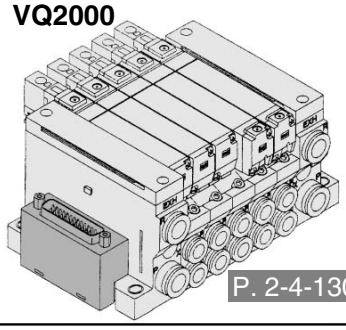
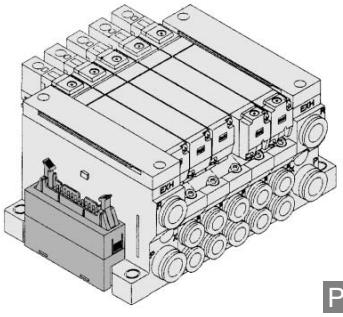
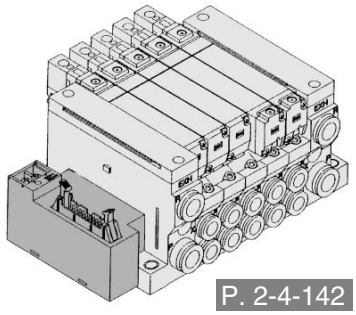
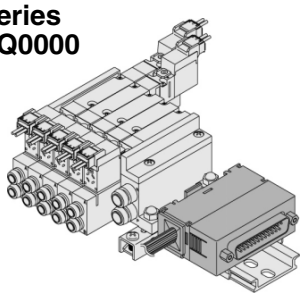
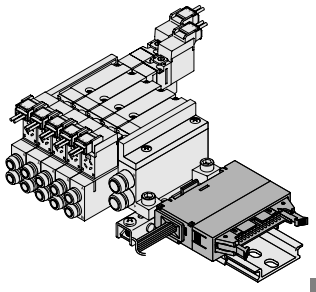
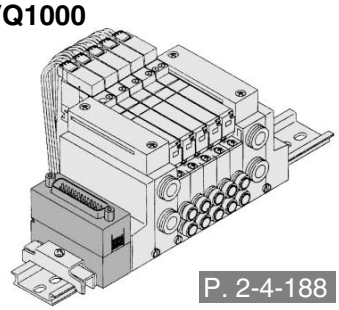
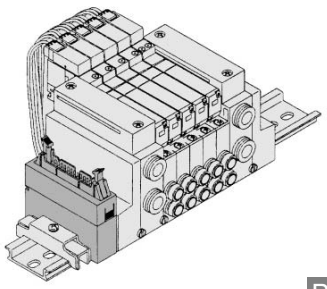
Valve Specifications

Base Mounted

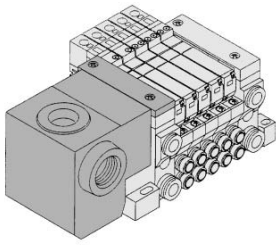
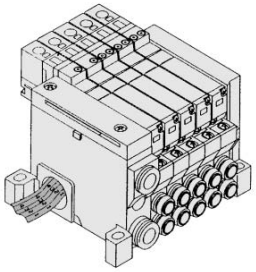
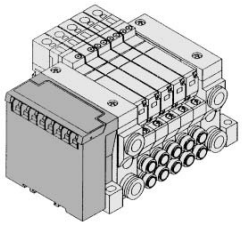
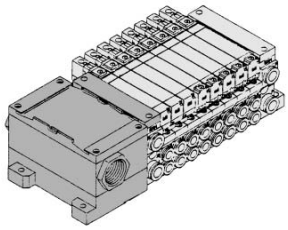
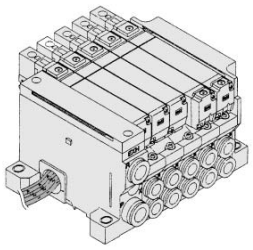
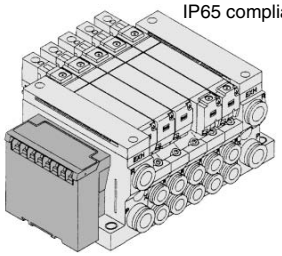
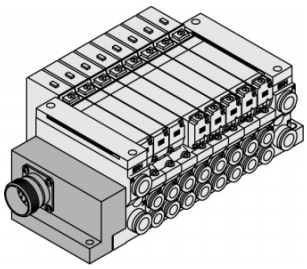
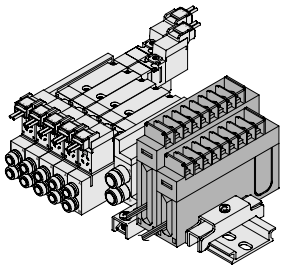
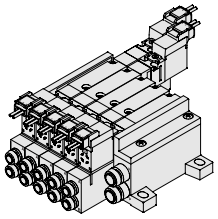
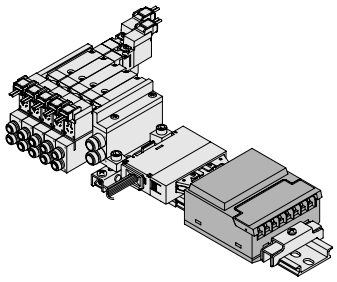
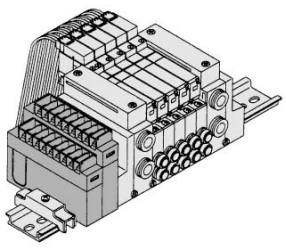
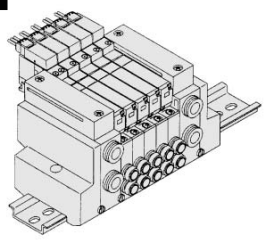
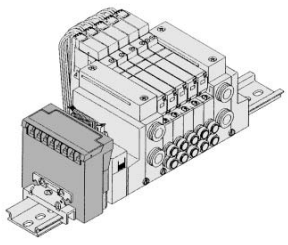
				Sonic conductance C [dm³/(s·bar)] 4/2 → 5/3 (A/B → R1/R2)		Type of actuation					Voltage			Electrical entry				Manual override		
				Double Single	3 position Closed center	Single	Double	Closed center	Exhaust center	Pressure center	12 V 24 V DC	100 V 110 V AC (50/60 Hz)	200 V 220 V AC (50/60 Hz)	Plug-in	Grommet	L plug connector	M plug connector	Push type, Tool required	Locking type	Locking type (Manual)
Plug-in	*Series VQ1000* P. 2-4-120	Rubber seal	**VQ□00**	0.72	0.72	●	●	●	●	●	●	●	● (F/L kit only)	●				●	●	●
		Metal seal	**VQ1□01**	1.0	0.65															
						P. 2-4-128														
	Series VQ2000 P. 2-4-124	Rubber seal	**VQ2□00**	2.6	2.0	●	●	●	●	●	●	●	● (F/L kit only)	●				●	●	●
		Metal seal	**VQ2□01**	3.2	2.2															
						P. 2-4-128														
Plug lead	*Series VQ0000* P. 2-4-182	Rubber seal	**VQ0□50**	0.44	0.32	●	●	●	●		●	●	●		●	●	●	●	●	
		Metal seal	**VQ0□51**	0.53	0.44															
						P. 2-4-186														
	Series VQ1000 P. 2-4-184	Rubber seal	**VQ1□10**	0.72	0.72	●	●	●	●	●	●					●		●	●	●
		Metal seal	**VQ1□11**	1.0	0.65															
						P. 2-4-186														

Option				
External pilot	●	●	●	
D-sub connector 15P	●	●	●	●
Flat ribbon cable 10P 16P 20P	●	●	●	●
Negative common specifications	For S, G kit, please contact SMC. ●	For S, G kit, please contact SMC. ●	For S, G kit, please contact SMC. ●	For S kit, please contact SMC. ●
One-touch fitting Inch size	●	●	●	●
For special wiring spec.	Except L kit ●	Except L kit ●	Except L kit ●	Except L kit ●
Manifold Option				
Blanking plate	●	●	●	●
Individual SUP/EXH	●	●	●	●
SUP/EXH passage spacer	●	●	●	●
Name plate	●	●	●	●
Back pressure check valve	●	●	●	
DIN rail mounting style	●	●	●	Standard ●
Built-in silencer	●	●	●	●
Silencer for EXH port	●	●	●	●
Elbow fitting for cylinder port	●	●	●	●
Two stations matching fittings for double flow rate	●	●	●	●
Plug for cylinder port	●	●	●	●
Regulator unit	●			
Ejector unit mounted	●			
Double check block	●	●	●	●
	P. 2-4-166	P. 2-4-172	P. 2-4-208	P. 2-4-210
	P. 2-4-177	P. 2-4-177	P. 2-4-215	P. 2-4-215

Manifold Variations

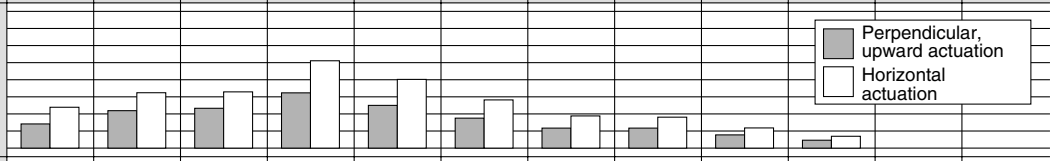
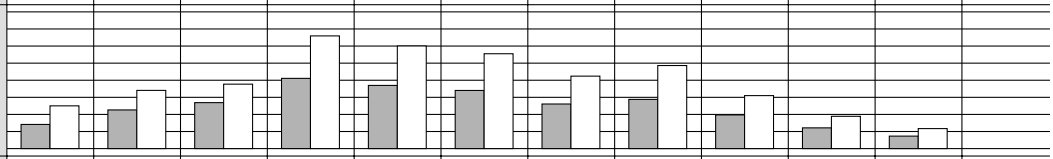
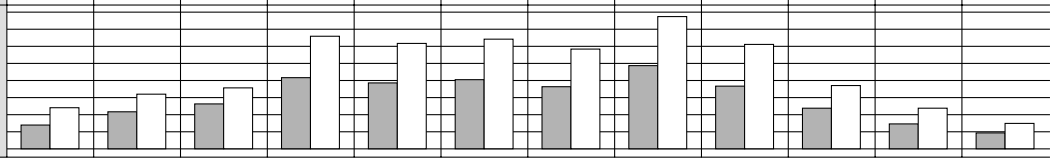
	F kit **D-sub connector** Conforming to MIL D-sub connector	**P** kit **Flat ribbon cable connector (26, 20, 16, 10 pins)** Conforming to MIL flat ribbon cable connector	**J** kit **Flat ribbon cable connector (20 pins)** Conforming to MIL flat ribbon cable connector PC Wiring System compatible	**G** kit **Flat ribbon cable with power supply terminal block** Conforming to MIL flat ribbon cable connector Applicable to OMRON's serial transmission unit PC Wiring System compatible
Plug-in	**Series VQ1000**  P. 2-4-130	P/J kit  P. 2-4-134		 P. 2-4-142
	Series VQ2000  P. 2-4-130	P/J kit  P. 2-4-134		 P. 2-4-142
Plug Lead	**Series VQ0000**  P. 2-4-188	P kit only  P. 2-4-192		—
	Series VQ1000  P. 2-4-188	P kit only  P. 2-4-192		—

Manifold Variations

T kit	L C kit	S kit	M kit
Terminal block box (Terminal block) Terminal blocks are compactly arranged on one side.	**Lead wire** Direct electrical entry type	**Serial transmission unit** Enables single-wire solenoid valve-PLC operation	**Circular connector** IP65 (Dusttight/Low jetproof type)
 Terminal block box P. 2-4-146	L kit  P. 2-4-150	 P. 2-4-154	—
 Enclosure IP65 compliant P. 2-4-146	L kit  Enclosure IP65 compliant P. 2-4-150	Enclosure IP65 compliant  P. 2-4-154	 W type only P. 2-4-158
 Terminal block P. 2-4-196	C kit  P. 2-4-200	 P. 2-4-204	—
 Terminal block P. 2-4-196	C kit  P. 2-4-200	 P. 2-4-204	—

Cylinder Speed Chart

Use as a guide for selection.
Please confirm the actual conditions with SMC Sizing Program.

Series	Average speed (mm/s)	Bore size											
		Series CJ2 Pressure 0.5 MPa Load factor 50% Stroke 60 mm			Series CM2 Pressure 0.5 MPa Load factor 50% Stroke 300 mm				Series MB, CA1 Pressure 0.5 MPa Load factor 50% Stroke 500 mm				
		ø6	ø10	ø16	ø20	ø25	ø32	ø40	ø40	ø50	ø63	ø80	ø100
VQ0151 Port size: One-touch fitting for ø4	800 700 600 500 400 300 200 100 0												
VQ1101 Port size: One-touch fitting for ø6	800 700 600 500 400 300 200 100 0												
VQ2101 Port size: One-touch fitting for ø8	800 700 600 500 400 300 200 100 0												

∗ It is when the cylinder is extending that is meter-out controlled by speed controller which is directly connected with cylinder, and its needle valve with being fully open.
∗ The average velocity of the cylinder is what the stroke is divided by the total stroke time.
∗ Load factor: ((Load weight x 9.8)/Theoretical force) x 100%

Conditions

Series	Conditions	Series CJ2	Series CM2	Series MB, CA1
VQ0151	Tube bore x Length	T0425 x 1 m		
	Speed controller	AS2001F-04		
	Silencer	AN103-X233		
VQ1101	Tube bore x Length	T0604 x 1 m		
	Speed controller	AS3001F-06		
	Silencer	AN103-X233		
VQ2101	Tube bore x Length	T0806 x 1 m		
	Speed controller	AS3001F-08		
	Silencer	AN200-KM8		

For details about certified products conforming to international standards, visit us at www.smcworld.com.

Series VQ1000
Base Mounted
Plug-in Unit

How to Order Manifold

VV5Q 1 1 – 08 C6 F U1 – ☐

Series

1	VQ1000

Manifold

1	Plug-in unit

Stations

01	1 station
⋮	⋮

The maximum and minimum number of stations are varied depending on kit. (Refer to the table below.)

Cylinder port

Symbol	Port size
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread
CM	With mixed size/with port plug (1)
L3	W/ elbow One-touch fitting ø3.2 for top piping
L4	W/ elbow One-touch fitting ø4 for top piping
L6	W/ elbow One-touch fitting ø6 for top piping
L5	Elbow M5 thread for top piping
B3	W/ elbow One-touch fitting ø3.2 for bottom piping
B4	W/ elbow One-touch fitting ø4 for bottom piping
B6	W/ elbow One-touch fitting ø6 for bottom piping
B5	Elbow M5 thread for bottom piping
LM	Mixed size for elbow piping

Note 1) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 2) Inch-size One-touch fittings are also available. For details, refer to page 2-4-179.
Note 3) M5 fittings for M5 thread are attached without being incorporated.

Simple specials are available with SMC Simple Specials System.
For details about applicable models, please contact SMC.

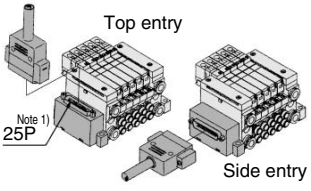
Option

Symbol	Option
Nil	None
2	200/220 VAC models (Applicable to F and L kits)
B	With back pressure check valve (2)
D	DIN rail mounting
G1	1 set of regulator unit (3)
G2	2 sets of regulator unit (3)
G3	3 sets of regulator unit (3)
J☐	With vacuum ejector unit (4)
K	Special wiring specifications (Not double wiring) (5)
N	With name plate
R	External pilot (6)
S	Built-in silencer, direct exhaust

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring by means of the manifold specification sheet. (Except L kit)
Note 6) Indicate "R" for the valve with external pilot.

Kit/Electrical entry/Cable length

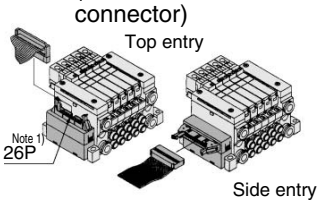
F kit (D-sub connector)



Connector entry direction: Top entry / Side entry — P. 2-4-130

Kit F	U0	Kit F	S0	Without cable	2 to 24 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

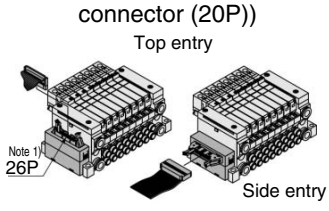
P kit (Flat ribbon cable connector)



Connector entry direction: Top entry / Side entry — P. 2-4-134

Kit P	U0	Kit P	S0	Without cable	2 to 24 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

J kit (Flat ribbon cable connector (20P))

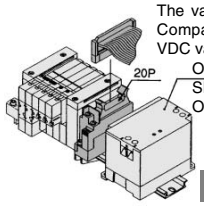


Connector entry direction: Top entry / Side entry — P. 2-4-138

Kit J	U0	Kit J	S0	Without cable	2 to 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

G Kit (Flat ribbon cable connector with power supply terminal block)

The valve is equipped with Compatible only with 24 VDC valves.



P. 2-4-142

Kit G	U0	Without cable	2 to 16 (2) stations	
	U1	With cable (1.5 m)		
	U2	With cable (3 m)		
	U3	With cable (5 m)		

Note 1) Besides the above, F and P kits with different number of pins are available. Refer to page 2-4-177 for details.
Note 2) For details, refer to page 2-4-178.

How to Order Valves

VQ 1 [1] 0 [0] Y – 5 [ ] [ ]

Series

1	VQ1000

Type of actuation

1		2 position single
2	Metal	2 position double
	Rubber	2 position double
3		3 position closed center
4		3 position exhaust center
5		3 position pressure center
A Note)		4 position dual 3 port valve (A) N.C N.C
B Note)		4 position dual 3 port valve (B) N.O N.O
C Note)		4 position dual 3 port valve (C) N.C N.O

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ Note)
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-129.

Note) For external pilot and negative COM specifications, refer to "Option" on pages 2-4-178 to 2-4-179.

Light/Surge voltage suppressor

Nil	Yes
E Note)	None

Note) Inapplicable to the S kit.

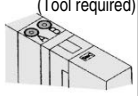
Coil voltage

1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

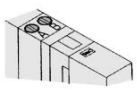
Note) 200/220 VAC models are applicable to F and L kits.

Manual override

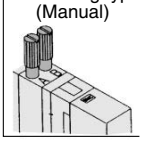
Nil: Non-locking push type (Tool required)



B: Push-locking slotted type



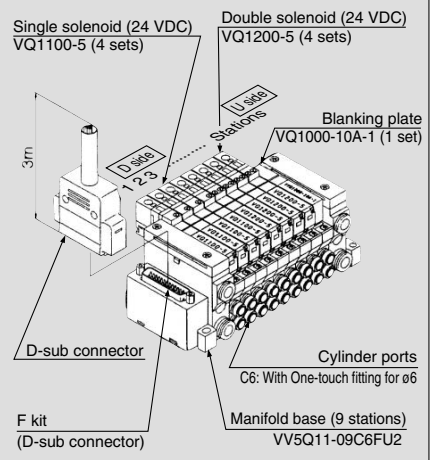
C: Locking type (Manual)



Note) Rubber seal type only.

How to Order Manifold Assembly

Example

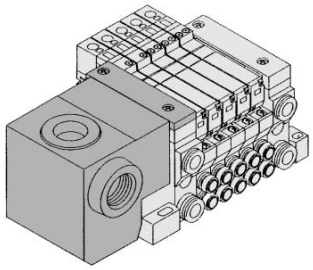


VV5Q11-09C6FU2 ···· 1 set (F kit 9 station manifold base no.)
∗VQ1100-5 ····· 4 sets (Single solenoid part no.)
∗VQ1200-5 ····· 4 sets (Double solenoid part no.)
∗VV1000-10A-1 ····· 1 set (Blanking plate part no.)
→ The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

Specify the part numbers for valves and options together beneath the manifold base part number. Besides, when the arrangement will be complicated, specify them by means of the manifold specification sheet.

VQC
SQ
VQ0
VQ4
VQ5
VQZ
VQD

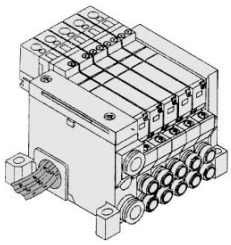
T kit (Terminal box)



P. 2-4-146

Kit T	O	Terminal block box	2 to 24 stations (2)

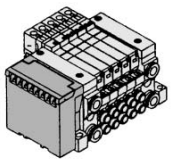
L kit (Lead wire cable)



P. 2-4-150

Kit L	0	With cable (0.6 m)	1 to 8 stations
	1	With cable (1.5 m)	
	2	With cable (3 m)	

S kit (Serial transmission unit)



The valve is equipped with an indicator light and surge voltage suppressor, and the voltage is 24 VDC. The dust proof SI unit is also available. Refer to page 2-4-154 for details.

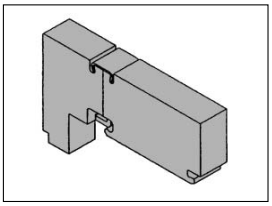
P. 2-4-154

Kit S	0	Without SI unit	Max.16 (2) stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	E	Matsushita Electric Works: MEWNET-F System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System	
	H	NKE Corp.: Uni-wire H System	
	J1	SUNX Corp.: S-LINK System (16 output points)	
	J2	SUNX Corp.: S-LINK System (8 output points)	Max. 8 stations
	K	Fuji Electric Co.: T-LINK Mini System	Max.16 stations
	Q	DeviceNet, CompoBus/D (OMRON Corp.)	
	R1	OMRON Corp.: CompoBus/S System (16 output points)	
	R2	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8 stations
	V	Mitsubishi Electric Corp.: CC-LINK System	Max. 16 stations

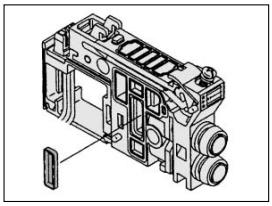
Manifold Option

P. 2-4-208

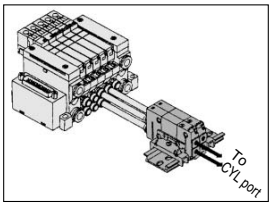
Blanking plate assembly
VVQ1000-10A-1



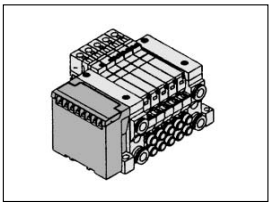
SUP block plate
VVQ1000-16A



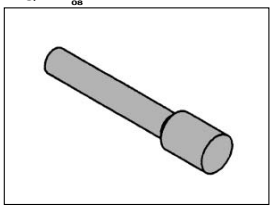
Double check block
VQ1000-FPG-□□



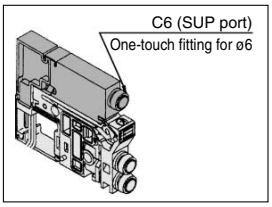
2 stations matching fitting assembly
VVQ1000-52A-C8



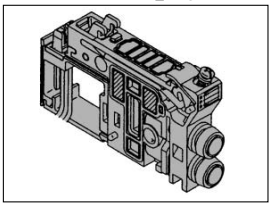
Blanking plate
KQ2P-$^{23}_{08}$



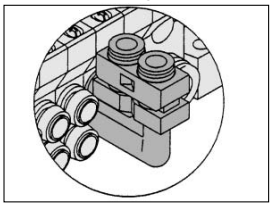
Individual SUP spacer
VVQ1000-P-1-C6



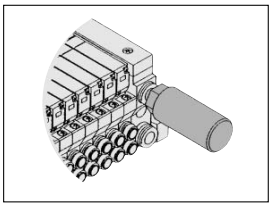
EXH block base assembly
VVQ1000-19A- $^{F\square}_{P\square}$ **-** $^{C3}_{C4}$ $^{C6}_{M5}$ $^{L\square}$



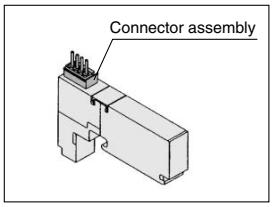
Elbow fitting assembly
VVQ1000-F-L $^{C3}_{C4}$ $^{C6}_{M5}$



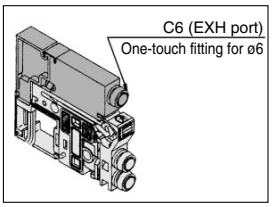
Silencer (For EXH port)
AN200-KM8/AN203-KM8



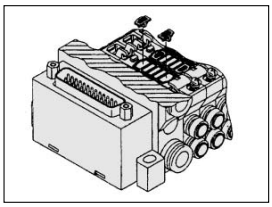
Blanking plate with connector
VVQ1000-1C□-□



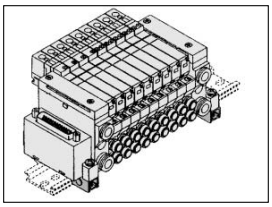
Individual EXH spacer
VVQ1000-R-1-C6



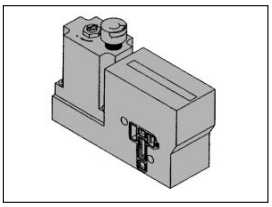
Back pressure check valve assembly [-B]
VVQ1000-18A



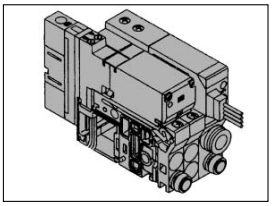
DIN rail mounting bracket [-D]
VVQ1000-57A



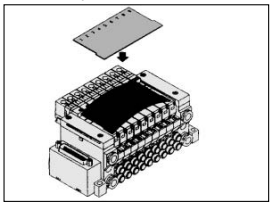
Regulator unit
VVQ1000-AR-1



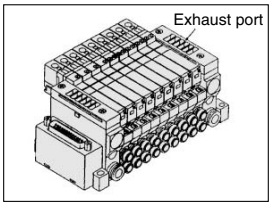
With vacuum ejector unit
[-J□]



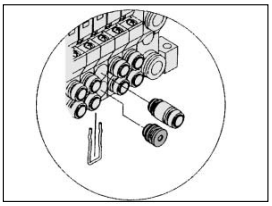
Name plate [-N]
VVQ1000- $^{N}_{NC}$ **-Station (1 to Max. stations)**



Built-in silencer,
direct exhaust [-S]



Port plug
VVQ0000-58A



• For cylinder port fittings part no., refer to page 2-4-175.
• For replacement parts, refer to page 2-4-227.

Series VQ2000
Base Mounted
Plug-in Unit

How to Order Manifold

VV5Q 2 1 – 08 C6 F U1 [ ]

Series

2	VQ2000

Manifold

1	Plug-in unit

Stations

01	1 station
⋮	⋮

The maximum and minimum number of stations are varied depending on kit. (Refer to the table below.)

Cylinder port

Symbol	Port size
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
C8	With One-touch fitting for ø8
CM	With mixed size/with port plug (1)
L4	W/ elbow One-touch fitting ø4 for top piping
L6	W/ elbow One-touch fitting ø4 for top piping

Kit type

Symbol	Port size
L8	W/ elbow One-touch fitting ø8 for top piping
B4	W/ elbow One-touch fitting ø4 for bottom piping
B6	W/ elbow One-touch fitting ø6 for bottom piping
B8	W/ elbow One-touch fitting ø8 for bottom piping
LM	Mixed size for elbow piping

Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) Inch-size One-touch fittings are available. For details, refer to page 2-4-179.

Simple specials are available with SMC Simple Specials System.
For details about applicable models, Contact SMC.

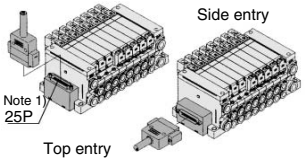
Option

Symbol	Option
Nil	None
B	Back pressure check valve (2)
D	DIN rail mounting style
K	Special wiring specifications (Except double wiring) (3)
N	With name plate
R	External pilot (4)
S	Built-in silencer, direct exhaust
W	Enclosure: Dust tight/splashproof type (IP65) [T, L, S and M kits only]

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -DNR.
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by manifold specification sheet.
Note 3) Specify the wiring specifications in the manifold specification sheet. (Except L kit)
Note 4) Indicate "R" for the valve with external pilot.

Kit/Electrical entry/Cable length

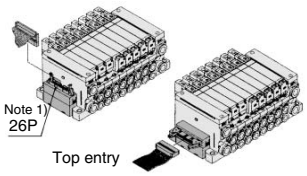
F kit (D-sub connector)



P. 2-4-130

Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	(2) 2 to 24 stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

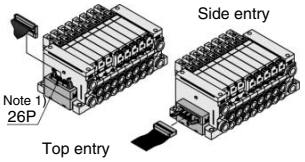
P kit (Flat ribbon cable connector)



P. 2-4-134

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	(2) 2 to24 stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

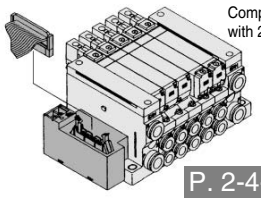
J kit (Flat ribbon cable connector (20P))



P. 2-4-138

Connector entry direction					
Top entry		Side entry			
Kit J	U0	Kit J	S0	Without cable	(2) 2 to16 stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

G kit (Flat ribbon cable connector with power supply terminal block)



P. 2-4-142

Kit G	U0	Without cable	(2) 2 to 16 stations
	U1	With cable (1.5 m)	
	U2	With cable (3 m)	
	U3	With cable (5 m)	

How to Order Valves

VQ 2 | 1 | 0 | 0 | Y | 5 | | | |

Series

2	VQ2000

Type of actuation

1		2 position single	Note) A	4 position dual 3 port valve (A)
2	Metal	2 position double	Note) B	4 position dual 3 port valve (B)
	Rubber	2 position double	Note) C	4 position dual 3 port valve (C)
3		3 position closed center		
4		3 position exhaust center		
5		3 position pressure center		

Note) Rubber seal type only.

Note) For sub-plate single unit type, refer to page 2-4-165.

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-129.

Enclosure

Nil	Dust-protected
W	Dusttight/Low jetproof type (IP65)

Manual override

Nil: Non-locking push type (tool required)

B: Push-locking slotted type

C: Locking type (Manual)

Light/Surge voltage suppressor

Nil	Yes
E Note)	None

Note) Inapplicable to the S kit.

Coil voltage

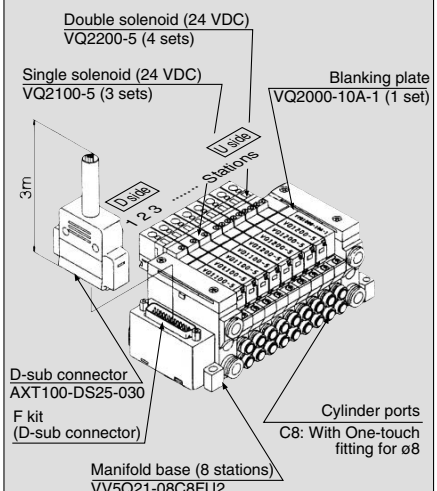
1	100 VAC (50/60 Hz)
2 Note)	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4 Note)	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) 200/220 VAC models are applicable to F and L kits.

Note) For external pilot and negative COM specifications, refer to "Option" on page 2-4-178 to 2-4-179.

How to Order Manifold Assembly

Example

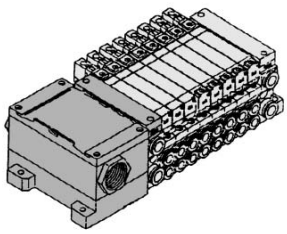


VV5Q21-08C8FU2 ··· 1 set (F kit 8 station manifold base no.)
∗VQ2100-5 ····· 3 sets (Single solenoid part no.)
∗VQ2200-5 ····· 4 sets (Double solenoid part no.)
∗VVQ2000-10A-1 ·· 1 set (Blanking plate part no.)

The asterisk denotes the symbol for assembly.
Prefix it to the part nos. of the solenoid valve, etc.

Specify the part numbers for valves and options together beneath the manifold base part number. Besides, when the arrangement will be complicated, specify them by means of the manifold specification sheet.

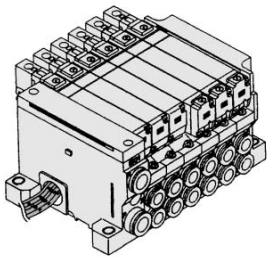
T kit (Terminal box)



Dust tight/Low jetproof type (IP65) available P. 2-4-146

Kit T	O	Terminal block box	2 to 20 stations (2)

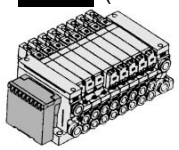
L kit (Lead wire cable)



Dust tight/Low jetproof type (IP65) available P. 2-4-150

Kit L			
	0	With cable (0.6 m)	1 to 8 stations
	1	With cable (1.5 m)	
	2	With cable (3 m)	

S kit (Serial transmission unit) (4)

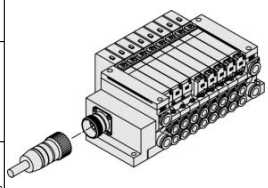


The valve is equipped with an indicator light and surge voltage suppressor, and the voltage is 24 VDC. The dusttight SI unit is available. Refer to page 2-4-154 for details. Dusttight/splashproof type (IP65) is also available. (Except SE and SG.)

P. 2-4-154

Kit S			
	O	Without SI unit	Max.16 (2) stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	BB (4)	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System(2 power supply lines)	Dust tight/ Low jetproof type Max.16 stations (IP65) only available
	C	OMRON Corp.: SYSBUS Wire System	Max.16 (2) stations
	D	SHARP Corp.: Satellite I/O Link System	
	E	Matsushita Electric Works: MEWNET-F System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System	
	H	NKE Corp.: Uni-wire H System	
	J1	SUNX Corp.: S-LINK System (16 output points)	
	J2	SUNX Corp.: S-LINK System (8 output points)	Max. 8 stations
	K	Fuji Electric Co.: T-LINK Mini System	Max.16 stations
	Q	DeviceNet, CompoBus/D (OMRON Corp.)	
	R1	OMRON Corp.: CompoBus/S System (16 output points)	
	R2	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8 stations
	V	Mitsubishi Electric Corp.: CC-LINK System	Max. 16 stations

M kit (Multi-connector)



P. 2-4-162

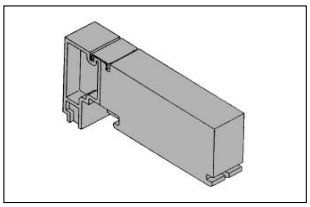
Kit M			
	0	Without cable	2 to 24 (2) stations
	1	With cable (1.5 m)	
	2	With cable (3 m)	
	3	With cable (5 m)	

Note 1) Besides the above, F and P kits with different number of pins are available. Refer to page 2-4-177 for details.
Note 2) For details, refer to page 2-4-178.
Note 3) Refer to the pages on respective kits for IP65 type. (T, L and S kits)
Note 4) Kits with IP65 enclosure applicable to input/output are also available. Refer to page 2-4-162 for details.

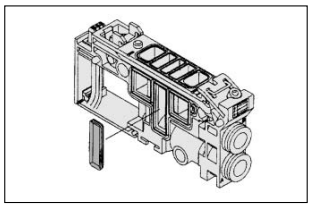
Manifold Option

P. 2-4-210

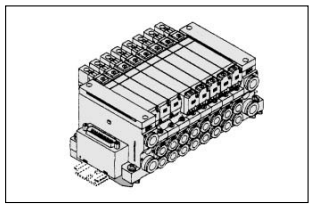
Blanking plate assembly
VVQ2000-10A-1



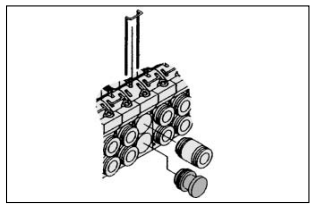
SUP block plate
VVQ2000-16A



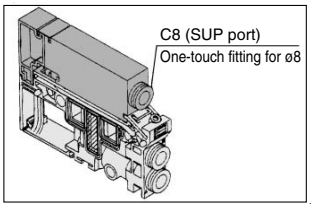
DIN rail mounting bracket [-D]
VVQ2000-57A



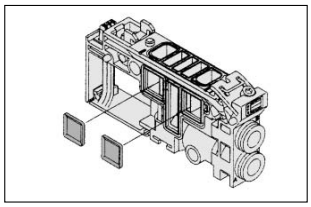
Port plug
VVQ1000-58A



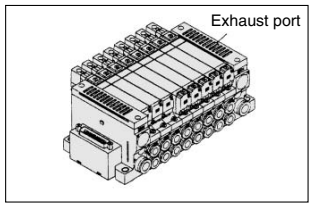
Individual SUP spacer
VVQ2000-P-1-C8



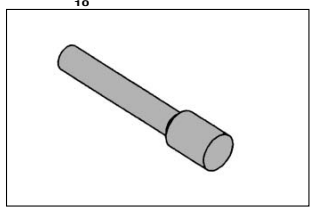
EXH block plate
VVQ2000-19A



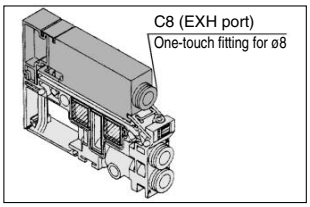
Built-in silencer,
direct exhaust [-S]



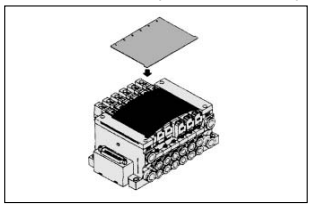
Blanking plug
KQ2P- $^{04}_{06}$ $^{08}_{10}$



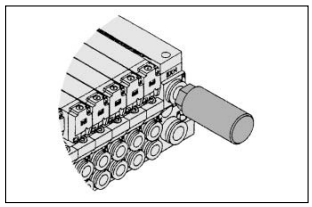
Individual EXH spacer
VVQ2000-R-1-C8



Name plate [-N]
VVQ2000-N-Station (1 to Max. stations)

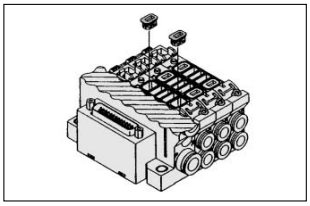


Silencer (For EXH port)
AN200-KM10

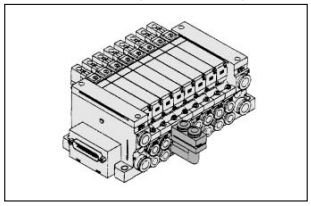


- For cylinder port fittings part no., refer to page 2-4-175.
- For replacement parts, refer to page 2-4-227.

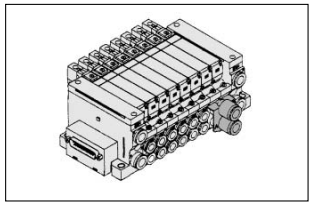
Back pressure check valve assembly [-B]
VVQ2000-18A



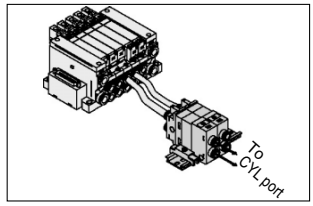
Elbow fitting assembly
VVQ2000-F-L (C4, C6, C8)



2 stations matching fitting assembly
VVQ2000-52A-C10



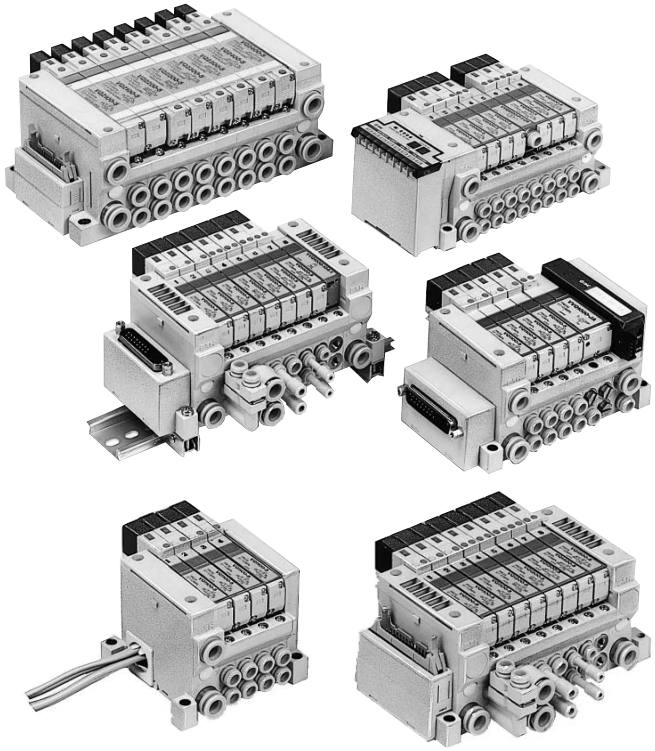
Double check block
VQ2000-FPG-□□



Series VQ1000/2000

Base Mounted

Plug-in Unit



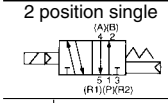
Model

Series	Number of solenoids		Model		Flow characteristics (1)						Response time (ms) (2)			Weight (g)
					1 → 2/4 (P → A/B)			2/4 → 3/5 (A/B → R1/R2)			Standard: 1 W H: 1.5 W	Low wattage: 0.5 W	AC	
					C [dm³/(s·bar)]	b	Cv	C [dm³/(s·bar)]	b	Cv				
VQ1000	2 position	Single	Metal seal	VQ1100	0.70	0.15	0.16	0.72	0.25	0.18	12 or less	15 or less	29 or less	64
			Rubber seal	VQ1101	0.85	0.20	0.21	1.0	0.30	0.25	15 or less	20 or less	34 or less	
		Double	Metal seal	VQ1200	0.70	0.15	0.16	0.72	0.25	0.18	10 or less	13 or less	13 or less	78
			Rubber seal	VQ1201	0.85	0.20	0.21	1.0	0.30	0.25	15 or less	20 or less	20 or less	
	3 position	Closed center	Metal seal	VQ1300	0.68	0.15	0.16	0.72	0.25	0.18	20 or less	26 or less	40 or less	
			Rubber seal	VQ1301	0.70	0.20	0.16	0.65	0.42	0.18	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ1400	0.68	0.15	0.16	0.72	0.25	0.18	20 or less	26 or less	40 or less	
			Rubber seal	VQ1401	0.70	0.20	0.16	1.0	0.30	0.25	25 or less	33 or less	47 or less	
		Pressure center	Metal seal	VQ1500	0.70	0.15	0.16	0.72	0.25	0.18	20 or less	26 or less	40 or less	
			Rubber seal	VQ1501	0.85	0.20	0.21	0.65	0.42	0.18	25 or less	33 or less	47 or less	
	4 position	Dual 3 port valve	Rubber seal	VQ1A/B/C01	0.70	0.20	0.16	0.70	0.20	0.16	25 or less	33 or less	47 or less	
VQ2000	2 position	Single	Metal seal	VQ2100	2.0	0.15	0.46	2.6	0.15	0.60	22 or less	29 or less	49or less	90
			Rubber seal	VQ2101	2.2	0.28	0.55	3.2	0.30	0.80	24 or less	31 or less	51or less	
		Double	Metal seal	VQ2200	2.0	0.15	0.46	2.6	0.15	0.60	15 or less	20 or less	20 or less	110
			Rubber seal	VQ2201	2.2	0.28	0.55	3.2	0.30	0.80	20 or less	26 or less	26 or less	
	3 position	Closed center	Metal seal	VQ2300	2.0	0.15	0.46	2.0	0.18	0.46	29 or less	38 or less	58 or less	
			Rubber seal	VQ2301	2.0	0.28	0.49	2.2	0.31	0.60	34 or less	44 or less	64 or less	
		Exhaust center	Metal seal	VQ2400	2.0	0.15	0.46	2.6	0.15	0.60	29 or less	38 or less	58 or less	
			Rubber seal	VQ2401	2.0	0.28	0.49	3.2	0.30	0.80	34 or less	44 or less	64 or less	
		Pressure center	Metal seal	VQ2500	2.4	0.17	0.57	2.0	0.18	0.46	29 or less	38 or less	58 or less	
			Rubber seal	VQ2501	3.2	0.28	0.80	2.2	0.31	0.60	34 or less	44 or less	64 or less	
	4 position	Dual 3 port valve	Rubber seal	VQ2A/B/C01	1.8	0.28	0.46	1.8	0.28	0.46	34 or less	44 or less	64 or less	

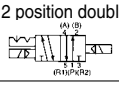
Note 1) Cylinder port size C6: (VQ1000), C8: (VQ2000) without check valve option for prevention of back pressure.
Note 2) As per JIS B 8375-1981 (Supply pressure; 0.5 MPa; with indicator light/surge voltage suppressor; clean air)
The response time is subject to the pressure and quality of the air. The values at the time of ON are given for double types.

JIS Symbol

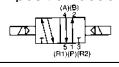
2 position single



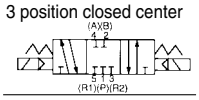
Metal — 2 position double



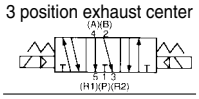
Rubber — 2 position double



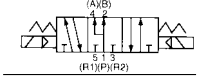
3 position closed center



3 position exhaust center



3 position pressure center



Standard Specifications

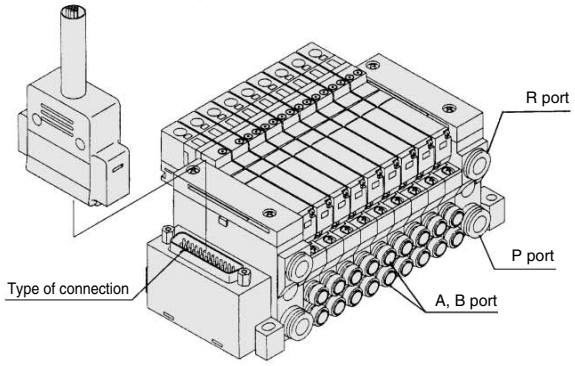
Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure		0.7 MPa (High pressure type: 0.8 MPa)	
	Minimum operating pressure	Single	0.1 MPa	0.15 MPa
		Double	0.1 MPa	0.1 MPa
		3 position	0.1 MPa	0.2 MPa
	Ambient and fluid temperature		–10 to 50°C (1)	
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required, Manual type) Option	
	Impact/Vibration resistance (2)		150/30 m/s²	
	Enclosure		Dust-protected, Dust tight/Low jetproof type (IP65) (5)	
Solenoid	Coil rated voltage		12 , 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA) (3), 0.5 W DC (21 mA) (4)	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA) (3), 0.5 W DC (42 mA) (4)	
		100 VAC	Inrush 1.2 VA (12 mA), Holding 1.2 VA (12 mA)	
		110 VAC	Inrush 1.3 VA (12 mA), Holding 1.3 VA (12 mA)	
		200 VAC	Inrush 2.4 VA (12 mA), Holding 2.4 VA (12 mA)	
		220 VAC	Inrush 2.6 VA (12 mA), Holding 2.6 VA (12 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance ··· No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance ··· No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Value for high voltage type (1.5 W)
Note 4) Value for low voltage type (0.5 W)
Note 5) Dusttight/Low jetproof type (IP65) is available on T, L, S and M kits of VQ2000.

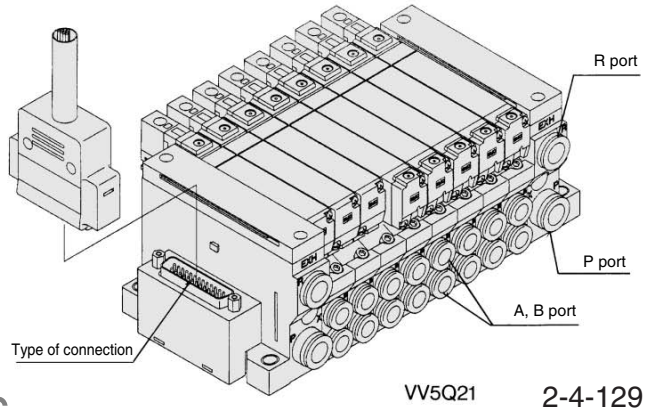
Manifold Specifications

Series	Base model	Type of connection	Porting specifications: Port location	Porting specifications: Port size (1) 1(P), 3(R)	Porting specifications: Port size (1) 4(A), 2(B)	Applicable stations (2)	Applicable solenoid valve	5 station weight (g)
VQ1000	**VV5Q11-□□□**	■ F kit–D-sub connector ■ P kit–Flat ribbon cable connector ■ J kit–Flat ribbon cable connector (20P) ■ G kit–Flat ribbon cable connector with terminal block ■ T kit–Terminal box ■ L kit–Lead wire cable ■ S kit–Serial transmission unit	Side	C8 (ø8) Option: Built-in silencer, direct exhaust	C3 (ø3.2) C4(ø4) C6 (ø6) M5 (M5 thread)	F, P, T kits: 2 to 24 stations J, G, S kit: 2 to 16 stations L kit: 1 to 8 stations	VQ1□00 VQ1□01	628 (Single) 759 (Double, 3 position)
VQ2000	**VV5Q21-□□□**	■ F kit–D-sub connector ■ P kit–Flat ribbon cable connector ■ J kit–Flat ribbon cable connector (20P) ■ G kit–Flat ribbon cable connector with terminal block ■ T kit–Terminal box ■ L kit–Lead wire cable ■ S kit–Serial transmission unit ■ M kit–Multi-connector	Side	C10 (ø10) Option: Built-in silencer, direct exhaust	C4 (ø4) C6 (ø6) C8 (ø8)	F, P kits: 2 to 24 stations J, G, S kit: 2 to 16 stations L kit: 1 to 8 stations T kit: 2 to 20 stations	VQ2□00 VQ2□01	1051 (Single) 1144 (Double, 3 position)

Note 1) Inch-size One-touch fittings are also available. For details, refer to page 2-4-179.
Note 2) For details, refer to page 2-4-178.

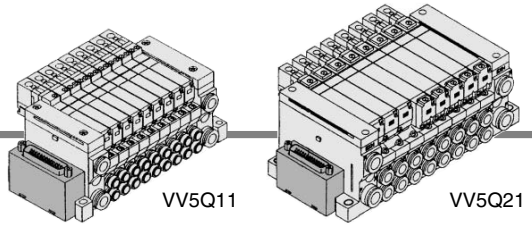


VV5Q11



VV5Q21

F VQ1000/2000 Kit (D-sub connector)



- The D-sub connector reduces installation labor for electrical connections.
- Using the D-sub connector (25P), (15P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 24.

Manifold Specifications

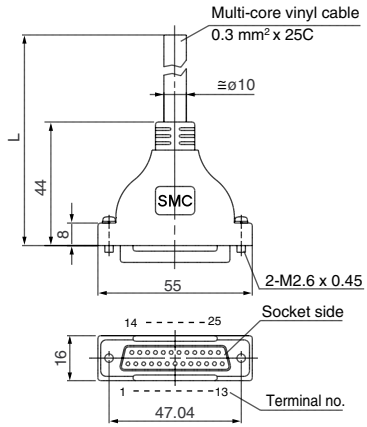
Series	Porting specifications			Applicable stations
	Port locaition	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 24 stations
VQ2000	Side	C10	C4, C6, C8	Max. 24 stations

D-sub Connector (25 pins)

Cable Assembly ●

AXT100-DS25- 015 / 030 / 050

The D-sub connector cable assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.



D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25 core x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

∗ For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Connector manufacturers' example
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Hirose Electric Co., Ltd.

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Voltage limit V, 1 min, AC	1000
Insulation resistance MΩkm, 20°C	5 or more

Note) The min. bending radius of D-sub cable assembly is 20 mm.

Wire Color by Terminal No. of D-sub Connector Cable Assembly

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

Note) Types with 15 pin are also available. Refer to page 2-4-177 for details.

How to Order Manifold

VV5Q 1 1 – 08 C6 F U 1 – N

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
24	24 stations

Note) For details, refer to page 2-4-178.

Connector entry direction

U	Top entry
S	Side entry

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	● (3)

Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type. Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) Inch-size One-touch fittings are available. For details, refer to page 2-4-179.

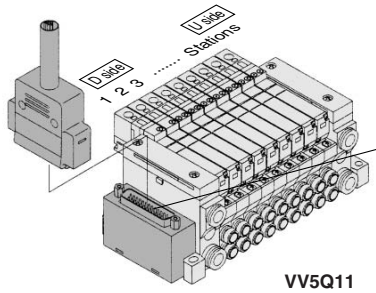
Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

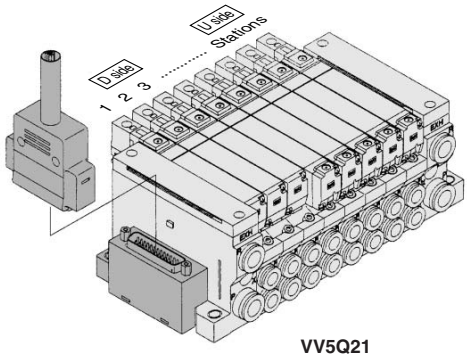
Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	With back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator unit			
G3	3 sets of regulator unit			
J□	With vacuum ejector unit	●		(4)
K	Special wiring specifications (Not double wiring)	●	●	(5)
N	With name plate	●	●	
R	External pilot	●	●	(6)
S	Built-in silencer, direct exhaust	●	●	

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring by using of the manifold specification sheet.
Note 6) Indicate "R" for the valve with external pilot.



VV5Q11

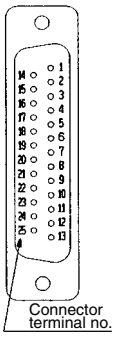


VV5Q21

The total number of stations is tabulated starting from station one on the D side.

Electrical wiring specifications

D-sub connector



D-sub connector assembly

AXT100-DS25- 015 / 030 / 050 Wire color

	Terminal no.		Polarity	Lead wire color	Dot marking
1 station	SOL.A 1	(–)	(+)	Black	None
	SOL.B 14	(–)	(+)	Yellow	Black
2 stations	SOL.A 2	(–)	(+)	Brown	None
	SOL.B 15	(–)	(+)	Pink	Black
3 stations	SOL.A 3	(–)	(+)	Red	None
	SOL.B 16	(–)	(+)	Blue	White
4 stations	SOL.A 4	(–)	(+)	Orange	None
	SOL.B 17	(–)	(+)	Purple	None
5 stations	SOL.A 5	(–)	(+)	Yellow	None
	SOL.B 18	(–)	(+)	Gray	None
6 stations	SOL.A 6	(–)	(+)	Pink	None
	SOL.B 19	(–)	(+)	Orange	Black
7 stations	SOL.A 7	(–)	(+)	Blue	None
	SOL.B 20	(–)	(+)	Red	White
8 stations	SOL.A 8	(–)	(+)	Purple	White
	SOL.B 21	(–)	(+)	Brown	White
9 stations	SOL.A 9	(–)	(+)	Gray	Black
	SOL.B 22	(–)	(+)	Pink	Red
10 stations	SOL.A 10	(–)	(+)	White	Black
	SOL.B 23	(–)	(+)	Gray	Red
11 stations	SOL.A 11	(–)	(+)	White	Red
	SOL.B 24	(–)	(+)	Black	White
12 stations	SOL.A 12	(–)	(+)	Yellow	Red
	SOL.B 25	(–)	(+)	White	None
	COM. 13	(+)	(–)	Orange	Red
			Positive common specifications	Negative common Note) specifications	

As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option. For details, refer to page 2-4-178.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-178.)
For details, refer to "Option" on page 2-4-178.

How to Order Valves

VQ 1 1 0 0 Y – 5 ☐ ☐

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Note) For external pilot and negative COM specifications, refer to "Option" on pages 2-4-178 to 2-4-179.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-129.

Light/Surge voltage suppressor

Nil	Yes
E	None

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

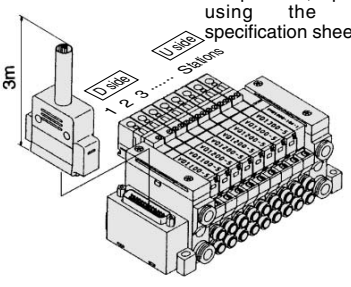
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
D-sub connector kit with cable (3 m)
VV5Q11-09C6FU2 ···· 1 set –Manifold base no.
*VQ1100-5 ····· 2 sets–Valve part no. (Stations 1 to 2)
*VQ1200-5 ····· 4 sets–Valve part no. (Stations 3 to 6)
*VQ1300-5 ····· 2 sets–Valve part no. (Stations 7 to 8)
*VVQ1000-10A-1 ····· 1 set–Blanking plate part no. (Station 9)

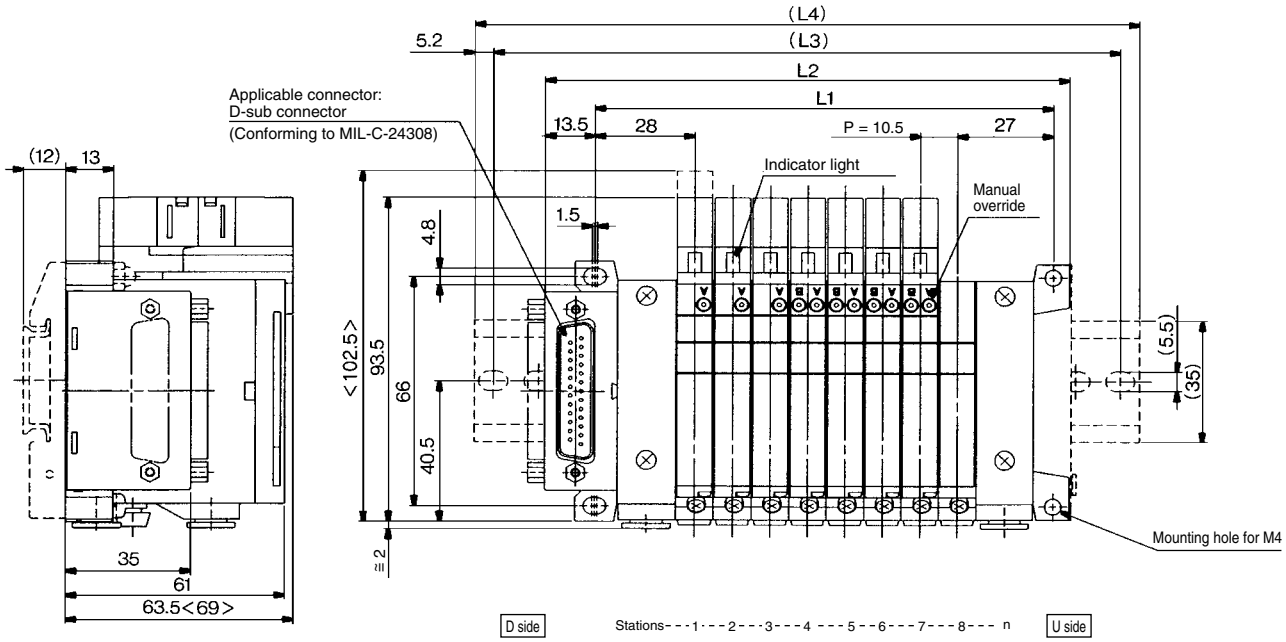
Prefix the asterisk to the part nos. of the solenoid valve, etc.

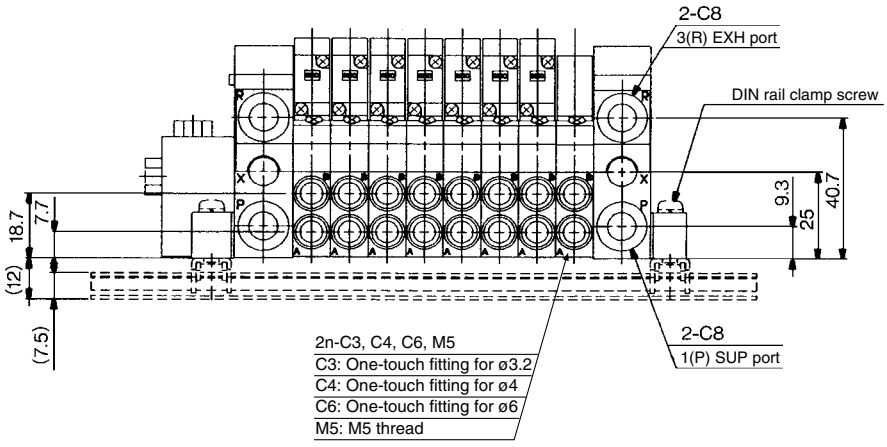
Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specified by using the manifold specification sheet.



VQ1000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-FS].





< >: AC

Dimensions

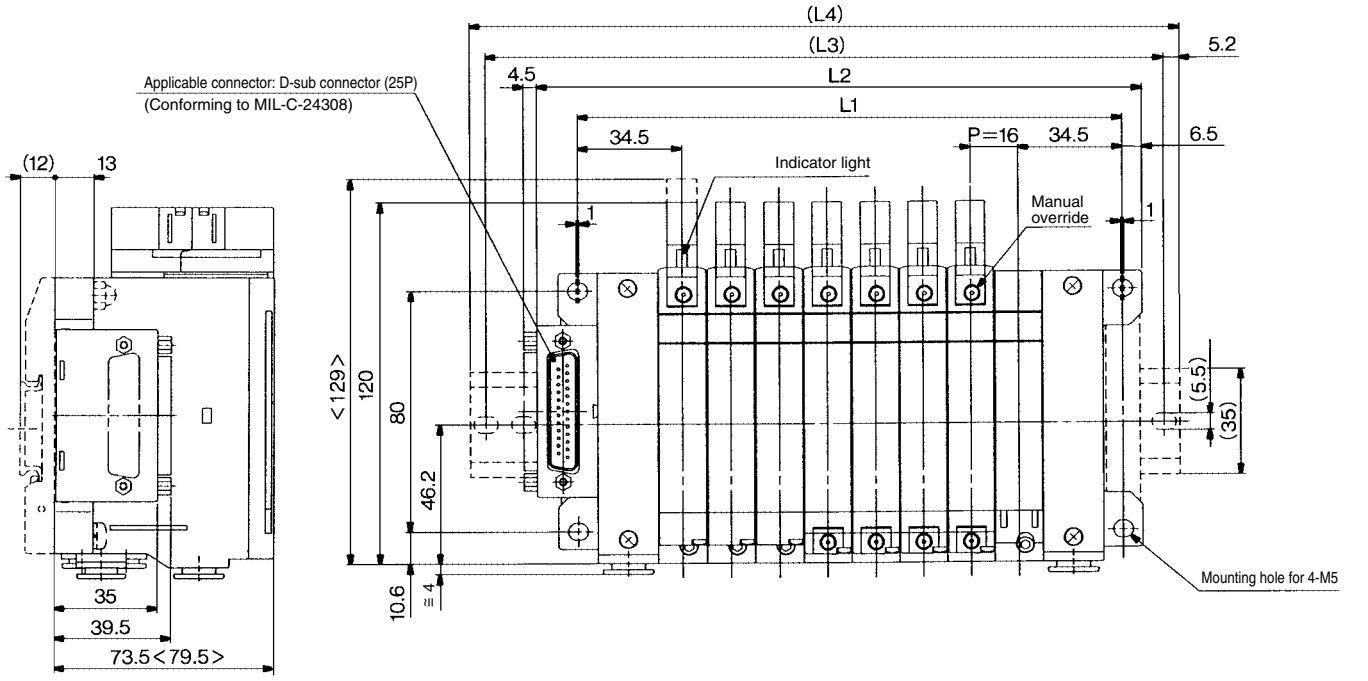
Formula L1 = 10.5n + 44.5, L2 = 10.5n + 62.5 n: Station (Maximum 24 stastions)

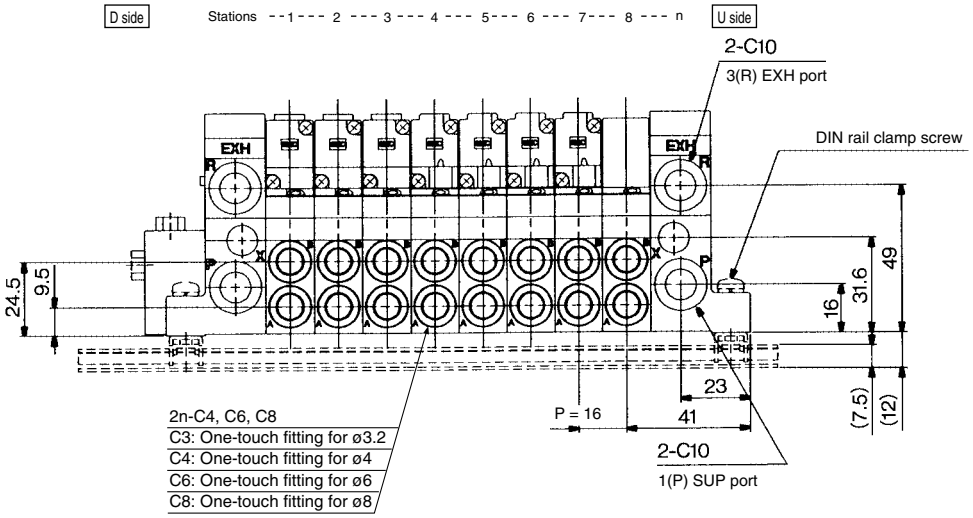
L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L1	65.5	76	86.5	97	107.5	118	128.5	139	149.5	160	170.5	181	191.5	202	212.5	223	233.5	244	254.5	265	275.5	286	296.5
L2	83.5	94	104.5	115	125.5	136	146.5	157	167.5	178	188.5	199	209.5	220	230.5	241	251.5	262	272.5	283	293.5	304	314.5
(L3)	112.5	125	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300	312.5	325	325	337.5
(L4)	123	135.5	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5	323	335.5	335.5	348

Vacuum ejector unit style: Formula L1 = 10.5n + 28.7 + (Number of ejector units x 26.7)
L2 = 10.5n + 46.3 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

VQ2000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-FS].





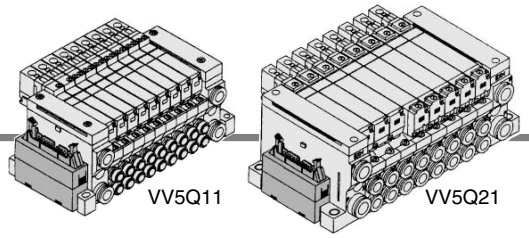
< >: AC

Dimensions

Formula L1 = 16n + 53, L2 = 16n + 73 n: Station (Maximum 24 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L1	85	101	117	133	149	165	181	197	213	229	245	261	277	293	309	325	341	357	373	389	405	421	437
L2	105	121	137	153	169	185	201	217	233	249	265	281	297	313	329	345	361	377	393	409	425	441	457
(L3)	137.5	150	162.5	187.5	200	212.5	225	250	262.5	275	300	312.5	325	337.5	350	375	387.5	400	412.5	437.5	450	462.5	487.5
(L4)	148	160.5	173	198	210.5	223	235.5	260.5	273	285.5	310.5	323	335.5	348	360.5	385.5	398	410.5	423	448	460.5	473	498

P VQ1000/2000 Kit (Flat ribbon cable connector)



- MIL flat ribbon cable connector reduces installation labor for electrical connection.
- Using the connector for flat ribbon cable (26P) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 24.

Manifold Specifications

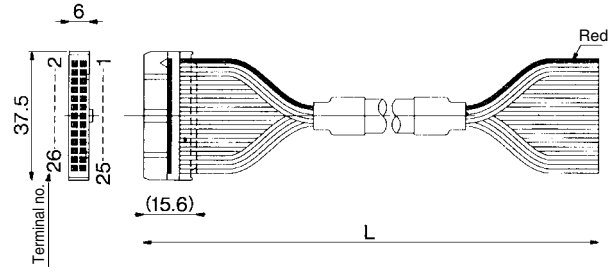
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 24 stations
VQ2000	Side	C10	C4, C6, C8	Max. 24 stations

Flat Ribbon Cable (26 pins)

Cable assembly

AXT100-FC26-$\frac{1}{3}$

(Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.)



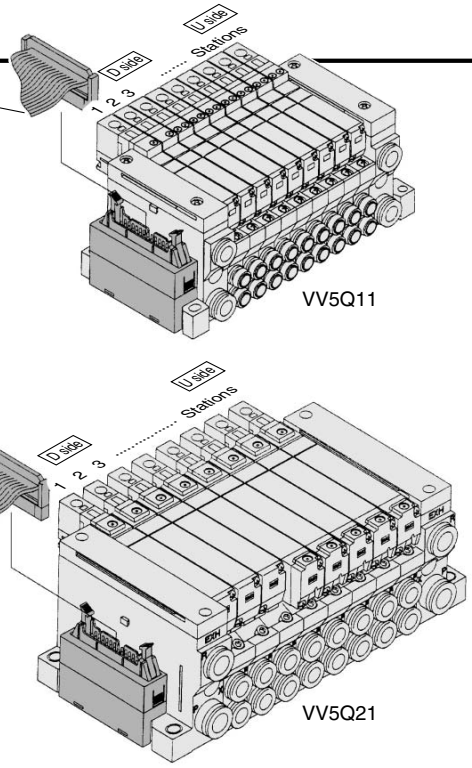
Flat Ribbon Cable Connector Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC26-1	Cable 26 core x 28AWG
3 m	AXT100-FC26-2	
5 m	AXT100-FC26-3	

∗ For other commercial connectors, use a 26 pins type with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

- Hirose Electric Co., Ltd.
- Sumitomo 3M Limited
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Oki Electric Cable Co., Ltd.



The total number of stations is tabulated starting from one on the D side.

How to Order Manifold

VV5Q 1 1 – 08 C6 P U 1 – N

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
24	24 stations

Note) For details, refer to page 2-4-178.

Connector entry direction

U	Top entry
S	Side entry

Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	●(3)

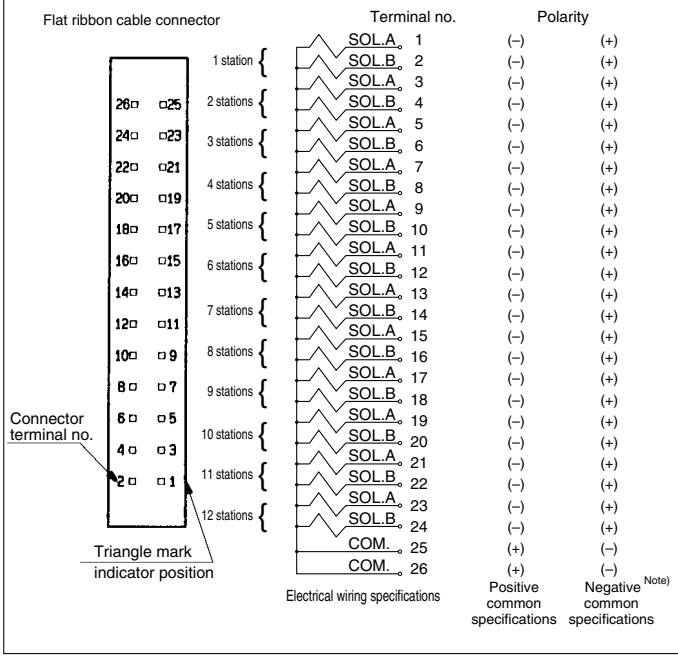
Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type.
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) Inch-size One-touch fittings are available. For details, refer to page 2-4-179.

Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	Back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator unit			
G3	3 sets of regulator unit			
J□	With vacuum ejector unit	●		(4)
K	Special Wiring Specifications (Not double wiring)	●	●	(5)
N	With name plate	●	●	
R	External pilot	●	●	(6)
S	Built-in silencer, direct exhaust	●	●	

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring specifications in the manifold specification sheet.
Note 6) Indicate "R" for the valve with external pilot.

● Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option.
For details, refer to page 2-4-178.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-178.)
For details, refer to "Option" on page 2-4-178.

How to Order Valves

VQ 1 1 0 0 Y — 5 ☐ ☐

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Note) For external pilot and negative COM specifications, refer to "Option" on pages 2-4-178 to 2-4-179.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-129.

Light/Surge voltage suppressor

Nil	Yes
E	None

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

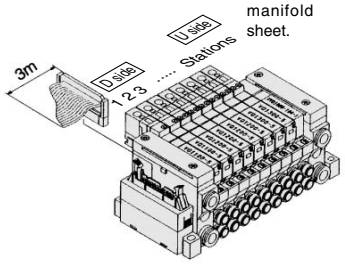
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Flat ribbon cable kit with 3 m cable
VV5Q11-09C6PU2 ···1 set–Manifold base no.
∗VQ1100-5 ·····2 sets–Valve part no. (Stations 1 to 2)
∗VQ1200-5 ·····4 sets–Valve part no. (Stations 3 to 6)
∗VQ1300-5 ·····2 sets–Valve part no. (Stations 7 to 8)
∗VVQ1000-10A-1 ·····1 set–Blanking plate no. (Station 9)

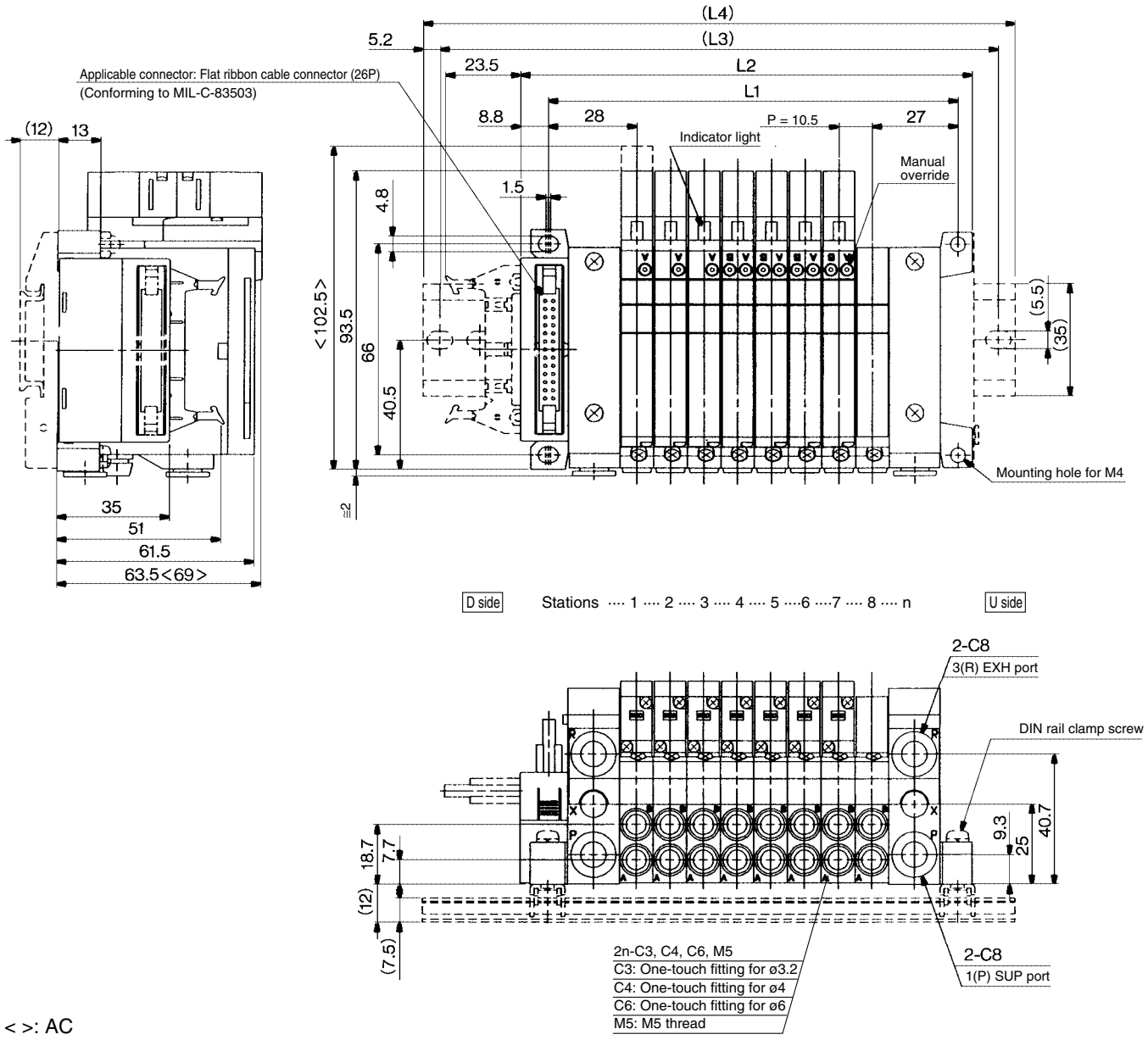
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specified by using the manifold specification sheet.



VQ1000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-PS].



< >: AC

Dimensions

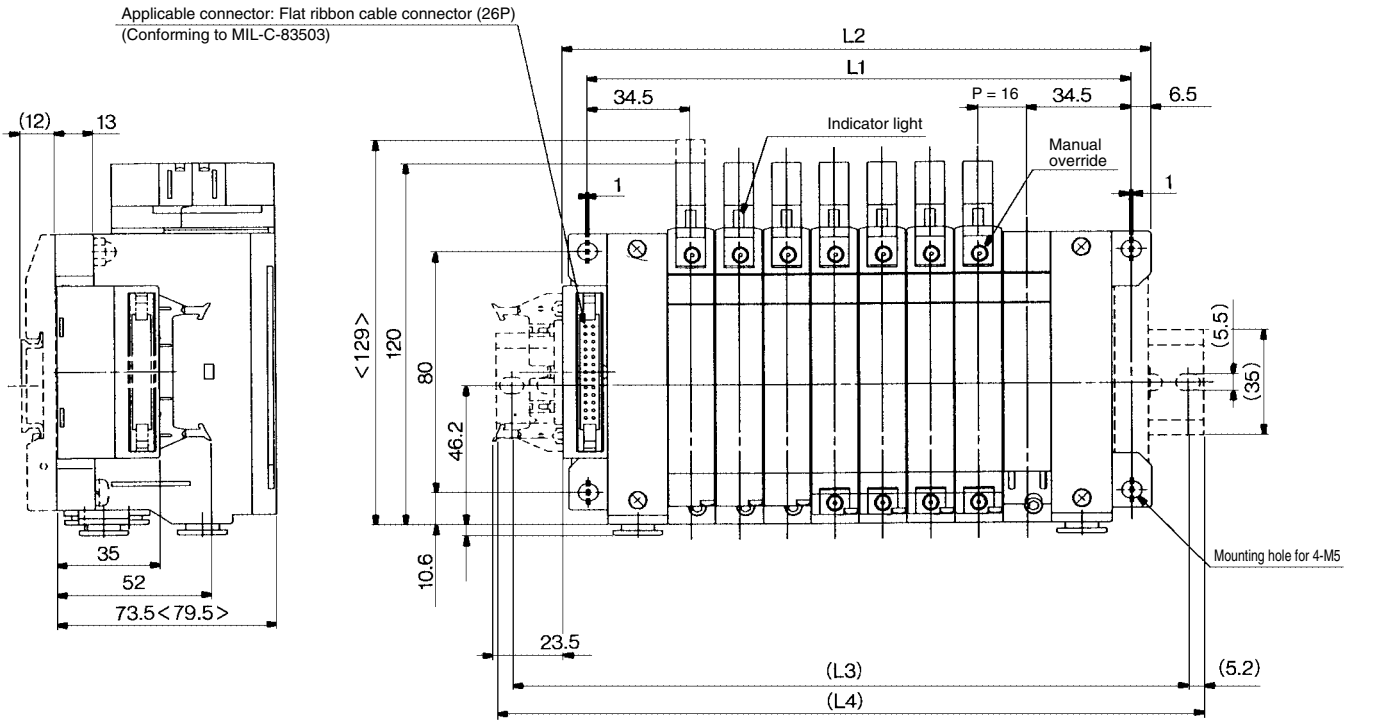
Formula L1 = 10.5n + 44.5, L2 = 10.5n + 57.5 n: Station (Maximum 24 stations)

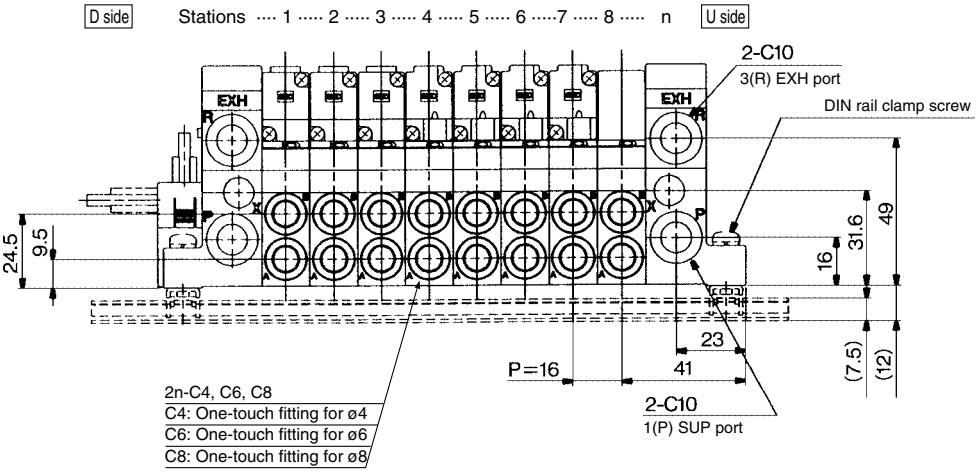
L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L1	65.5	76	86.5	97	107.5	118	128.5	139	149.5	160	170.5	181	191.5	202	212.5	223	233.5	244	254.5	265	275.5	286	296.5
L2	78.5	89	99.5	110	120.5	131	141.5	152	162.5	173	183.5	194	204.5	215	225.5	236	246.5	257	267.5	278	288.5	299	309.5
(L3)	112.5	125	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	225	237.5	250	262.5	275	287.5	287.5	300	312.5	325	337.5
(L4)	123	135.5	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	235.5	248	260.5	273	285.5	298	298	310.5	323	335.5	348

Vacuum ejector unit style: Formula L1 = 10.5n + 28.7 + (Number of ejector units x 26.7)
L2 = 10.5n + 41.3 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

VQ2000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-PS].





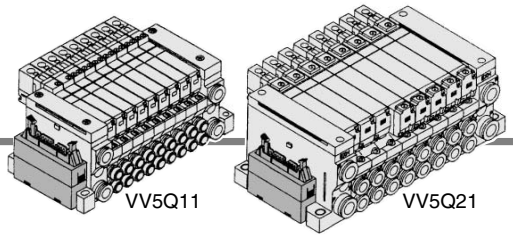
< >: AC

Dimensions

Formula L1 = 16n + 53, L2 = 16n + 68 n: Station (Maximum 24 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L1	85	101	117	133	149	165	181	197	213	229	245	261	277	293	309	325	341	357	373	389	405	421	437
L2	100	116	132	148	164	180	196	212	228	244	260	276	292	308	324	340	356	372	388	404	420	436	452
(L3)	125	150	162.5	175	187.5	212.5	225	237.5	262.5	275	287.5	300	312.5	337.5	350	362.5	387.5	400	412.5	425	450	462.5	475
(L4)	135.5	160.5	173	185.5	198	223	235.5	248	273	285.5	298	310.5	323	348	360.5	373	398	410.5	423	435.5	460.5	473	485.5

J VQ1000/2000 Kit (Flat ribbon cable connector)



- MIL flat ribbon cable connector reduces installation labor for electrical connection.
- The use of flat ribbon cable connectors (20P) conforming to MIL standards provides a wide range of compatibility with conventional connectors.
- Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Manifold Specifications

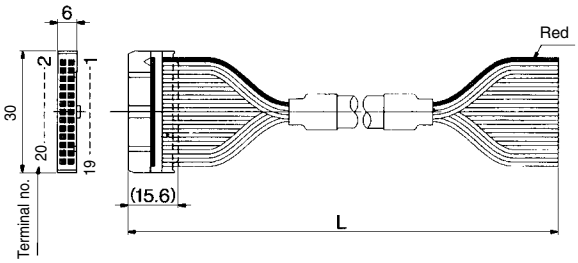
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C10	C4, C6, C8	Max. 16 stations

Flat Ribbon Cable (26 pins)

Cable assembly

AXT100-FC20-$\frac{1}{3}$

(Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.)



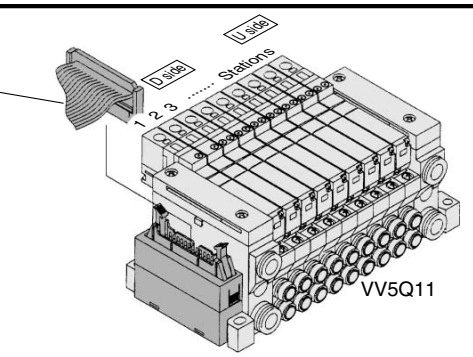
Flat Ribbon Cable Connector Assembly (Option)

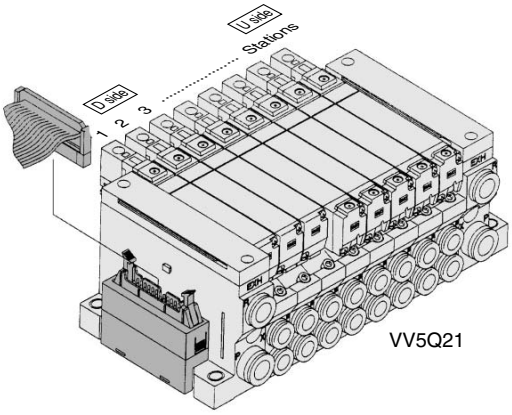
Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC20-1	Cable 20 core x 28AWG
3 m	AXT100-FC20-2	
5 m	AXT100-FC20-3	

∗ For other commercial connectors, use a 20 pins with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

- Hirose Electric Co., Ltd.
- Sumitomo 3M Limited
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Oki Electric Cable Co., Ltd.





The total number of stations is tabulated starting from one on the D side.

How to Order Manifold

VV5Q 1 1 – 08 C6 J U 1 – N

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
16	16 stations

Note) For details, refer to page 2-4-178.

Connector entry direction

U	Top entry
S	Side entry

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	● (3)

Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type.
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) Inch-size One-touch fittings are available. For details, refer to page 2-4-179.

Cable (Length)

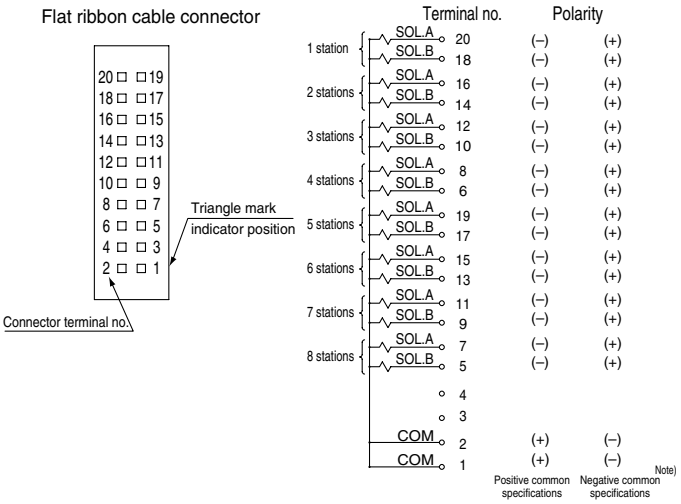
0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	Back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator unit			
G3	3 sets of regulator unit			
J□	With vacuum ejector unit	●		(4)
K	Special Wiring Specifications (Not double wiring)	●	●	(5)
N	With name plate	●	●	
R	External pilot	●	●	(6)
S	Built-in silencer, direct exhaust	●	●	

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring specifications in the manifold specification sheet.
Note 6) Indicate "R" for the valve with external pilot.

• Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option.
For details, refer to page 2-4-178.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-178.)
For details, refer to "Option" on page 2-4-178.

How to Order Valves

VQ 1 1 0 0 Y — 5 ☐ ☐

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H	High pressure type	(1.5 W) ○
Y	Low wattage type	(0.5 W) ○

Coil voltage

5	24 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) For external pilot and negative COM specifications, refer to "Option" on pages 2-4-178 to 2-4-179.

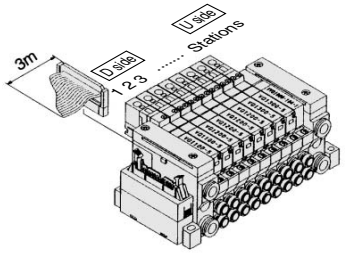
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Flat ribbon cable kit with 3 m cable
VV5Q11-09C6PU2 ··· 1 set–Manifold base no.
∗VQ1100-5 ····· 2 sets–Valve part no. (Stations 1 to 2)
∗VQ1200-5 ····· 4 sets–Valve part no. (Stations 3 to 6)
∗VQ1300-5 ····· 2 sets–Valve part no. (Stations 7 to 8)
∗VVQ1000-10A-1 ···· 1 set–Blanking plate part no. (Station 9)

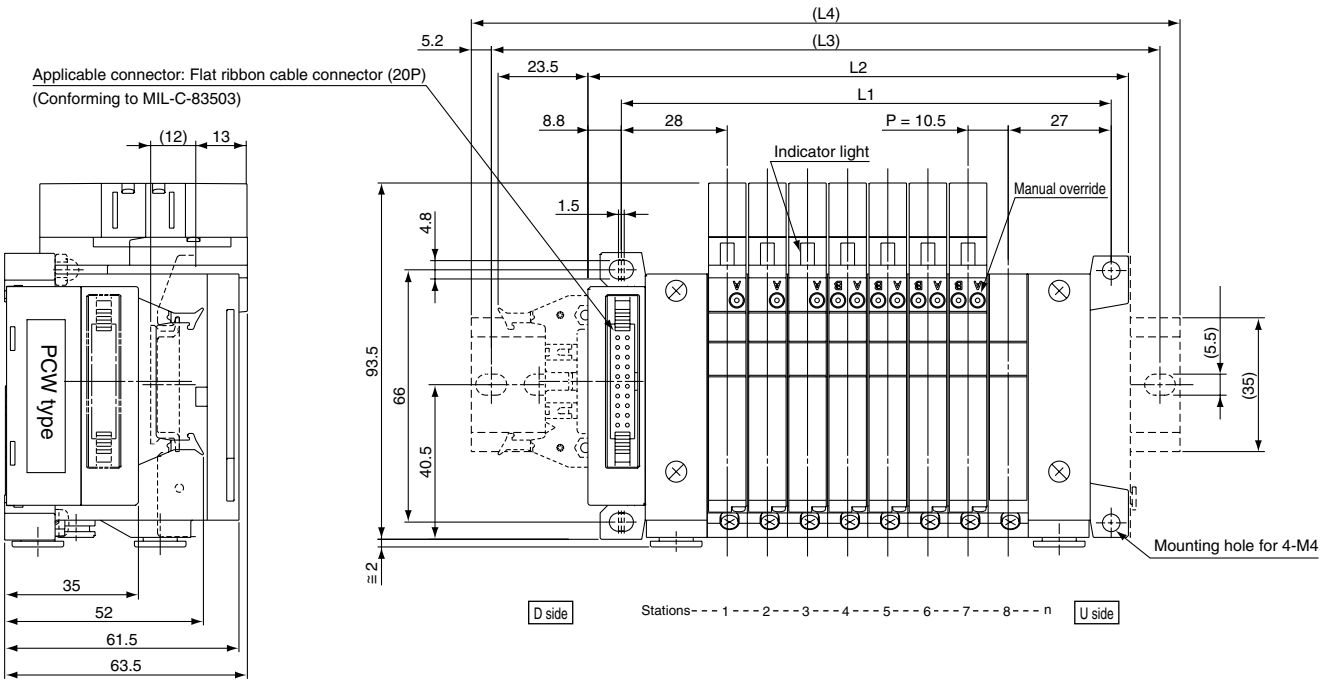
Prefix the asterisk to the part nos. of the solenoid valve, etc.

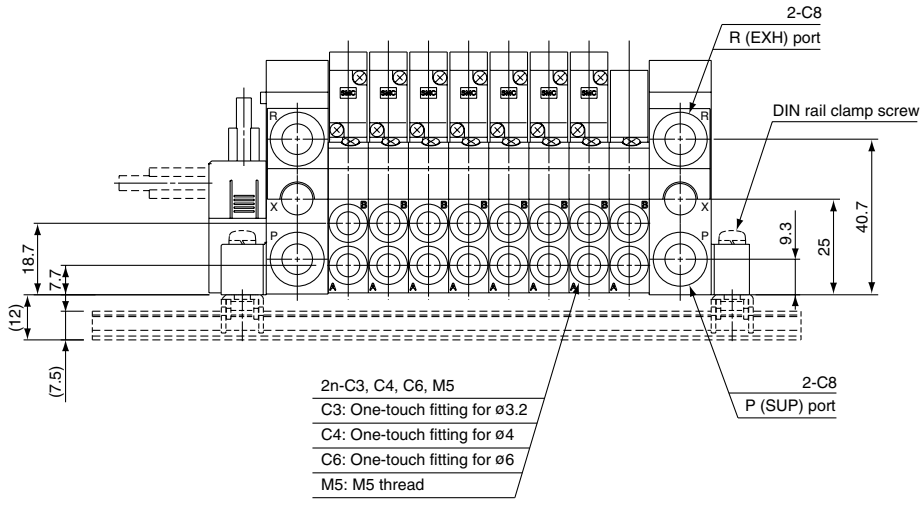
When ordering, specify the part nos. in order from the 1st. station in the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ1000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-PS].





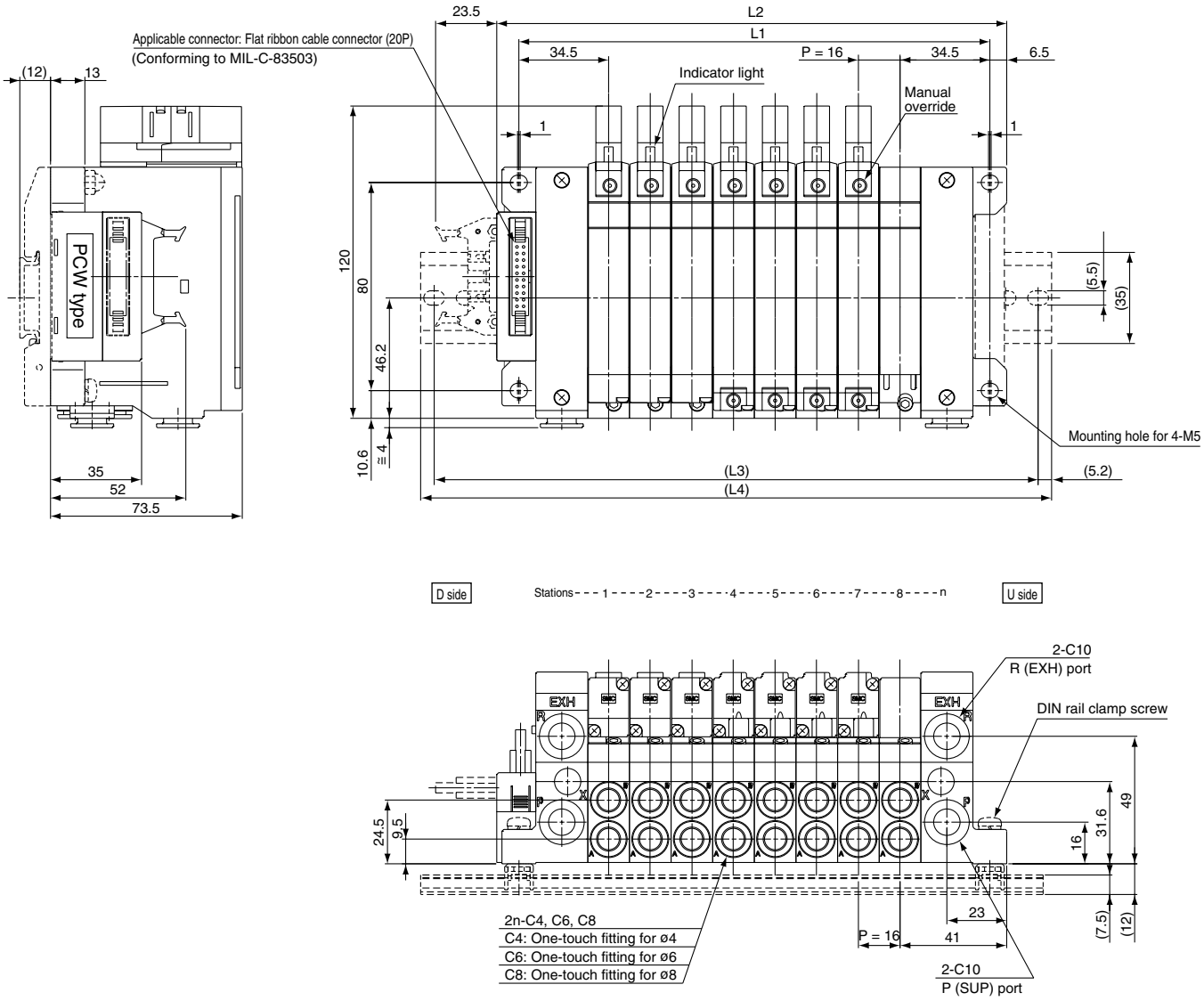
Dimensions

Formula L1 = 10.5n + 44.5, L2 = 10.5n + 57.5 n: Station (Maximum 16 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	65.5	76	86.5	97	107.5	118	128.5	139	149.5	160	170.5	181	191.5	202	212.5
L2	78.5	89	99.5	110	120.5	131	141.5	152	162.5	173	183.5	194	204.5	215	225.5
(L3)	112.5	125	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	225	237.5	250
(L4)	123	135.5	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	235.5	248	260.5

VQ2000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-PS].

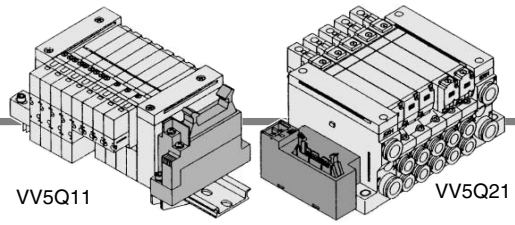


Dimensions

Formula L1 = 16n + 53, L2 = 16n + 68 n: Station (Maximum 16 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	85	101	117	133	149	165	181	197	213	229	245	261	277	293	309
L2	100	116	132	148	164	180	196	212	228	244	260	276	292	308	324
(L3)	125	150	162.5	175	187.5	212.5	225	237.5	262.5	275	287.5	300	312.5	337.5	350
(L4)	135.5	160.5	173	185.5	198	223	235.5	248	273	285.5	298	310.5	323	348	360.5

G VQ1000/2000
Kit (Flat ribbon cable connector with terminal block)



- Terminal block for power supply equipped with a 20 pins flat cable connection for rationalized connection of valves.
- Solenoid valves and power supply can be connected by the same cable to a specific output unit that requires power supply from the output section to the internal circuit. (SI unit)
- Maximum stations are 16.

Manifold Specifications

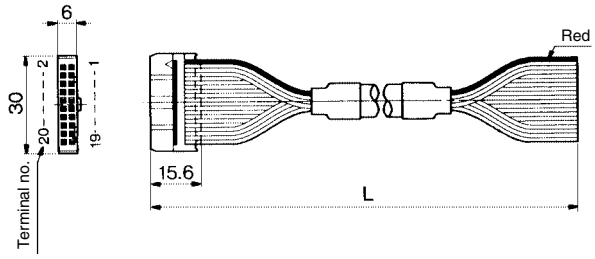
Series	Porting specifications			Applicable stations
	Port licaition	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C10	C4, C6, C8	Max. 16 stations

Flat Ribbon Cable (20 pins)

Cable assembly

AXT100-FC20-$\frac{1}{3}$

(Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to How to Order Manifold.)



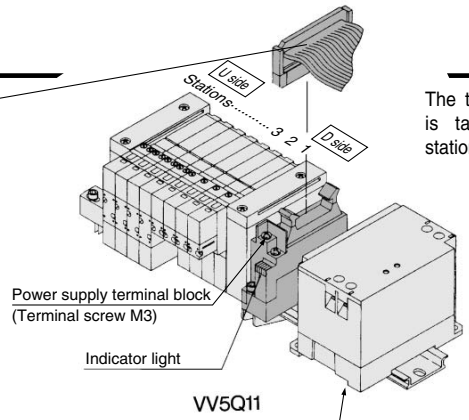
Flat Ribbon Cable Connector Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC20-1	Cable 20 core x 28AWG
3 m	AXT100-FC20-2	
5 m	AXT100-FC20-3	

∗ For other commercial connectors, use a 20 pins with strain relief conforming to MIL-C-83503.

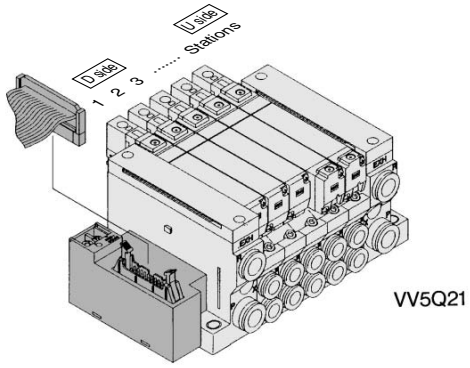
Connector manufacturers' example

- Hirose Electric Co., Ltd.
- Oki Electric Cable Co. Ltd.
- J.S.T. Mfg. Co., Ltd.
- Japan Aviation Electronics Industry, Ltd.
- Sumitomo 3M Limited
- Fujitsu Limited



The total number of stations is tabulated starting from station one on the D side.

SI unit made by OMRON Corp.
Mountable for G71-OD16 (Order separately)



How to Order Manifold

VV5Q 1 1 – 08 C6 G □ □ – N

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
16 Note)	16 stations

Note) For details, refer to page 2-4-178.

Connector entry direction, Top entry

Nil	For VQ1000
U	For VQ2000

Cable (Length)

0	Without cable
1	Cable length 1.5 m
2	Cable length 3 m
3	Cable length 5 m

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	●

Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type.
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) Inch-size One-touch fittings are available. For details, refer to page 2-4-179.

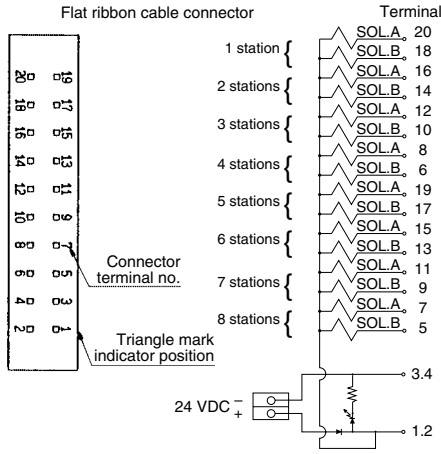
Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	Back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator unit			
G3	3 sets of regulator unit			
J□	With vacuum ejector unit	●		(4)
K	Special Wiring Specifications (Not double wiring)	●	●	(5)
N	With name plate	●	●	
R	External pilot	●	●	(6)
S	Built-in silencer, direct exhaust	●	●	

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring specifications in the manifold specification sheet.
Note 6) Indicate "R" for the valve with external pilot.

● Connector assembly

Electric circuit diagram (Below wiring is the case of all double solenoid connections.)



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-178.

How to Order Valves

VQ 1 1 0 0 Y – 5 ☐ ☐

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H	High pressure type	(1.5 W) ○
Y	Low wattage type	(0.5 W) ○

Coil voltage

5	24 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Lockking type (Tool required)
C	Locking type (Manual)

Note) For external pilot specifications, refer to "Option" on page 2-4-179.

How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>

Flat ribbon cable with power supply terminal block and 3 m cable

VV5Q11-08C6G2 ··· 1 set–Manifold base no.

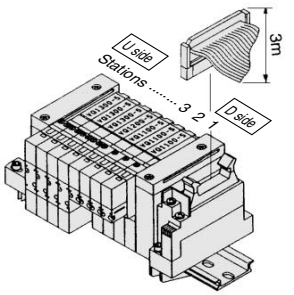
∗VQ1100-5 ····· 4 sets–Valve part no. (Stations 1 to 4)

∗VQ1200-5 ····· 1 set–Valve part no. (Station 5)

∗VQ1300-5 ····· 3 sets–Valve part no. (Stations 6 to 8)

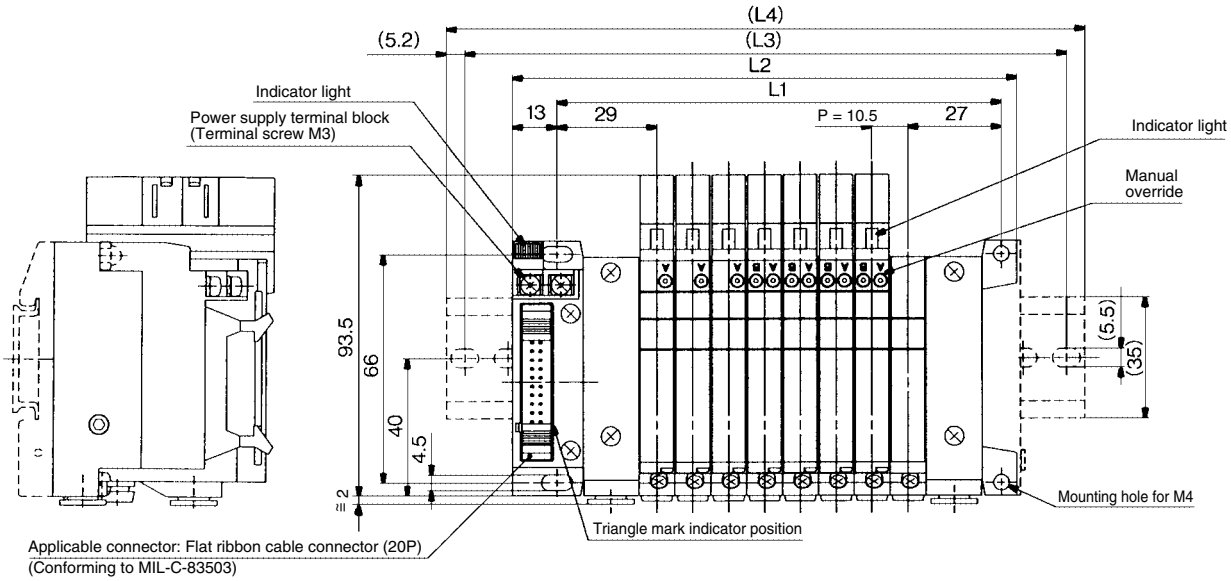
Prefix the asterisk to the part nos. of the solenoid valve, etc.

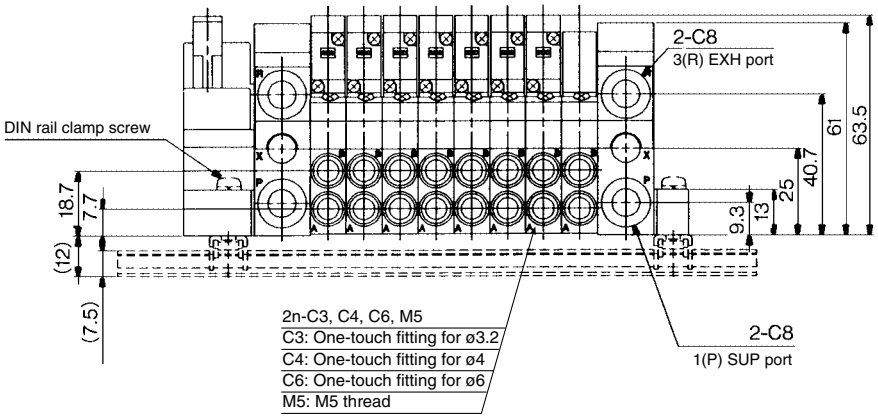
Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ1000

The broken lines and dimensions in parentheses indicate DIN rail mounting style [-D].





Dimensions

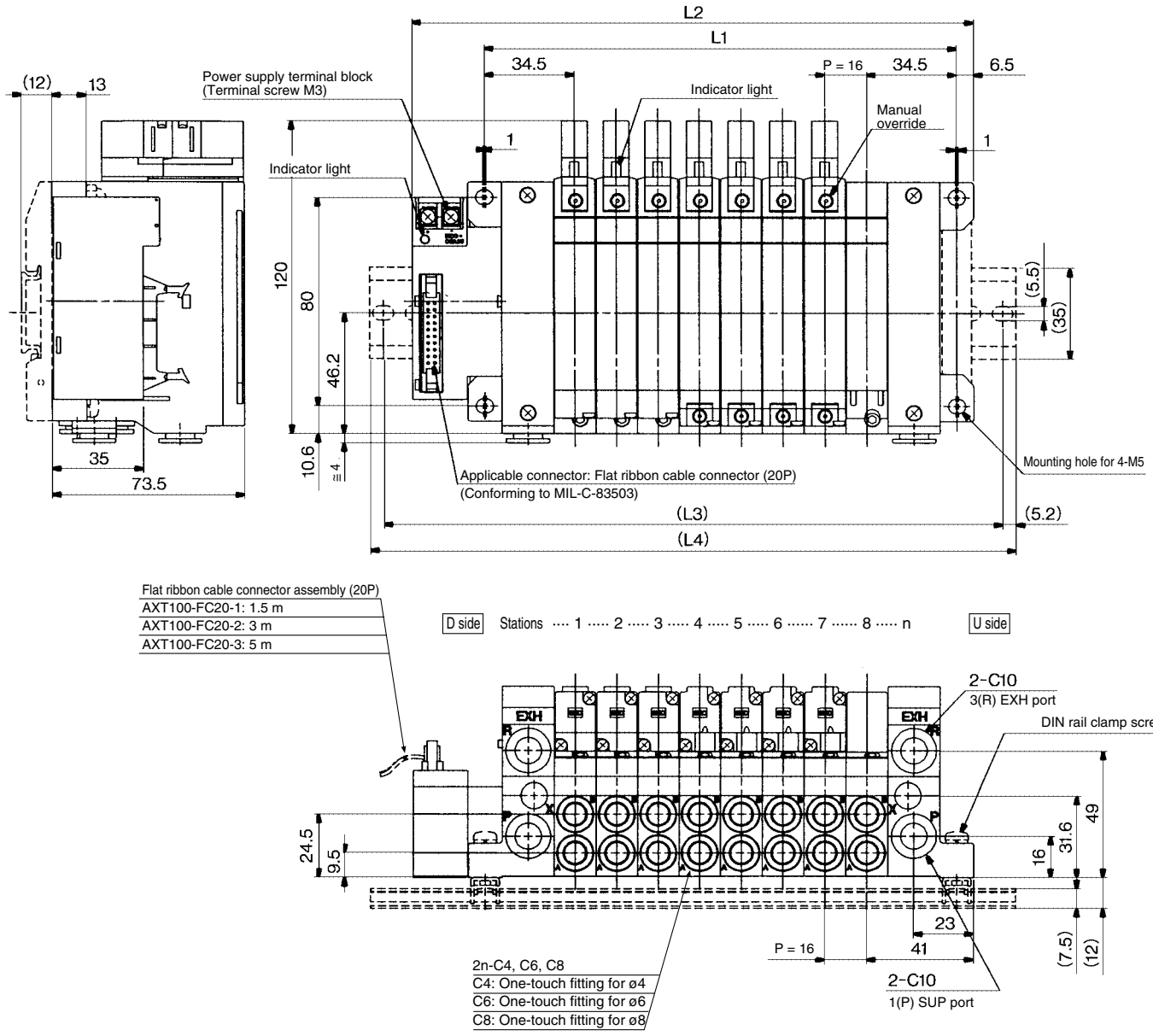
Formula L1 = 10.5n + 45.5, L2 = 10.5n + 63 n: Station (Maximum 16 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	66.5	77	87.5	98	108.5	119	129.5	140	150.5	161	171.5	182	192.5	203	213.5
L2	84	94.5	105	115.5	126	136.5	147	157.5	168	178.5	189	199.5	210	220.5	231
(L3)	112.5	125	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	262.5
(L4)	123	135.5	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	273

Vacuum ejector unit style: Formula L1 = 10.5n + 29.7 + (Number of ejector units x 26.7)
L2 = 10. 5n + 46.8 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

VQ2000

The broken lines indicate the DIN rail mounting style [-D].



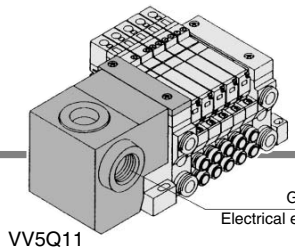
Dimensions

Formula L1 = 16n + 53, L2 = 16n + 87 n: Station (Maximum 16 stations)

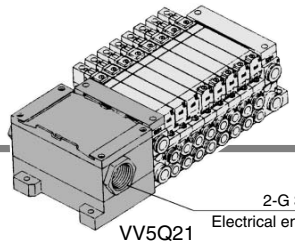
L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	85	101	117	133	149	165	181	197	213	229	245	261	277	293	309
L2	119	135	151	167	183	199	215	231	247	263	279	295	311	327	343
(L3)	150	162.5	175	187.5	212.5	225	237.5	262.5	275	287.5	300	325	337.5	350	362.5
(L4)	160.5	173	185.5	198	223	235.5	248	273	285.5	298	310.5	335.5	348	360.5	373

Vacuum ejector unit style: Formula L1 = 10.5n + 29.7 + (Number of ejector units x 26.7)
L2 = 10. 5n + 46.8 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

T VQ1000/2000 Kit (Terminal block box kit)



VV5Q11



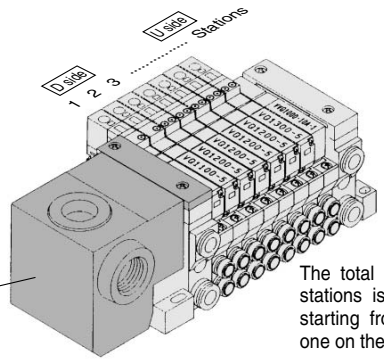
VV5Q21

IP65 compliant

- This kit has a small terminal box inside a junction box. The electrical entry port {VQ1000: G 1/2, VQ2000: G 3/4} permits connection of conduit fittings.
- Maximum stations are 24.
- Enclosure: Dusttight/Low jetproof type (IP65) compliant (Series VQ2000)

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 24 stations
VQ2000	Side	C10	C4, C6, C8	Max. 20 stations



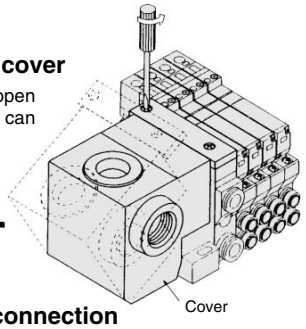
The total number of stations is tabulated starting from station one on the D side.

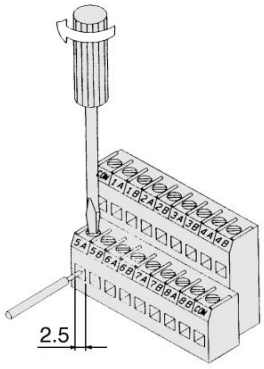
Terminal block connection

Open the terminal block cover to connect the wires to the terminal block.

Step 1. How to remove terminal block cover

Loosen the screws on the terminal block cover and open it in the direction shown by the arrow. The cover can then be removed from the terminal block.



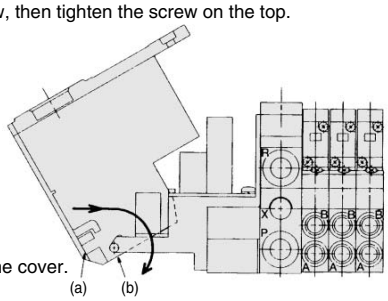


Step 2. Wire connection

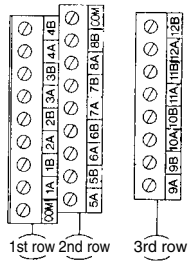
The diagram on the left shows the terminal block wiring schematic. All stations are provided with double solenoid wiring. Insert each lead wire into the terminal opening and tighten the screw directly above.
How to connect is inserting the lead wire into the terminal window, then tighten the screw on the top.

Step 3. How to replace terminal block cover

Hook groove (a) on shaft (b) and close the cover. Then tighten the screws.



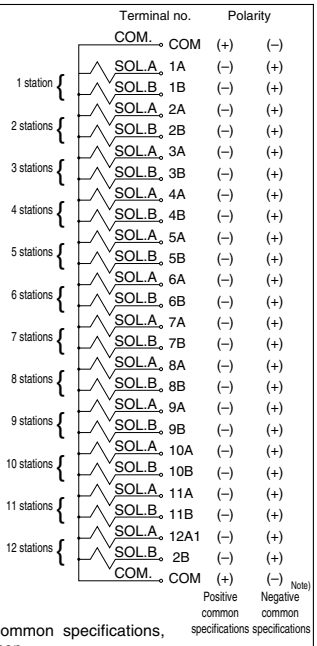
● Electrical wiring specifications: VQ1000



The quantity of terminal blocks used depends on the number of manifold stations:

Manifold	Terminal blocks
2 to 8 stations	2 rows
9 to 12 stations	3 rows

As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option. For details, refer to page 2-4-178.



Note) When using the negative common specifications, use valves for negative common.
For details, refer to "Option" on page 2-4-178.

How to Order Manifold

VV5Q 1 1 – 08 C6 T 0 – N

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
24 Note)	24 stations

Note) VQ2000: Max. 20 stations
For details, refer to page 2-4-178.

For negative common specifications, refer to "Option" on page 2-4-178.

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	● (3)

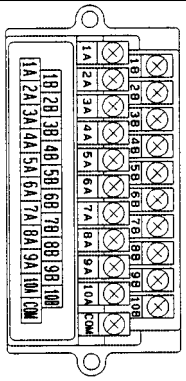
Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type.
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) For One-touch fittings in inch size, refer to "Option" on page 2-4-179.

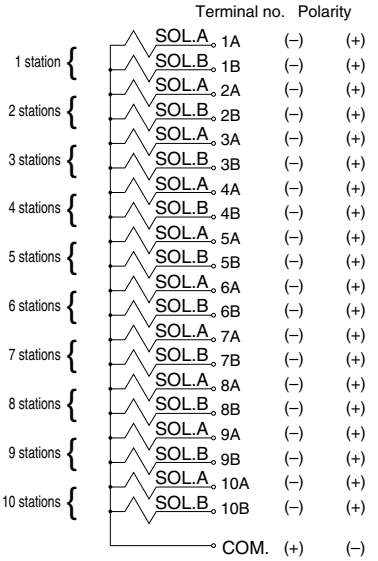
Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	With back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator unit			
G3	3 sets of regulator unit			
J□	With vacuum ejector unit	●		(4)
K	Special wiring specifications (Not double wiring)	●	●	(5)
N	With name plate	●	●	
R	External pilot	●	●	(6)
S	Built-in silencer, direct exhaust	●	●	
W	Enclosure: Dusttight/Low jetproof type (IP65)		●	

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring specifications in the manifold specification sheet.
Note 6) Indicate "R" for the valve with external pilot.

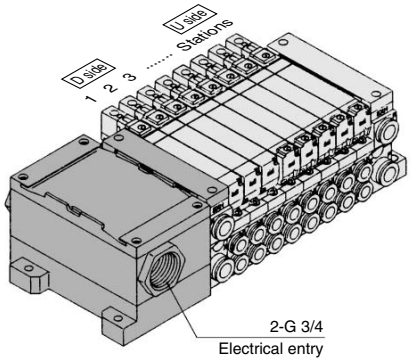
● Special wiring specifications: VQ2000



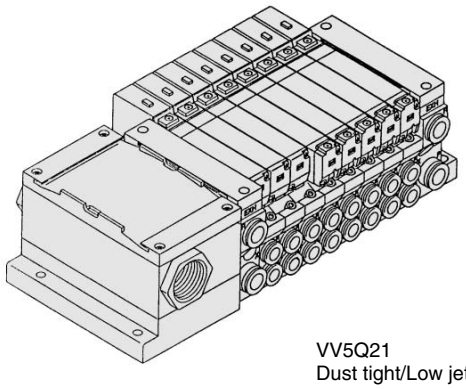


Irrespective of the valves or options, the internal wiring is made double (connected to SOL.A and SOL.B) for respective stations of the manifold.
Mixed single and double wiring is available as an option. For details, refer to page 2-4-178.

Note) When using the negative common specifications, use valves for negative common.
For details, refer to "Option" on page 2-4-178.



The total number of stations is tabulated starting from station one on the D side.



VV5Q21
Dust tight/Low jetproof type

How to Order Valves

VQ 1 1 0 0 Y – 5 □ □ □

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Note) For external pilot and negative COM specifications, refer to "Option" on pages 2-4-178 to 2-4-179.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Coil voltage

1	100 VAC (50/60 Hz)
3	100 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note) For power consumption of AC type, refer to page 2-4-179.

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Enclosure

Nil	Dust-protected
W	Dusttight/Low jetproof type (IP65) Note)

Note) VQ2000 only.

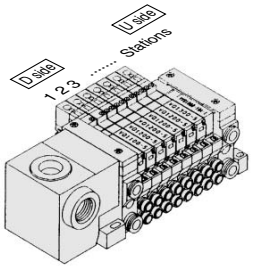
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Terminal block box kit
VV5Q11-08C6T0 ··· 1 set–Manifold base no.
∗VQ1100-5 ····· 2 sets–Valve part no. (Stations 1 to 2)
∗VQ1200-5 ····· 4 sets–Valve part no. (Stations 3 to 6)
∗VQ1300-5 ····· 1 set–Valve part no. (Station 7)
∗VVQ1000-10A-1 ··· 1 set–Blanking plate part no. (Station 8)

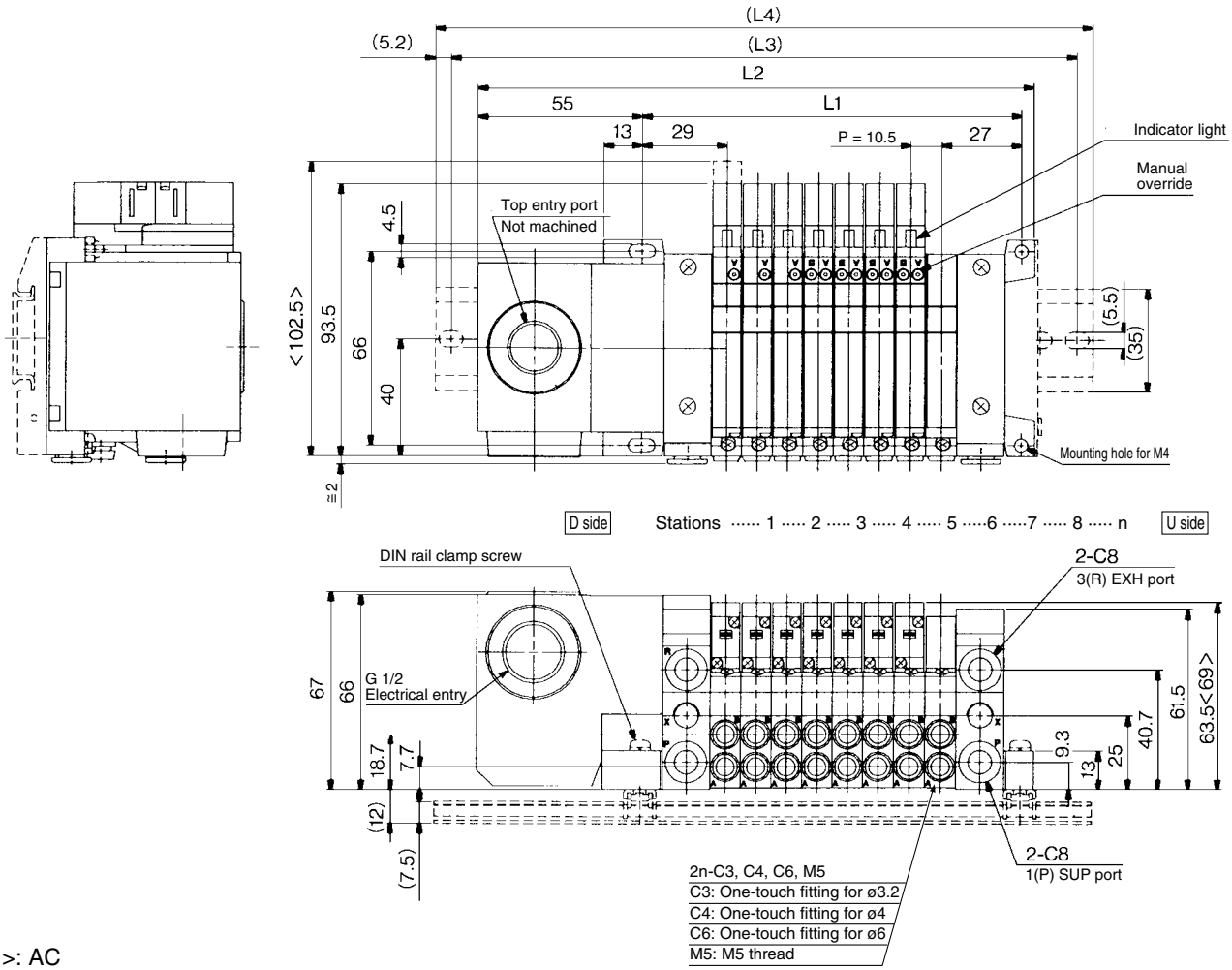
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ1000

The broken lines and dimensions in parentheses indicate DIN rail mounting style [-D].



< >: AC

Dimensions

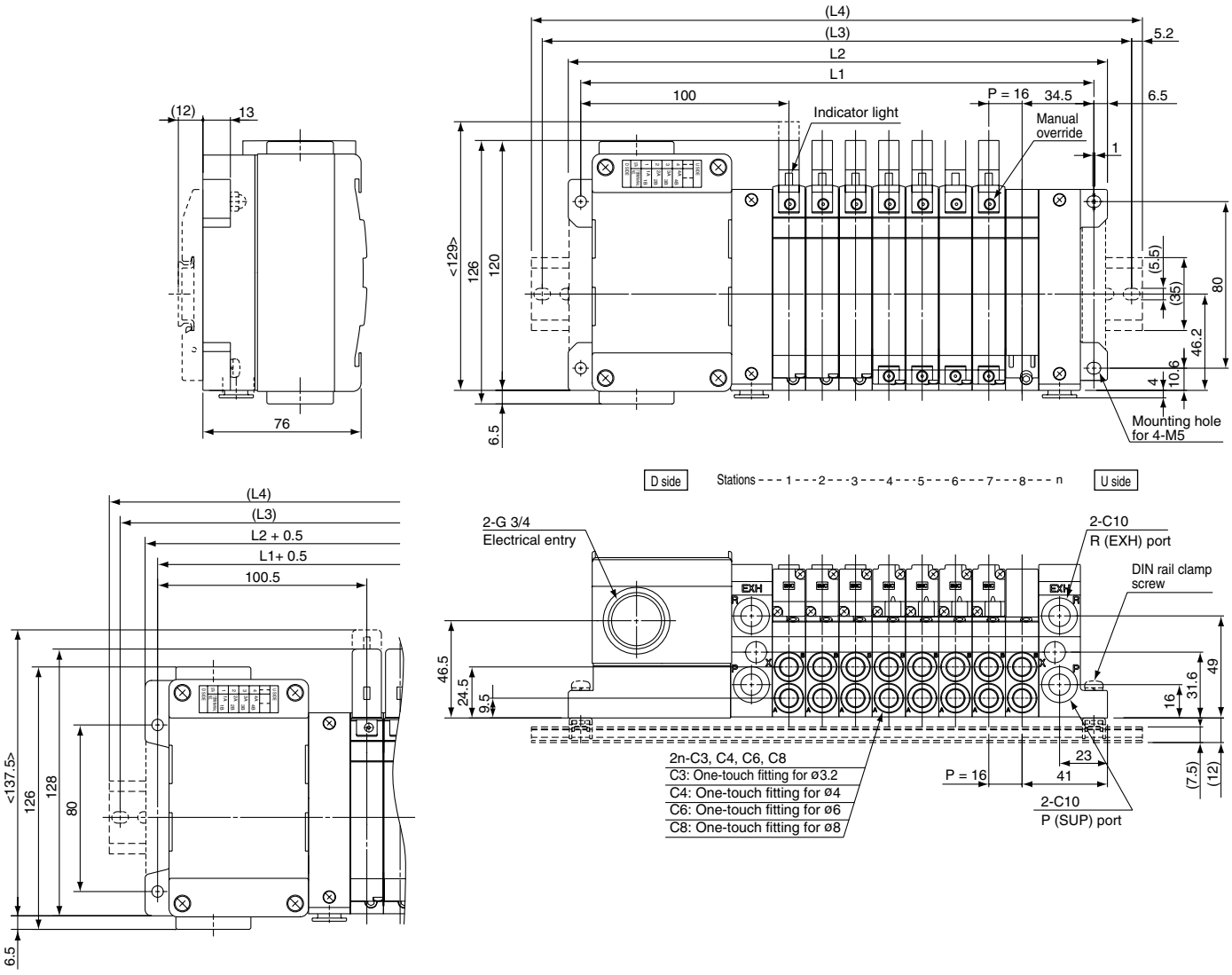
Formula L1 = 10.5n + 45.5, L2 = 10.5n + 105 n: Station (Maximum 24 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L1	66.5	77	87.5	98	108.5	119	129.5	140	150.5	161	171.5	182	192.5	203	213.5	224	234.5	245	255.5	266	276.5	287	297.5
L2	126	136.5	147	157.5	168	178.5	189	199.5	210	220.5	231	241.5	252	262.5	273	283.5	294	304.5	315	325.5	336	346.5	357
(L3)	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	262.5	262.5	275	287.5	300	312.5	325	325	337.5	350	362.5	375	387.5
(L4)	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	273	273	285.5	298	310.5	323	335.5	335.5	348	360.5	373	385.5	398

Vacuum ejector unit style: Formula L1 = 10.5n + 29.7 + (Number of ejector units x 26.7)
L2 = 10.5n + 88.8 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

VQ2000

The broken lines and dimensions in parentheses indicate DIN rail mounting style [-D].



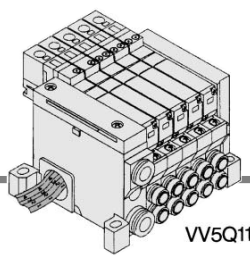
< >: AC

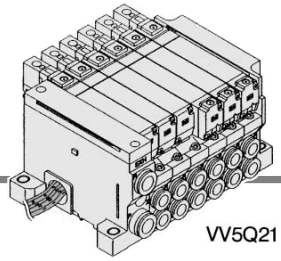
Dimensions

Formula L1 = 16n + 118.5, L2 = 16n + 131 n: Station (Maximum 10 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
L1	150.5	166.5	182.5	198.5	214.5	230.5	246.5	262.5	278.5	294.5	310.5	326.5	342.5	358.5	374.5	390.5	406.5	422.5	438.5
L2	163	179	195	211	227	243	259	275	291	307	323	339	355	371	387	403	419	435	451
(L3)	187.5	200	225	237.5	250	262.5	287.5	300	312.5	337.5	350	362.5	375	400	412.5	425	450	462.5	475
(L4)	198	210.5	235.5	248	260.5	273	298	310.5	323	348	360.5	373	385.5	410.5	423	435.5	460.5	473	485.5

L VQ1000/2000 Kit (Lead wire cable)


VV5Q11

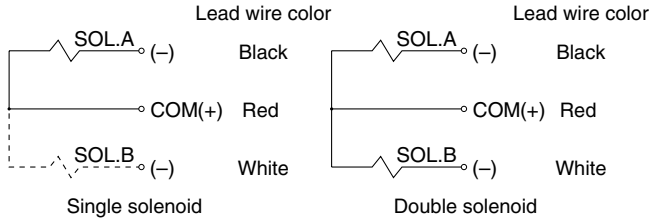

VV5Q21

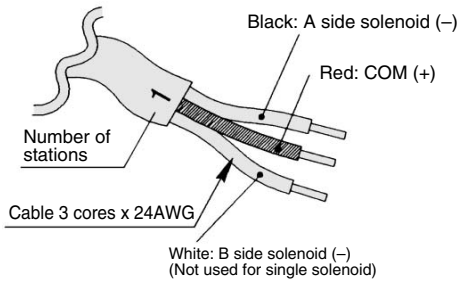
IP65 compliant

- Direct electrical entry. Models with one or more stations are available.
- (SUP) and R (EXH) ports are provided on one side for further space savings.
- Maximum stations are 8.
- Enclosure: Dusttight/Low jetproof type (IP65) compliant (Series VQ2000)

Wiring specifications: Positive COM ●

Three lead wires are attached to each station regardless of the type of valve which is mounted.
The red wire is for COM connection.





Use any of the following cable lead wire assembly to change the lead wire length:

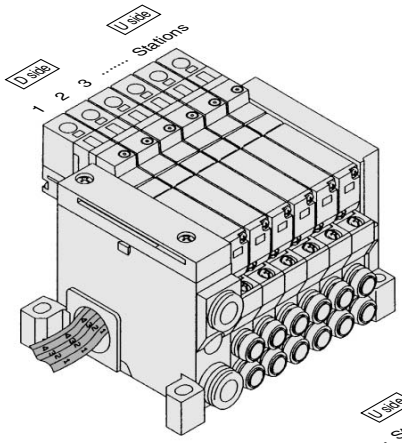
Lead Wire Assembly with Connector

Lead wire length	Part no.
0.6 m	**VVQ1000-84A-6-**∗
1.5 m	**VVQ1000-84A-15-**∗
3 m	**VVQ1000-84A-30-**∗

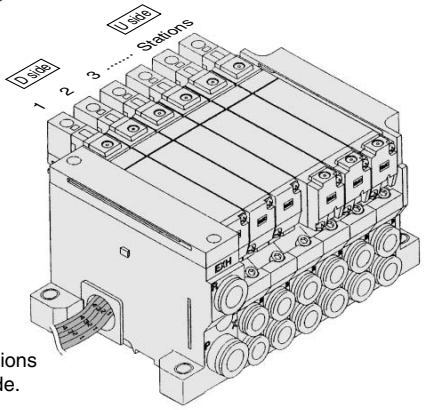
∗ No. of stations 1 to 8

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 8 stations
VQ2000	Side	C10	C6, C8	Max. 8 stations



VV5Q11



VV5Q21

The total number of stations is tabulated on the D side.

How to Order Manifold

VV5Q 1 1 – 06 C6 L 1 – N

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

01	1 station
⋮	⋮
08	8 stations

Note) For negative common specifications, refer to "Option" on page 2-4-178.

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	● (3)

Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type. (VQ1000 only)
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) Inch-size One-touch fittings are available. For details, refer to page 2-4-179.

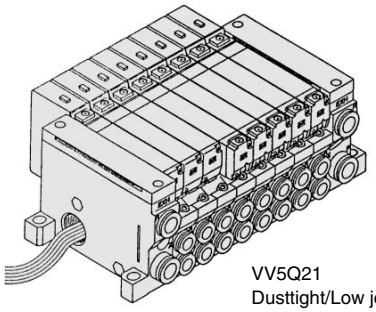
Cable (Length)

0	Cable length 0.6 m
1	Cable length 1.5 m
2	Cable length 3 m

Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	With back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator units	●		(3)
G3	3 sets of regulator units	●		(3)
J□	With vacuum ejector unit	●		(4)
N	With name plate	●	●	
R	External pilot	●	●	(5)
S	Built-in silencer, direct exhaust	●	●	
W	Enclosure: Dusttight/Low jetproof type (IP65)		●	

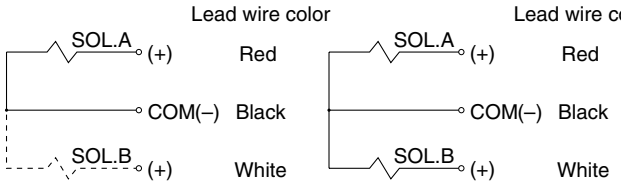
Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BRS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by the manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Indicate "R" for the valve with external pilot.

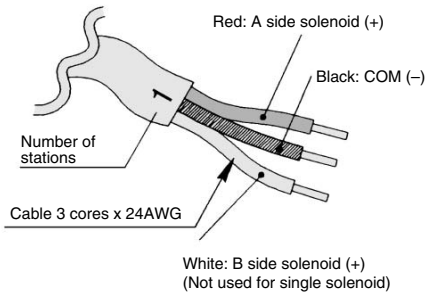


VV5Q21
Dusttight/Low jetproof type

● Wiring specifications: Negative COM (Option)

Three lead wires are attached to each station regardless of the type of valve which is mounted.
The black wire is for COM connection.





Lead Wire Assembly with Connector

Lead wire length	Part no.
0.6 m	**VVQ1000-84AN-6-**∗
1.5 m	**VVQ1000-84AN-15-**∗
3 m	**VVQ1000-84AN-30-**∗

∗ No. of stations 1 to 8

Note) When using the negative common specifications, use valves for negative common. For negative common specifications, refer to "Option" on page 2-4-178.

How to Order Valves

VQ 1 1 0 0 Y — 5 ☐ ☐ ☐

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Note) For external pilot and negative COM specifications, refer to "Option" on 2-4-178 to 2-4-179.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ Note)
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-129.

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof Note) type (IP65)

Note) VQ2000 only.

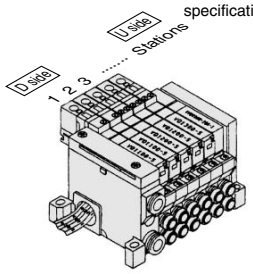
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Lead wire kit with cable (3 m)
VV5Q11-06C6L2 ···· 1 set–Manifold base no.
∗VQ1100-5 ····· 2 sets–Valve part no. (Stations 1 to 2)
∗VQ1200-5 ····· 2 sets–Valve part no. (Stations 3 to 4)
∗VQ1300-5 ····· 1 set–Valve part no. (Station 5)
∗VVQ1000-10A-1 ··· 1 set–Blanking plate part no. (Station 6)

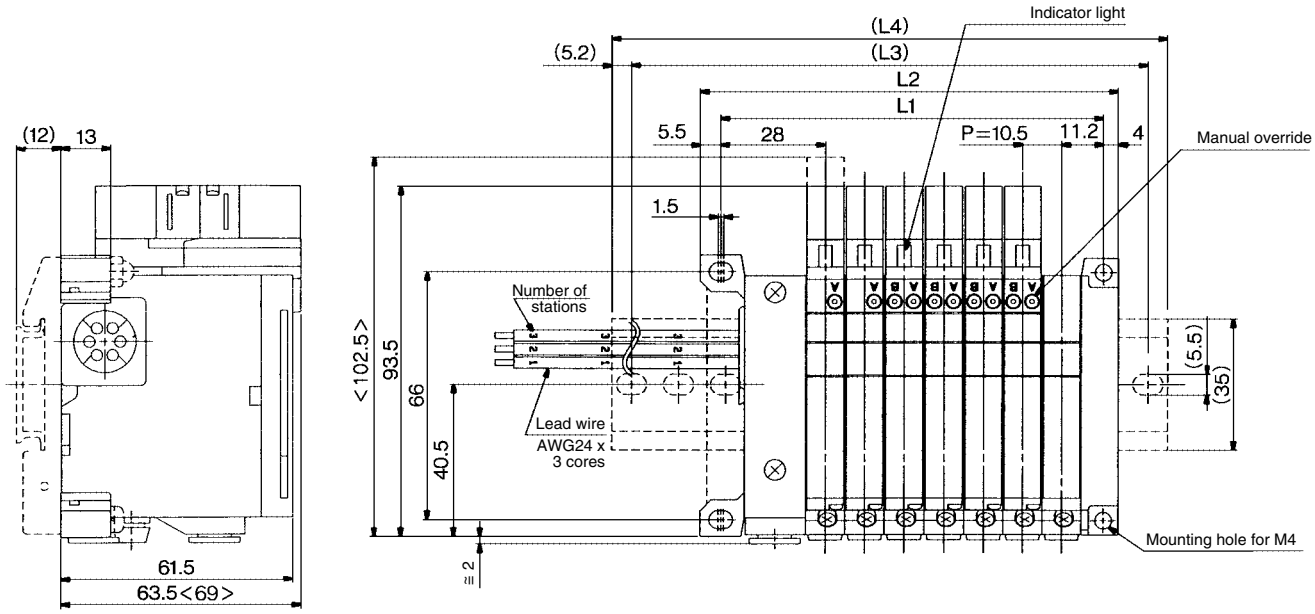
Prefix the asterisk to the part nos. of the solenoid valve, etc.

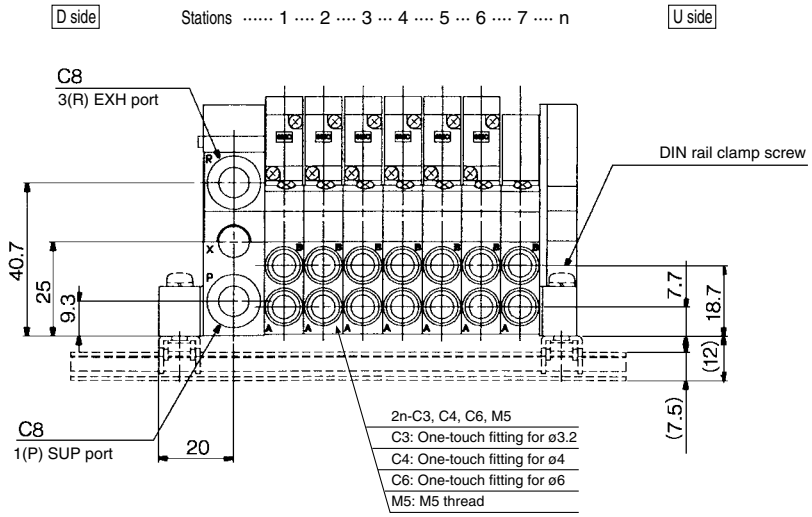
Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ1000

The broken lines indicate DIN rail mounting style [-D].





< >: AC

Dimensions

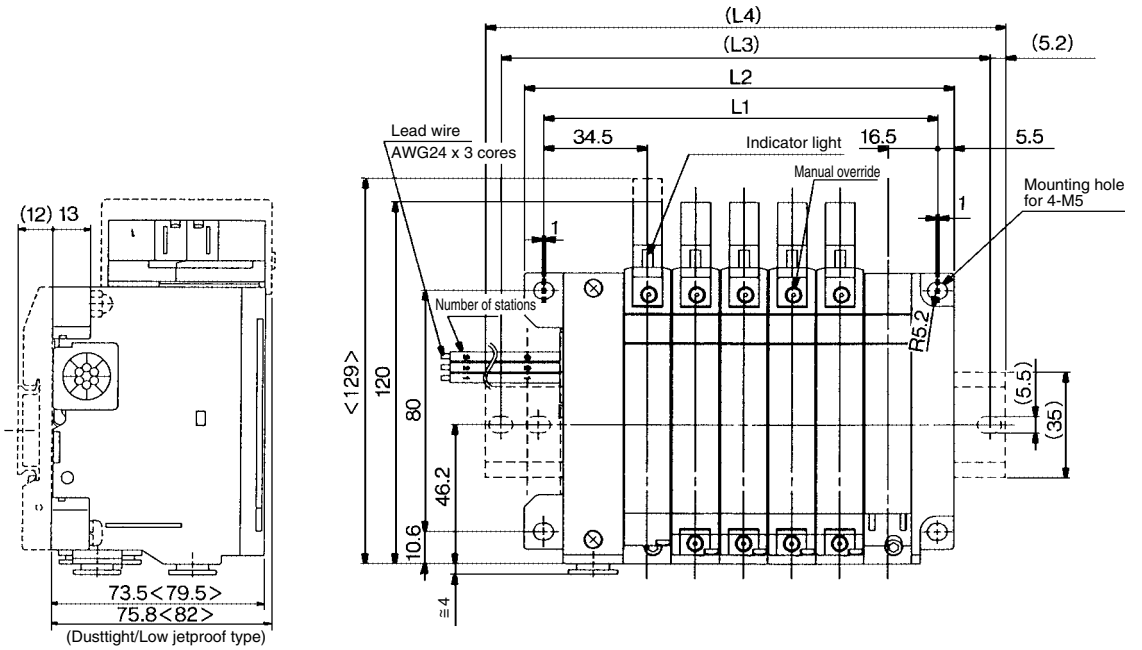
Formula L1 = 16n + 35, L2 = 16n + 47 n: Station (Maximum 8 stations)

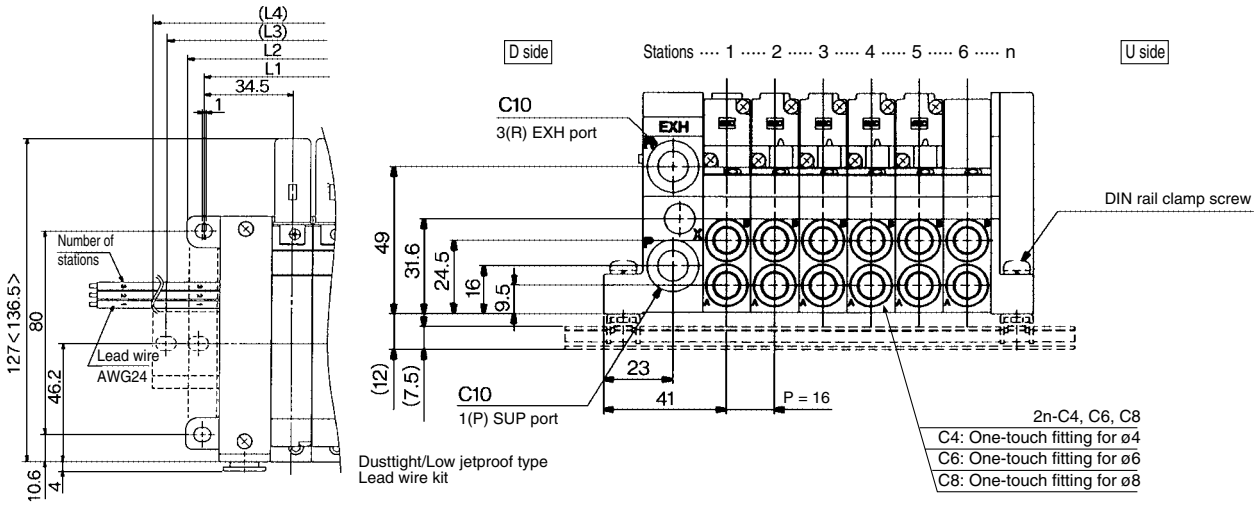
L \ n	1	2	3	4	5	6	7	8
L1	39	49.5	60	70.5	81	91.5	102	112.5
L2	48.5	59	69.5	80	90.5	101	111.5	122
(L3)	75	87.5	87.5	100	112.5	125	137.5	150
(L4)	85.5	98	98	110.5	123	135.5	148	160.5

Vacuum ejector unit style: Formula L1 = 10.5n + 28.5 + (Number of ejector units x 26.7)
L2 = 10.5n + 38 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

VQ2000

The broken lines indicate the DIN rail mounting style [-D].





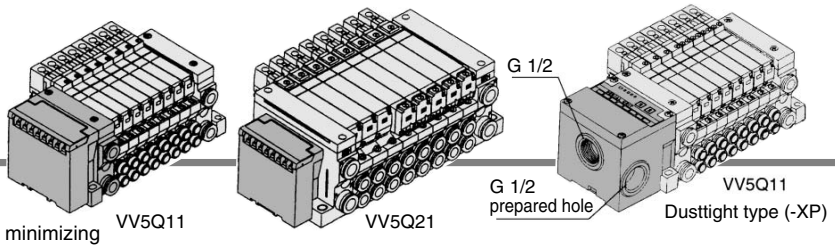
< >: AC

Dimensions

Formula L1 = 16n + 35, L2 = 16n + 47 n: Station (Maximum 8 stations)

L \ n	1	2	3	4	5	6	7	8
L1	51	67	83	99	115	131	147	163
L2	63	79	95	111	127	143	159	175
(L3)	87.5	100	125	137.5	150	162.5	184.5	200
(L4)	98	110.5	135.5	148	160.5	173	198	210.5

S VQ1000/2000 Kit (Serial transmission unit)

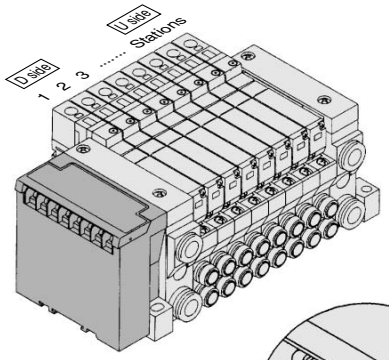


IP65 compliant

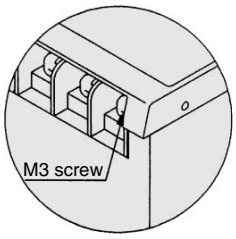
- The serial transmission system reduces wiring work, while minimizing wiring and saving space.
- The system comes in type SA (generic for small scale systems) for equipment with a small number of I/O points, or 32 points max., type SB (applicable to Mitsubishi Electric models) for controlling 512 I/O points max., type SC (applicable to OMRON models), type SD (applicable to SHARP models: 504 points max.), type SF (applicable to NKE models: 128 points max.), type SJ (applicable to SUNX models), type SK (applicable to Fuji Electric models), type SQ (applicable to OMRON's Compo Bus/D), and type SR (applicable to OMRON's Compo Bus/S).
- Max. 16 stations. (Specify a model with 9 to 16 stations by using the manifold specification sheet.)
- Enclosure: Dusttight, Low jetproof type (IP65) compliant (Series VQ2000)

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ1000	Side	C8	C3, C4, C6, M5	Max. 16 stations
VQ2000	Side	C10	C4, C6, C8	Max. 16 stations



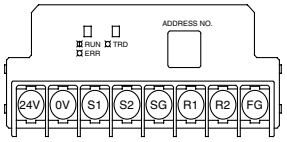
- Stations are counted from station 1 on the D side.
- Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. The optional specification permits the mixture of single and double wiring. For details, refer to page 2-4-178.



Item	Specifications
External power supply	24 VDC +10%, –5%
Current consumption (Internal unit)	SA, SB, SBB, SD, SE, SF1, SH, SG, SJ½, SK, SQ, SR½, SU, SV: 0.1A SC: 0.3A

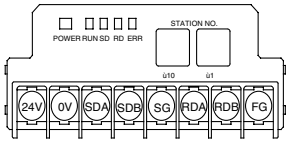
Name of terminal block (LED)

Type SA
With general type SI unit (Series EX300)



LED	Description
TRD	Lighting during data reception
RUN/ERR	Blinking when received data is normal; Lighting when data reception

Type SB
Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System



LED	Description
POWER	Lighting when power is turned ON
RUN	Lighting when data transmission with the master station is normal
RD	Lighting during data reception
SD	Lighting during data transmission
ERR.	Lighting when reception data error occurs. Light turns off when the error is corrected.

Note

- T unit
  Can be connected with PLC I/O card for serial transmission.
  EX300-TMB1···For models of Mitsubishi Electric Corporation
  EX300-TTA1···For models of OMRON Corporation
  EX300-TFU1···For models of Fuji Electri Co., Ltd.
  EX300-TOO1··· For general models
- ∗ Up to 32 points per unit.
- No. of output points, 16 points

- Master station:
  PLC made by Mitsubishi Electric Corporation
  Series MELSEC-A
  AJ71PT32-S3, AJ71T32-S3
  A1SJ71PT32-S3
- ∗ Max. 64 stations, connected to remote I/O stations (Max. 512 points).
- No. of output points, 16 points. No. of sta. occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

How to Order Manifold

VV5Q 1 1 – 08 C6 S A – N – XP

Series

1	VQ1000
2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
16 Note	16 stations

Note) For details, refer to page 2-4-178.

Cylinder port

Symbol	Port size	VQ1000	VQ2000
C3	With One-touch fitting for ø3.2	●	
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	●	●
C8	With One-touch fitting for ø8		●
M5	M5 thread	●	
CM	With mixed size/with port plug	●	● (3)

Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type. (VQ1000 only).
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Specify as "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) For inch-size One-touch fittings, refer to "Option" on page 2-4-179.

Model

O	Without SI unit	Max.16 stations
A	With general type SI unit (Series EX300)	
B (2)	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
BB	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System (2 power supply lines)	
C	OMRON Corp.: SYSBUS Wire System	
D	SHARP Corp.: Satellite I/O Link System	
E	Matsushita Electric Works: MEWNET-F System	
F1	NKE Corp.: Uni-wire System (16 output points)	
G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System	
H	NKE Corp.: Uni-wire H System	
J1	SUNX Corp.: S-LINK System (16 output points)	
J2	SUNX Corp.: S-LINK System (8 output points)	Max. 8 stations
K	Fuji Electric Co.: T-LINK Mini System	Max.16 stations
Q	DeviceNet, CompoBus/D (OMRON Corp.)	
R1	OMRON Corp.: CompoBus/S System (16 output points)	
R2	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8 stations
U	JEMANET (JPCN-1)	Max. 16 stations
V	Mitsubishi Electric Corp.: CC-LINK System	Max. 16 stations

Note 1) The general type requires a transmission unit on CPU side.
Note 2) SBB kit is usable only for VQ2000 dusttight/low jetproof type (IP65).

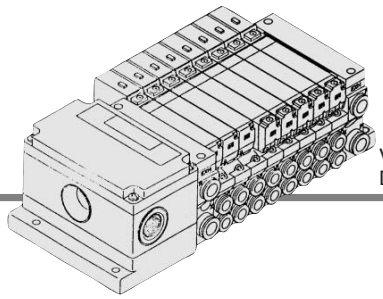
Dust-protected type (-XP)

Suffix "-XP" for the dust-protected type SI units. (Except SE and SQ)

Option

Symbol	Option	VQ1000	VQ2000	Note
Nil	None	●	●	
B	With back pressure check valve	●	●	(2)
D	DIN rail mounting style	●	●	
G1	1 set of regulator unit	●		(3)
G2	2 sets of regulator unit			
G3	3 sets of regulator unit			
J□	With vacuum ejector unit	●		(4)
K	Special wiring specifications (Not double wiring)	●	●	(5)
N	With name plate	●	●	
R	with external pilot	●	●	(6)
S	Built-in silencer, direct exhaust	●	●	
W	Enclosure: Dust tight/Low jetproof type (IP65) (Except SE)		●	(8)

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -BRS.
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by manifold specification sheet.
Note 3) Specify the mounting position in the manifold specification sheet.
Note 4) Refer to page 2-4-170 for the details of ejector mounted styles. A combination of "J" and "N" is unavailable.
Note 5) Specify the wiring specifications in the manifold specification sheet.
Note 6) Indicate "R" for the valve with external pilot.
Note 7) A combination of "W" and "XP" is unavailable.
Note 8) Refer to "Dimensions" on page 2-4-157 for SI unit and valve, in case of W (dusttight/low jetproof type).



VV5Q21
Dust tight Low jetproof type (-W)

● SI unit output and coil numbering

<Wiring example 1>

SI unit output no. ····· 0 1 2 3 4 5 6 7 8 9

	A	B	A	B	A	Un-used	A	Un-used	A	B
SI unit	Double		Double		Single		Single		Single	
Stations	1		2		3		4		5	

Double wiring (Standard)

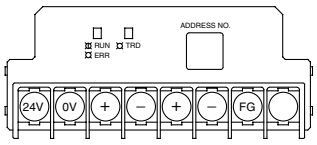
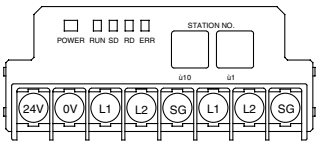
Mixed wiring is available as an option.
Use the manifold specification sheet to specify.

<Wiring example 2>

SI unit output no. ····· 0 1 2 3 4 5 6 7

	A	B	A	B	A	A	A	B
SI unit	Double		Double		Single	Single	Single	
Stations	1		2		3	4	5	

Single/Double mixed wiring (Option)

	Type SC OMRON Corporation SYSBUS Wire System	Type SD SHARP Corporation Satellite I/O Link System
Name of terminal block (LED)		
	LED / Description RUN: Lights when transmission is normal and PLC is in operation mode T/R ERR: Blinks during data transmission/reception ON when transmission is abnormal.	LED / Description POWER: ON when power supply is ON RUN: Lights when power is ON and slave stations are operating normally ERROR: Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit R.SET HOLD: ON for master unit control input
Note	• Master station unit: OMRON PLC SYSMAC C (CV) series Types C500-RM201 and C200H-RM201 ∗ 32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit: SHARP's PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW 31LM ∗ Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ 1 1 0 0 Y — 5 ☐ ☐

Series

1	VQ1000
2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Note) For external pilot and negative COM specifications, refer to "Option" on pages 2-4-178 to 2-4-179.

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H	High pressure type	(1.5 W) ○
Y	Low wattage type	(0.5 W) ○

Coil voltage

5	24 VDC; With indicator light/surge voltage suppressor

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Enclosure

Nil	Dust-protected
W	Dust tight/Low jetproof type (IP65) Note)

Note) VQ2000 only.

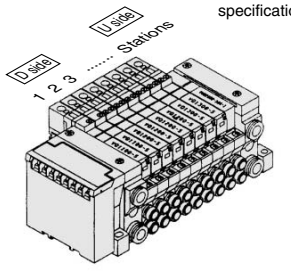
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

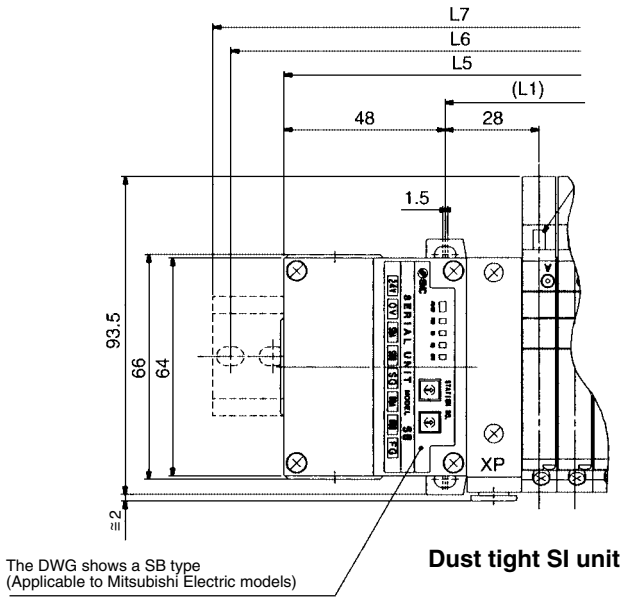
<Example>
Serial transmission kit
VV5Q11-08C6SA ··· 1 set–Manifold base no.
∗VQ1100-5 ····· 2 sets–Valve part no. (Stations 1 to 2)
∗VQ1200-5 ····· 4 sets–Valve part no. (Stations 3 to 6)
∗VQ1300-5 ····· 1 set–Valve part no. (Station 7)
∗VVQ1000-10A-1 ··· 1 set–Blanking plate part no. (Station 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.

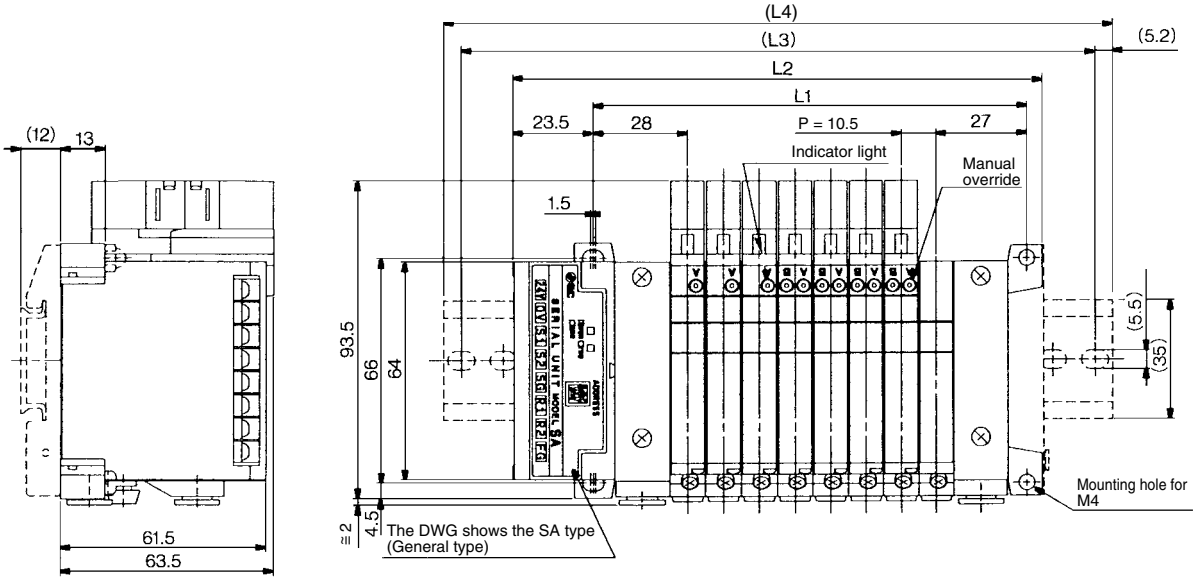


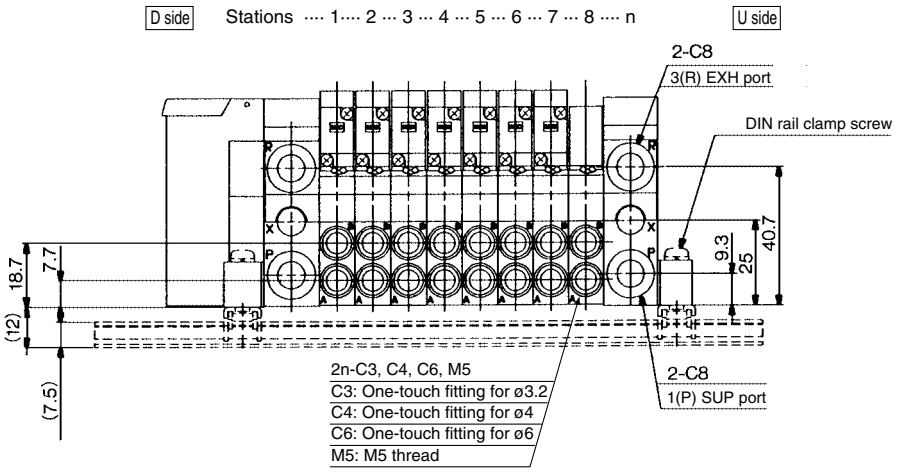
VQ1000



The broken lines indicate DIN rail mounting style [-D].

Dust tight SI unit





Vacuum ejector unit style: Formula
L1 = 10.5n + 28.7 + (Number of ejector units x 26.7)
L2 = 10.5n + 56.3 + (Number of ejector units x 26.7)
L4 is L2 plus about 30.

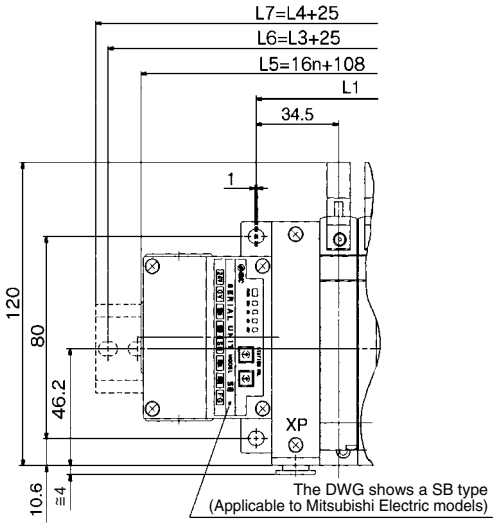
Note) Manifolds with SI unit for Matsushita Electric Works' MEWNET FP and Rockwell Automation's model are the same with L5, L6 and L7 dimensions of dustproof SI unit.

Dimensions

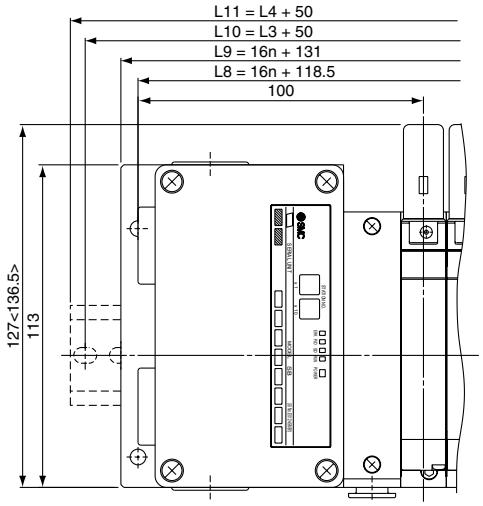
Dust-protected type SI unit: L5 = 10.5n + 97, L6 = L3 + 25, L7 = L4 + 25
Formula L1 = 10.5n + 44.5, L2 = 10.5n + 72.5 n: Station (Maximum16 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	65.5	76	86.5	97	107.5	118	128.5	139	149.5	160	170.5	181	191.5	202	212.5
L2	93.5	104	114.5	125	135.5	146	156.5	167	177.5	188	198.5	209	219.5	230	240.5
(L3)	125	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	250	262.5
(L4)	135.5	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	260.5	273

VQ2000

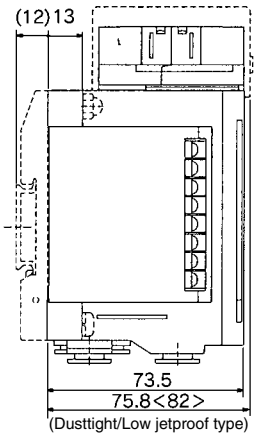


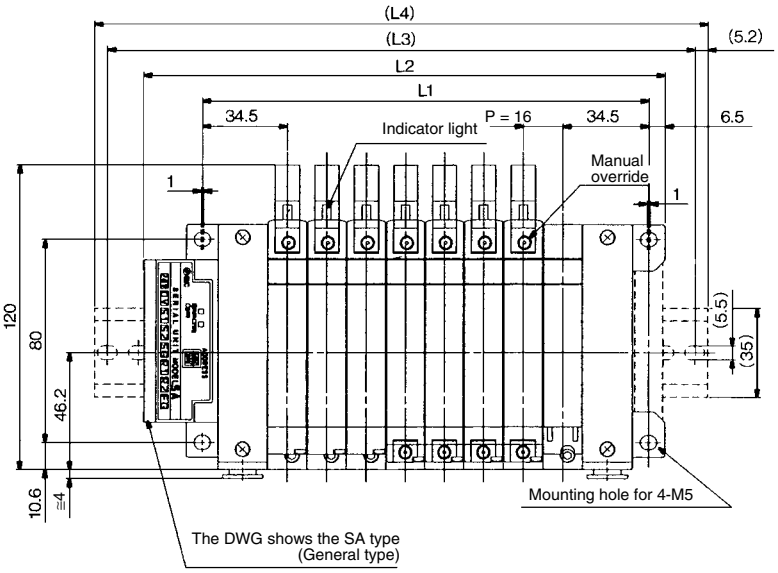
Dusttight SI unit



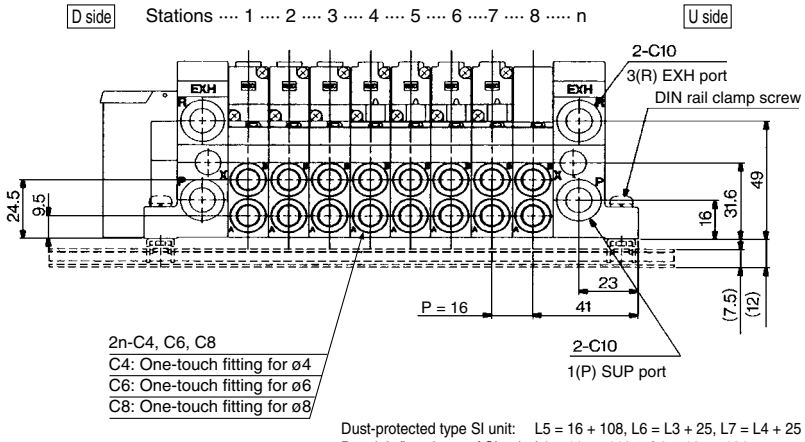
The broken lines indicate the DIN rail mounting style [-D].

Dust tight/Low jetproof type (IP65) SI unit





< >: AC



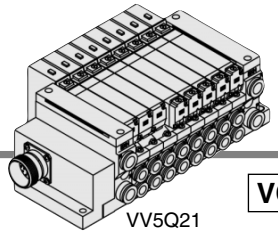
Dust-protected type SI unit: L5 = 16 + 108, L6 = L3 + 25, L7 = L4 + 25
Dusttight/Low jetproof SI unit: L8 = 16n + 118.5, L9 = 16n + 131
L10 = L3 + 50, L11 = L4 + 50
Formula : L1 = 16n + 53, L2 = 16n + 83 n: Stations (Maximum 16 stations)

Dimensions

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	85	101	117	133	149	165	181	197	213	229	245	261	277	293	309
L2	115	131	147	163	179	195	211	227	243	259	275	291	307	323	339
(**L3**)	137.5	162.5	175	187.5	200	225	237.5	250	262.5	287.5	300	312.5	337.5	350	362.5
(**L4**)	148	173	185.5	198	210.5	235.5	248	260.5	273	298	310.5	323	348	360.5	373

Note) Manifolds with SI unit for Matsushita Electric Works' MEWNET FP and Rockwell Automation's model are the same with L5, L6 and L7 dimensions of dustproof SI unit.

M VQ2000
Kit (Flat ribbon cable connector)


VV5Q21

VQ2000 only

- MIL flat cable connector reduces installation labor for electrical connection.
- Manifold and connectors, both compliant with the IP65 rating (dusttight, low jetproof), provide a high degree of protection for the electrical parts.
- Maximum stations are 24.

Manifold Specifications

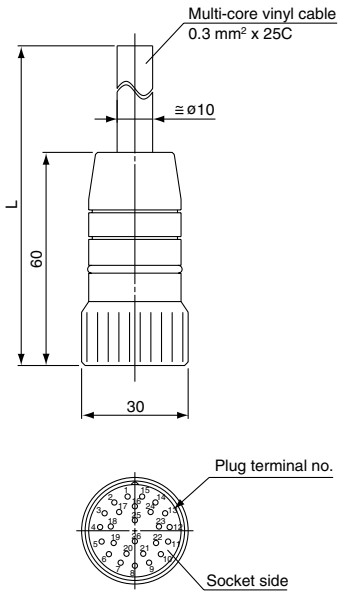
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ2000	Side	C10	C4, C6, M8	Max. 24 stations

Circular Connector (26 pins)

Cable assembly ●

AXT100-MC26- 015 / 030 / 050

(Circular connector assembly included in a specific manifold model no. specific manifold model no. Refer to How to Order Manifold.)



Circular Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-MC26-015	Cable 25 core x 24AWG
3 m	AXT100-MC26-030	
5 m	AXT100-MC26-050	

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Voltage limit V, 1 min, AC	1000
Insulation resistance MΩkm, 20°C	5 or more

Note) The minimum bending radius of circular connector cable is 20 mm.

Circular Connector Cable Assembly Terminal No.

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None
26	White	None

How to Order Manifold

VV5Q 2 1 – 08 C6 M 1 – N W

Enclosure
IP65 (Dust tight/Low jetproof type)

Series

2	VQ2000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
24	24 stations

Note) For details, refer to page 2-4-178.

Cylinder port

Symbol	Port size
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
C8	With One-touch fitting for ø8
CM	With mixed size/with port plug

Note 1) Insert "L" (top piping) or "B" (bottom piping) for elbow type.
Example) B6 (Elbow One-touch fittings for ø6, bottom piping.)
Note 2) Indicate "LM" for models with elbow fittings and mixed cylinder port sizes.
Note 3) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 4) Inch-size One-touch fittings are available. For details, refer to page 2-7-179.

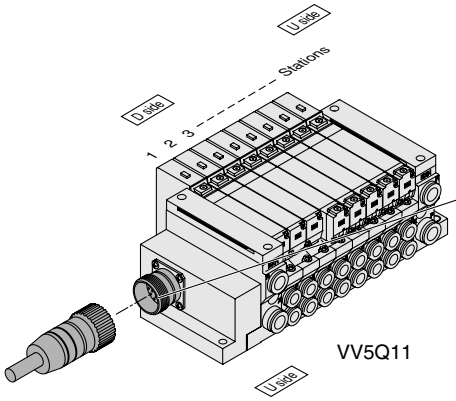
Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

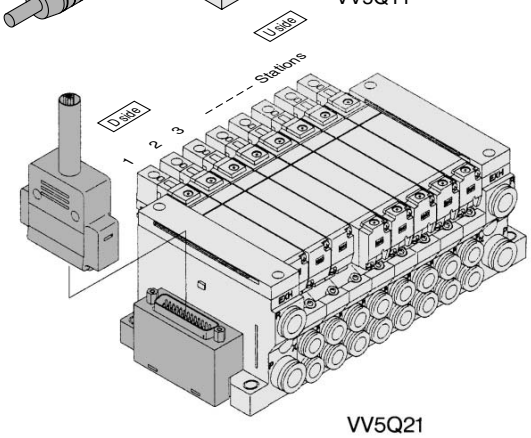
Option

Symbol	Option	Note
Nil	None	
B	With back pressure check valve	(2)
D	DIN rail mounting	
K	Special wiring specifications (Not double wiring)	(3)
N	With name plate	
R	External pilot	(4)

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -BKR
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations.
Note 3) If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 4) Specify the wiring by using of the manifold specification sheet.
Indicate "R" for the valve with external pilot.



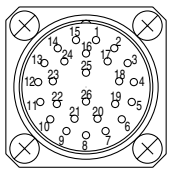
VV5Q11



VV5Q21

The total number of stations is tabulated starting from station one on the D side.

● Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 12 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option. For details, refer to page 2-7-178.

Circular connector cable assembly
AXT100-MC26-$^{015}_{030}_{050}$ Wire Color

	Terminal no.	Polarity	Lead wire color	Dot marking
1 station {	SOL.A 1	(–)	(+) Black	None
	SOL.B 2	(–)	(+) Brown	None
2 stations {	SOL.A 3	(–)	(+) Red	None
	SOL.B 4	(–)	(+) Orange	None
3 stations {	SOL.A 5	(–)	(+) Yellow	None
	SOL.B 6	(–)	(+) Pink	None
4 stations {	SOL.A 7	(–)	(+) Blue	None
	SOL.B 8	(–)	(+) Purple	White
5 stations {	SOL.A 9	(–)	(+) Gray	Black
	SOL.B 10	(–)	(+) White	Black
6 stations {	SOL.A 11	(–)	(+) White	Red
	SOL.B 12	(–)	(+) Yellow	Red
7 stations {	SOL.A 13	(–)	(+) Orange	Red
	SOL.B 14	(–)	(+) Yellow	Black
8 stations {	SOL.A 15	(–)	(+) Pink	Black
	SOL.B 16	(–)	(+) Blue	White
9 stations {	SOL.A 17	(–)	(+) Purple	None
	SOL.B 18	(–)	(+) Gray	None
10 stations {	SOL.A 19	(–)	(+) Orange	Black
	SOL.B 20	(–)	(+) Red	White
11 stations {	SOL.A 21	(–)	(+) Brown	White
	SOL.B 22	(–)	(+) Pink	Red
12 stations {	SOL.A 23	(–)	(+) Gray	Red
	SOL.B 24	(–)	(+) Black	White
(Max.)	COM. 25	(+)	(–) White	None
	COM. 26	(+)	(–) White	None
			Positive common specifications	Negative common specifications Note)

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-178.)
For details, refer to "Option" on page 2-4-178.

How to Order Valves

VQ 2 1 0 0 Y — 5 W

Enclosure
IP (Dusttight/ Low jetproof type)

Series

2	VQ2000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	○ Note)
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-129.

Coil voltage

1	100 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	None

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual)

Note) For external pilot and negative COM specifications, refer to "Option" on 2-4-178 to 2-4-179.

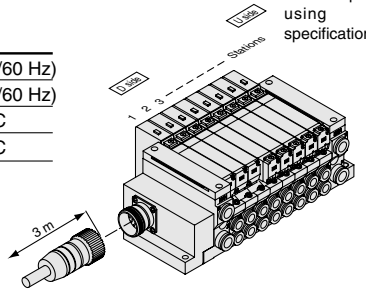
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Flat ribbon cable kit with 3 m cable
VV5Q21-09C6M2-W··· 1 set–Manifold base no.
∗VQ2100-5w ····· 2 sets–Valve part no. (Stations 1 to 2)
∗VQ2200-5w····· 4 sets–Valve part no. (Stations 3 to 6)
∗VQ2300-5w····· 2 sets–Valve part no. (Stations 7 to 8)
∗VVQ2000-10A-1····· 1 set–Blanking plate part no. (Station 9)

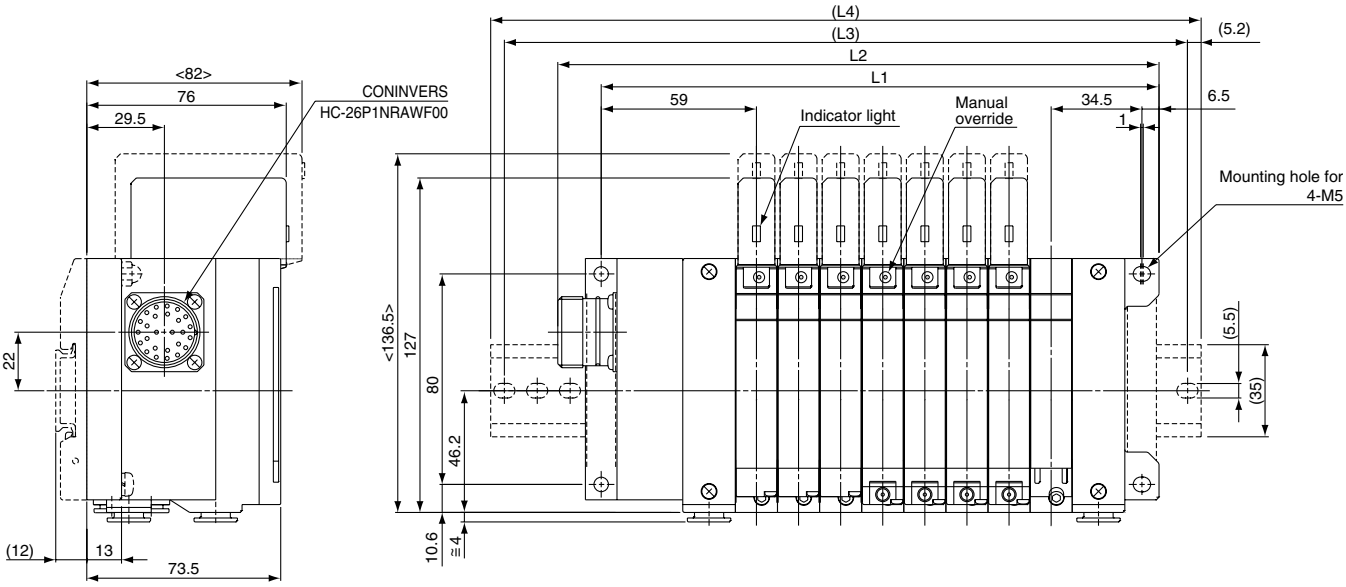
Prefix the asterisk to the part nos. of the solenoid valve, etc.

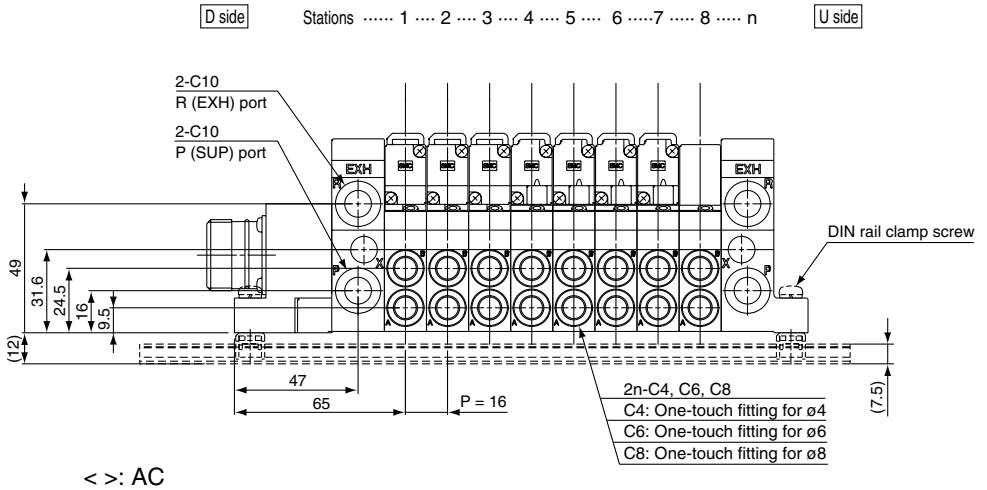
When ordering, specify the part nos. in order from the 1st station in the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ2000

The broken lines indicate the DIN rail mounting style [-D] and the side entry connection [-FS].





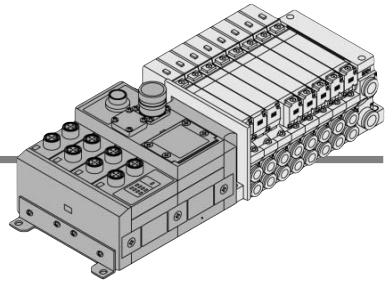
< >: AC

Dimensions

Formula L1 = 16n + 77.5, L2 = 16n + 100.5 n: Station (Maximum 12 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12
L1	109.5	125.5	141.5	157.5	173.5	189.5	205.5	221.5	237.5	253.5	269.5
L2	132.5	148.5	164.5	180.5	196.5	212.5	228.5	244.5	260.5	276.5	292.5
(L3)	162.5	175	187.5	200	225	237.5	250	275	287.5	300	312.5
(L4)	173	185.5	198	210.5	235.5	248	260.5	285.5	298	310.5	323

S VQ2000
Kit (Serial transmission kit) for I/O IP65 compliant



VQ2000 only

Applicable network **DeviceNet/PROFIBUS-DP**

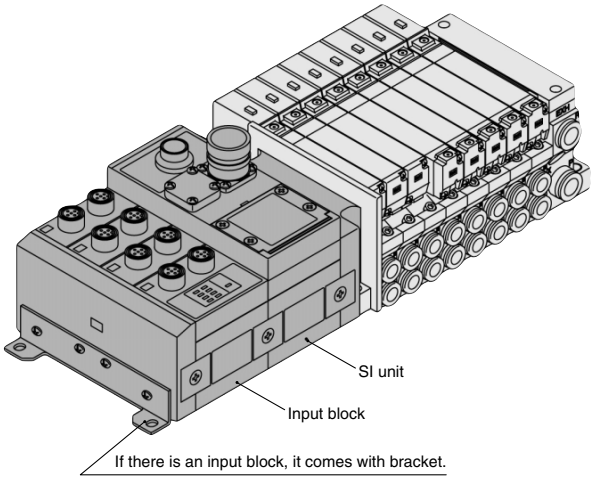
- **The serial transmission system reduces wiring work, while minimizing wiring and saving space.**

SI unit for DeviceNet/PROFIBUS

As a slave for DeviceNet/PROFIBUS, it is possible to control ON/OFF of a solenoid valve with the maximum of 32 points. Furthermore, by connecting a discrete input block, it is possible to input the sensor signal for 32 points at the maximum.

Input block

Meaning of an expansion block, connecting with SI unit, for sensor-inputting for auto switches, etc. Sensor-input is available up to 8 per one input block. By the NPN/PNP switch, it is able to adjust COM to sensor.



VQ2000 IP65, Applicable to Input/Output, Serial Transmission Type

How to Order Manifold

VV5Q21 — 08 C6 S D QW 1 [ ] — N W

VQ2000 Plug-in series

Stations

01	1 station
⋮	⋮
16	16 stations

Cylinder port

Symbol	Port size
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
C8	With One-touch fitting for ø8
CM	With mixed size/with port plug

SI unit mounting
D: D side mounting

Model

0W	Without SI unit	
QW	DeviceNet	+COM
NWN	PROFIBUS-DP	–COM

Note) Only +COM is available for DeviceNet. Order a mounting valve with +COM.
Since PROFIBUS is –COM only, order –COM for valves to be mounted.

Input block COM

Nil	PNP(+) or SI/Input block: None
N	NPN (–)

Input block

Nil	SI unit/Input block: None
0	Input block: None
1	Input block 1 pc.
2	Input block 2 pcs.
3	Input block 3 pcs.
4	Input block 4 pcs.

Option

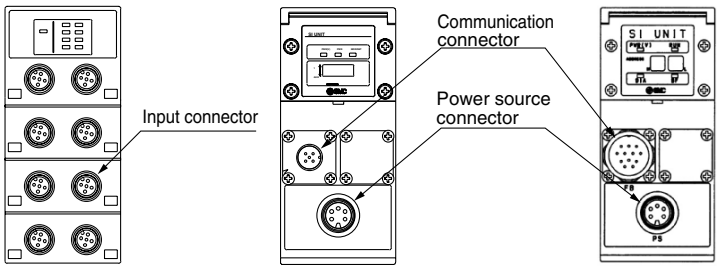
Symbol	Option
Nil	None
B	With back pressure check valve
D	DIN rail mounting style
K	Special wiring specifications (Not double wiring)
N	With name plate
R	External pilot

Note) When two or more symbols are specified, indicate them alphabetically.
Example: -DNR

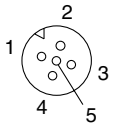
Enclosure
IP65 (Dust tight/Low jetproof type)

Details in Connector

Input block **SI Unit (DeviceNet)** **SI Unit (PROFIBUS-DP)**

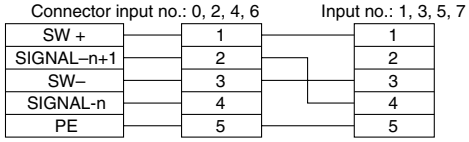


● **Input connector: M12 5 pins (XS2F compatible made by OMRON Corp.) x 8 pcs.**
Cable side connector example: XS2G made by OMRON Corp.



Number	Description	Function
1	SW+	Sensor power supply +
2	N.C.	Open *
3	SW–	Sensor power supply –
4	SIGNAL	Sensor input signal
5	PE	Protective sensor ground

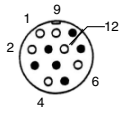
* No. 2 pin of the input no. 0, 2, 4, 6 connector (connectors aligned in the right side on the input block) is connected internally with no. 4 pin (sensor input no.) of the input no. 1, 3, 5, 7 respectively. Thereby, it is possible to directly input 2 points which is bundled into 1 cable by the cluster connector, etc.



⚠ Caution

When an enclosure equivalent to IP65 is required, place a waterproof cover on the unused input connector. As for waterproof cover, order it separately.
Example: OMRON Corp. XS2Z-12

● **Communication connector (PROFIBUS-DP): Made by CONINVERS GmbH RC-2RS1N12 12 pins**
Cable side connector example: Made by Siemens AG 6ES5 760-2CB11

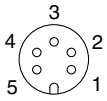


Number	Description	Function
1	M5V	GND Terminal
2	A	Signal-N
4	B	Signal-P
6	+5V	Terminal +5 V
9	SIELD	Shield ground
12	RTS	Optical fiber (Reserve)

Pin no. 3, 5, 7, 8, 10 and 11 marked with ● are open.

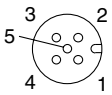
* Connector's shape and pin assignment is interchangeable with ET200C made by Siemens AG.

● **Power source connector: Series 723 (made by Franz Binder GmbH) 5 pins (72309-0115-80-05)**
Cable side connector example: Franz Binder GmbH 72309-0114-70-15, etc.
* Din type 5 pins.



Number	Description	Function
1	SV24V	For solenoid valve +24 V
2	SV0V	For solenoid valve 0 V
3	PE	Protective ground
4	SW24V	<DeviceNet> For input block +24 V, <Profibus or Interbus> For input unit and SI unit +24 V
5	SW0V	<DeviceNet> For input block 0 V, <Profibus or Interbus> For input unit and SI unit 0 V

● **Communication connector (DeviceNet): M12 5 pins (for DeviceNet compliant)**
Example of corresponding cable assemblies with connector: OMRON Corporation: DCA1-5CN05F1 Karl Lumberg GmbH & Co. KG: RKT5-56

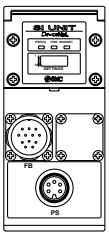


Number	Description	Function
1	Drain	Drain/Shield
2	V+	Circuit power supply +
3	V–	Circuit power supply –
4	CAN_H	Signal H
5	CAN_L	Signal L

Item conforming to Micro Style connector in DeviceNet specifications.

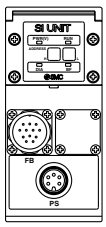
Indicator Unit (LED) Descriptions and Functions

■ SI Unit (DeviceNet)



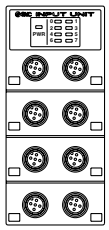
Description	Function
PWR(V)	ON when solenoid valve power supply is turned ON
PWR	ON when DeviceNet circuit power supply input is turned ON
MOD/NET	OFF: Power supply off, off line, or when checking duplication of MAC_ID
	Green blinking: Waiting for connection (On line)
	Green ON: Connection established (On line)
	Red blinking: Connection time out (Minor communication abnormality occurs)
	Red ON: MAC_ID duplication error, or BUSOFF error (Major communication abnormality occurs)

■ SI Unit (PROFIBUS-DP)



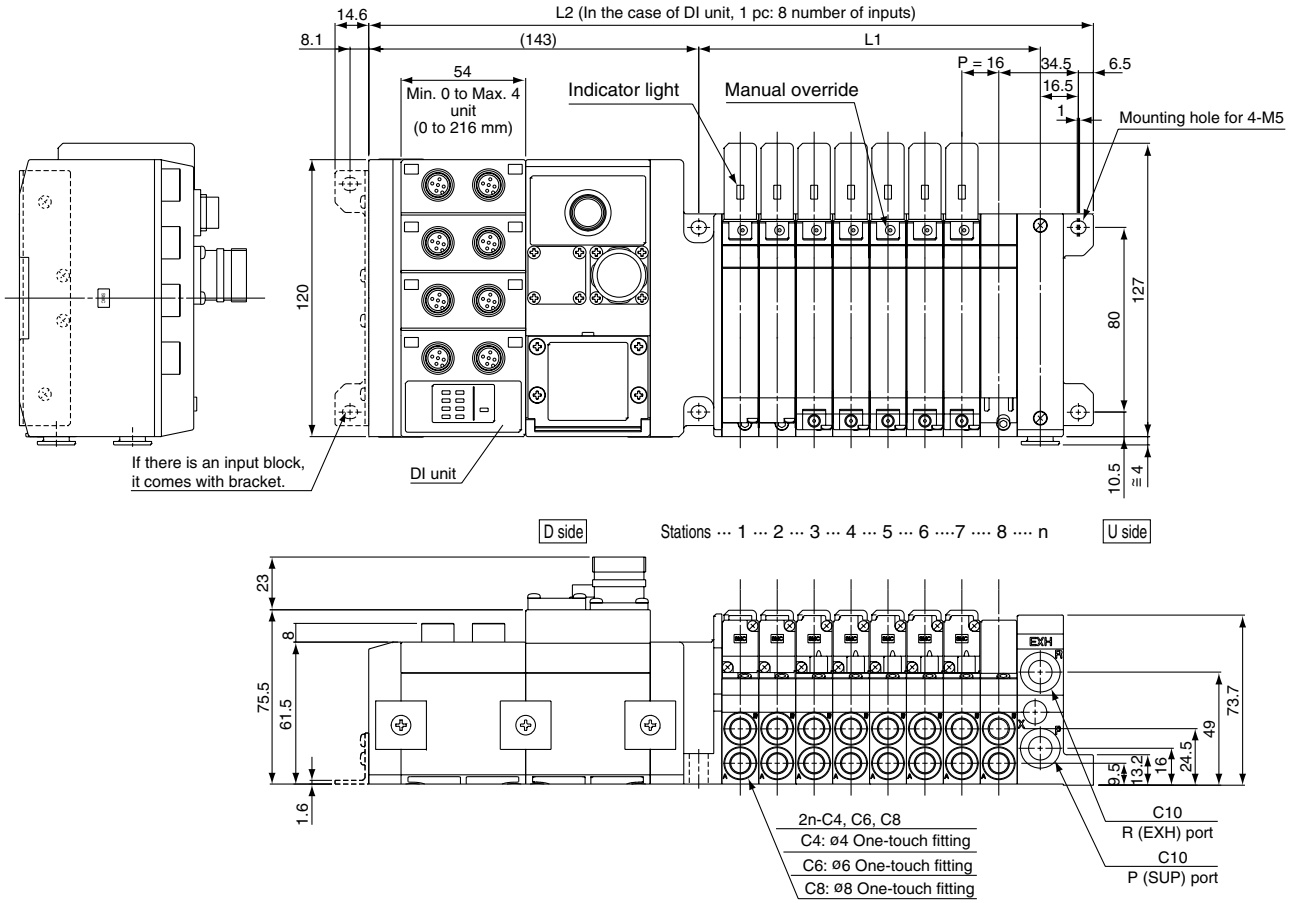
Description	Function
PWR	ON when solenoid valve power supply is turned ON OFF when the power supply voltage is less than 19 V
RUN	ON when operating (SI unit power supply is ON)
DIA	ON when self-diagnosis device detects abnormality
BF	ON for BUS abnormality

■ Input block



Description	Function
PWR	ON when sensor power is turned ON OFF when short circuit protection is working
0 to 7	ON when each sensor input goes ON

VV5Q21S kit
(Serial transmission kit: EX240)



Dimensions

Formula L1 = 16n + 36.5, L2 = 16n + 186 (In the case of 1 pc. DI unit, 54 mm will be added for increasing every 1 pcs.) n: Station

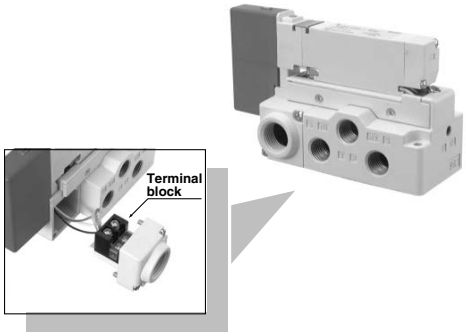
L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	68.5	84.5	100.5	116.5	132.5	148.5	164.5	180.5	196.5	212.5	228.5	244.5	260.5	276.5	292.5
L2	218	234	250	266	282	298	314	330	346	362	378	394	410	426	442

VQ2000 Only

Sub-plate Single Unit

Conforming to IP65 in standard specifications

Easy-to-use terminal block



How to Order

Valve + Sub-plate

VQ2 1 0 0 – 5 W – 02

Entry is the same as standard products.

Enclosure

Nil	Dust tight
W Note)	IP65 (Dust tight/Low jetproof type)

Note) Valves are IP65 specifications.

Thread type

Nil	Rc
N	NPT
T	NPTF
F	G

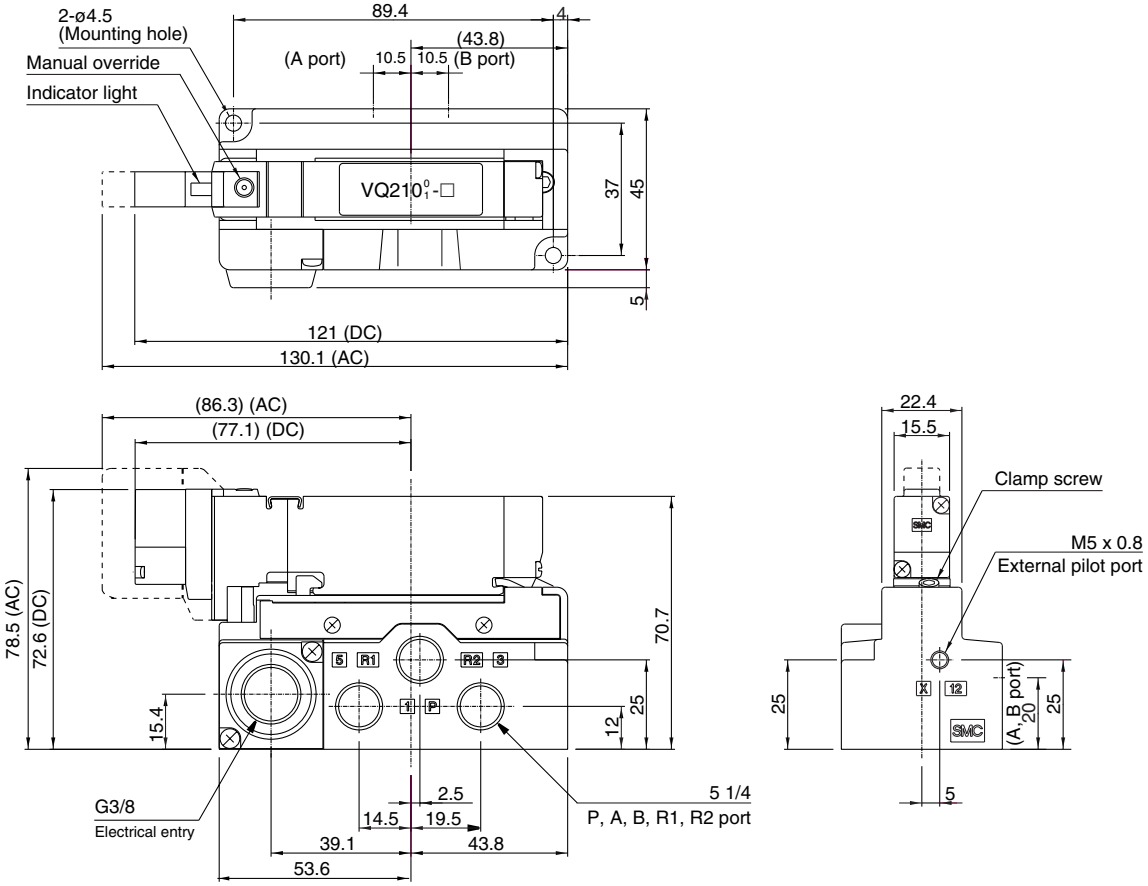
With and without sub-plate

Nil	Without sub-plate
02	With sub-plate (Port size: 1/4)

In the case of sub-plate alone

VQ2000 – PW – 02

Dimensions

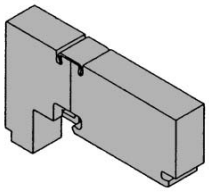


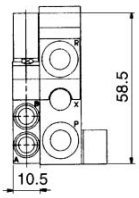
Manifold Option Parts for VQ1000

Blanking plate assembly
VVQ1000-10A-1

JIS Symbol

It is used by attaching on the manifold block for being prepared for removing a valve for maintenance reasons or planning to mount a spare valve, etc.

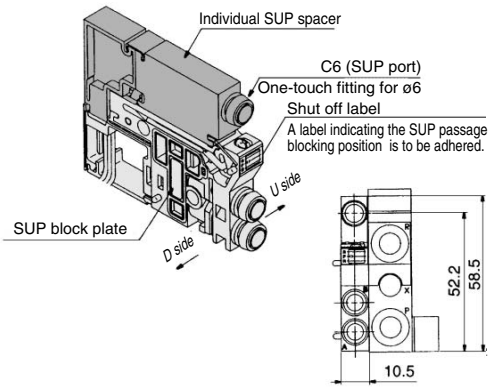


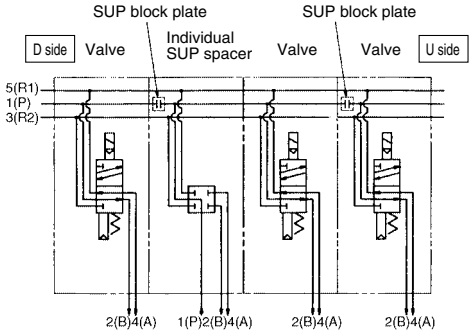


Individual SUP spacer
VVQ1000-P-1-C6

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.)
Block both sides of the station, for which the supply pressure from the individual SUP spacer is used, with SUP block plates. (Refer to the application ex.)

* Specify the spacer mounting position and SUP block plate position on the manifold specification sheet.
  The block plate are used in two places for one set. (Two SUP block plates for blocking SUP station are attached to the individual SUP spacer.)
* Electric wiring is connected to the position of the manifold station where the individual SUP spacer is mounted.

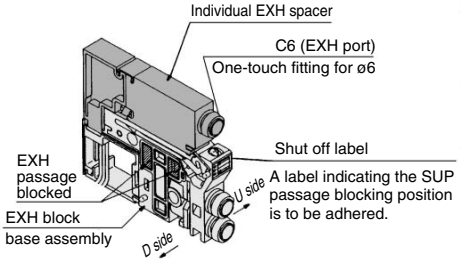


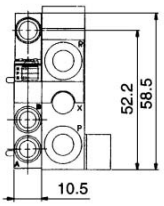


Individual EXH spacer
VVQ1000-R-1-C6

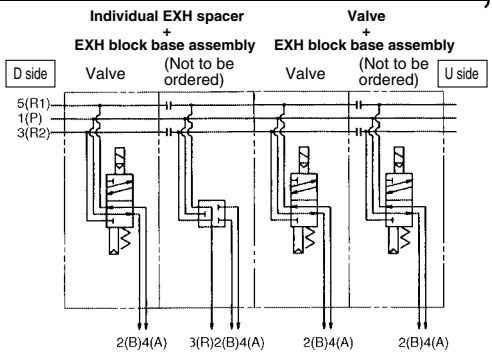
When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (One station space is occupied.)
Block both sides of the individual valve EXH station. (See example)

* Specify the mounting position, as well as the EXH block base or EXH block plate position on the manifold specification sheet. The block plate are used in two places for one set. (Two EXH block plates for blocking EXH station are attached to the individual EXH spacer.)
* An EXH block base assembly is used in the blocking position when ordering an EXH spacer incorporated with a manifold no. However, do not order an EXH block base assembly because it is attached to the spacer.
  When separately ordering an individual EXH spacer, separately order an EXH block base assembly because it is not attached to the spacer.
* Electric wiring is connected to the position of the manifold station where the individual EXH spacer is mounted.





Description/Model	Stations	1	2	3	4	5	6	7
Valve	Single	●		●	●			
	⋮							
Option	Individual EXH spacer VVQ1000-R-1-C6		●					
	EXH shut off position: Specify 2 places.	●		●				



SUP block plate
VVQ1000-16A

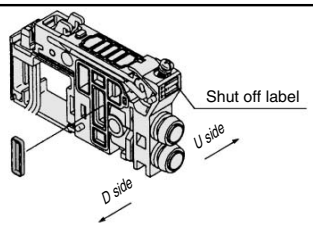
When different pressures, high and low, are supplied to one manifold, a SUP block plate is inserted between the stations under different pressures.

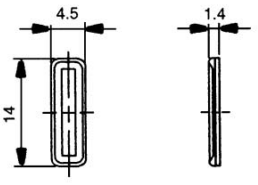
* Specify the number of stations on the manifold specification sheet.

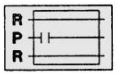
<Shut off label>

When using block plates for SUP passage, indication label for confirmation of the blocking position from outside is attached. (One label of each)

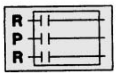
* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.







SUP passage block



SUP/EXH passage blocked

Blanking plate with connector
VVQ1000-1C-□□

Style of manifold

1	VV5Q11

Connector

Nil	Without connector
1	With connector/2-wire
2	With connector/4-wire

Lead wire length (mm)

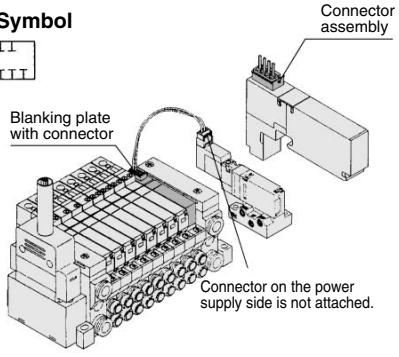
Nil	300	20	2000
6	600	25	2500
10	1000	30	3000
15	1500		

Blanking plate with a connector for individually outputting electricity to drive a single valve or equipment that are not on the manifold base.

* When "N" is suffixed to the nameplate, the plate will be different from a standard shape.

Note) Electric current should be 1A or less. (Including the mounted valves.)

JIS Symbol

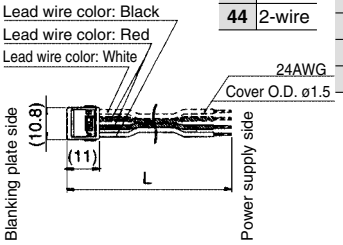


Connector assembly part no.
AXT661-43A-6

43	4-wire
44	2-wire

Lead wire length: L

Nil	300 mm
6	600 mm
10	1000 mm
20	2000 mm
30	3000 mm



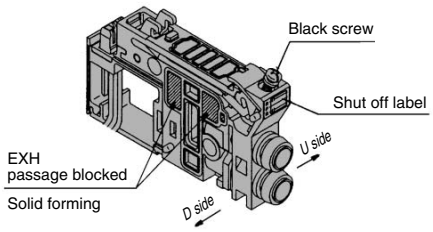
EXH block base assembly
VVQ1000-19A-F□P□L□ (C3, C4, C6, M5)

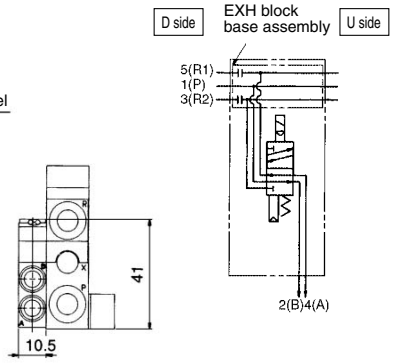
Manifold block assembly ●
Electrical entry

F1	For F kit (2 to 12 stations)/Double wiring
F2	For F kit (13 to 24 stations)/Double wiring
F3	For F kit (2 to 24 stations)/Single wiring
P1	For P, G, T, S kit (2 to 12 stations)/Double wiring
P2	For P, G, T, S kit (13 to 24 stations)/Double wiring
P3	For P, G, T, S kit (2 to 24 stations)/Single wiring
L0 *	L0 kit
L1 *	L1 kit ＊1 to 8 stations
L2 *	L2 kit

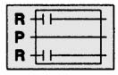
The manifold block assembly is used between stations for which exhaust is desired to be divided when valve exhaust affects other stations due to the circuit configuration. The EXH passage on the D-side is blocked in the EXH block base assembly. It is also used in combination with an individual EXH spacer for individual exhaust.

<Blocking indication label>
When blocking the EXH passage with an EXH block base assembly, indication label for confirmation of the blocking position from outside is attached. (One label for each)
＊ When ordering a EXH block base incorporated with the manifold no., a block indication label is attached to the manifold.

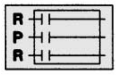




＊ Specify the number of stations on the manifold specification sheet.
＊ When ordering by using the manifold specification form, specify the EXH block base assembly no. by adding suffix "＊" below the manifold no.



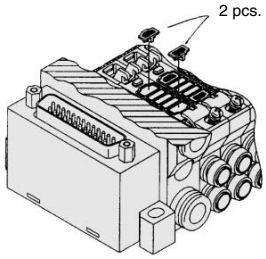
EXH passage blocked



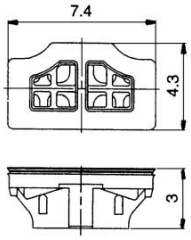
SUP/EXH passage blocked

Back pressure check valve assembly [-B]
VVQ1000-18A

It prevents cylinder malfunction caused by other valve exhaust. Insert it into R (EXH) port on the manifold side of a valve which is affected. It is effective when a single action cylinder is used or an exhaust center type solenoid valve is used.
Note) When a check valve for back pressure prevention is desired, and is to be installed only in certain manifold stations, write clearly the part no. and specify the number of stations by using the manifold specification sheet.



＊ When ordering assemblies incorporated with a manifold, add suffix "-B" to the manifold no.

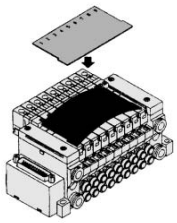


(Precautions)
1. The back pressure check valve assembly is assembly parts with a check valve structure. However, as slight air leakage is allowed for the back pressure, take care the exhaust air will not be throttled at the exhaust port.
2. When a back pressure check valve is mounted, the effective area of the valve will decrease, by about 20%.

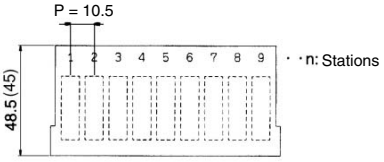
Name plate [-N]
VVQ1000-N/NC N-Station (1 to Max. stations)

N: Standard
NC: For mounting blanking plate with connector

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.
＊ When the blanking plate with connector is mounted, it automatically will be "VVQ1000-NC-n" with an option symbol [-N]



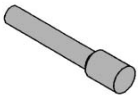
＊ When ordering assemblies incorporated with a manifold, add suffix "-N" to the manifold no.

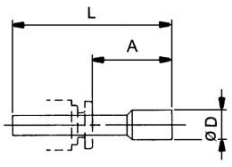


Note) ( ): For VVQ1000-NC-n

Blanking plug (For One-touch fittings)
KQ2P-23/04/06/08

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.



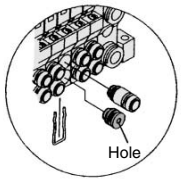


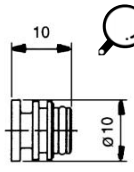
Dimensions

Applicable fittings size ød	Model	A	L	D
3.2	**KQ2P-23**	16	31.5	3.2
4	**KQ2P-04**	16	32	6
6	**KQ2P-06**	18	35	8
8	**KQ2P-08**	20.5	39	10

Port plug
VVQ0000-58A

The plug is used to block the cylinder port when using a 4 port valve as a 3 port valve.

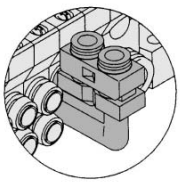


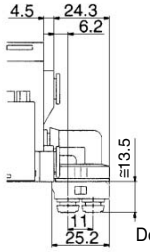


＊ When ordering a plug incorporated with a manifold, indicate "CM" for the port size in the manifold no., as well as, the mounting position and number of stations and cylinder port mounting positions, A and B, on the manifold specification sheet.
＊ Lightly screw an M3 screw in the port plug hole and pull it for removal.

Elbow fitting assembly
VVQ1000-F-L (C3, C4, C6, M5)

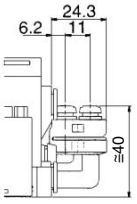
It is used for piping that extends upward or downward from the manifold.
When installing it in part of the manifold stations, specify the assembly no. and the mounting position and number of stations by means of the manifold specification sheet.
＊ When mounting elbow fittings assembly on the edge of manifold station and a silencer on EXH port, select a silencer, AN203-KM8.
Silencer (AN200-KB8) is interfered with fittings.





Downward

＊ When ordering assemblies incorporated with a manifold, indicate "L□" or "B□" for the manifold port size. (When installed in all stations.)

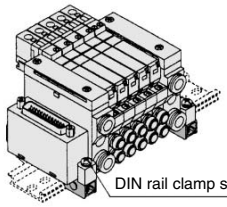


Upward

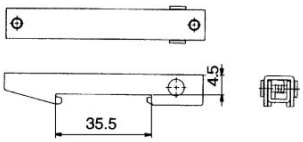
Manifold Option Parts for VQ1000

DIN rail mounting bracket
VVQ1000-57A

It is used for mounting a manifold on a DIN rail. The DIN rail mounted bracket is fixed to the manifold end plate. (The specification is the same as that for the option "-D".)
1 set of DIN rail mounting bracket is used for 1 manifold (2 DIN rail mounting brackets).



∗ When ordering assemblies incorporated with a manifold, add suffix "D" to the manifold no.

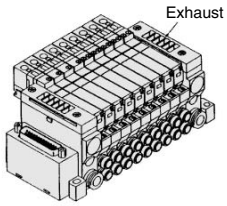


Mounting screws are attached

Built-in silencer, Direct exhaust [-S]

This is a type with an exhaust port a top the manifold end plate. The built-in silencer exhibits an excellent noise suppression effect. (Silencing effect: 30 dB)

Note) A large quantity of drainage generated in the air source results in exhaust of air together with drainage. For maintenance, refer to page 2-4-176.

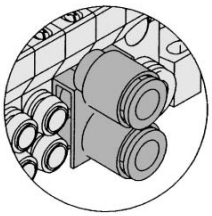


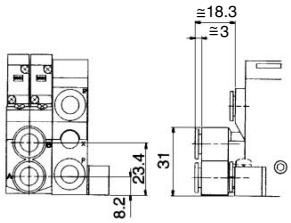
∗ When ordering assemblies incorporated with a manifold, add suffix "S" to the manifold no.

2 stations matching fitting assembly
VVQ1000-52A-C8

For driving a cylinder with a large bore, valves for two stations are operated to double the flow rate. This assembly for the cylinder port is used in that case. The assembly is equipped with One-touch fittings for a ø8 bore.

∗ The bore for the manifold no. is "CM". Clearly indicate the 2 station matching fitting assembly no., and specify the number of stations and positions by means of the manifold specifications.
∗ In 2 station matching fitting assembly, a special clip which is combined in one-piece of 2 stations is attached as a holding clip.

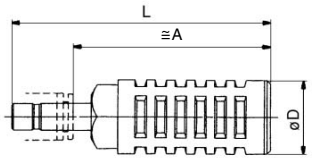




Silencer (For EXH port)

This silencer is to be inserted into the EXH port (One-touch fittings) of the common exhaust type

∗ When mounting elbow fittings assembly (VVQ1000-F-L□) on the edge of manifold station, select a silencer, AN203-KM8.
Silencer (AN200-KM8) is interfered with fittings.



Dimensions

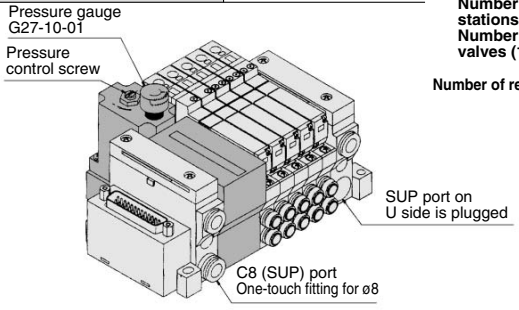
Series	Applicable fittings size ød	Model	A	L	D	Effective area (mm²)	Noise reduction (dB)
VQ1000	8	AN200-KM8	59	78	22	20	30
		AN203-KM8	32	51	16	14	25 ∗

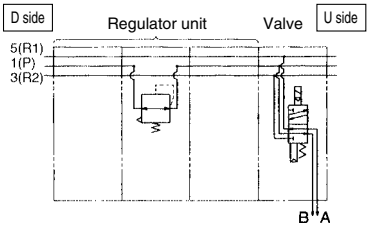
Regulator unit
VVQ1000-AR-1

The regulator controls the SUP air pressure in a manifold. Supply air from D side SUP port is regulated. SUP port on U side is plugged.

Specifications

Maximum operating pressure	0.8 MPa
Set pressure range	0.05 to 0.7 MPa
Ambient and fluid temp.	5 to 50°C
Fluid	Air
Cracking pressure	0.02 MPa
Structure	Relieving type





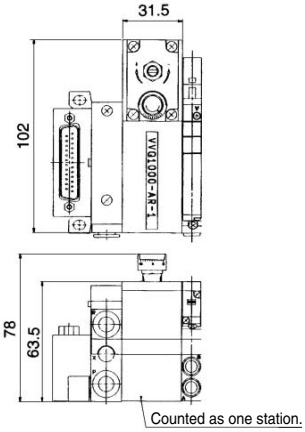
• How to Order

Indicate an option symbol "-G"∗ for the manifold no. and be sure to specify the mounting position and number of stations by means of the manifold specification form. One unit is counted as one station and occupies a space for three stations, therefore, pay attention to the manifold size.
The regulator valve unit, to which no wire is connected, valves can be mounted up to the standard max. number of stations of each kit.

How to order manifold
VV5Q11-14C6FUO-DG2

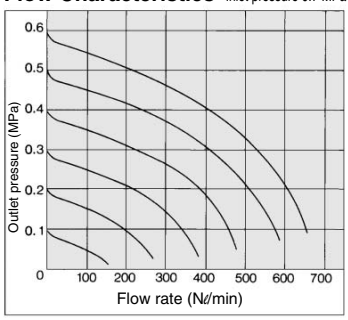
Number of manifold stations
Number of mounted valves (12)
+
Number of regulator units (2)

Number of regulator units (2) (Max. 3 units)
With regulator unit
Others, option symbols: to be indicated alphabetically.



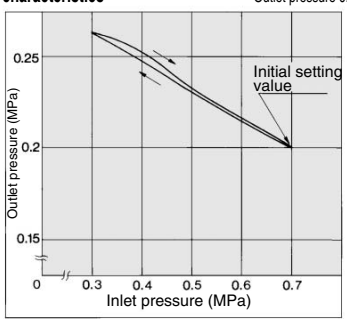
Flow Characteristics

Conditions: Inlet pressure 0.7 MPa



Pressure characteristics

Conditions (Initial setting) Inlet pressure 0.7 MPa
Outlet pressure 0.2 MPa



⚠ Caution

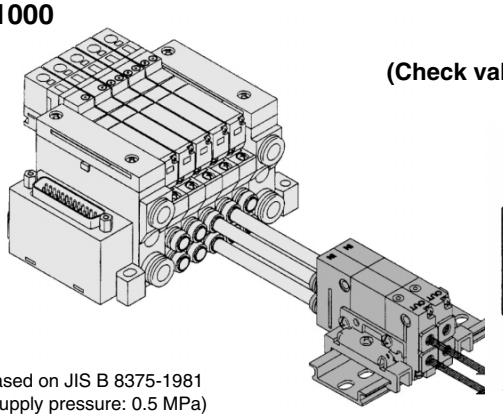
• Pressure setting
Check the supply pressure and then turn the pressure control screw to set the secondary pressure. Turning the screw clockwise will increase the secondary pressure while turning it counterclockwise decrease the pressure. (Set the pressure by turning the screw in the increase direction.)

• Installation
Since some level of the actuator's operational frequency may lead to a sharp pressure change, pay attention to the pressure gauge durability.

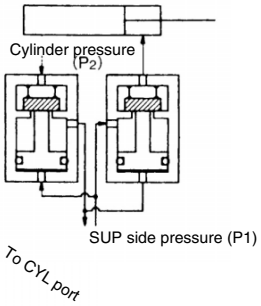
Double check block (Separated type): For VQ1000

VQ1000-FPG-□□

It is used on the outlet side piping to keep the cylinder in the intermediate position for a long time. Combining the double check block with a built-in pilot type double check valve and a 3 position exhaust center solenoid valve will enable the cylinder to stop in the middle or maintain its position for a long time.
The combination with a 2 position single/double solenoid valve will permit this block to be used for preventing the dropping at the cylinder stroke end when the SUP residual pressure is released.



(Check valve operation principle)



Specifications

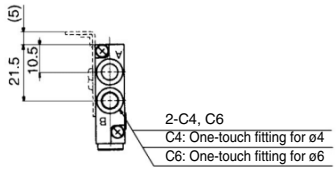
Max. operating pressure	0.8 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temp.	–5 to 50°C
Flow characteristics: C	0.60 dm³/(s·bar)
Max. operating frequency	180 CPM

Note) Based on JIS B 8375-1981
(Supply pressure: 0.5 MPa)

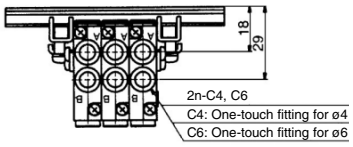
VVQ1000-FPG-02 1 set
∗ VQ1000-FPG-C6M5-D 2 pcs.

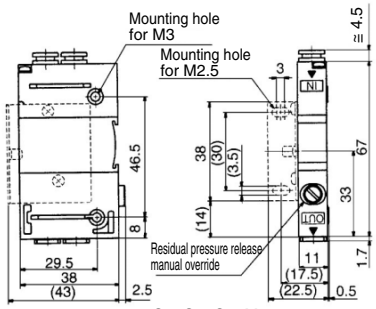
Dimensions

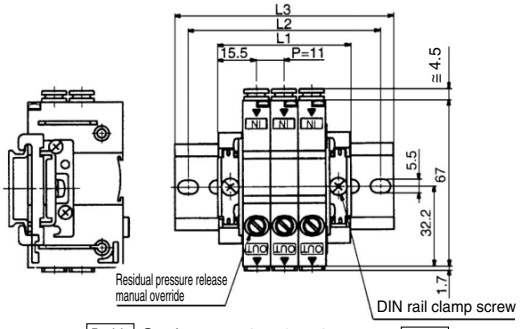
Single unit



Manifold



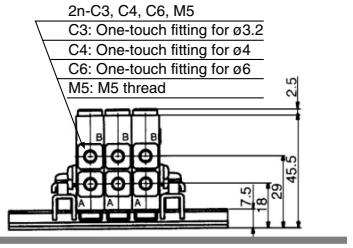




Dimensions Formula L1 = 11n + 20 n: Station (Maximum 24)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	31	42	53	64	75	86	97	108	119	130	141	152
L2	50	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175
L3	60.5	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5

L \ n	13	14	15	16	17	18	19	20	21	22	23	24
L1	163	174	185	196	207	218	229	240	251	262	273	284
L2	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300
L3	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5



How to Order

Double check block

VQ1000-FPG- C4 M5 F

IN side port size

C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6

OUT side port size

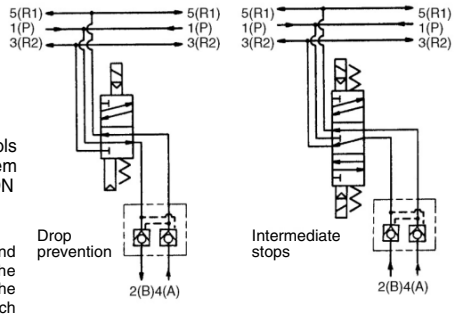
M5	M5 thread
C3	One-touch fitting for ø3.2
C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

Option

Nil	None
F	With bracket
D	DIN rail mounting style (For manifold)
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically. Example) -DN

2 position **<Example>** **3 position exhaust center**



Manifold

VVQ1000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Example>
VVQ1000-FPG-06··6 types of manifold
∗VQ1000-FPG-C4M5-D, 3 sets
∗VQ1000-FPG-C6M5-D, 3 sets
} Double Check block

Bracket Assembly

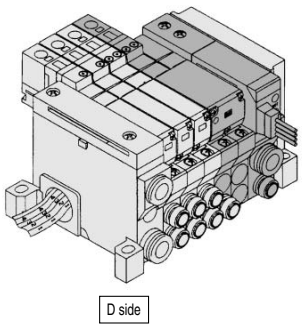
Part no.	Tightening torque
VQ1000-FPG-FB	0.22 to 0.25 N·m

⚠ Caution

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap. Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- Combining double check block with 3 position closed center or pressure center solenoid valve will not work.
- M5 fitting assembly is attached, not incorporated into the double check block. After screwing in the M5 fittings, mount the assembly on the double check block. {Tightening torque: 0.8 to 1.2 N·m}
- If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

Manifold Option/Vacuum Ejector Unit: VQ1000

A vacuum ejector unit can be mounted on the manifold base for a solenoid valve. Instead of mounting the valve and vacuum ejector unit separately, this option reduces piping, wiring and creates additional space savings.



Note 1) SUP and EXH ports on the vacuum ejector unit manifold base are arranged on D side alone. The end plate on the U side is the same as that used in the L kit.
Note 2) Individual piping is provided for the supply and exhaust ports of the vacuum ejector unit.
Note 3) The manifold with an vacuum ejector unit type is mounted from the U side.
Note 4) One vacuum ejector unit corresponds to one station.
* Specify the position of stations on the manifold specification sheet.

Specifications

Unit no.	VVQ1000-J□-□□□-A	VVQ1000-J□-□□□-B
Nozzle diameter (mm)	0.7	1.0
Max. suction flow rate N (ℓ/min)	11	20
Max. vacuum pressure	–630 mmHg	
Max. operating pressure	0.8 MPa	
Standard supply pressure	0.5 MPa	
Operating temperature	5 to 50°C	

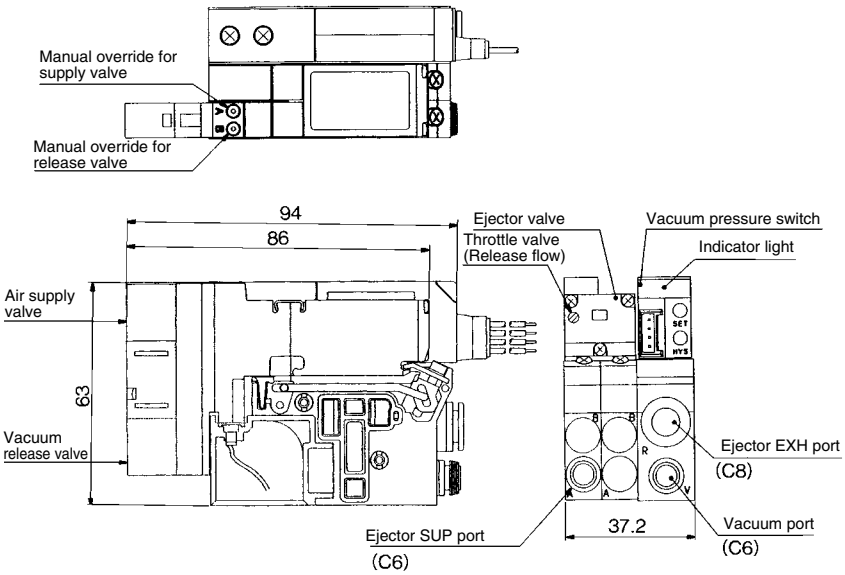
Maximum Number of Ejector Units

(Max. number of ejector units is subject to the number of valve stations.)

Max. number of ejector units	Max. number of mounted valves		
	F, P, T kit	S, G, J kit	L kit
1	11(20)	7(14)	7
2	10(16)	6(12)	6
3	9(12)	5(10)	5
4	8(8)	4(8)	—
5	4(4)	3(4)	—

Note) The max. number of mounted valves applies to double wiring. Parenthesized numbers apply to single wiring. Please contact SMC for conditions other than the above or mixed wiring.

Dimensions



How to Order

VV5Q11-05C6FUO-J P 1 S

Vacuum switch

Nil	None
P	With

Ejection unit

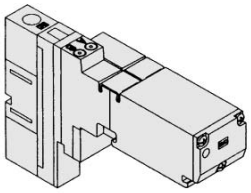
1 to 5

Others, option symbols: to be indicated alphabetically.

Example) VV5Q11-05C6FUO-JP1····1 set–Manifold part no.
*VQ1100-5 ·····2 sets–Valve part no. (Stations 1 to 2)
*VQ1200-5 ·····2 sets–Valve part no. (Stations 3 to 4)
*VVQ1000-J1-5-A ··· 1 set–Ejector valve part no.
*ZSE1-00-15-CL ····· 1 set–Vacuum switch part no.

Note 1) Count one ejector unit as one manifold station.
Note 2) The ejector unit is mounted next to the U-side end plate.
Note 3) The U-side end plate is used exclusively for ejector units. (Without P and R port)
Note 4) The dimension of manifold with an ejector unit is different from the standard dimension. See the formula for calculating the dimensions for each kit.

How to Order Vacuum Ejector Valves



VVQ1000 − J [1] − [5] [H] [C] − [A]

Manifold

1	Plug-in unit

Coil voltage

1	100 VAC (50/60 Hz)	5	24 VDC
2	200 VAC (50/60 Hz)	6	12 VDC
3	110 VAC (50/60 Hz)	9	Others
4	220 VAC (50/60 Hz)		

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0W) ○	○ (1)
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5W) ○	—
N	Negative COM	○	—

Specifications

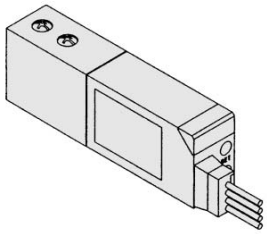
Symbol	Nozzle diameter	Vacuum release valve
A	ø0.7	With
B	ø1.0	

Manual override

Nil	Non-locking push type
B	Locking type (Tool required)
C	Locking type (Manual)

Note 1) For power consumption of AC type, refer to page 2-4-129.
Note 2) When two or more symbols are specified, indicate them alphabetically.

How to Order Vacuum Pressure Switches



ZSE1 − 00 − [15] − [CL]

Switch/Voltage (Solid state: 12 to 24 VDC)

14	NPN/1 setting, 3 revolution adjustment
15	NPN/1 setting, 200° adjustment
16	NPN/2 setting, 3 revolution adjustment
17	NPN/2 setting, 200° adjustment
18	NPN/1 setting, 3 revolution adjustment, analog
19	NPN/1 setting, 200° adjustment, analog

Wiring specifications

Nil	Grommet type, Lead wire length 0.6 m
L	Grommet type, Lead wire length 3 m
C	Connector type, Lead wire length 0.6 m
CL	Connector type, Lead wire length 3 m
CN	Without connector Note)

Note) When ordering the switch with 5 m lead wire length, order separately the switch without connector and the connector. (Refer to below.) Besides, as for details, refer to the Vacuum Equipment catalog.

How to order connectors
- Without lead wire (Connector 1 pc., Socket 4 pcs.) ····· ZS-20-A
- With lead wire ····· ZS-20-5A-50

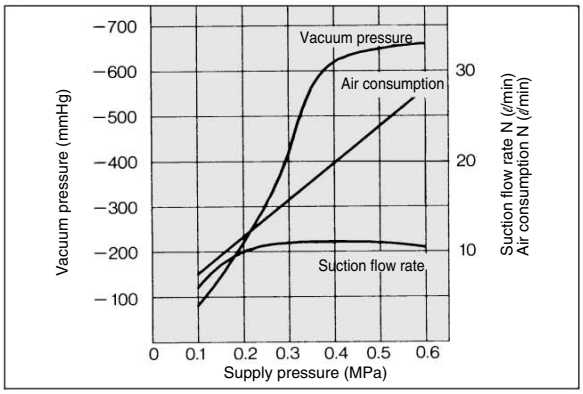
Lead wire length

Nil	0.6 m
30	3 m
50	5 m

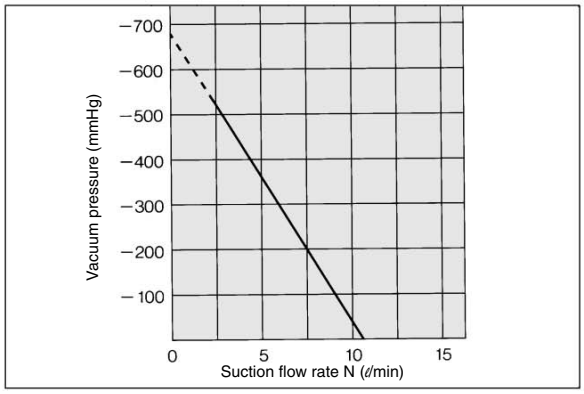
(The flow characteristics are for the supply pressure of 0.5 MPa.)

Flow/Exhaust Characteristics of Ejector Unit

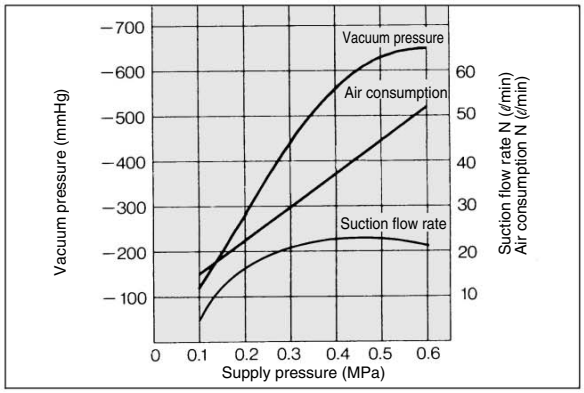
Nozzle Diameter ø0.7
Exhaust Characteristics



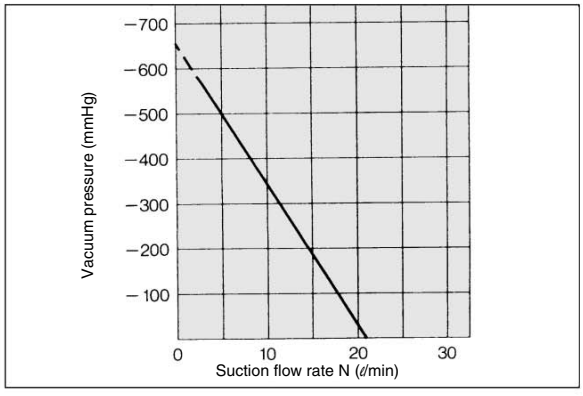
Flow Characteristics



Nozzle Diameter ø1.0



Flow Characteristics

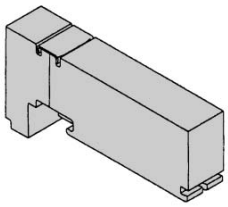


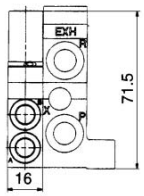
Manifold Option Parts for VQ2000

Blanking plate assembly
VVQ2000-10A-1

It is used by attaching on the manifold block for being prepared for removing a valve for maintenance reasons or planning to mount a spare valve, etc.

JIS Symbol

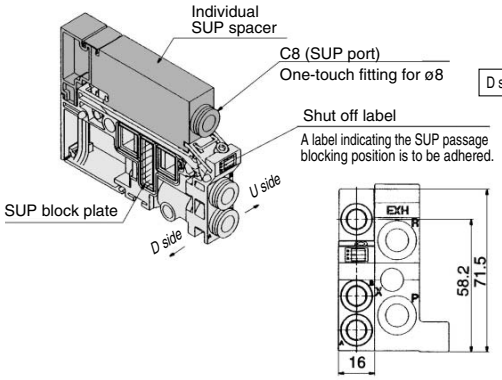


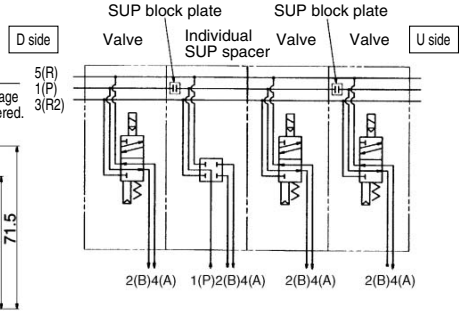


Individual SUP spacer
VVQ2000-P-1-C8

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.)
Block both sides of the station, for which the supply pressure from the individual SUP spacer is used, with SUP block plates. (Refer to the application ex.)

* Specify the spacer mounting position and SUP block plate position on the manifold specification sheet. The block plate are used in two places for one set. (Two SUP block plates for blocking SUP station are attached to the individual SUP spacer.)
* Electric wiring is connected to the position of the manifold station where the individual SUP spacer is mounted.

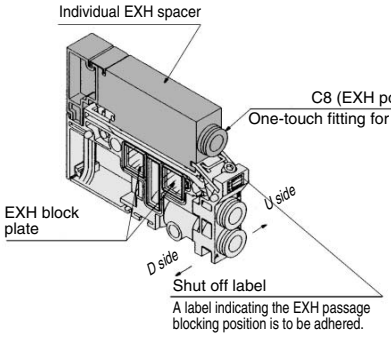


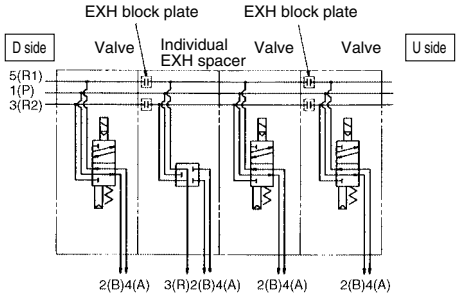


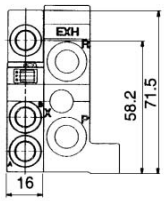
Individual EXH spacer
VVQ2000-R-1-C8

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (One station space is occupied.)
Block both sides of the individual valve EXH station. (See example)

* Specify the mounting position, as well as the EXH block base or EXH block plate position on the manifold specification sheet. The block plates are used in two places for one set. (Two EXH block plates for blocking EXH station are attached to the individual EXH spacer.)
* Electric wiring is connected to the position of the manifold station where the individual EXH spacer is mounted.





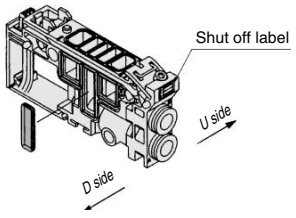


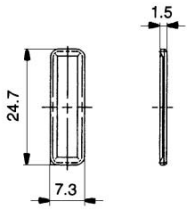
SUP block plate
VVQ2000-16A

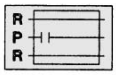
When different pressures, high and low, are supplied to one manifold, a SUP block plate is inserted between the stations under different pressures.

* Specify the number of stations on the manifold specification sheet.

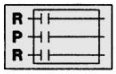
<Blocking indication label>
When using block plates for SUP passage, indication label for confirmation of the blocking position from outside is attached. (One label of each)







SUP passage blocked



SUP/EXH passage blocked

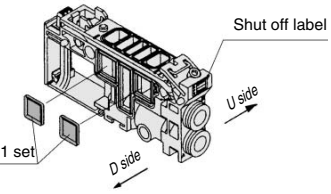
* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.

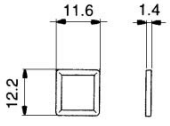
EXH block plate
VVQ2000-19A

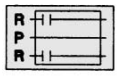
The EXH block plate is used between stations for which exhaust is desired to be divided when valve exhaust affects other stations due to the circuit configuration. It is also used in combination with an individual EXH spacer for individual exhaust.

* Specify the number of stations on the manifold specification sheet.

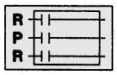
<Blocking indication label>
When blocking the EXH passage with an EXH block plate, an indication label for confirmation of the blocking position from outside is attached. (One label for each)







EXH passage blocked



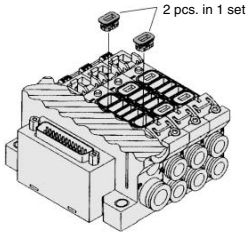
SUP/EXH passage blocked

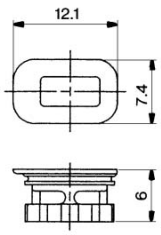
* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.

Back pressure check valve assembly [-B]
VVQ2000-18A

It prevents cylinder malfunction caused by other valve exhaust. Insert it into R (EXH) port on the manifold side of a valve which is affected. It is effective when a single action cylinder is used or an exhaust center type solenoid valve is used.

Note) When a check valve for back pressure prevention is desired, and is to be installed only in certain manifold stations, write clearly the part no. and specify the number of stations by using the manifold specification sheet.





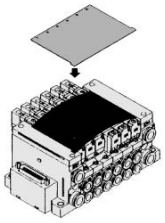
∗ When ordering assemblies incorporated with a manifold, add suffix "-B" to the manifold no.

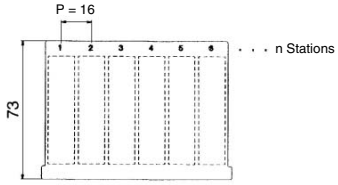
(Precautions)

1. The back pressure check valve assembly is assembly parts with a check valve structure. However, as slight air leakage is allowed for the back pressure, take care the exhaust air will not be throttled at the exhaust port.
2. When a back pressure check valve is mounted, the effective area of the valve will decrease, by about 20%.

Name plate [-N]
VVQ2000-N-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.
• Suffix "N" to the manifold part no.

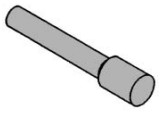


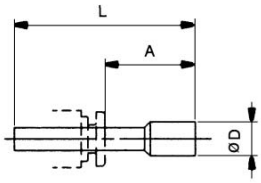


∗ When ordering assemblies incorporated with a manifold, add suffix "-N" to the manifold no.

Blanking plug (For One-touch fittings)
KQ2P-$^{04}_{06}_{08}$

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.



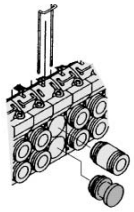


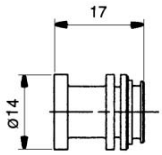
Dimensions

Applicable fittings size ød	Model	A	L	D
4	**KQ2P-04**	16	32	6
6	**KQ2P-06**	18	35	8
8	**KQ2P-08**	20.5	39	10

Port plug
VVQ1000-58A

The plug is used to block the cylinder port when using a 4 port valve as a 3 port valve.

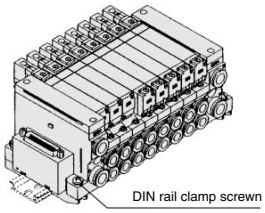


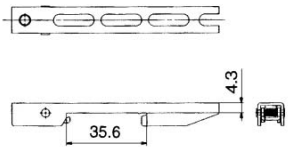


∗ When ordering a plug incorporated with a manifold, indicate "CM" for the port size in the manifold no., as well as, the mounting position and number of stations and cylinder port mounting positions, A and B, in the manifold specification sheet.

DIN rail mounting bracket
VVQ2000-57A

It is used for mounting a manifold on a DIN rail. The DIN rail mounted bracket is fixed to the manifold end plate. (The specification is the same as that for the option "-D".) 1 set of DIN rail mounting bracket is used for 1 manifold (2 DIN rail mounting brackets).



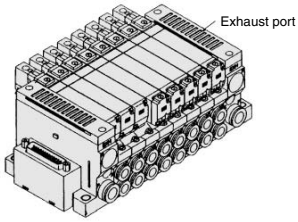


∗ When ordering assemblies incorporated with a manifold, add suffix "-D" to the manifold no.

Built-in silencer, Direct exhaust [-S]

This is a type with an exhaust port atop the manifold end plate. The built-in silencer exhibits an excellent noise suppression effect. (Silencing effect: 30 dB)

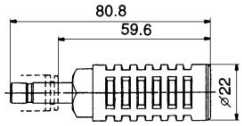
Note) A large quantity of drainage generated in the air source results in exhaust of air together with drainage.
● For maintenance, refer to page 2-4-176.



∗ When ordering assemblies incorporated with a manifold, add suffix "-S" to the manifold no.

Silencer (For EXH port)

This silencer is to be inserted into the EXH port (One-touch fittings) of the common exhaust type.

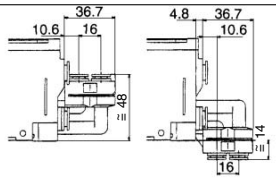


Dimensions

Series	Applicable fittings size ød	Model	A	L	D	Effective area (mm²) (Cv factor)	Noise reduction (dB)
VQ2000	10	**AN200-KM10**	59.6	80.8	22	26 (1.4)	30

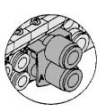
Elbow fitting assembly
VVQ2000-F-L (C4, C6, C8)

It is used for piping that extends upward or downward from the manifold.
When installing it in part of the manifold stations, specify the assembly no. and the mounting position and number of stations by using the manifold specification sheet.

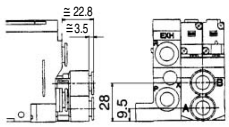


2 stations matching fitting assembly
VVQ2000-52A-C10

For driving a cylinder with a large bore, valves for two stations are operated to double the flow rate. This assembly for the cylinder port is used in that case.
This assembly for the cylinder port is used in that case.



∗ The bore for the manifold no. is "CM". Clearly indicate the 2 station matching fitting assembly no., and specify the number of stations and positions in the manifold specification sheet.



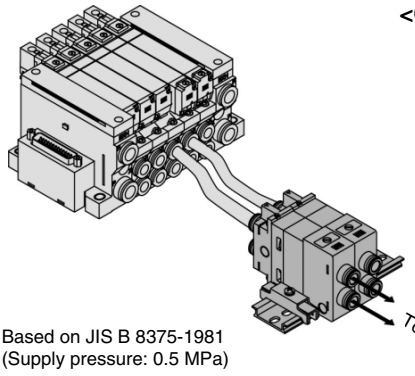
Manifold Option

Double check block (Separated type)
VQ2000-FPG-□□-□

It is used on the outlet side piping to keep the cylinder in the intermediate position for a long time. Combining the double check block with a built-in pilot type double check valve and a 3 position exhaust center solenoid valve will enable the cylinder to stop in the middle or maintain its position for a long time.
The combination with a 2 position single/double solenoid valve will prevent the dropping at the cylinder stroke end when the SUP residual pressure is released.

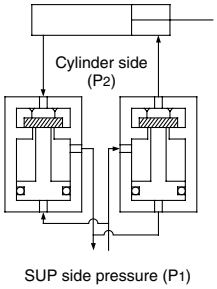
Specifications

Max. operating pressure	0.8 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temp.	–5 to 50°C
Flow characteristics: C	–3.0 dm³/(s·bar)
Max. operating frequency	180 c.p.m



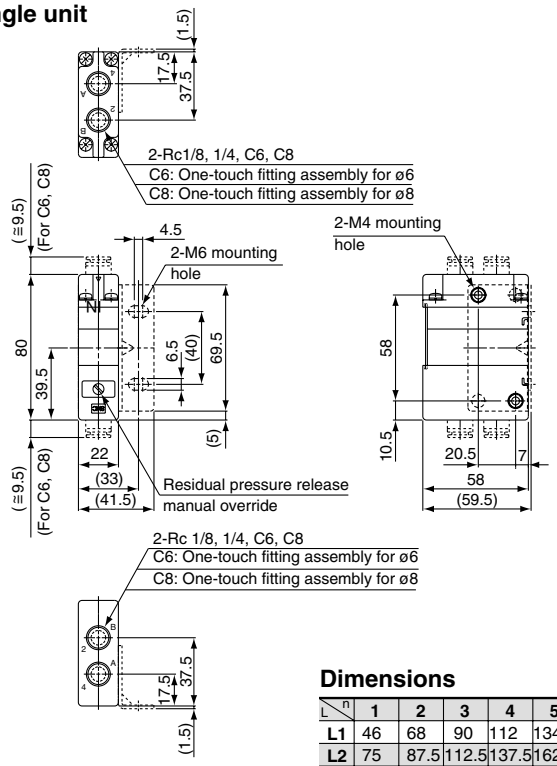
Note) Based on JIS B 8375-1981
(Supply pressure: 0.5 MPa)

<Check valve operation principle>

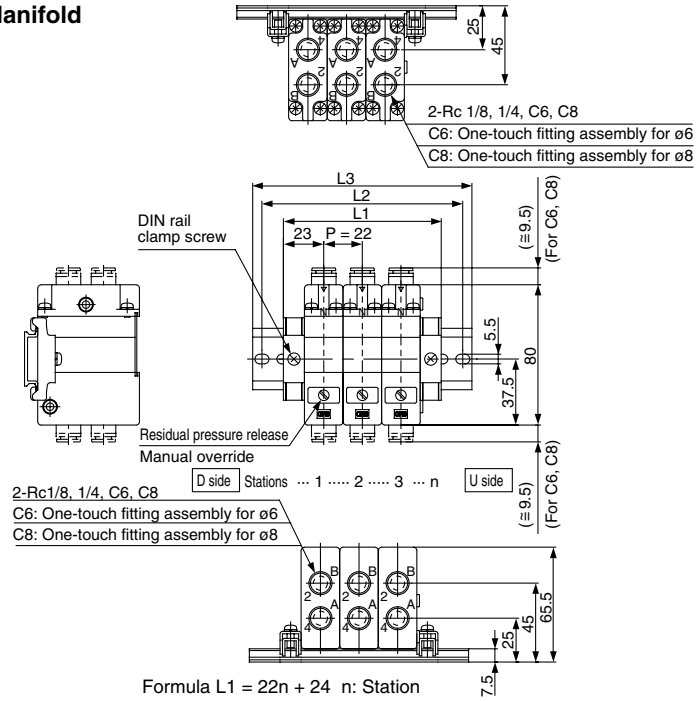


Dimensions

Single unit



Manifold



Dimensions

Formula L1 = 22n + 24 n: Station

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46	68	90	112	134	156	178	200	222	244	266	288	310	332	354	376
L2	75	87.5	112.5	137.5	162.5	175	200	225	250	262.5	287.5	312.5	337.5	362.5	375	400
L3	85.5	98	123	148	173	185.5	210.5	235.5	260.5	273	298	323	348	373	385.5	410.5

How to Order

Double check block

VQ2000-FPG- 01 01 F

IN side port size

01	Rc 1/8
02	Rc 1/4
C6	One-touch fitting for ø6
C8	One-touch fitting for ø8

OUT side port size

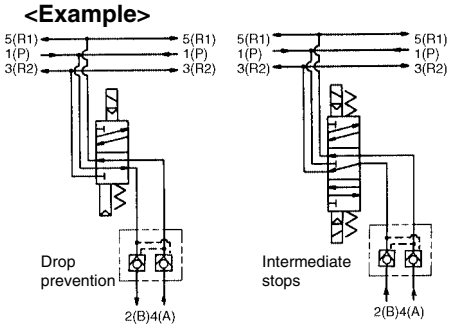
01	Rc 1/8
02	Rc 1/4
C6	One-touch fitting for ø6
C8	One-touch fitting for ø8

Option

Nil	None
D	DIN rail mounting style (For manifold)
F	With bracket
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically.

<Example>



Manifold

VVQ2000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Ordering Example>
VVQ2000-FPG-06····6 stations manifold
∗VQ2000-FPG-C6C6-D: 3 sets
∗VQ2000-FPG-C8C8-D: 3 sets
} Double check block

Bracket Assembly

Part no.	Tightening torque
VQ2000-FPG-FB	0.8 to 1.0 N·m

⚠ Caution

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap.
  Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- Combining double check block with 3 position closed center or pressure center solenoid valve will not work.
- M5 fitting assembly is attached, not incorporated into the double check block. After screwing in the M5 fittings, mount the assembly on the double check block.
  [Tightening torque: 0.8 to 1.2 N·m]

Connection threads	Proper tightening torque (N·m)
Rc 1/8	7 to 9
Rc 1/4	12 to 14

- If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

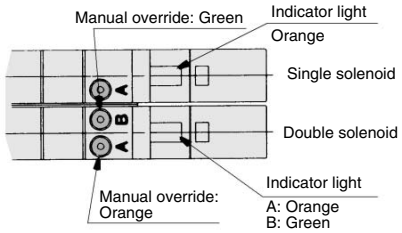
⚠ Precautions 1

Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

Light/Surge Voltage Suppressor

⚠ Caution

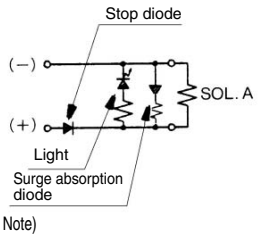
The lighting positions are concentrated on one side for both single solenoid type and double solenoid type. In the double solenoid type, A side and B side energization are indicated by two colors which match the colors of the manual overrides.



(DWG shows a VQ1000 case.)

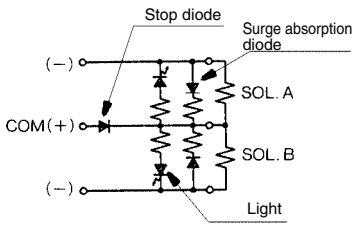
DC circuit diagram

Single solenoid



Note)
A side energization: A light (orange) illuminates.
B side energization: B light (green) illuminates.

Double solenoid



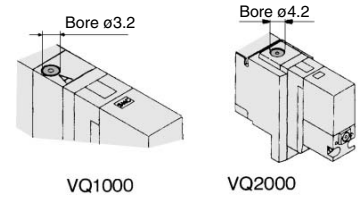
With wrong wiring preventing ability (stop dieode).
Equipped with a surge absorption
(surge absorption diode) mechanism.

Manual Override

⚠ Warning

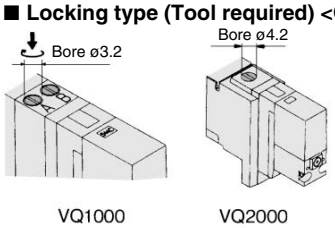
Without an electric signal for the solenoid valve the manual override is used for switching the main valve.
Push type is standard. (Tool required)
Option: Locking type (Tool required/Manual)

■ Push type (Tool required)



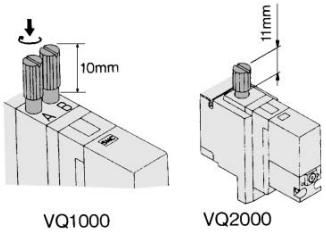
Push down on the manual override button with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

■ Locking type (Tool required) <Option>



Push down on the manual override button with a small screwdriver or with your fingers until it stops. Turn clockwise by 90° to lock it. Turn it counterclockwise to release it.

■ Locking type (Manual) <Option>



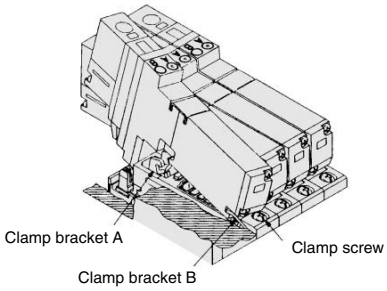
Push down on the manual override button with a small screwdriver or with your fingers until it stops. Turn clockwise by 90° to lock it. Turn it counterclockwise to release it.

⚠ Caution

Do not apply excessive torque when turning the locking type manual override.
(0.1 N·m or less)

How to Mount/Remove Solenoid Valve

⚠ Caution



Removing

1. Loosen the clamp screw until it turns freely. (The screw is captive.)
2. Lift the coil side of the valve body while pressing down slightly on the screw head and remove it from the clamp bracket B. When the screw head cannot be pressed easily, gently press the area near the manual override of the valve.

Mounting

1. Press down on the clamp screw. → Clamp bracket A opens. Diagonally insert the hook on the valve end plate side into clamp B.
2. Press the valve body downward. (When the screw is released, it will be locked by clamp bracket A.)
3. Tighten the clamp screw. (Proper tightening torque: VQ1000, 0.25 to 0.35 N·m; VQ2000, 0.5 to 0.7 N·m.)

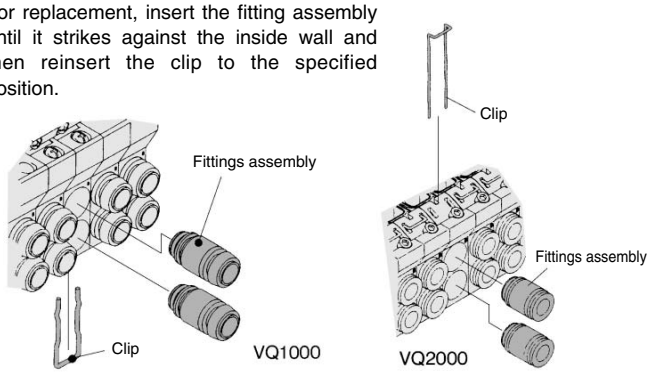
⚠ Caution

Dust on the sealing surface of the gasket or solenoid valve can cause air leakage.

Replacement of Cylinder Port Fittings

⚠ Caution

The cylinder port fittings are a cassette for easy replacement.
The fittings are blocked by a clip inserted from the top of manifold. Remove the clip with a screwdriver to remove fittings.
For replacement, insert the fitting assembly until it strikes against the inside wall and then reinsert the clip to the specified position.



Applicable tubing O.D.	Fitting assembly part no.	
	VQ1000	**VQ2000**
Applicable tubing ø3.2	VVQ1000-50A-C3	—
Applicable tubing ø4	VVQ1000-50A-C4	VVQ1000-51A-C4
Applicable tubing ø6	VVQ1000-50A-C6	VVQ1000-51A-C6
Applicable tubing ø8	—	VVQ1000-51A-C8
M5	VVQ1000-50A-M5	—

∗ Refer to "Option" on pages 2-4-172 to 2-4-173 for other types of fittings.

⚠ Caution

1. Use caution that O-rings must be free from scratches and dust. Otherwise, air leakage may result.
2. After screwing in the fittings, mount the M5 fitting assembly on the manifold base. {Tightening torque: 0.8 to 1.2 N·m}
3. Purchasing order is available in units of 10 pieces.

⚠ Precautions 2

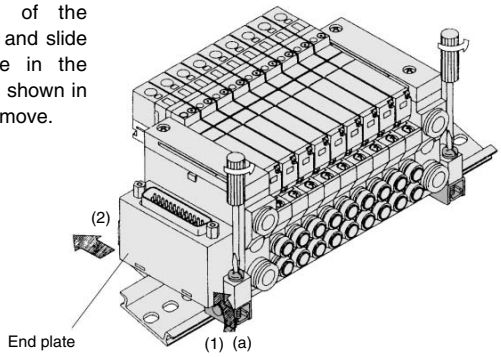
Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

Mounting/Removing from the DIN Rail

⚠ Caution

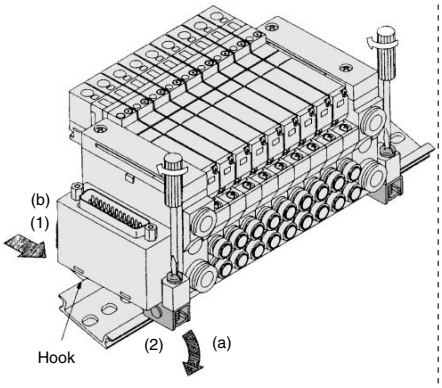
Removing

1. Loosen the clamp screw on side (a) of the end plate on both sides.
2. Lift side (a) of the manifold base and slide the end plate in the direction of (2) shown in the figure to remove.



Mounting

1. Hook side (b) of the manifold base on the DIN rail.
2. Press down side (a) and mount the end plate on the DIN rail.
   Tighten the clamp screw on side (a) of the end plate.
   The proper tightening torque for screws is 0.4 to 0.6 N·m.



Enclosure IP65

⚠ Caution

Wires, cables, connectors, etc. used for models conforming to IP65 should also have enclosures equivalent to or of stricter than IP65.

Built-in Silencer Replacement Element

⚠ Caution

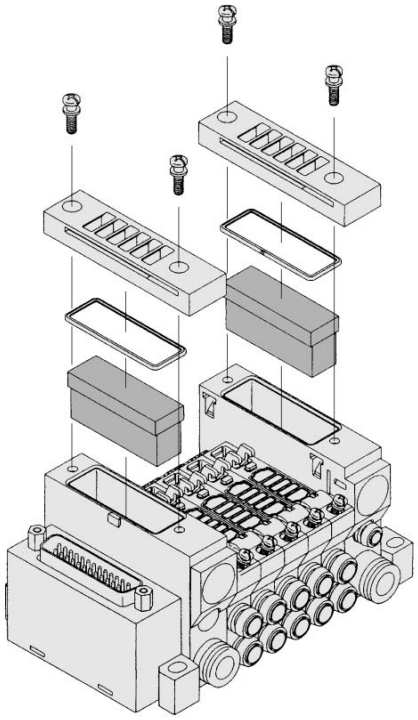
A silencer element is incorporated in the end plate on both sides of the A dirty and choked element may reduce cylinder speed or cause malfunction. Clean or replace the dirty element.

Element Part No.

Type	Element part no.	
	VQ1000	**VQ2000**
Built-in silencer, direct exhaust	VVQ1000-82A-1	VVQ2000-82A-1

∗ The minimum order quantity is 10 pcs.

Remove the cover from the top of the end plate and remove the old element with a screwdriver, etc.



How to Calculate the Flow Rate

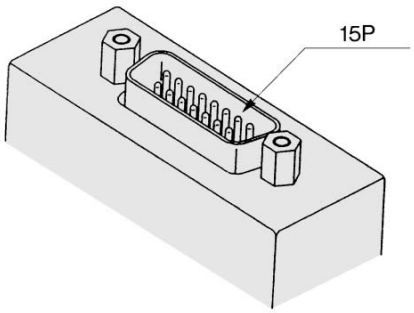
For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

Option

Different Number of Connector Pins

F and P kits with the following number of pins are available besides the standard number (F = 25; P = 26). Select the desired number of pins and cable length from the cable assembly list.
Place an order for the cable assembly separately.

F kit (D-sub connector) 15 pins



How to order manifold

VV5Q11 — 06 C6 F SA — N

- 06: Stations
- C6: Cylinder port
- SA: Kit/Electrical entry
- N: Option

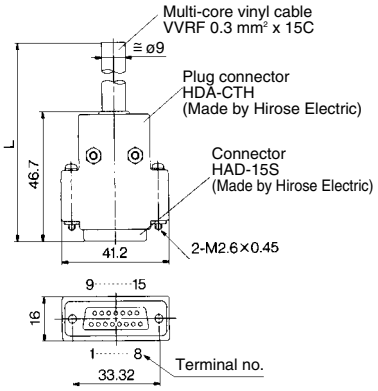
How to Order
D-sub connector, 15 pins
Connector location–Side (horizontal)
Without cable

Kit/Electrical entry

Pins \ Location	Top entry		Side entry	
15P (Max. 7 stations)	Kit F	UA	Kit F	SA

Wiring Specifications

* In the same way as the 25-pin models (standard), the terminal no. 1 is for SOL.A at the 1st station, the terminal no. 9 for SOL.B at the 1st station, and the terminal no. 8 for COM.



Wire Color Table by Terminal No. of D-sub Connector Cable Assembly

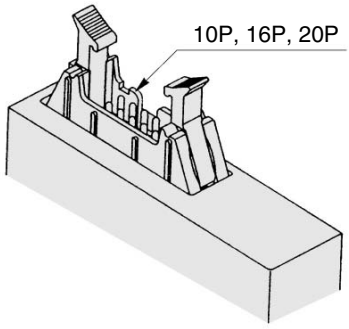
Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black

D-sub Connector Cable Assembly

Cable length (L) \ Pins	15P
1.5 m	AXT100-DS15-1
3 m	AXT100-DS15-2
5 m	AXT100-DS15-3

* For other commercial connectors, use a type conforming to MIL-C-24308.

P kit (Flat ribbon cable connector) 10 pins, 16 pins, 20 pins



How to order manifold

VV5Q11 — 06 C6 P SC — N

- 06: Stations
- C6: Cylinder port
- SC: Kit/Electrical entry
- N: Option

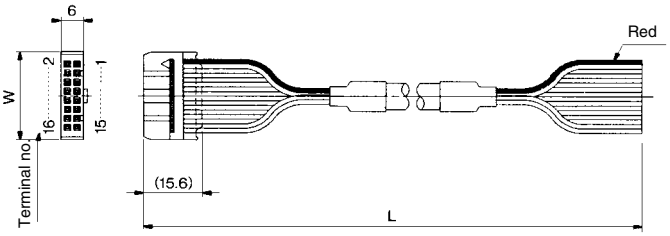
How to Order
Flat ribbon cable, 20 pins
Connector location–Side (Horizontal)
Without cable

Kit/Electrical entry

Pins \ Location	Top entry		Side entry	
10P (Max. 4 stations)	Kit P	UA	Kit P	SA
16P (Max. 7 stations)		UB		SB
20P (Max. 9 stations)		UC		SC

Wiring Specifications

* In the same way as the 26-pin models (standard), the terminal no. 1 is for SOL.A at the 1st station, the terminal no. 2 for SOL.B at the 1st station, and two pins from the max. terminal numbers are for COM.



Flat Ribbon Cable Assembly

Cable length (L) \ Pins	10P	16P	20P
1.5 m	AXT100-FC10-1	AXT100-FC16-1	AXT100-FC20-1
3 m	AXT100-FC10-2	AXT100-FC16-2	AXT100-FC20-2
5 m	AXT100-FC10-3	AXT100-FC16-3	AXT100-FC20-3
Connector width (W)	17.2	24.8	30

* For other commercial connectors, use a type with strain relief conforming to MIL-C-83503.

Option

Special Wiring Specifications

In the internal wiring of F kit, P kit, J kit, G kit, T kit and S kit, double wiring (connected to SOL. A and SOL. B) is adopted for each station regardless of the valve and option types.
Mixed single and double wiring is available as an option.

1. How to Order

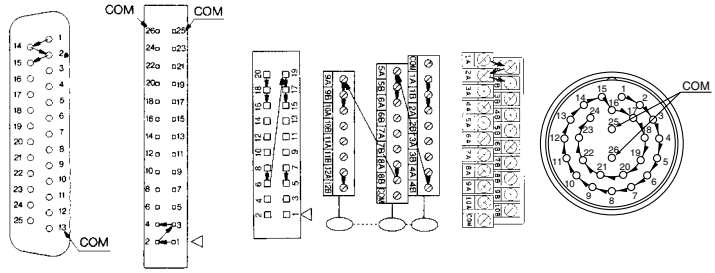
Indicate an option symbol "-K", for the manifold no. and be sure to specify the mounting position and number of stations of the single and double wiring by means of the manifold specification sheet.

Example) **VV5Q11-08C6FU1-D K S**

Others, option symbols: to be indicated alphabetically.

2. Wiring specifications

With the A side solenoid of the 1st station as no.1 (meaning, to be connected to no.1 terminal), without making any terminals vacant.



F kit D-sub connector (25P) | **P kit** Flat ribbon cable connector (26P) | **J/G kit** | **T kit** Terminal block (VQ1000, 24 termials) | **T kit** Terminal block (VQ2000) | **M kit**

3. Max. number of stations

The maximum number of stations depends upon the number of solenoids. Assuming one for a single and two for a double, determine the number of stations so that the total number is not more than the max. number given in the following table.

Kit	F kit (D-sub connector)		P kit (Flat ribbon cable connector)				J kit (Flat ribbon cable connector)	G kit (Flat ribbon cable with terminal block)
Type	F S U □ 25P	F S U A 15P	P S U □ 26P	P S U C 20P	P S U B 16P	P S U A 10P	J S U □ 20P	G
Max. points	24	14	24	18	14	8	16	16

Kit		T kit (Terminal block)		S kit (Serial transmission)	M kit (Circular connector)
Type	VQ1000	2 rows of terminal blocks	3 rows of terminal blocks	S□	M□
		16	24		
Max. points	VQ2000	20		16	24

Negative Common Specifications

Specify the valve model no. as shown below for negative COM specification. The manifold no. shown below is for the T and L kits. For other kits the standard manifold can be used. For negative COM S or G kit, please contact SMC.

VQ1100 N − 5

Negative common specifications

How to order negative COM manifold

T kit:

VV5Q11 − 06 C6 T N − N

Option
Negative common specifications
Cylinder port
Stations

L kit:

VV5Q11 − 06 C6 L N 1 − N

Stations
Cylinder port
Negative common specifications
Option
Electrical entry
Cable length

0	With cable (0.6 m)
1	With cable (1.5 m)
2	With cable (3 m)

External Pilot Specifications

When the supply air pressure is lower than the required minimum operating pressure (0.1 to 0.2 MPa) for the solenoid valve (or when the valve is used for vacuum), specify an external pilot model. Order a manifold or valve by suffixing the external pilot specification, "R".
The X-port of the manifold base is equipped with One-touch fittings for external pilot.
VQ1000: C4 (One-touch fitting for ø4)
VQ2000: C6 (One-touch fitting for ø6)

How to order manifold

VV5Q11-08C6FU1-R S

Others, option symbols: to be indicated alphabetically.

How to order valves

VQ1100 R – 5

External pilot specifications

Note 1) When low wattage type is also desired, specify as "RY".
Note 2) In this valve pilot exhaust is connected to the EA passage of the manifold. Therefore, it is not possible to supply air from EXH port, nor vacuum from ports other than SUP port.

Inch-size One-touch Fittings

The valve with inch-size One-touch fittings is shown below.

VV5Q11 – 06 N7 PS0 – N

Stations
Option
Kit/Electrical entry
Cylinder port

Symbol		N1	N3	N7	N9	M5T	NM
Applicable tubing O.D. (Inch)		ø1/8"	ø5/32"	ø1/4"	ø5/16"	10-32UNF (M5 thread)	Mixed
4(A), 2(B) port	VQ1000	●	●	●	—	●	●
	VQ2000	—	●	●	●	—	●

Note) When inch-size fittings are selected for the cylinder port, use inch size fittings for both P and R port.

1(P), 3(R) port size
VQ1000 ····· ø5/16" (N9)
VQ2000 ····· ø3/8" (N11)

Option

DIN Rail Mounting

Each manifold can be mounted on a DIN rail. Order it by indicating a DIN rail mounting option symbol, "-D". In this case, a DIN rail which is approx. 30 mm longer than the manifold with the specified number of stations is attached.

● **When DIN rail is unnecessary**
(DIN rail mounting brackets only are attached.)
Indicate the option symbol, -DO, for the manifold no.

Example)

VV5Q11-08C6FU1-D0S

Others, option symbols: to be indicated alphabetically.

● **When using DIN rail longer than the manifold with specified number of stations**
Clearly indicate the necessary number of stations next to the option symbol "-D" for the manifold no.

Example)

VV5Q11-08C6FU1-D09S

DIN rail for 9 stations

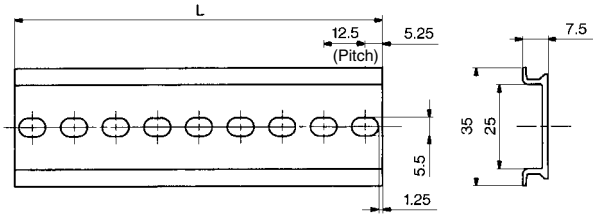
Others, option symbols: to be indicated alphabetically.

● **When changing the manifold style into a DIN rail mounting style.**
Order brackets for mounting a DIN rail. (Refer to "Option" on pages 2-4-168 and 2-4-173.)

No. VVQ1000-57A (For VQ1000)
VVQ2000-57A (For VQ2000)
2 pcs. per one set.

● **When ordering DIN rail only**
DIN rail no.: AXT100-DR-□

As for □, specify the number from the DIN rail table.
For L dimension, refer to the dimensions of each kit.



L Dimension

L = 12.5 x n + 10.5

No.	1	2	3	4	5	6	7	8	9	10
L dimension	23	35.5	48	60.5	73	85.5	98	110.5	123	135.5
No.	11	12	13	14	15	16	17	18	19	20
L dimension	148	160.5	173	185.5	198	210.5	223	235.5	248	260.5
No.	21	22	23	24	25	26	27	28	29	30
L dimension	273	285.5	298	310.5	323	335.5	348	360.5	373	385.5
No.	31	32	33	34	35	36	37	38	39	40
L dimension	398	410.5	423	435.5	448	460.5	473	485.5	498	510.5

Series VQ0000
Base Mounted
Plug Lead Unit

How to Order Manifold

VV5Q 05 – 08 C4 F U1 – D

Series/Manifold

05	VQ0000

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit.
(Refer to the table below.)

Cylinder port

Symbol	Port size
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
M5	M5 thread
CM	With mixed size/with port plug Note)

Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-216.
Note 3) M5 fittings for M5 thread are attached without being incorporated.

Simple specials are available with SMC Simple Specials System.
For details about applicable models, please contact SMC.

Kit type

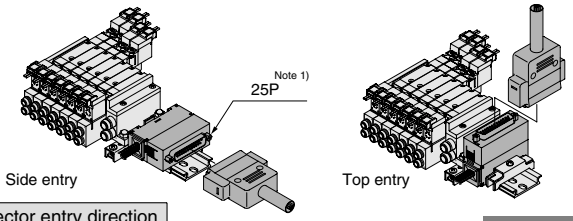
Option

Symbol	Option
Nil	None
D	DIN rail mounting style (2)
K	Special wiring specifications (Not double wiring) (3)
N	With name plate
S	Built-in silencer, direct exhaust

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -DNS
Note 2) F, P, S, and T kits for VQ0000 are all equipped with a DIN rail, so include suffix "-D."
Note 3) Specify the wiring specifications on the manifold specification sheet. (Except C kit)

Kit/Electrical entry: Cable length

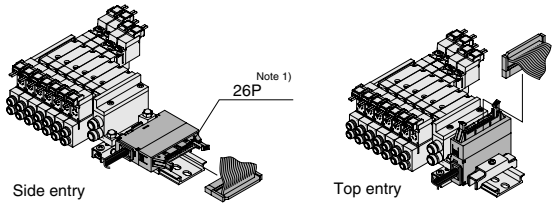
F kit (D-sub connector)



P. 2-4-188

Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 stations (2)
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

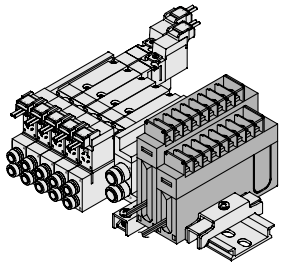
P kit (Flat ribbon cable connector)



P. 2-4-192

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 stations (2)
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

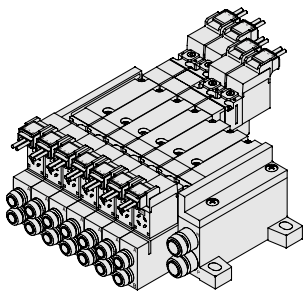
T kit (Terminal block)



P. 2-4-196

Kit T	1	Number of terminals: 8, 1 row	Applicable stations 1 to 8 stations
	2	Number of terminals: 16, 2 rows	Applicable stations 5 to 16 stations

C kit (Connector)

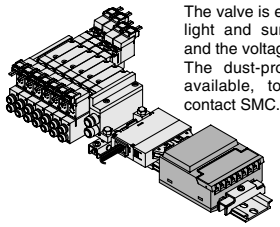


P. 2-4-200

C	Connector kit	Max. 16 stations

S kit (Serial transmission unit)

The valve is equipped with an indicator light and surge voltage suppressor, and the voltage is 24 VDC.
The dust-protected type SI unit is available, too. For details, please contact SMC.



P. 2-4-204

Kit S (3)	0	Without SI unit	Max. 16 stations (2)
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	H	NKE Corp.: Uni-wire H System	

Note 1) Besides the above, F and P kits with different number of pins are available. Refer to page 2-4-215 for details.
Note 2) For details, refer to page 2-4-216.
Note 3) Please consult with SMC for the following serial transmission kits: Matsushita Electric Works, Ltd.; Rockwell Automation, Inc.; SUNX Corporation; Fuji Electric Co., Ltd.; OMRON Corporation.

How to Order Valves

VQ 0 1 5 0 Y – 5 LO

Series

0	VQ0000

Type of actuation

1		2 position single
2	Metal	2 position double
2	Rubber	2 position double
3		3 position closed center
4		3 position exhaust center

Body type

5	VQ0000

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-216.
Note 2) F, P, T and S kits requires connector assembly when increasing valve stations. Refer to "Option" on page 2-4-216 for parts nos.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-186.

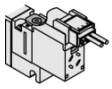
Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

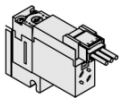
Note) The C kits are applicable to 200/220 VAC. Please contact SMC for other kits.

Manual override

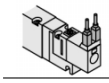
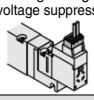
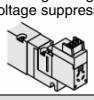
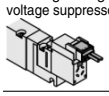
Nil: Non-locking push type (Tool required)



B: Locking type (Tool required)



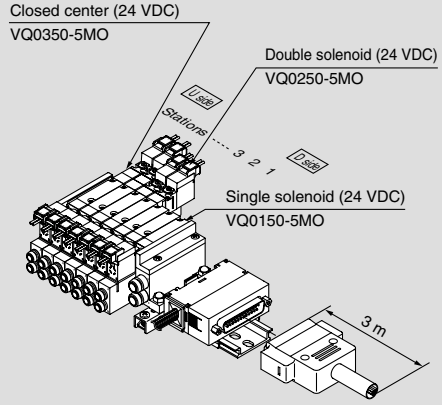
Electrical entry

G: Grommet (C Kit only Except AC.)	**L**: L plug connector With lead wire	**LO**: L plug connector Without connector
	With light/surge voltage suppressor 	With light/surge voltage suppressor 
	M: M plug connector With lead wire	**MO**: M plug connector Without connector
	With light/surge voltage suppressor 	With light/surge voltage suppressor 

Note 1) LO or MO type valve is used for F, P, T, and S kits. The plug connector and lead wire are attached to the manifold.
Note 2) In cases of L and M type the connector direction is based on the pilot valve.

How to Order Valve Manifold Assembly

Example



VV5Q05-07C4FS2-D··· 1 set (F kit 7 station manifold base no.)
* VQ0150-5MO··· 3 sets (Single solenoid part no.)
* VQ0250-5MO··· 2 sets (Double solenoid part no.)
* VQ0350-5MO··· 2 sets (3 position solenoid part no.)

The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

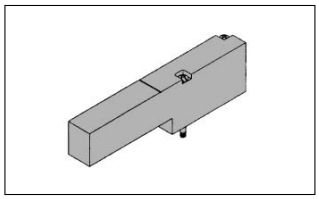
Specify the part numbers for valves and options together beneath the manifold base part number. Besides, when the arrangement will be complicated, specify them by means of the manifold specification sheet.

VQC
SQ
VQ0
VQ4
VQ5
VQZ
VQD

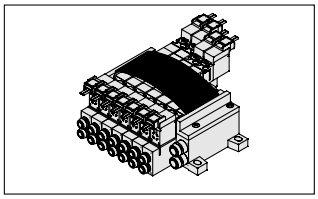
Manifold Option

P. 2-4-208

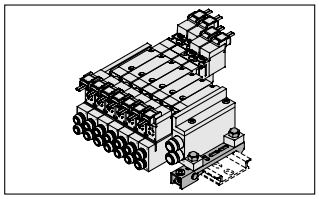
Blanking plate assembly
VVQ0000-10A-5



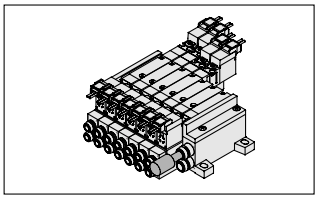
Name plate [-N*]
VVQ0000-N5-Station (1 to Max. stations)



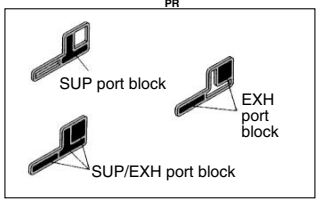
DIN rail mounting bracket [-D]
VVQ0000-57A-5



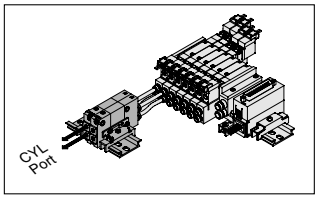
Silencer
AN103-X233



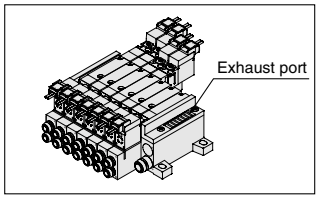
SUP/EXH block plate
VVQ0000-16A-5- P R PR



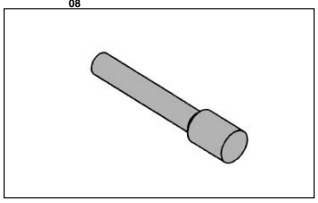
Double check block
VQ1000-FPG-□□



Built-in silencer, direct exhaust [-S]

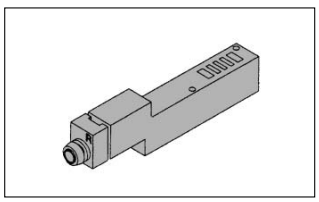


Blanking plug
KQ2P- 23 04 06 08

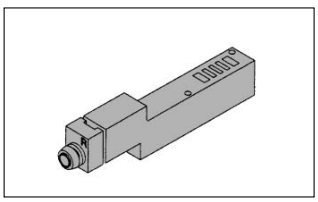


- For cylinder port fittings part no., refer to page 2-4-213.
- For replacement parts, refer to page 2-4-231.

Individual SUP spacer
VVQ0000-P-5-C4



Individual EXH spacer
VVQ0000-R-5-C4



For details about certified products conforming to international standards, visit us at www.smcworld.com.

Series VQ1000
Base Mounted
Plug Lead Unit

How to Order Manifold

VV5Q 12 – 08 C6 F U1 – D

Series/Manifold

12	VQ1000

Stations

01	1 station
⋮	⋮

The number of max. stations differs from kit to kit. (Refer to the table below.)

Cylinder port

Symbol	Port size
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread
CM	With mixed size/with port plug
L3	With elbow One-touch fitting ø3.2 for top piping
L4	With elbow One-touch fitting ø4 for top piping
L6	With elbow One-touch fitting ø6 for top piping
L5	Elbow M5 thread for top piping
B3	With elbow One-touch fitting ø3.2 for bottom piping
B4	With elbow One-touch fitting ø4 for bottom piping
B6	With elbow One-touch fitting ø6 for bottom piping
B5	Elbow M5 thread for bottom piping
LM	Mixed size for elbow piping

Kit type

Option

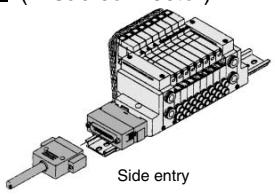
Symbol	Option
Nil	None
B	With back pressure check valve
D	DIN rail mounting style (3)
K	Special wiring specifications (Not double wiring) (4)
N	With name plate
S	Built-in silencer, direct exhaust

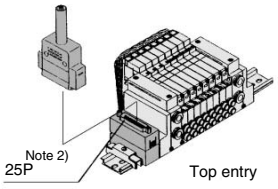
Note 1) Specify "Mixed size/with port plug" in the manifold specification sheet.
Note 2) For One-touch fittings in inch sizes, refer to "Option" on page 2-4-216.
Note 3) M5 fittings for M5 thread are attached without being incorporated.

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BNS
Note 2) Models with a suffix "-B" have check valves for prevention of back pressure at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using manifold specification sheet.
Note 3) Manifold is a DIN rail mounting style, and so suffix -D should be indicated.
Note 4) Specify the wiring specifications in the manifold specification sheet. (Except C kit)

Kit/Electrical entry/Cable length

F kit (D-sub connector)

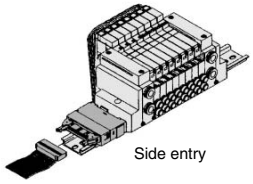


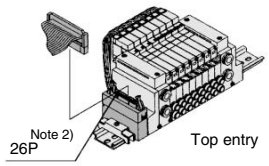


P. 2-4-188

Connector entry direction					
Top entry		Side entry			
Kit F	U0	Kit F	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

P kit (Flat ribbon cable connector)

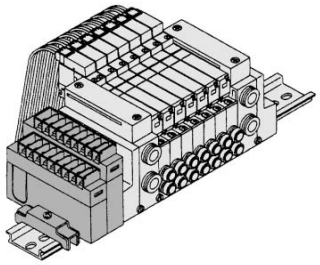




P. 2-4-192

Connector entry direction					
Top entry		Side entry			
Kit P	U0	Kit P	S0	Without cable	Max. 16 (2) stations
	U1		S1	With cable (1.5 m)	
	U2		S2	With cable (3 m)	
	U3		S3	With cable (5 m)	

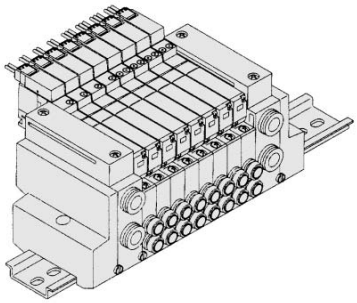
T kit (Terminal block)



P. 2-4-196

kit T	1	Number of terminals: 8, 1 row	Applicable stations 1 to 8 stations
	2	Number of terminals: 16, 2 rows	Applicable stations (2) 5 to 16 stations

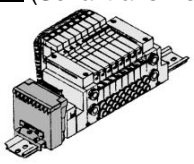
C kit (Connector)



P. 2-4-200

C	Connector kit	Max. 16 stations

S kit (Serial transmission unit)



The valve is equipped with an indicator light and surge voltage suppressor, and the voltage is 24 VDC.
The dust-protected type SI unit is available, too. For details, please contact SMC.

P. 2-4-204

Kit S	0	Without SI unit	Max.16 (2) stations
	A	With general type SI unit (Series EX300)	
	B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System	
	C	OMRON Corp.: SYSBUS Wire System	
	D	SHARP Corp.: Satellite I/O Link System	
	E	Matsushita Electric Works: MEWNET-F System	
	F1	NKE Corp.: Uni-wire System (16 output points)	
	G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System	
	H	NKE Corp.: Uni-wire H System	
	J1	SUNX Corp.: S-LINK System (16 output points)	
	J2	SUNX Corp.: S-LINK System (8 output points)	Max. 8 stations
	K	Fuji Electric Co.: T-LINK Mini System	Max.16 stations
	Q	DeviceNet, CompoBus/D (OMRON Corp.)	
	R1	OMRON Corp.: CompoBus/S System (16 output points)	
	R2	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8 stations
	V	Mitsubishi Electric Corp.: CC-LINK System	Max. 16 stations

Note 1) Besides the above, F and P kits with different number of pins are available. Refer to page 2-4-215 for details.
Note 2) For details, refer to page 2-4-216.

Simple specials are available with SMC Simple Specials System. For details about applicable models, please contact SMC.

SMC

How to Order Valves

VQ 1 [1] 1 [0] Y – 5 [LO] [ ]

Series

0	VQ0000

Type of actuation

1		2 position single
2	Metal	2 position double
	Rubber	2 position double
3		3 position closed center
4		3 position pressure center

Body type

1	VQ1000

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H	High pressure type	(1.5 W) ○
Y	Low wattage type	(0.5 W) ○

Electrical entry

L: L plug connector With lead wire	LO: L plug connector Without connector
With light/surge voltage suppressor	With light/surge voltage suppressor

Note) LO type valve is used for F, P, T, and S kits. The plug connector and lead wire are attached to the manifold.

Manual override

Nil: Non-locking push type (Tool required)

B: Locking type (Tool required)

C: Locking type (Manual)

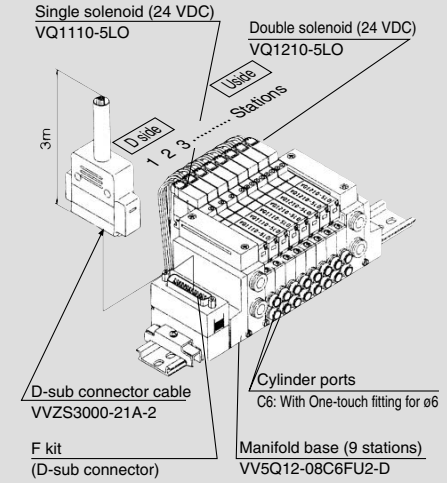
Coil voltage

5	24 VDC
6	12 VDC

Note 1) For negative common specifications, refer to "Option" on page 2-4-216.
Note 2) F, P, T and S kits requires connector assembly when increasing valve stations. For part nos., refer to "Option" on page 2-4-216.
For power consumption of AC type, refer to page 2-4-186.

How to Order Valve Manifold Assembly

Example



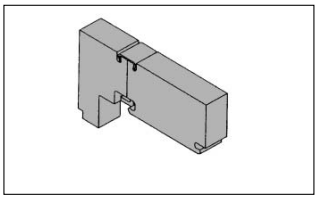
VV5Q12-08C6FU2-D ··· 1 set (F kit 8 station manifold base no.)
*VQ1110-5LO ····· 4 sets (Single solenoid part no.)
*VQ1210-5LO ····· 4 sets (Double solenoid part no.)
The asterisk denotes the symbol for assembly. Prefix it to the part nos. of the solenoid valve, etc.

Specify the part numbers for valves and options together beneath the manifold base part number. Besides, when the arrangement will be complicated, specify them by means of the manifold specification sheet.

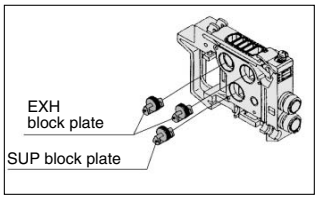
Manifold Option

P. 2-4-208

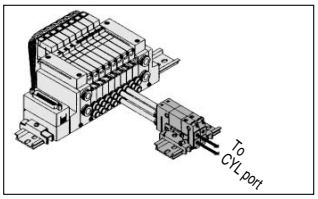
Blanking plate assembly
VVQ1000-10A-1



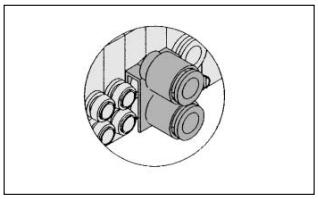
SUP/EXH block plate
VVQ1000-16A-2



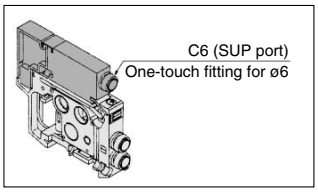
Double check block
VVQ1000-FPG-□□



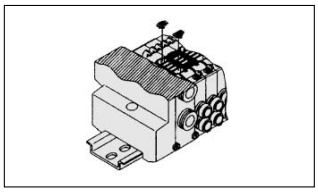
2 stations matching fitting assembly
VVQ1000-52A-C8



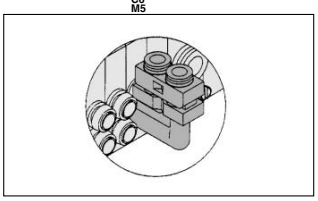
Individual SUP spacer
VVQ1000-P-1-C6



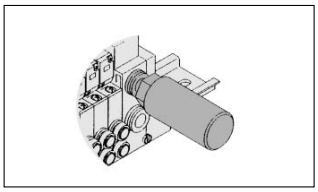
Back pressure check valve assembly [-B]
VVQ1000-18A



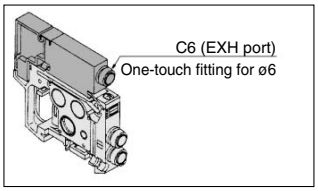
Elbow fitting assembly
VVQ1000-F-L C3 C4 C6 M5



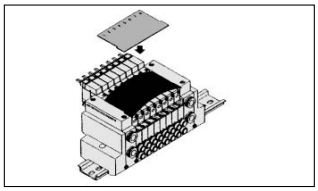
Silencer
AN200-KM8



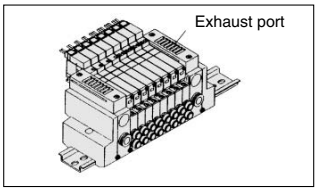
Individual EXH spacer
VVQ1000-R-1-C6



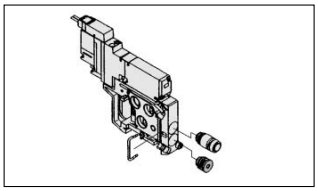
Name plate [-N∗]
VVQ1000-N2-Station (1 to Max. stations)



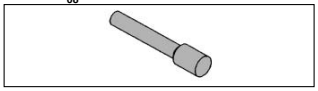
Built-in silencer, direct exhaust [-S]



Port plug
VVQ0000-58A

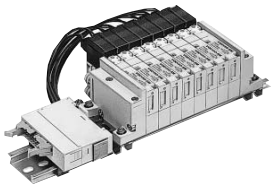
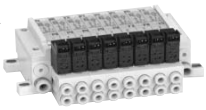


Blanking plug
KQ2P- 23 04 06 08



• For cylinder port fittings part no., refer to page 2-4-213.
• For replacement parts, refer to page 2-4-231.

Series VQ0000/1000
Base Mounted
Plug Lead Unit

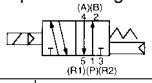

Model

Series	Number of solenoids		Model		Flow characteristic (1) 1 → 4/2 (P → A/B) C [dm³/(s·bar)]	b	Cv	Flow characteristic (1) 4/2 → 5/3 (A/B → R1/R2) C [dm³/(s·bar)]	b	Cv	Response time (ms) (2) Standard: 1 W H: 1.5 W	Low wattage: (3) 0.5 W	AC (3)	Weight (g)
VQ0000	2 position	Single	Metal seal	VQ0150	0.41	0.20	0.10	0.44	0.26	0.11	12 or less	15 or less	29 or less	36
			Rubber seal	VQ0151	0.53	0.20	0.12	0.53	0.22	0.13	15 or less	20 or less	34 or less	
		Double	Metal seal	VQ0250	0.41	0.20	0.10	0.44	0.26	0.11	10 or less	13 or less	13 or less	50
			Rubber seal	VQ0251	0.53	0.20	0.12	0.53	0.22	0.13	15 or less	20 or less	20 or less	
	3 position	Closed center	Metal seal	VQ0350	0.32	0.10	0.07	0.32	0.20	0.07	20 or less	26 or less	40 or less	
			Rubber seal	VQ0351	0.43	0.21	0.10	0.44	0.24	0.11	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ0450	0.32	0.10	0.07	0.44	0.26	0.11	20 or less	26 or less	40 or less	
			Rubber seal	VQ0451	0.43	0.21	0.10	0.53	0.22	0.13	25 or less	33 or less	47 or less	
VQ1000	2 position	Single	Metal seal	VQ1110	0.70	0.15	0.16	0.72	0.25	0.18	12 or less	15 or less	29 or less	
			Rubber seal	VQ1111	0.85	0.20	0.21	1.0	0.30	0.25	15 or less	20 or less	34 or less	
		Double	Metal seal	VQ1210	0.70	0.15	0.16	0.72	0.25	0.18	10 or less	13 or less	13 or less	64
			Rubber seal	VQ1211	0.85	0.20	0.21	1.0	0.30	0.25	15 or less	20 or less	20 or less	
	3 position	Closed center	Metal seal	VQ1310	0.68	0.15	0.16	0.72	0.25	0.18	20 or less	26 or less	40 or less	78
			Rubber seal	VQ1311	0.70	0.20	0.16	0.65	0.42	0.18	25 or less	33 or less	47 or less	
		Exhaust center	Metal seal	VQ1410	0.68	0.15	0.16	0.72	0.25	0.18	20 or less	26 or less	40 or less	
			Rubber seal	VQ1411	0.70	0.20	0.16	1.0	0.30	0.25	25 or less	33 or less	47 or less	
		Pressure center	Metal seal	VQ1510	0.70	0.15	0.16	0.72	0.25	0.18	20 or less	26 or less	40 or less	
			Rubber seal	VQ1511	0.85	0.20	0.21	0.65	0.42	0.18	25 or less	33 or less	47 or less	

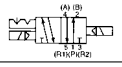
Note 1) Cylinder port size C4: (VQ0000), C6: (VQ1000) without check valve option for prevention of back pressure. As per JIS B 8375-1981 (Supply pressure: 0.5 MPa; with indicator light/surge voltage suppressor; clean air)
Note 2) The response time is subject to the pressure and quality of the air. The values at the time of ON are given for double types.
Note 3) AC type is only for VQ0000.

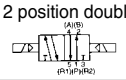
JIS Symbol

2 position single

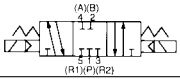


Metal / Rubber: 2 position double

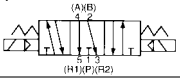




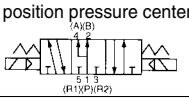
3 position closed center



3 position exhaust center



3 position pressure center



Standard Specifications

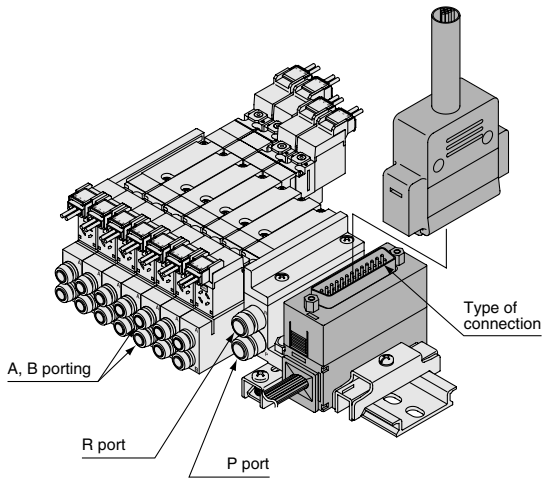
Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	
	Maximum operating pressure		0.7 MPa (High pressure type: 0.8 MPa)	
	Min. operating pressure	Single	0.1 MPa	0.15 MPa
		Double	0.1 MPa	
		3 position	0.1 MPa	0.2 MPa
	Ambient and fluid temperature		–10 to 50°C (1)	
	Lubrication		Not required	
	Manual override		Non-locking push type/Locking type (Tool required, Manually operated) Option	
	Impact/Vibration resistance (2)		150/30 m/s²	
	Enclosure		Dust tight	
Solenoid	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Equivalent to class B	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA)(3), 0.5 W DC (21 mA)(4)	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA)(3), 0.5 W DC (42 mA)(4)	
		100 VAC	VQ0000	Inrush 0.5 VA (5 mA), Holding 0.5 VA (5 mA)
		110 VAC		Inrush 0.55 VA (5 mA), Holding 0.55 VA (5 mA)
		200 VAC		Inrush 1.0 VA (5 mA), Holding 1.0 VA (5 mA)
		220 VAC		Inrush 1.1 VA (5 mA), Holding 1.1 VA (5 mA)

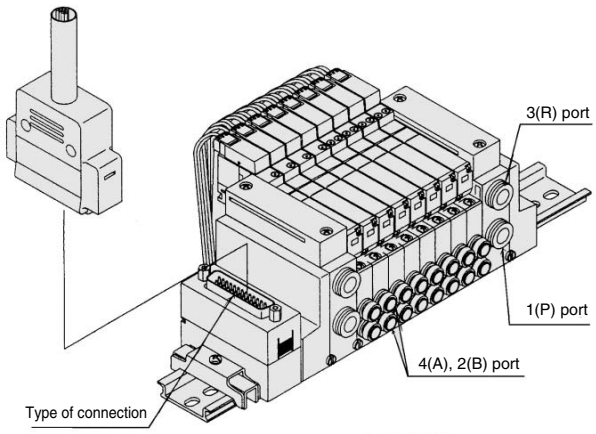
Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Value for high pressure type (1.5 W)
Note 4) Value for low pressure type (0.5 W)
Note 5) AC type is available only on VQ0000.

Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Applicable stations (2)	Applicable solenoid valve	5 station weight (g)
			Port location	Port size (1)				
				1(P), 3(R)	4(A), 2(B)			
VQ0000	**VV5Q05-□□□**	■ F kit– D-sub connector ■ P kit–Flat ribbon cable connector ■ T kit–Terminal block ■ C kit–Individual connector ■ S kit–Serial transmission	Side	C6 (ø6) Option (Built-in silencer, direct exhaust)	C3 (ø3.2) C4 (ø4) M5 (M5 thread)	1 to 16 stations	VQ0□50 VQ0□51	330 (Single) 400 (Double, 3 position)
VQ1000	**VV5Q12-□□□**	■ F kit–D-sub connector ■ P kit–Flat ribbon cable connector ■ T kit–Terminal block ■ C kit–Individual connector ■ S kit–Serial transmission	Side	C8 (ø8) Option (Built-insilencer, direct exhaust)	C3 (ø3.2) C4 (ø4)C6 (ø6) M5 (M5 thread)	1 to 16 stations	VQ1□10 VQ1□11	818 (Single) 885 (Double, 3 position)

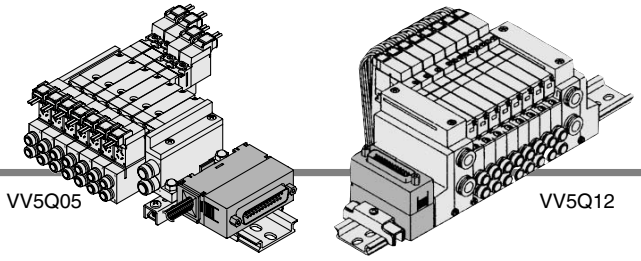
Note 1) Inch-size One-touch fittings are also available. For details, refer to page 2-4-216.
Note 2) For details, refer to page 2-4-216.





VV5Q12

F VQ0000/1000 Kit (D-sub connector)



- The D-sub connector reduces installation labor for electrical connections.
- Using the D-sub connector (25P), (15P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
  Top or side connector receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Manifold Specifications

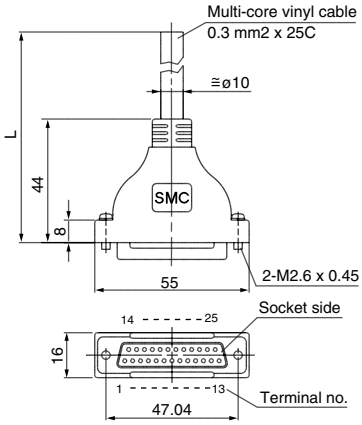
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max. 16 stations
VQ1000	Side	C8	C3, C4, C6, M5	Max. 16 stations

D-sub Connector (25 pins)

Cable assembly ●

AXT100-DS25- 015 / 030 / 050

(The D-sub connector cable assembly can be ordered individually or included with manifold. Refer to How to Order Manifold.)



D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25-core x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

∗ For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Connector manufacturers' example

- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Hirose Electric Co., Ltd.

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Insulation resistance V, 1 min, AC	1000
Insulation resistance MΩD, 20°C	5 or more

Note) The minimum bending radius of D-sub cable assembly is 20 mm.

Wire Color by Terminal No. of D-sub Connector Cable Assembly

Terminal no.	Dot marking	Lead wire color
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

Note) Types with 15 pin are also available. Refer to page 2-4-215 for details.

How to Order Manifold

VV5Q 12 – 08 C6 F U 1 – D

Series/Manifold

05	VQ0000	Plug lead unit
12	VQ1000	

Stations

01	1 station
⋮	⋮
08	8 stations Note)

Note) As option, the maximum number of stations can be increased by special wiring specifications. For details, refer to page 2-4-216.

Cylinder port

Symbol	Port size	VQ0000	VQ1000
C3	With One-touch fitting for ø3.2	●	●
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6		●
M5	M5 thread	●	●
CM	With mixed size/with port plug	●	●

Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-216.

Connector entry direction

U	Top entry
S	Side entry

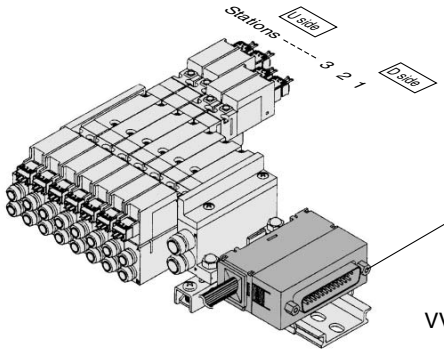
Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Option

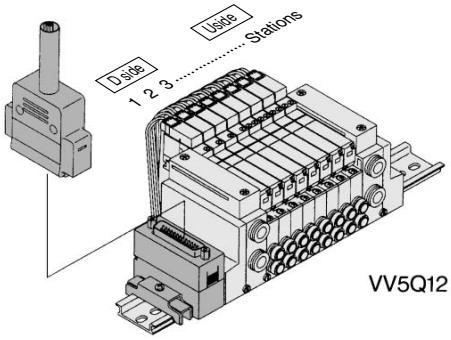
Symbol	Option	VQ0000	VQ1000
B	With back pussure check valve		● (2)
D	DIN rail mounting style	●	● (3)
K	Special wiring specifications (Not double wiring)	●	● (4)
N	With name plate	●	●
S	Built-in silencer, direct exhaust	●	●

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -BNS
Note 2) Models with a suffix "-B" have the back pressure check valve at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) F kit of VQ0000 and all of VQ1000 are equipped with a DIN rail, so indicate suffix "D".
Note 4) Specify the wiring specifications on the manifold specification sheet.



VV5Q05

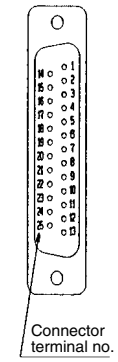
The total number of stations is tabulated starting from station one on the D side.



VV5Q12

Electrical wiring specifications

D-sub connector assembly
AXT100-DS25- 015 / 030 / 050 Wire color



	Terminal no.	Polarity		Lead wire color	Dot marking
1 station	SOL.A	1	(–)	(+) Black	None
	SOL.B	14	(–)	(+) Yellow	Black
2 stations	SOL.A	2	(–)	(+) Brown	None
	SOL.B	15	(–)	(+) Pink	Black
3 stations	SOL.A	3	(–)	(+) Red	None
	SOL.B	16	(–)	(+) Blue	White
4 stations	SOL.A	4	(–)	(+) Orange	None
	SOL.B	17	(–)	(+) Purple	None
5 stations	SOL.A	5	(–)	(+) Yellow	None
	SOL.B	18	(–)	(+) Gray	None
6 stations	SOL.A	6	(–)	(+) Pink	None
	SOL.B	19	(–)	(+) Orange	Black
7 stations	SOL.A	7	(–)	(+) Blue	None
	SOL.B	20	(–)	(+) Red	White
8 stations	SOL.A	8	(–)	(+) Purple	White
	SOL.B	21	(–)	(+) Brown	White
	COM.	13	(+)	(–) Orange Note)	Red
				Positive common specifications	Negative common specifications

As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option.
For details, refer to page 2-4-216.

Note) When using the negative common specifications, use valves for negative common. (Refer to page 2-4-216.)

How to Order Valves

VQ 1 1 1 0 Y – 5 LO

Series

0	VQ0000
1	VQ1000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center (VQ1000 only)

Body type

5	VQ0000	Plug lead unit
1	VQ1000	

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-216.
Note 2) Connector assembly will be required when the F kits add a valve. For part nos., refer to "Option" on page 2-4-216.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-186.

Coil voltage

		VQ0000	VQ1000
1	100 VAC (50/60 Hz)	●	—
3	110 VAC (50/60 Hz)	●	—
5	24 VDC	●	●
6	12 VDC	●	●

Electrical entry

		VQ0000	VQ1000
LO	L plug connector without connector	●	●
MO	M plug terminal without connector	●	—

Note) Plug connector and lead wire layers are attached to the manifold.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual) Note)

Note) VQ1000 only.

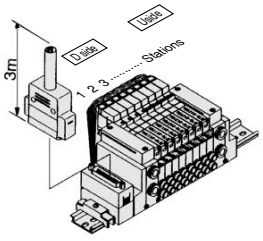
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

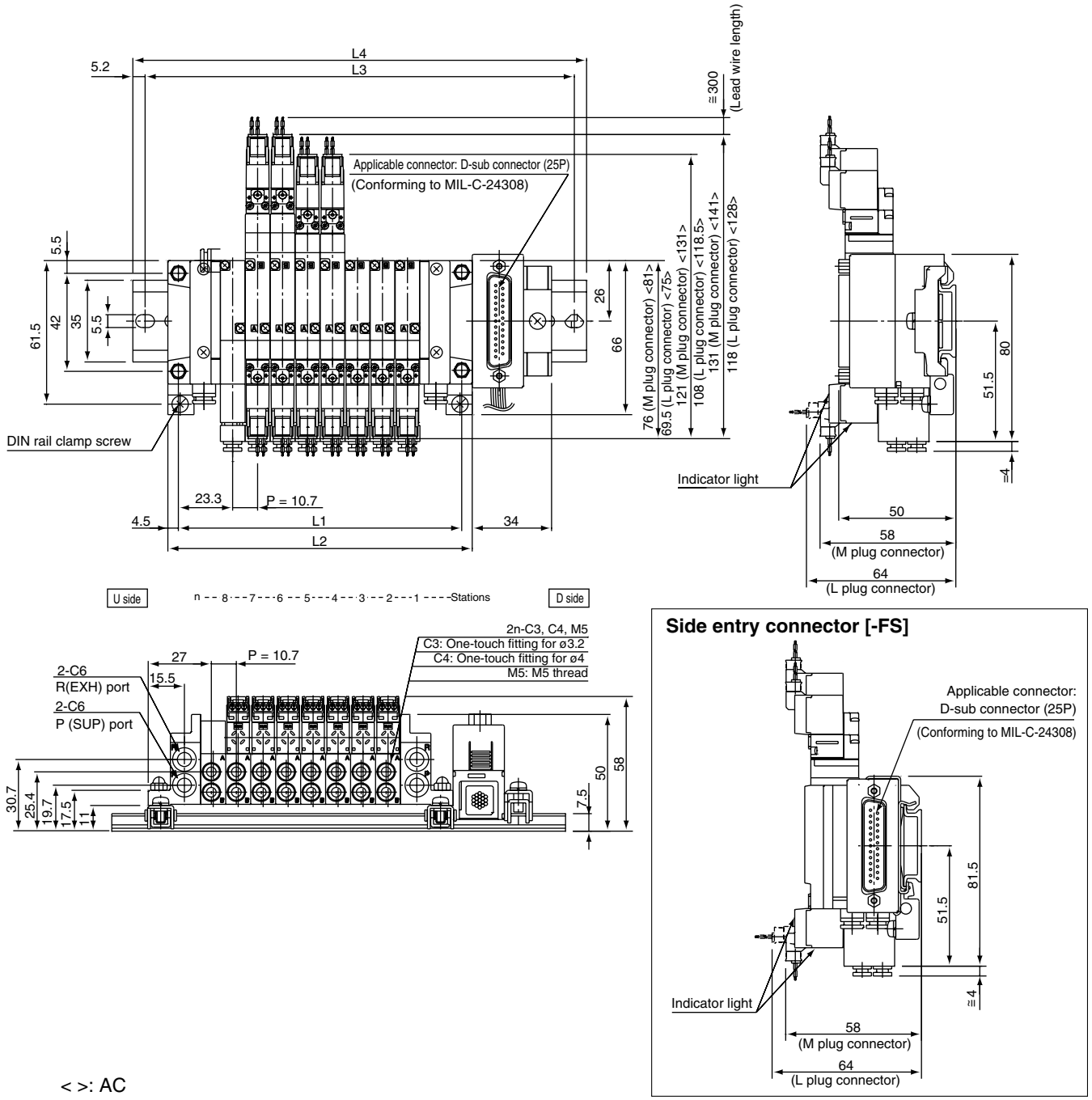
<Example>
D-sub connector kit with cable (3 m)
VV5Q12-08C6FU2-D ··· 1 set–Manifold base no.
∗VQ1110-5LO ····· 4 sets–Valve part no. (Stations 1 to 4)
∗VQ1210-5LO ····· 4 sets–Valve part no. (Stations 5 to 8)
∗VQ1310-5LO ····· 2 sets–Valve part no. (Stations 7 to 8)
∗VVQ1000-10A-1 ···· 1 set–Blanking plate part no. (Station 9)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specified by using the manifold specification sheet.



VQ0000



Side entry connector [-FS]

< >: AC

Formula L1 = 10.7n + 36, L2 = 10.7n + 45
n: Station (Maximum 16 stations)

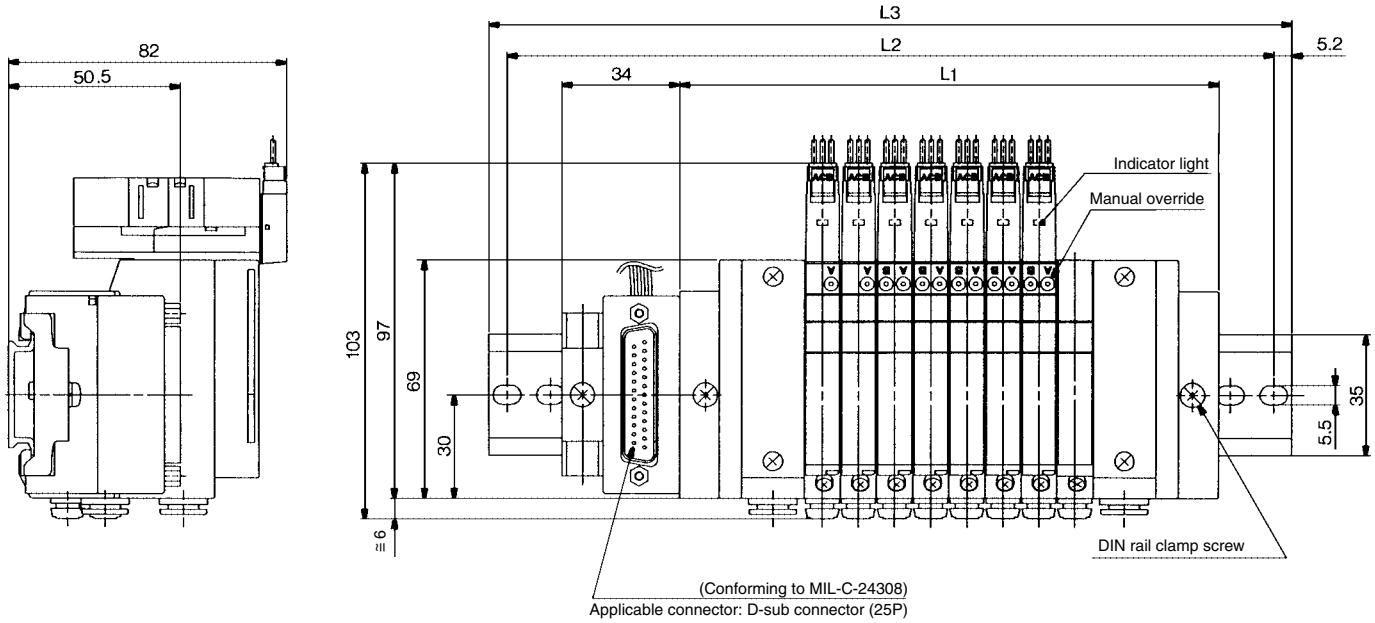
Dimensions: Top Entry Connector [-FU]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46.5	57.4	68.1	78.8	89.5	100.2	110.9	121.6	132.3	143	153.7	164.4	175.1	185.8	196.5	207.2
L2	55.7	66.4	77.1	87.8	98.5	109.2	119.9	130.6	141.3	152	162.7	173.4	184.1	194.8	205.5	216.2
L3	112.5	125	137.5	150	162.5	175	175	187.5	200	212.5	225	237.5	250	250	262.5	275
L4	123	135.5	148	160.5	173	185.5	185.5	198	210.5	223	235.5	248	260.5	260.5	273	285.5

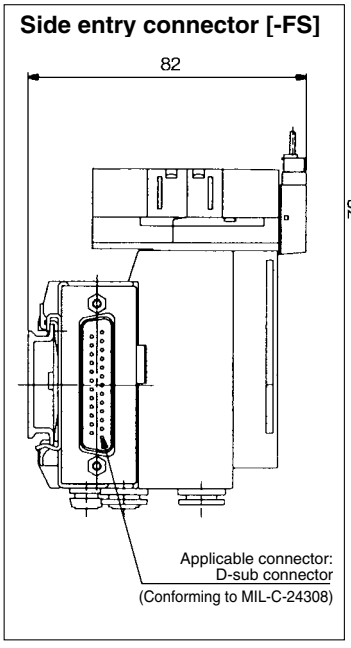
Dimensions: Side Entry Connector [-FS]

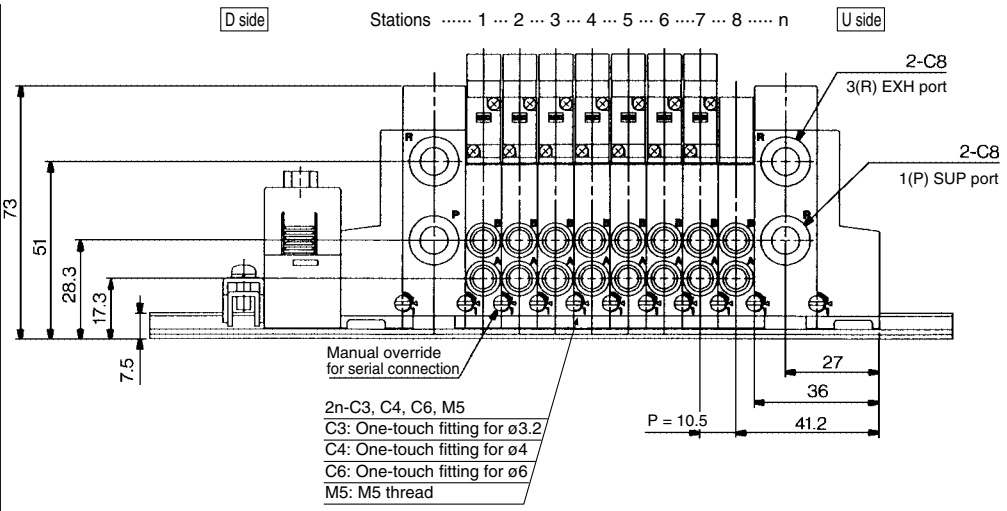
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	137.5	150	150	162.5	175	187.5	200	212.5	225	225	237.5	250	262.5	275	287.5	300
L4	148	160.5	160.5	173	185.5	198	210.5	223	235.5	235.5	248	260.5	273	285.5	298	310.5

VQ1000



Side entry connector [-FS]





Dimensions: Top Entry Connector [-FU]

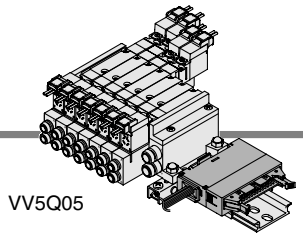
Formula L1 = 10.5n + 72 n: Station (Maximum 16 stations)

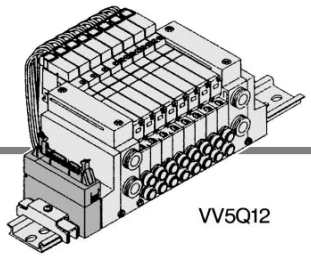
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	82.5	93	103.5	114	124.5	135	145.5	156	166.5	177	187.5	198	208.5	219	229.5	240
L2	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	262.5	275	287.5	300
L3	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	273	285.5	298	310.5

Dimensions: Side Entry Connector [-FS]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L2	162.5	175	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300	312.5	312.5
L3	173	185.5	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5	323	323

P VQ0000/1000 Kit (Flat ribbon cable connector)


VV5Q05


VV5Q12

- MIL flat ribbon cable connector reduces installation labor savings for electrical connection.
- Using the connector for flat ribbon cable (26P), (10P, 16P, 20P as an option) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.
  Top or side receptacle position can be selected in accordance with the available mounting space.
- Maximum stations are 16.

Manifold Specifications

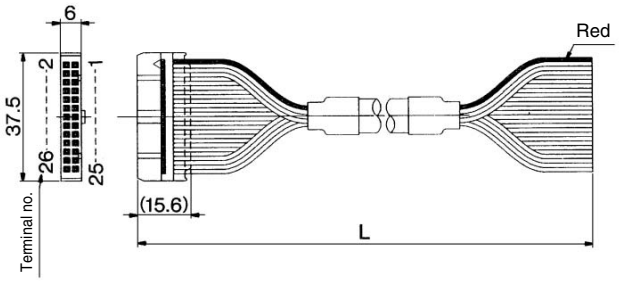
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max.16 stations
VQ1000	Side	C8	C3, C4, C6, M5	Max.16 stations

Flat Ribbon Cable (26 pins)

Cable assembly ●

AXT100-FC26-$\frac{1}{3}^{\frac{1}{8}}$

(Flat ribbon cable connector assembly can be ordered individually or included in a specific manifold model no. Refer to "How to Order Manifold".)



Flat Ribbon Cable Connector Assembly (Option)

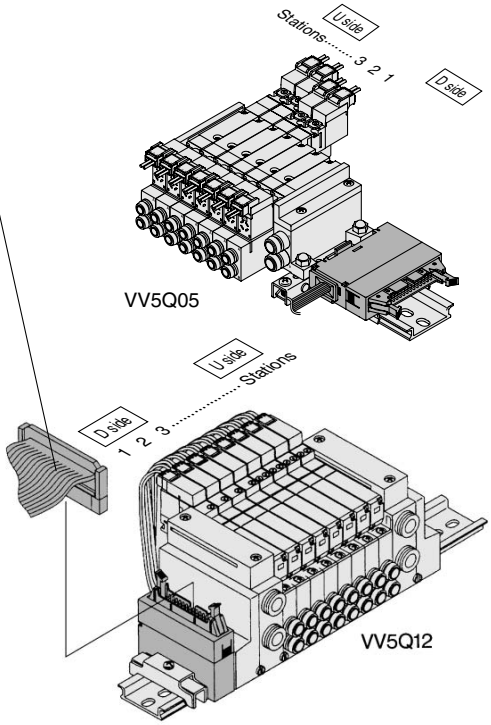
Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-FC26-1	Cable 26 cores x 28AWG
3 m	AXT100-FC26-2	
5 m	AXT100-FC26-3	

∗ For other commercial connectors, use a 26 pins type with strain relief conforming to MIL-C-83503.

Connector manufacturers' example

- Hirose Electric Co., Ltd.
- Sumitomo 3M Limited
- Fujitsu Limited
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Oki Electric Cable Co., Ltd.

Note) Types with 10, 16, or 20 pin are also available. Refer to page 2-4-215 for details.



The total number of stations is tabulated starting from one on the D side.

How to Order Manifold

VV5Q **12** — **08** **C6** **P** **U** **1** — **D** ☐

Series/Manifold

05	VQ0000	Plug lead unit
12	VQ1000	

Stations

01	1 station
⋮	⋮
16	16 stations Note)

Note) As an option, the maximum number of stations can be increased by special wiring specifications. For details, refer to page 2-4-216.

Connector entry direction

U	Top (Vertical)
S	Side (Horizontal)

Cable (Length)

0	Without cable
1	With cable (1.5 m)
2	With cable (3 m)
3	With cable (5 m)

Cylinder port

Symbol	Port size	VQ0000	VQ1000
C3	With One-touch fitting for ø3.2	●	●
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6		●
M5	M5 thread	●	●
CM	With mixed size/with port plug	●	●

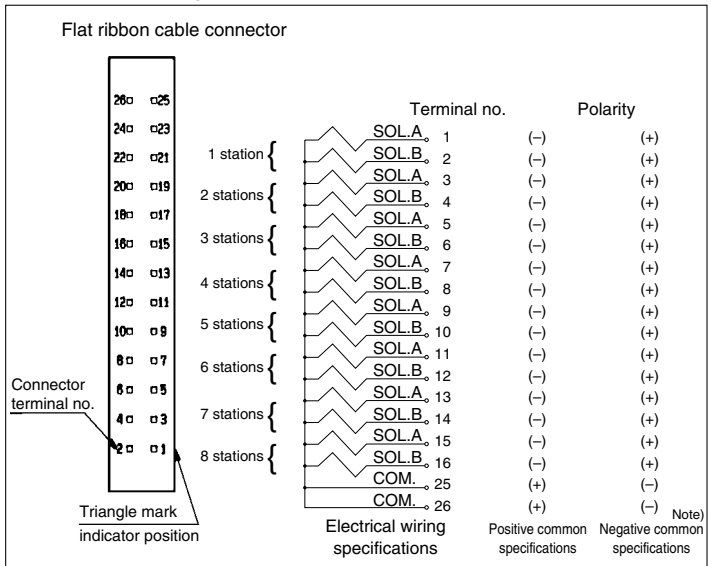
Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-216.

Option

Symbol	Option	VQ0000	VQ1000
B	With back pressure check valve		● (2)
D	DIN rail mounting style	●	● (3)
K	Special wiring specification (Not double wiring)	●	● (4)
N	With name plate	●	●
S	Built-in silencer (Direct exhaust)	●	●

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BNS
Note 2) Models with a suffix "-B" have the back pressure check valve at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) P kit of VQ0000 and all of VQ1000 are equipped with a DIN rail, so indicate suffix "D".
Note 4) Specify the wiring specifications on the manifold specification sheet.

● Electrical wiring specifications



As the standard electrical wiring specifications, double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station for 8 stations or less, regardless of valve and option types.
Mixed single and double wiring is available as an option.
For details, refer to page 2-4-216.

Note) When using the negative commons specifications, use valves for negative common. (Refer to page 2-4-216.)

How to Order Valves

VQ 1 1 1 0 Y – 5 LO

Series

0	VQ0000
1	VQ1000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center (VQ1000 only)

Body type

5	VQ0000	Plug lead unit
1	VQ1000	

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-126.
Note 2) Connector assembly will be required when the P kits add a valve. For part nos., refer to "Option" on page 2-4-126.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-186.

Coil voltage

		VQ0000	VQ1000
1	100 VAC (50/60 Hz)	●	—
3	110 VAC (50/60 Hz)	●	—
5	24 VDC	●	●
6	12 VDC	●	●

Electrical entry

		VQ0000	VQ1000
LO	L plug connector without connector	●	●
MO	M plug terminal without connector	●	—

Note) Plug connector and lead wire are attached to the manifold.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual) Note)

Note) VQ1000 only.

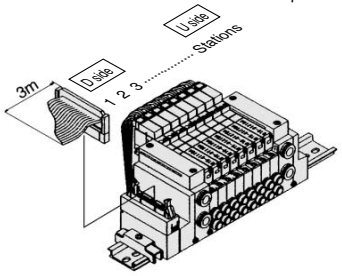
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

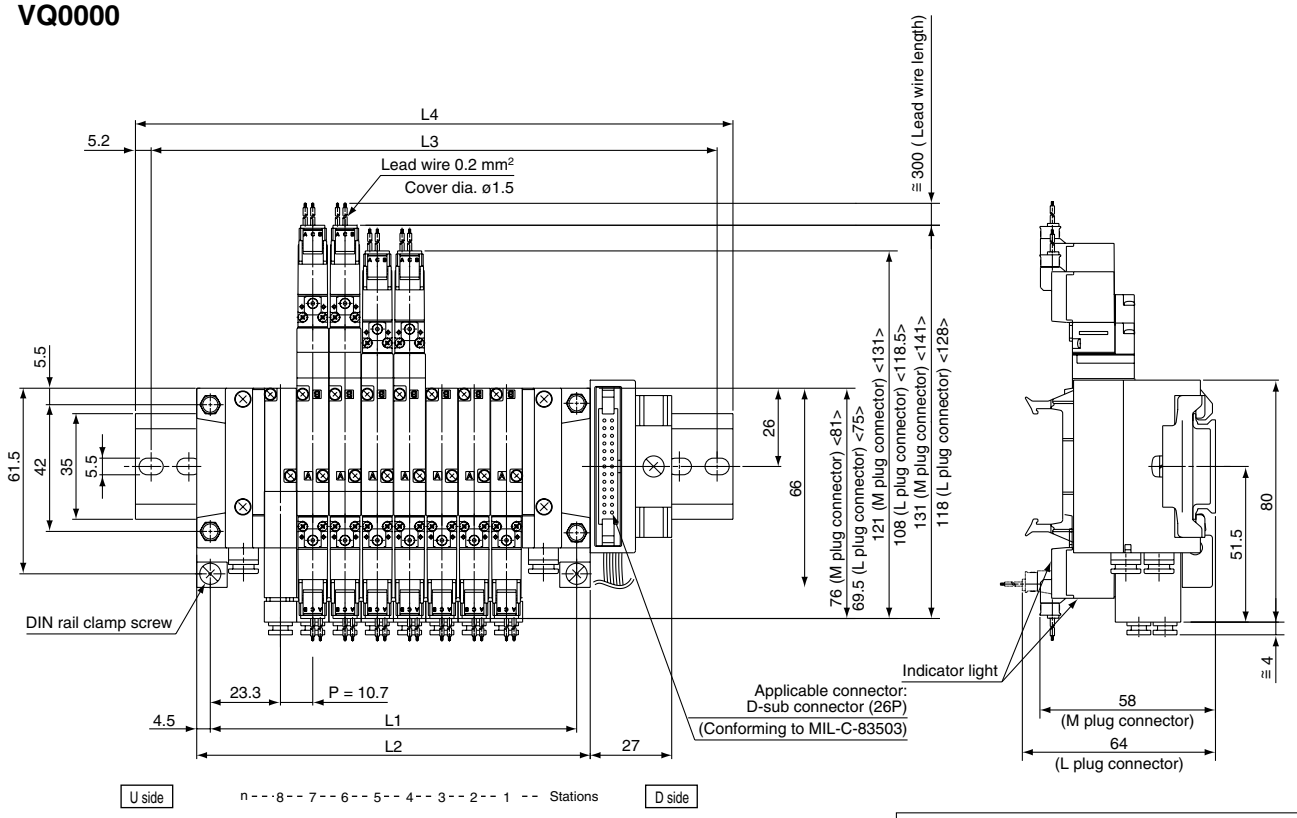
<Example>
Flat ribbon cable kit with 3 m cable
VV5Q12-08C6PU1-D ···1 set–Manifold base no.
∗VQ1110-5LO ·····4 sets–Valve part no. (Stations 1 to 4)
∗VQ1210-5LO ·····3 sets–Valve part no. (Stations 5 to 8)

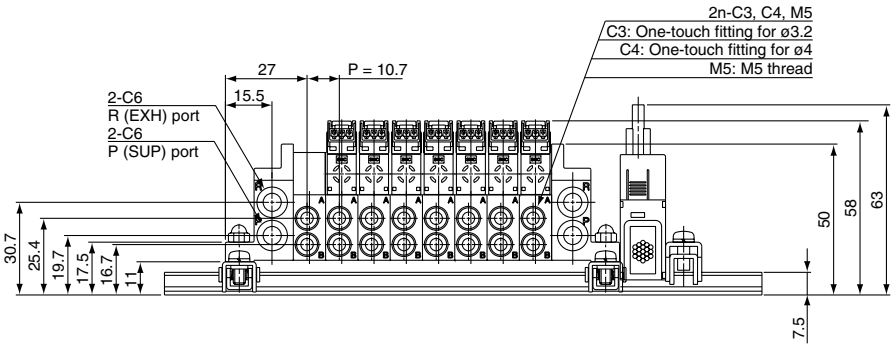
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



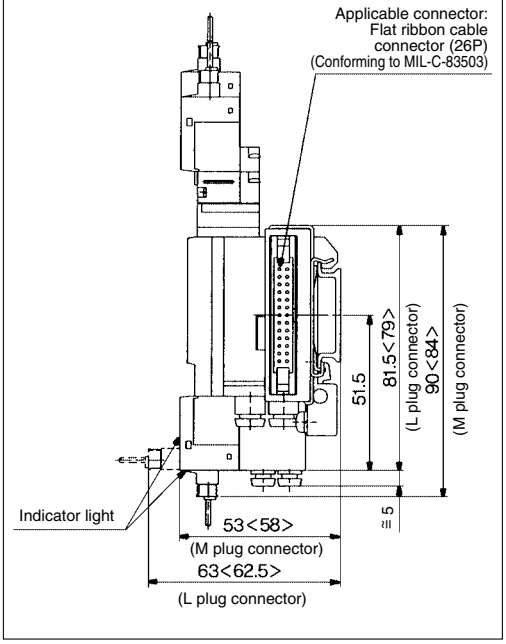
VQ0000





< >: AC

Side entry connector [-PS]



Formula L1 = 10.7n + 36, L2 = 10.7n + 45
n: Station (Maximum 16 stations)

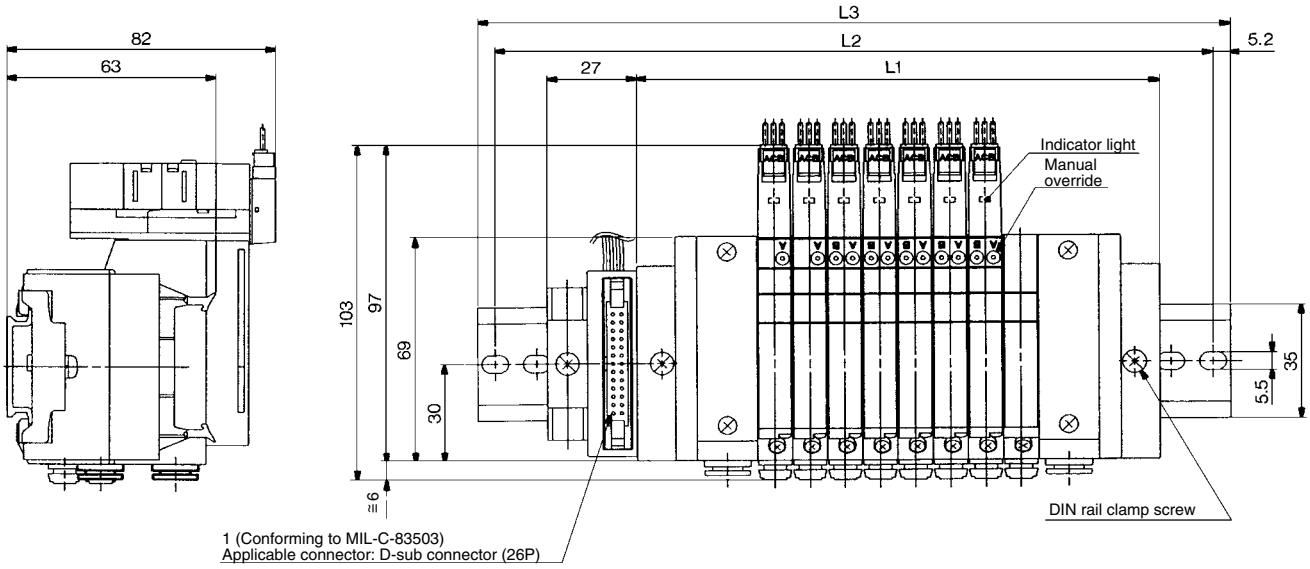
Dimensions: Top Entry Connector [-PU]

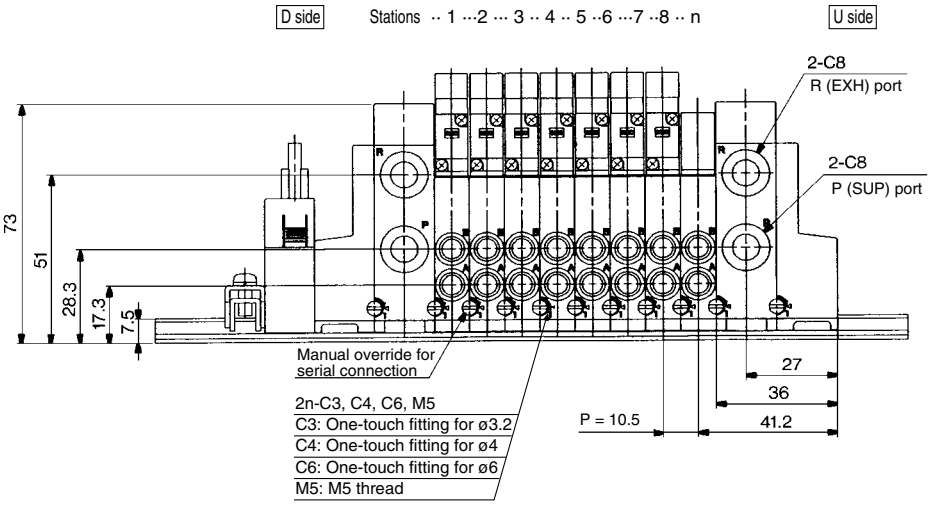
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46.7	57.4	68.1	78.8	89.5	100.2	110.9	121.6	132.3	143	153.7	164.4	175.1	185.8	196.5	207.2
L2	55.7	66.4	77.1	87.8	98.5	109.2	119.9	130.6	141.3	152	162.7	173.4	184.1	194.8	205.5	216.2
L3	112.5	125	125	137.5	150	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	275
L4	123	135.5	135.5	148	160.5	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	285.5

Dimensions: Side Entry Connector [-PS]

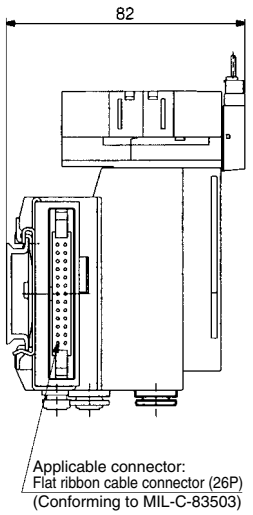
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L3	137.5	150	150	162.5	175	187.5	200	212.5	225	225	237.5	250	262.5	275	287.5	300
L4	148	160.5	160.5	173	185.5	198	210.5	223	235.5	235.5	248	260.5	273	285.5	298	310.5

VQ1000





Side entry connector [-PS]



Dimensions: Top Entry Connector [-PU]

Formula L1 = 10.5n + 72 n: Station (Maximum 16 stations)

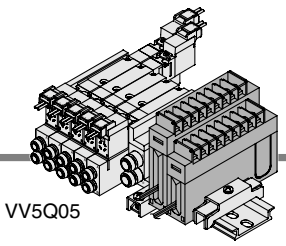
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	82.5	93	103.5	114	124.5	135	145.5	156	166.5	177	187.5	198	208.5	219	229.5	240
L2	137.5	150	150	162.5	175	187.5	200	212.5	225	225	237.5	250	262.5	275	287.5	287.5
L3	148	160.5	160.5	173	185.5	198	210.5	223	235.5	235.5	248	260.5	273	285.5	298	298

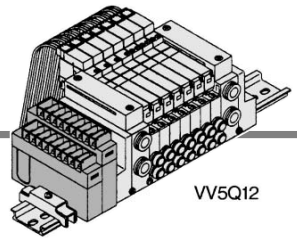
Dimensions: Side Entry Connector [-PS]

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L2	162.5	175	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300	312.5	312.5
L3	173	185.5	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5	323	323

T VQ0000/1000 Kit (Terminal block)

- It is a standard terminal block type.
- Two quantities of terminals can be selected in accordance with the number of stations. (8 terminals/16 terminals)
- Maximum stations are 8. (16 stations as an option)

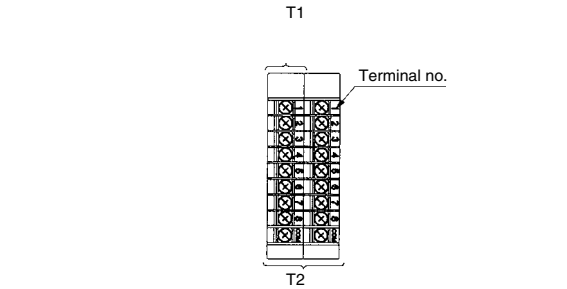

VV5Q05


VV5Q12

Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max.16 stations
VQ1000	Side	C6	C3, C4, C6, M5	Max.16 stations

● Electrical wiring specifications



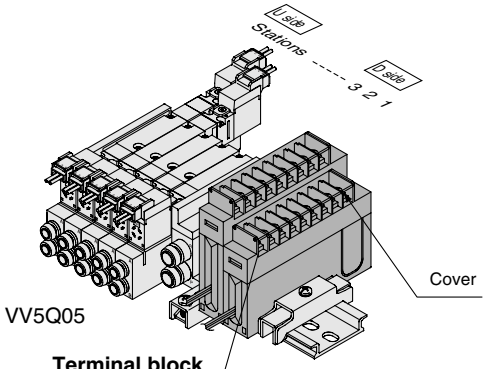
In the case of double wiring (standard spec.)
T1 (Terminal block of 1 row): 1-4 stations
T2 (Terminal block of 2 rows): 5-8 stations
T1 and T2 can be optionally chosen by adopting the combinations of single and double wiring (option spec.) etc.

The quantity of terminal blocks used depends on the number of manifold stations

Manifold	Terminal blocks
1 to 4 stations	1 row
5 to 8 stations	2 rows

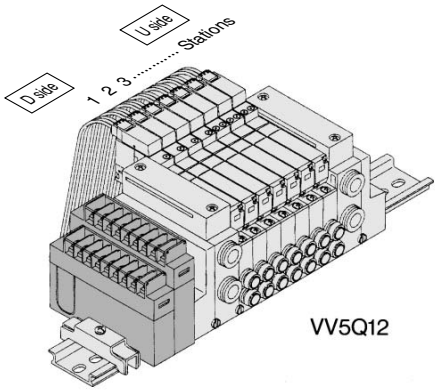
Note) Wiring other than those above is possible. For details, refer to page 2-4-216.

Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-216.



Terminal block connections

Open the terminal block cover to connect the wires to the terminal block. (With M3 thread)



How to Order Manifold

VV5Q | **12** | **08** | **C6** | **T** | **2** | **D** | _____ Option

Series/Manifold

05	VQ0000	Plug lead unit
12	VQ1000	

Stations

01	1 station
⋮	⋮
16	16 stations Note)

Note) Refer to page 2-4-216 for details.

Cylinder ports

Symbol	Port size
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread
CM	With mixed size/with port plug Note)

Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-216.

Number of terminals

1	8 terminals in 1 row	Applicable stations 1 to 4 stations (Double wiring), 8 stations (Single wiring)
2	16 terminals in 2 rows	Applicable stations 5 to 8 stations (Double wiring), 16 stations (Single wiring)

Note) The number of terminal blocks can be chosen regardless of station qty. Suffix the option symbol, "K" when the wiring specifications are special.

Option

Symbol	Option	VQ0000	VQ1000
B	With back pressure check valve		● (2)
D	DIN rail mounting style	●	● (3)
K	Special wiring specifications (Not double wiring)	●	● (4)
N	With name plate	●	●
S	Built-in silencer, direct exhaust	●	●

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -BNS
Note 2) Models with a suffix "-B" have the back pressure check valve at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) T kit of VQ0000 and all of VQ1000 are equipped with a DIN rail, so indicate suffix "-D".
Note 4) Specify the wiring specifications on the manifold specification sheet.

How to Order Valves

VQ | **1** | **1** | **1** | **0** | **Y** | **–** | **5** | | |

Series

0	VQ0000
1	VQ1000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center (VQ1000 only)

Body type

5	VQ0000	Plug lead unit
1	VQ1000	

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-216.

Note 2) Connector assembly will be required when the T kits add a valve.
For part nos., refer to "Option" on page 2-4-216.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-186.

Electrical entry

		VQ0000	VQ1000
LO	L plug connector without connector	●	●
MO	M plug connector without connector	●	—

Note) Plug connector and lead wire layers are attached to the manifold.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual) Note)

Note) Available only for VQ1000

Coil voltage

		VQ0000	VQ1000
1	100 VAC (50/60 Hz)	●	—
3	110 VAC (50/60 Hz)	●	—
5	24 VDC	●	●
6	12 VDC	●	●

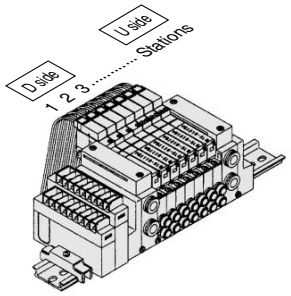
How to Order Manifold Assembly

Specify the part numbers for valves and options together beneath the manifold base part number.

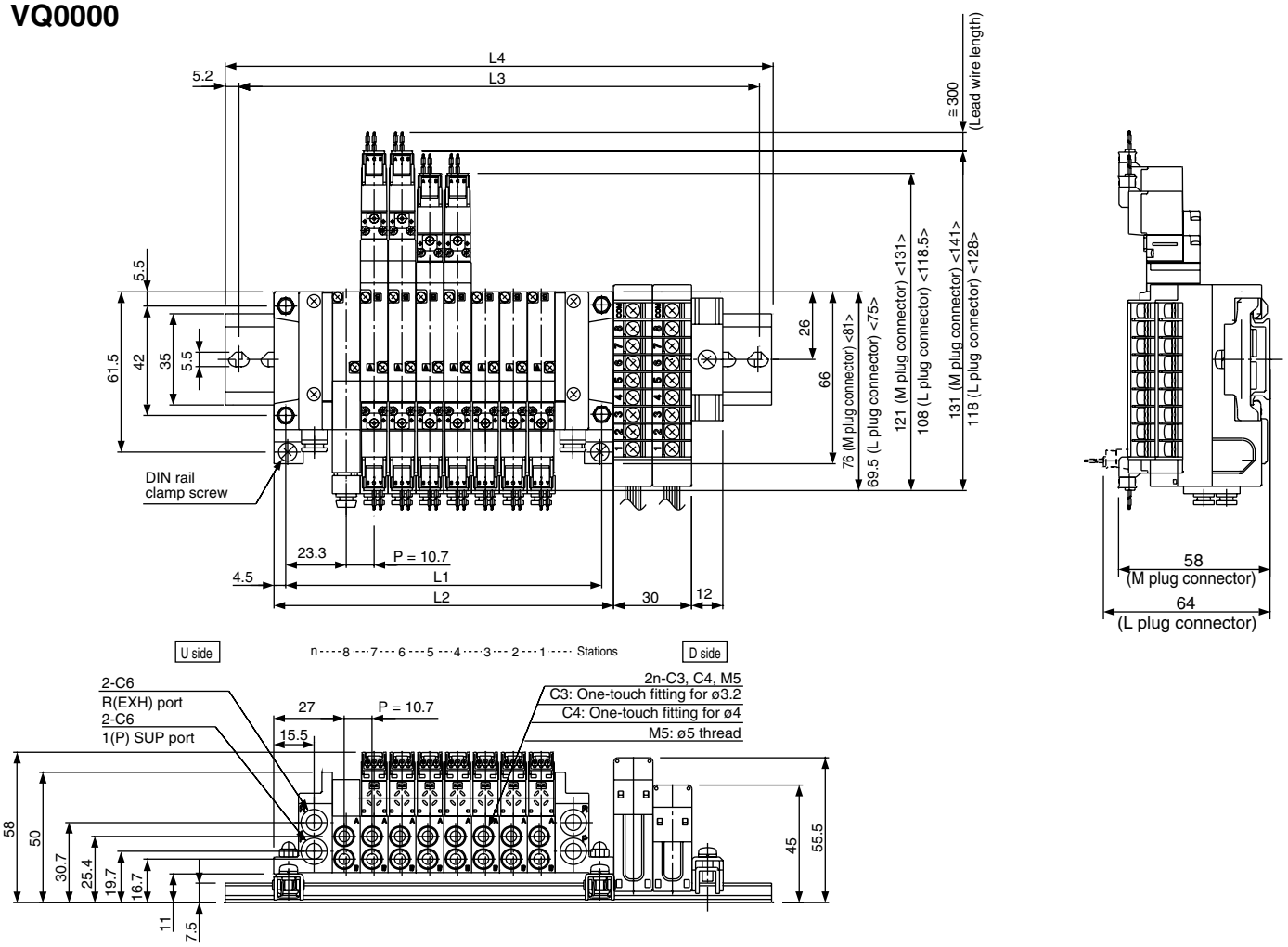
<Example>
Flat ribbon cable kit with 3 m cable
VV5Q12-07C6T2-D ··· 1 set–Manifold base no.
∗VQ1110-5LO ····· 4 sets–Valve part no. (Stations 1 to 4)
∗VQ1210-5LO ····· 3 sets–Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ0000



This drawing shows the case of VV5Q05-□□T2-D□.

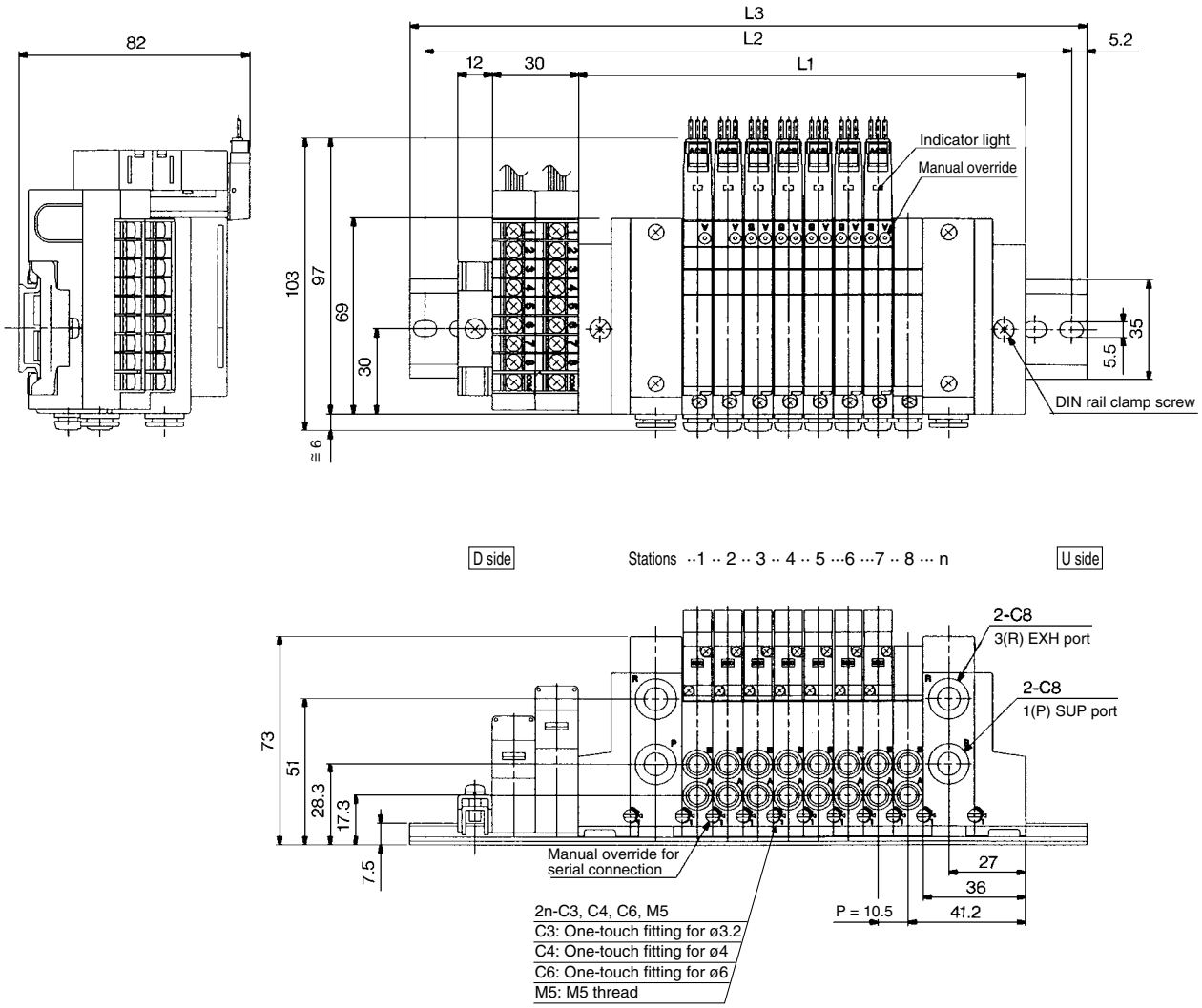
< >: AC

Dimensions

Formula L1 = 10.7n + 36, L2 = 10.7n + 45 n: Station (Maximum16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46.7	57.4	68.1	78.8	89.5	100.2	110.9	121.6	132.3	143	153.7	164.4	175.1	185.8	196.5	207.2
L2	55.7	66.4	77.1	87.8	98.5	109.2	119.9	130.6	141.3	152	162.7	173.4	184.1	194.8	205.5	216.2
L3	125	137.5	150	150	162.5	175	187.5	200	212.5	225	225	237.5	250	262.5	275	287.5
L4	135.5	148	160.5	160.5	173	185.5	198	210.5	223	235.5	235.5	248	260.5	273	285.5	298

VQ1000



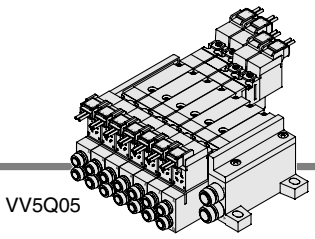
This drawing shows the case of VV5Q12-□□T2-D□.

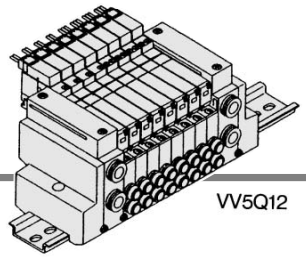
Dimensions

Formula L1 = 10.5n + 72 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	82.5	93	103.5	114	124.5	135	145.5	156	166.5	177	187.5	198	208.5	219	229.5	240
L2	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300	312.5
L3	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5	323

C VQ0000/1000 Kit (Connector)

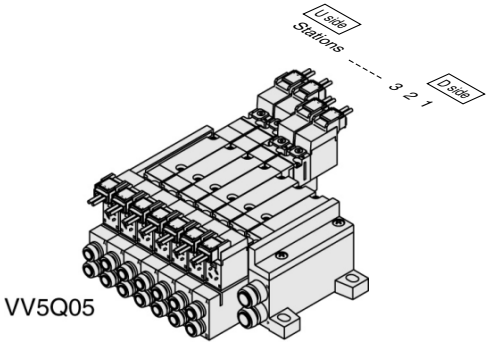

VV5Q05


VV5Q12

● Standard with lead wires plug-connected to each valve individually.
● Maximum stations are 16.

Manifold Specifications

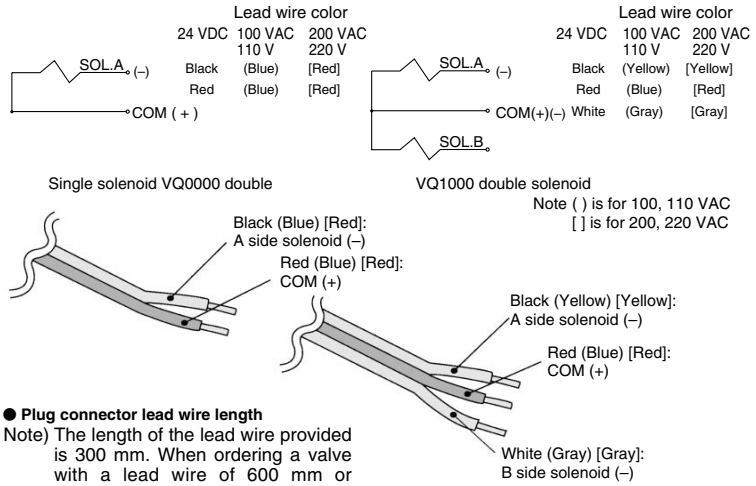
Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max. 16
VQ1000	Side	C8	C3, C4, C6, M5	Max.16 stations



VV5Q05

Wiring specifications: Positive COM ●

● **The lead wires are connected to the valve as shown below. Connect each to the power supply side.**



● **Plug connector lead wire length**

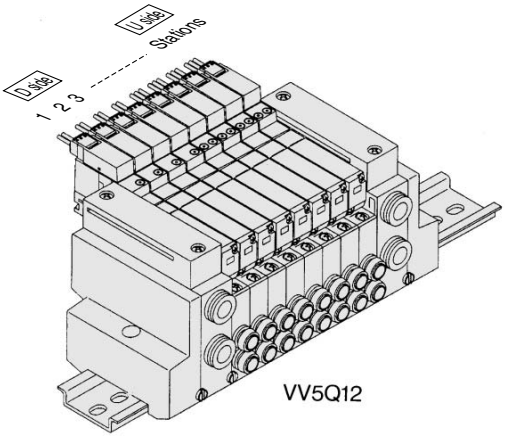
Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1110-5LO····· 3 pcs.
AXT661-14A-10 ····· 3 pcs.

Connector Assembly (For DC)

Lead wire length	Part no. for single & VQ0000 double	Part no. for VQ1000 double
Socket (3 pcs.)	AXT661-12A	
300 mm	AXT661-14A	AXT661-13A
600 mm	AXT661-14A-6	AXT661-13A-6
1000 mm	AXT661-14A-10	AXT661-13A-10
2000 mm	AXT661-14A-20	AXT661-13A-20
3000 mm	AXT661-14A-30	AXT661-13A-30

Note) 100/110 VAC for single: AXT661-31A-□; for double: AXT661-32A-□
200/220 VAC for single: AXT661-34A-□; for double: AXT661-35A-□



VV5Q12

How to Order Manifold

VV5Q **12** — **08** **C6** **C** – **N**

Series/Manifold

05	VQ0000	Plug lead unit
12	VQ1000	

Stations

01	1 station
⋮	⋮
16	16 stations

Cylinder port

Symbol	Port size	VQ0000	VQ1000
C3	With One-touch fitting for ø3.2	●	●
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	—	●
M5	M5 thread	●	●
CM	With mixed size/with port plug	●	● Note)

Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) For One-touch fittings in inch sizes, refer to "Option" on page 2-4-216.

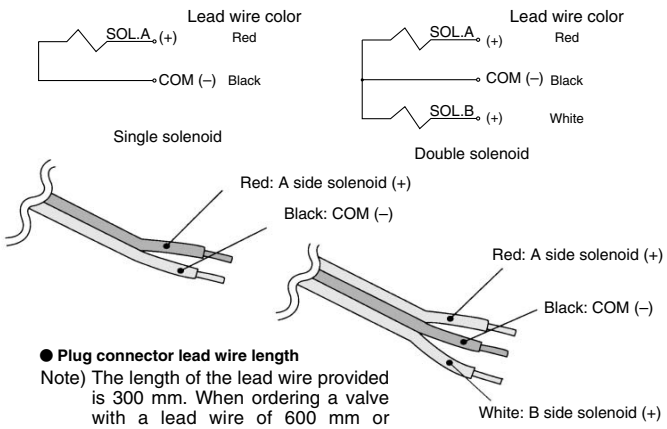
Option

Symbol	Option	VQ0000	VQ1000
Nil	None	●	—
B	With back pressure check valve	—	● (2)
D	DIN rail mounting style	●	● (3)
N	With name plate	●	●
S	Built-in silencer, direct exhaust	●	●

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -BNS
Note 2) Models with a suffix "-B" have the back pressure check valve at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) VQ1000 are all equipped with a DIN rail, so indicate suffix "-D".

● Wiring specifications: Negative COM (Option) for VQ1000

● The lead wires are connected to the valve as shown below. Connect each to the power supply side.



● Plug connector lead wire length

Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ1110N-5LO·····3 pcs.
AXT661-14AN-10·····3 pcs.

Connector Assembly Part No.

Lead wire length	Single	Double solenoid part no.
Socket (3 pcs.)	AXT661-12A	
300 mm	AXT661-14AN	AXT661-13AN
600 mm	AXT661-14AN-6	AXT661-13AN-6
1000 mm	AXT661-14AN-10	AXT661-13AN-10
2000 mm	AXT661-14AN-20	AXT661-13AN-20
3000 mm	AXT661-14AN-30	AXT661-13AN-30

Note) When using the negative common specifications, use valves for negative common.

(Series VQ0□50 has no polarity, so the negative common is applicable to standard models.)

How to Order Valves

VQ 1 1 1 0 Y – 5 L □

Series

0	VQ0000
1	VQ1000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center (VQ1000 only)

Body type

5	VQ0000	Plug lead unit
1	VQ1000	

Seal

0	Metal seal
1	Rubber seal

Note 1) For negative common specifications, refer to "Option" on page 2-4-216.

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-186.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual) Note)

Note) Available only for VQ1000.

Electrical entry

		VQ0000	VQ1000
G	Grommet (Except AC)	●	—
L	L plug connector with lead wire	●	●
LO	L plug connector without connector	●	●
M	M plug connector with lead wire	●	—
MO	M plug terminal without connector	●	—

Coil voltage

		VQ0000	VQ1000
1	100 VAC (50/60 Hz)	●	—
2	200 VAC (50/60 Hz)	●	—
3	110 VAC (50/60 Hz)	●	—
4	220 VAC (50/60 Hz)	●	—
5	24 VDC	●	●
6	12 VDC	●	●

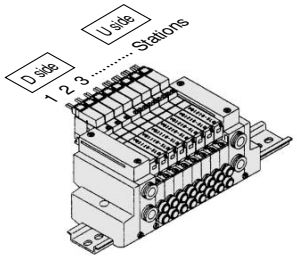
How to Order Manifold Assembly

Please indicate manifold base type, corresponding valve, and option parts.

<Example>
Connector kit
VV5Q12-08C6C-D ····1 set–Manifold base no.
∗VQ1110-5 ·····3 sets–Valve part no. (Stations 1 to 3)
∗VQ1210-5 ·····4 sets–Valve part no. (Stations 4 to 7)
∗VVQ1000-10A-1···1 set–Blanking plate part no. (stations 8)

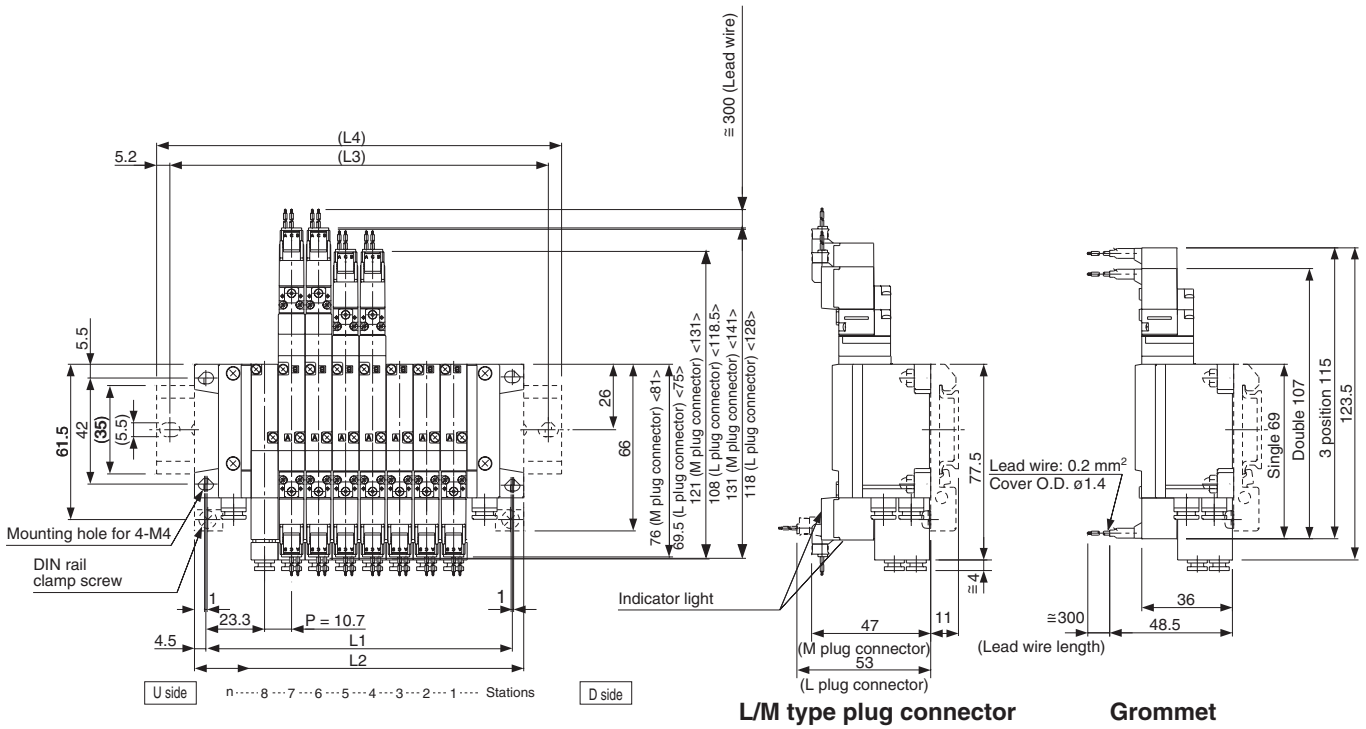
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.

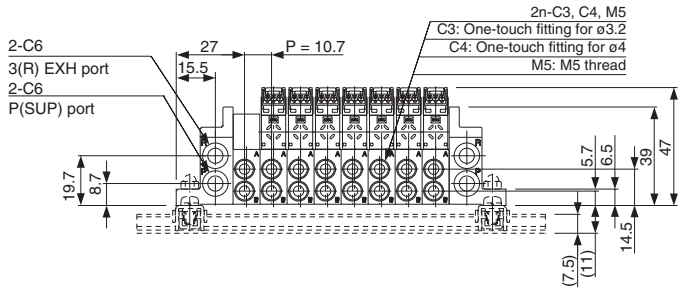


VQ0000

The broken lines indicate DIN rail mounting style [-D].



L/M type plug connector **Grommet**



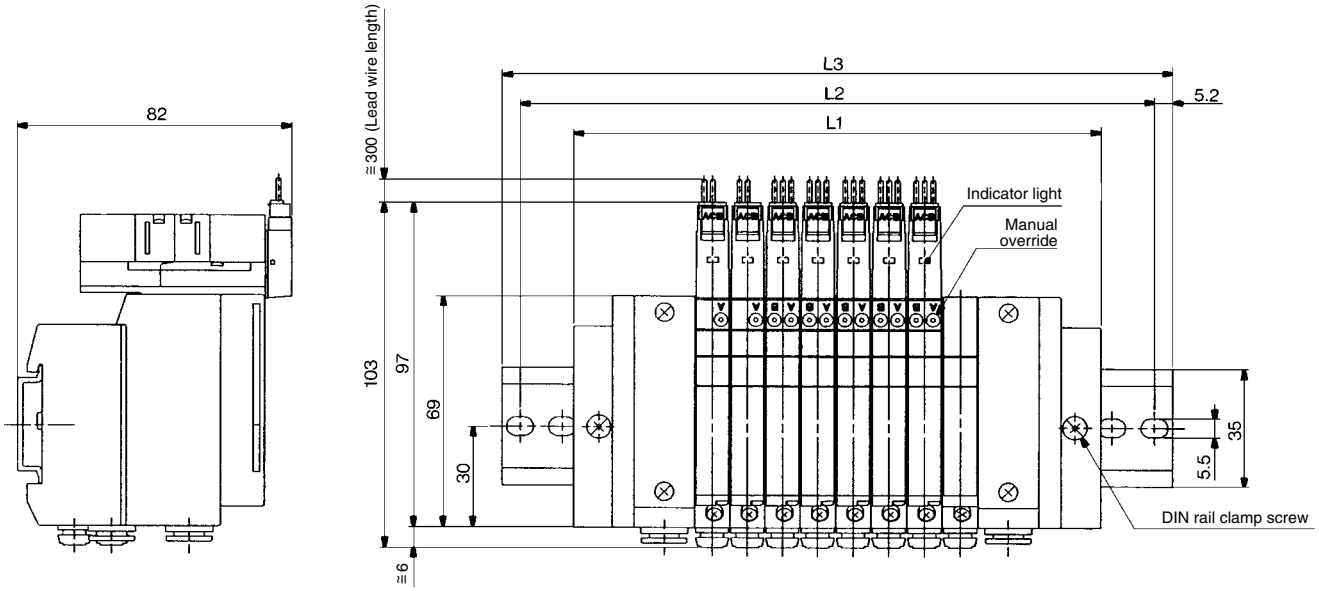
< >: AC

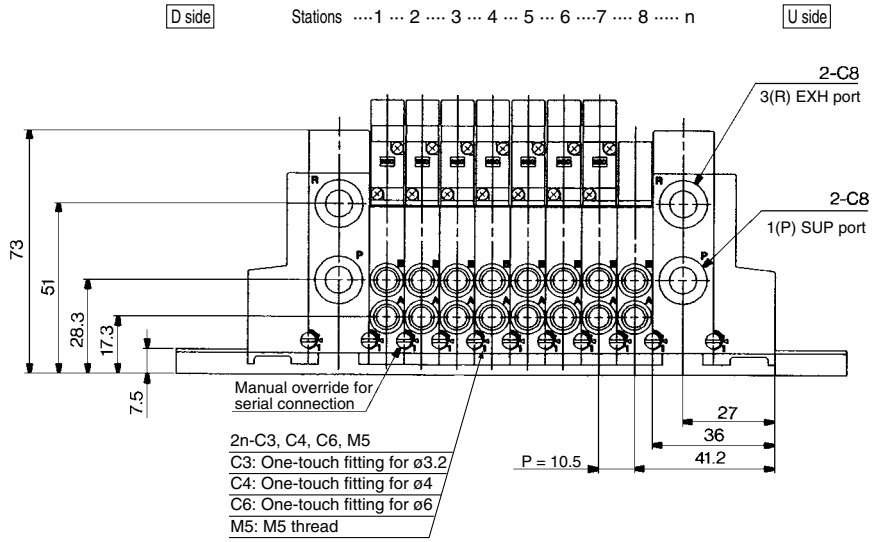
Dimensions

Formula L1 = 10.7n + 36, L2 = 10.7n + 45 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46.7	57.4	68.1	78.8	89.5	100.2	110.9	121.6	132.3	143	153.7	164.4	175.1	185.8	196.5	207.2
L2	55.7	66.4	77.1	87.8	98.5	109.2	119.9	130.6	141.3	152	162.7	173.4	184.1	194.8	205.5	216.2
(L3)	87.5	87.5	100	112.5	125	137.5	150	162.5	162.5	175	187.5	200	212.5	225	225	237.5
(L4)	98	98	110.5	123	135.5	148	160.5	173	173	185.5	198	210.5	223	235.5	235.5	248

VQ1000



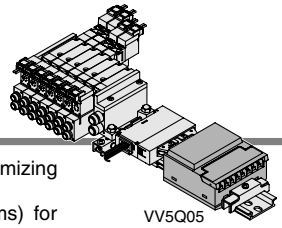


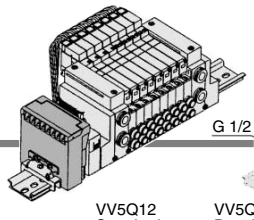
Dimensions

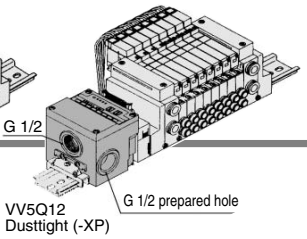
Formula L1 = 10.5n + 72 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	82.5	93	103.5	114	124.5	135	145.5	156	166.5	177	187.5	198	208.5	219	229.5	240
L2	112.5	112.5	125	137.5	150	162.5	175	187.5	187.5	200	212.5	225	237.5	250	250	262.5
L3	123	123	135.5	148	160.5	173	185.5	198	198	210.5	223	235.5	248	260.5	260.5	273

S VQ0000/1000 Kit (Serial transmission unit)



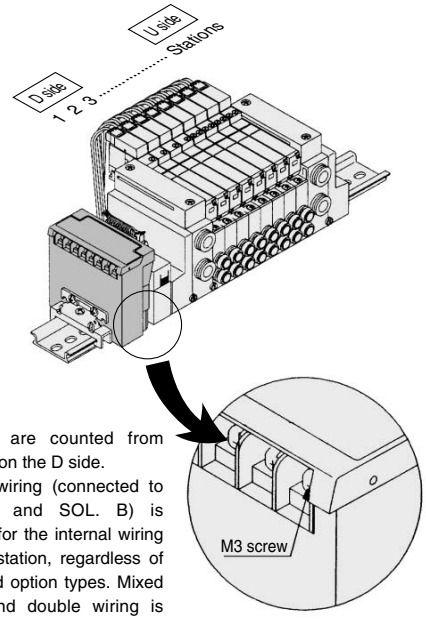




- The serial transmission system reduces wiring work, while minimizing wiring and saving space.
- The system comes in type SA (generic for small scale systems) for equipment with a small number of I/O points, or 32 points max., type SB (applicable to Mitsubishi Electric models) for controlling 512 I/O points max., type SC (applicable to OMRON models), type SD (applicable to SHARP models: 504 points max.), type SF (applicable to NKE models: 128 points max.), type SJ (applicable to SUNX models), type SK (applicable to Fuji Electric models), type SQ (applicable to OMRON's Compo Bus/D), and type SR (applicable to OMRON's Compo Bus/S).
- Max. 8 stations. (Specify a option model with 9 to 16 stations by using the manifold specification sheet.)

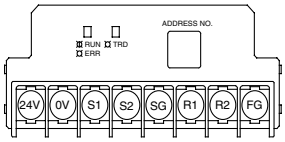
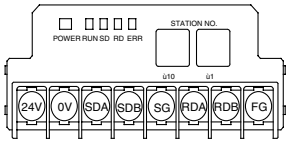
Manifold Specifications

Series	Porting specifications			Applicable stations
	Port location	Port size		
		1(P), 3(R)	4(A), 2(B)	
VQ0000	Side	C6	C3, C4, M5	Max.16 stations
VQ1000	Side	C8	C3, C4, C6, M5	Max.16 stations



- Stations are counted from station 1 on the D side.
- Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. Mixed single and double wiring is available as an option. For details, refer to page 2-4-216.

Item	Specifications
External power supply	24 VDC, +10%, –5%
Current consumption (Internal unit)	SA, SB, SD, SE, SF, SG, SJ, SK, SQ, SR, SH, SV: 0.1A SC: 0.3A

	Type SA With general type SI unit (Series EX300)	Type SB Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System
Name of terminal block (LED)	 LED / Description TRD: Lighting during data reception RUN/ERR: Blinking when received data is normal; Lighting when data reception	 LED / Description POWER: Lighting when power is turned ON RUN: Lighting when data transmission with the master station is normal RD: Lighting during data reception SD: Lighting during data transmission ERR.: Lighting when reception data error occurs Light turns off when the error is corrected
Note	• T unit Can be connected with PLC I/O card for serial transmission. EX300-TMB1···· For models of Mitsubishi Electric Corporation EX300-TTA1···· For models of OMRON Corporation EX300-TFU1···· For models of Fuji Electric Co., Ltd. EX300-T001··· For general models ∗ Up to 32 points per unit. • No. of output points, 16 point	• Master station: PLC made by Mitsubishi Electric Corporation Series MELSEC-A AJ71PT32-S3, AJ71T32-S3 A1SJ71PT32-S3 ∗ Max. 64 stations, connected to remote I/O stations (Max. 512 points). • No. of output points, 16 points. No. of sta. occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

How to Order Manifold

VV5Q 12 – 08 C6 S A – D – XP

Dust-protected type (-XP) (VQ1000 only)
Suffix "-XP" for the dust-protected type SI unit.
(Except SE and SQ.)

Series/Manifold

05	VQ0000	Plug lead unit
12	VQ1000	

Stations

01	1 station
⋮	⋮
16	16 stations Note)

Note) For details, refer to page 2-4-216.

Cylinder port

Symbol	Port size	VQ0000	VQ1000
C3	With One-touch fittings for ø3.2	●	●
C4	With One-touch fitting for ø4	●	●
C6	With One-touch fitting for ø6	—	●
M5	M5 thread	●	●
CM	With mixed size/with port plug	●	●

Note 1) Specify "Mixed size/with port plug" on the manifold specification sheet.
Note 2) For inch-size One-touch fittings, refer to "Option" on page 2-4-216.

Model

0	Without SI unit		
Note 1) **A**	With general type SI unit (Series EX300)		
B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System		
C	OMRON Corp.: SYSBUS Wire System		
D	SHARP Corp.: Satellite I/O Link System		Max.16 stations
Note 2) **E**	Matsushita Electric Works: MEWNET-F System		
F1	NKE Corp.: Uni-wire System (16 output points)		
Note 2) **G**	Rockwell Automation: Allen Bradley Remote I/O (RIO) System		
H	NKE Corp.: Uni-wire H System		
Note 2) **J1**	SUNX Corp.: S-LINK System (16 output points)		
Note 2) **J2**	SUNX Corp.: S-LINK System (8 output points)	Max. 8 stations	
Note 2) **K**	Fuji Electric Co.: T-LINK Mini System		
Note 2) **Q**	DeviceNet, CompoBus/D (OMRON Corp.)		Max.16 stations
Note 2) **R1**	OMRON Corp.: CompoBus/S System (16 output points)		
Note 2) **R2**	OMRON Corp.: CompoBus/S System (8 output points)	Max. 8 stations	
Note 2) **V**	Mitsubishi Electric Corp.: CC-LINK System	Max. 16 stations	

Note 1) The general type requires a transmission unit on CPU side.
Note 2) Usable only for VQ1000

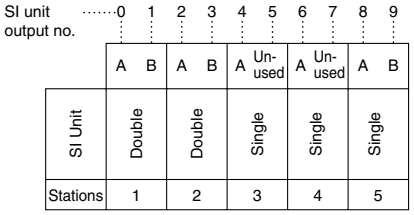
Option

Symbol	Option	VQ0000	VQ1000	Note
B	With back pressure check valve	—	●	(2)
D	DIN rail mounting	●	●	(3)
K	Special wiring specifications (Not double wiring)	●	●	(4)
N	With name plate	●	●	
S	Built-in silencer, direct exhaust	●	●	

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -BNS
Note 2) Models with a suffix "-B" have the back pressure check valve at all manifold stations. If not all stations need this check valve, specify the stations where check valves are installed by using the manifold specification sheet.
Note 3) S kit of VQ0000 and all of VQ1000 are equipped with a DIN rail, so indicate suffix "-D".
Note 4) Specify the wiring specifications on the manifold specification sheet.

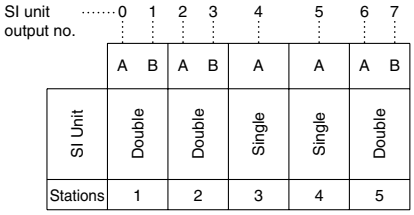
● SI unit output and coil numbering

<Wiring example 1>

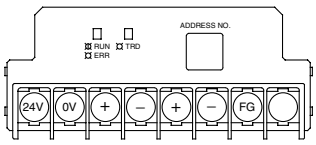
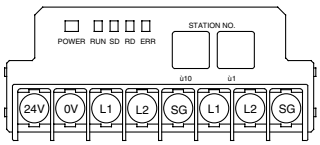


Double wiring (Standard)

<Wiring example 2> Mixed wiring is available as an option.
Use the manifold specification sheet to specify.



Single/Double Mixed Wiring (Option)

	Type SC OMRON Corporation SYSBUS Wire System	Type SD SHARP Corporation Satellite I/O Link System
Name of terminal block (LED)		
	LED / Description RUN: Lights when transmission is normal and PLC is in operation mode T/R ERR: Blinks during data transmission/reception ON when transmission is abnormal	LED / Description POWER: ON when power supply is ON RUN: Lights when power is ON and slave stations are operating normally ERROR: Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit R.SET HOLD: ON for master unit control input
Note	• Master station unit: OMRON PLC SYSMAC C(CV) series Types C500-RM201 and C200H-RM201 ∗ 32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit: SHARP's PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW-31LM ∗ Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ 1 1 1 0 Y — 5 LO

Series

0	VQ0000
1	VQ1000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center (VQ1000 only)

Body type

5	VQ0000	Plug lead unit
1	VQ1000	

Seal

0	Metal seal
1	Rubber seal

Note) Connector assembly will be required when the S kits add a valve.
For part nos., refer to "Option" on page 2-4-216.

Function

Symbol	Specifications	DC
Nil	Standard type	(1.0 W) ○
H	High pressure type	(1.5 W) ○
Y	Low wattage type	(0.5 W) ○

Coil voltage

5	24 VDC; With light/surge voltage suppressor

Electrical entry

		VQ0000	VQ1000
LO	L plug terminal without connector	●	●
MO	M plug terminal without connector	●	—

Note) Plug connector and lead wire layers are attached to the manifold.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)
C	Locking type (Manual) Note)

Note) Available only for VQ1000

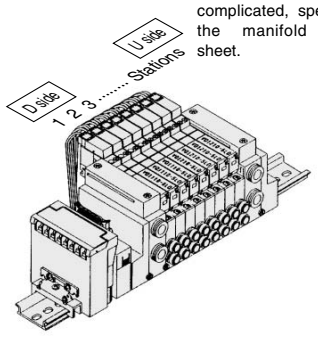
How to Order Manifold Assembly

Please indicate manifold base type, corresponding valve, and option parts.

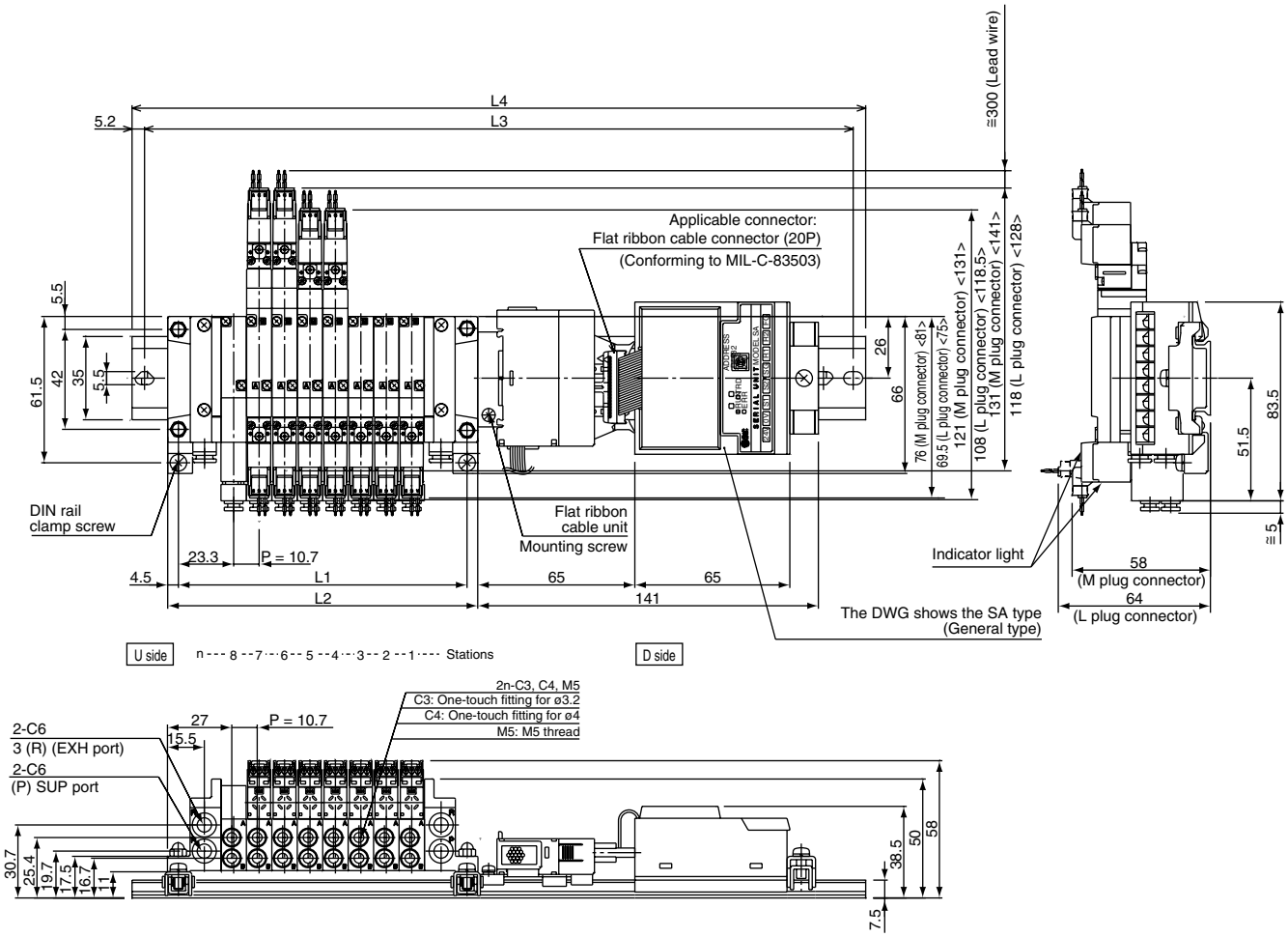
<Example>
Serial transmission kit
VV5Q12-08C6SA-D ····1 set-Manifold base no.
∗VQ1110-5LO ·····4 sets-Valve part no. (Stations 1 to 4)
∗VQ1210-5LO ·····3 sets-Valve part no. (Stations 5 to 8)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Write sequentially from the 1st station on the D side. When part nos. written collectively are complicated, specify by using the manifold specification sheet.



VQ0000

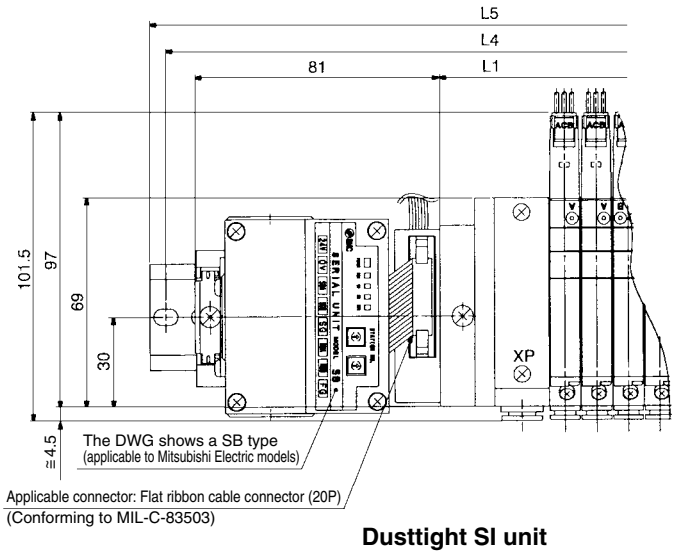


Dimensions

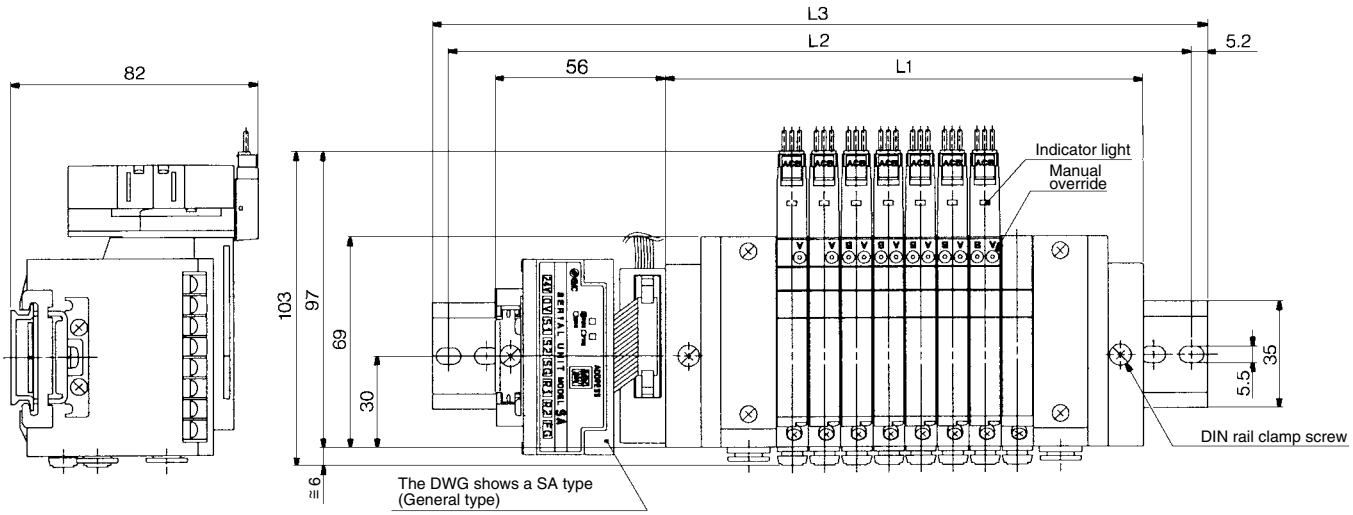
Formula L1 = 10.7n + 36, L2= 10.7n + 45 n: Station (Maximum 16 stations)

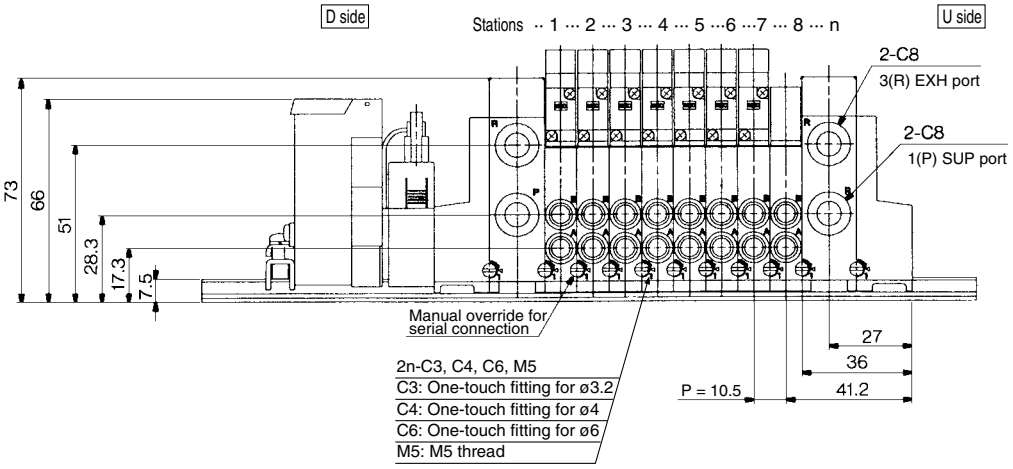
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	46.7	57.4	68.1	78.8	89.5	100.2	110.9	121.6	132.3	143	153.7	164.4	175.1	185.8	196.5	207.2
L2	55.7	66.4	77.1	87.8	98.5	109.2	119.9	130.6	141.3	152	162.7	173.4	184.1	194.8	205.5	216.2
L3	225	237.5	250	250	262.5	275	287.5	300	312.5	325	325	337.5	350	362.5	375	387.5
L4	235.5	248	260.5	260.5	273	285.5	298	310.5	323	335.5	335.5	348	360.5	373	385.5	398

VQ1000



Dusttight SI unit





Dimensions

Dust-protected type SI unit: L4 = L3 + 25, L5 = L4 + 25
Formula L1 = 10.5n + 72 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	82.5	93	103.5	114	124.5	135	145.5	156	166.5	177	187.5	198	208.5	219	229.5	240
L2	162.5	175	187.5	200	200	212.5	225	237.5	250	262.5	275	275	287.5	300	312.5	325
L3	173	185.5	198	210.5	210.5	223	235.5	248	260.5	273	285.5	285.5	298	310.5	323	335.5

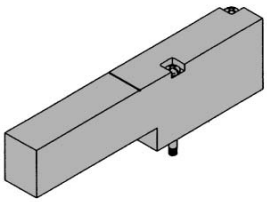
* Manifolds with SI unit for Matsushita Electric Works' MEWNET FP and Rockwell Automation's model are the same with L4 and L5 dimensions of dustproof SI unit.

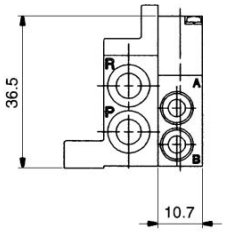
Manifold Option Parts for VQ0000

Blanking plate assembly
VVQ0000-10A-5

JIS Symbol

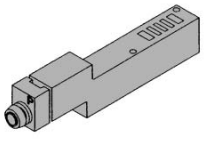
It is used by attaching on the manifold block for being prepared for removing a valve for maintenance reasons or planning to mount a spare valve, etc.

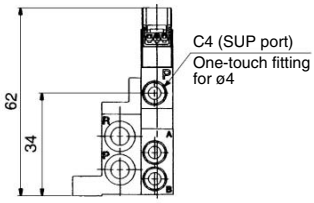


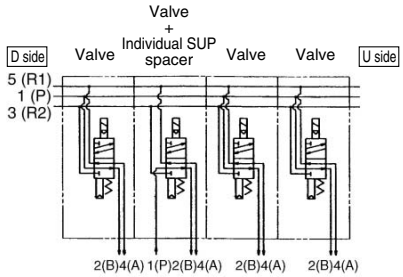


Individual SUP spacer
VVQ0000-P-5-C4

When the same manifold is to be used for different pressures, this spacer is mounted under the valve to equip each valve with an individual supply port.

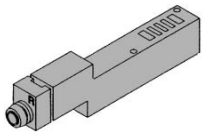


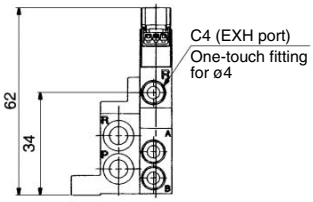


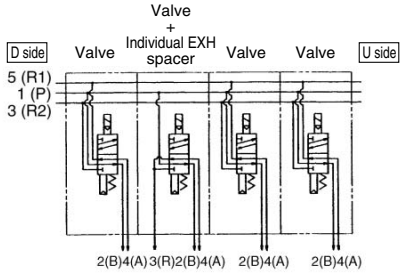


Individual EXH spacer
VVQ0000-R-5-C4

When a valve exhaust affects other stations due to the circuit configuration, this spacer is mounted under the valve to equip each valve with an individual valve exhaust.







SUP/EXH block plate
VVQ0000-16A-5- P (SUP) R (EXH) PR (SUP/EXH)

1(P) (For SUP)

When different pressures, high and low, are supplied to one manifold, block a plate is inserted between the stations under different pressures.

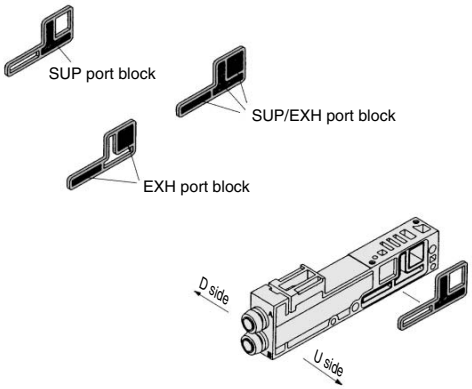
3(R) (For EXH)

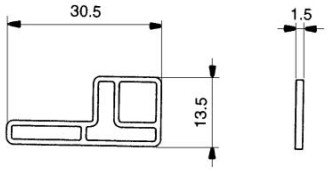
When a valve exhaust affects other stations due to the circuit configuration, this plate is used between the stations where exhaust should be separated.

1(P), 3(R) (For SUP/EXH)

When blocking SUP and EXH simultaneously, SUP/EXH block plate (PR) is used.

* Specify the number of stations on the manifold specification sheet.

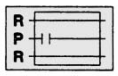




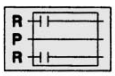
<Blocking indication label>

When blocking the SUP, EXH passage with a SUP, EXH block plate, indication label for confirmation of the blocking position from outside is attached. (One label for each)

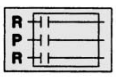
* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.



SUP passage blocked
(VVQ0000-16A-5-P)



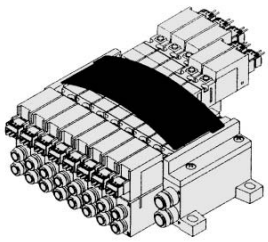
EXH passage blocked
(VVQ0000-16A-5-R)



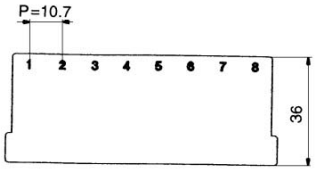
SUP/EXH passage blocked
(VVQ0000-16A-5-PR)

Name plate [-N*]
VVQ0000-N5-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.



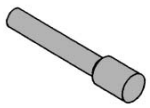
* When ordering assemblies incorporated with a manifold, add suffix "N" to the manifold no.

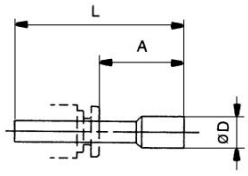


Blanking plug (For One-touch fittings)

KQ2P- $^{23}_{04}$ $_{06}$

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.





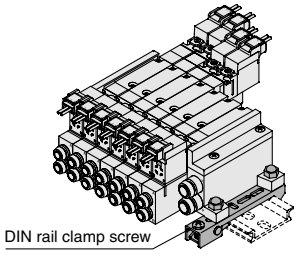
Dimensions

Applicable fitting size ød	Model	A	L	D
3.2	**KQ2P-23**	16	31.5	3.2
4	**KQP-04**	16	32	6
6	**KQP-06**	18	35	8

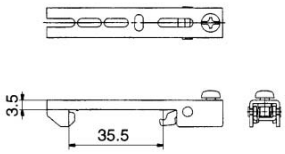
DIN rail mounting bracket [-D]

VVQ0000-57A-5 (VQ0000)

It is used for mounting a VV5Q05 type manifold on a DIN rail. The DIN rail mounting bracket is fixed to the manifold end plate. (The specification is the same as that for the option "-D".)
1 set of DIN rail mounting bracket is used for 1 set of manifold (2 DIN rail mounting brackets).



∗ When ordering assemblies incorporated with a manifold, add suffix "-D" to the manifold no.

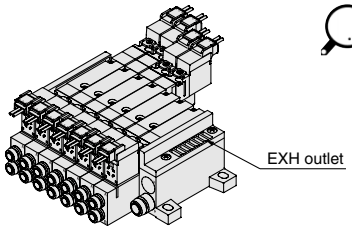


Built-in silencer, Direct exhaust [-S]

This is an exhaust port on the manifold end plate. The built-in silencer exhibits an excellent noise suppression effect. (Silencing effect: 20 dB)

Note) A large quantity of drainage generated in the air source results in exhaust of air together with drainage.

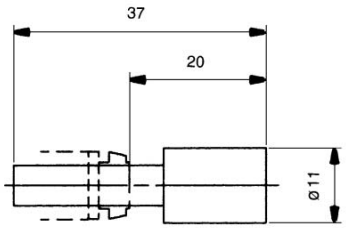
● For maintenance, refer to page 2-4-214.



∗ When ordering assemblies incorporated with a manifold, add suffix "-S" to the manifold no.

Silencer (For EXH port)

This is inserted into the centralized type EXH port (One-touch fitting).



Dimensions

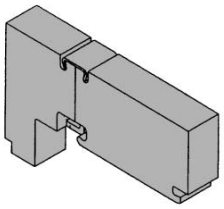
Series	Applicable fitting size ød	Model	A	L	D	Effective area (mm²)	Noise reduction (dB)
VQ0000	6	AN103-X233	20	37	11	7	25

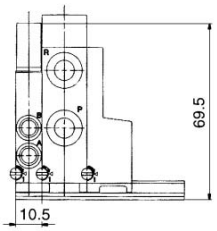
Manifold Option Parts for VQ1000

Blanking plate assembly
VVQ1000-10A-1

JIS Symbol

It is used by attaching on the manifold block for being prepared for removing a valve for maintenance reasons or planning to mount a spare valve, etc.

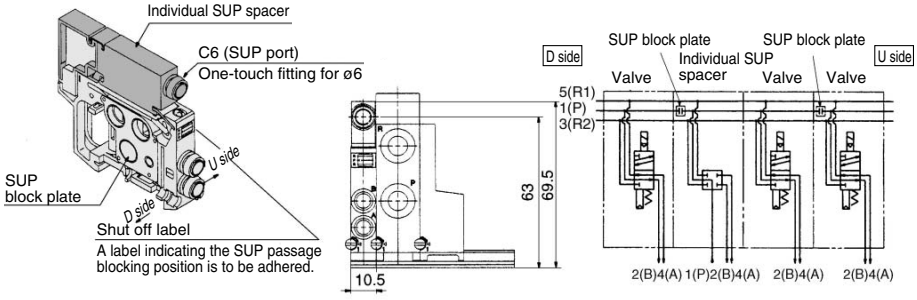




Individual SUP spacer
VVQ1000-P-2-C6

When the same manifold is to be used for different pressures, individual SUP spacers are used as SUP ports for different pressures. (One station space is occupied.)
Block both sides of the station, for which the supply pressure from the individual SUP spacer is used, with SUP block plates. (Refer to the application ex.)

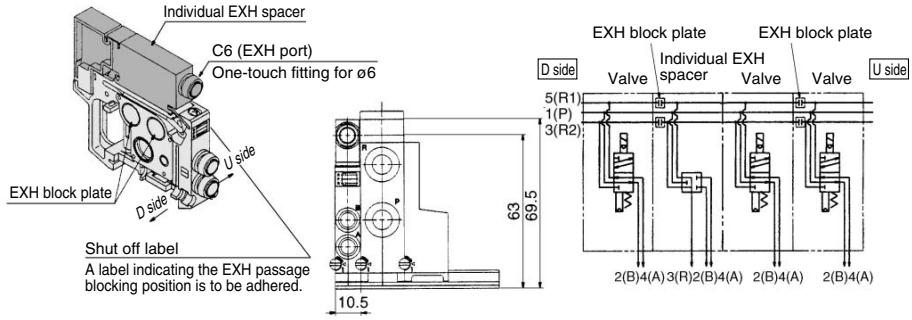
* Specify the spacer mounting position and SUP block plate position on the manifold specification sheet. The block plates are used in two places for one set. (Two SUP block plates forblocking SUP station are attached to the individual SUP spacer.)



Individual EXH spacer
VVQ1000-R-2-C6

When valve exhaust affects other stations due to the circuit configuration, this spacer is used for individual valve exhaust. (One station space is occupied.)
Block both sides of the individual valve EXH station. (See example.)

* Specify the mounting position, as well as EXH block base or EXH block plate position on the manifold specification sheet. The block plates are used in two places for one set.



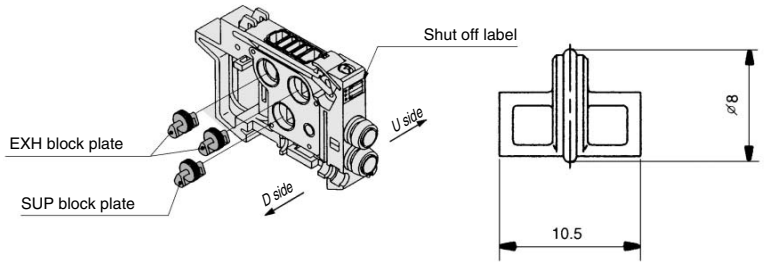
SUP/EXH block plate
VVQ1000-16A-2

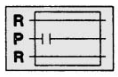
When different pressures, high and low, are supplied to one manifold, a SUP block plate is inserted between the stations under different pressures.
When a valve exhaust affects other stations due to the circuit configuration, this plate is also used between the stations where exhaust should be separated. It is also used for individual exhaust by combining an EXH block plate with an individual EXH spacer.
(2 EXH plates are necessary for 1 station.)
Note) The SUP/EXH block plate is common.

* Specify the number of stations on the manifold specification sheet.

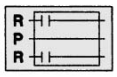
<Blocking indication label>
When using block plates for SUP/EXH passage, the indication label for confirmation of the blocking position from outside is attached. (One label for each)

* When ordering a block plate incorporated with the manifold no., a block indication label is attached to the manifold.

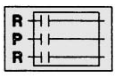




SUP passage blocked



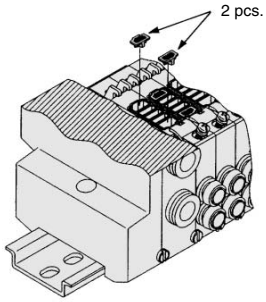
EXH passage blocked



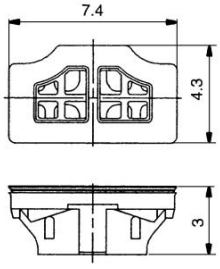
SUP/EXH passage blocked

Back pressure check valve assembly [-B]
VVQ1000-18A

It prevents cylinder malfunction caused by other valve exhaust. Insert it into R (EXH) port on the manifold side of a valve which is affected. It is effective when a single acting cylinder is used or an exhaust center type solenoid valve is used.
Note) When a check valve for back pressure prevention is desired to be installed only in certain manifold stations, write clearly the part no. and specify the station numbers by using the manifold specification sheet.



* When ordering assemblies incorporated with a manifold, add suffix "-B" to the manifold no.



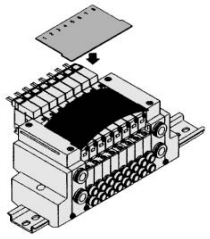
<Precautions>

1. Back pressure check valve assembly is assembled with a check valve structure. However, as slight air leakage is allowed for the back pressure, take note the exhaust air will not be throttled at the exhaust port.
2. When a back pressure check valve is mounted, the effective orifice of the valve will decrease by about 20%.

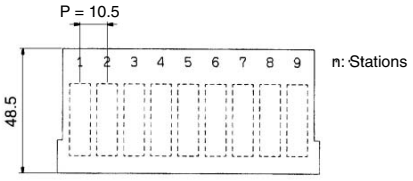
Name plate [-N∗]

VVQ1000-N2-Station (1 to Max. stations)

It is a transparent resin plate for placing a label that indicates solenoid valve function, etc.
Insert it into the groove on the side of the end plate and bend it as shown in the figure.



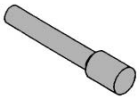
∗ When ordering assemblies incorporated with a manifold, add suffix "-N" to the manifold no.

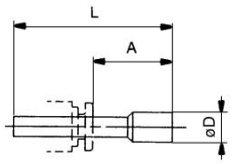


Blanking plug (For One-touch fittings)

KQ2P- $^{23}_{04}$ $^{06}_{08}$

It is inserted into an unused cylinder port and SUP/EXH ports.
Purchasing order is available in units of 10 pieces.



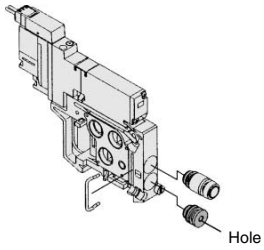


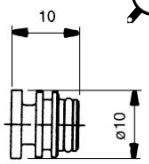
Dimensions

Applicable fitting size ød	Model	A	L	D
3.2	**KQ2P-23**	16	31.5	3.2
4	**KQP-04**	16	32	6
6	**KQP-06**	18	35	8
8	**KQP-08**	20.5	39	10

Port plug VVQ0000-58A

The plug is used to block the cylinder port when using a 4 port valve as a 3 port valve.



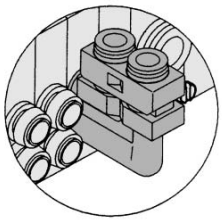


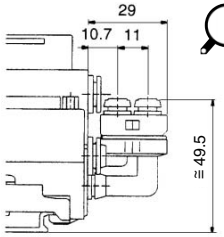
∗ When ordering a plug incorporated with a manifold, indicate "CM" for the port size in the manifold no., as well as, the mounting position and number of stations andcylinder port mounting positions, A and B, by means of the manifold specification sheet.
∗ Lightly screw an M3 screw in the port plug hole and pull it for removal.

Elbow fittings assembly

VVQ1000-F-L $^{C3}_{C4}$ $^{C6}_{M5}$

It is used for piping that extends upward or downward from the manifold.
When not mounting it to all manifold stations, clearly write the elbow type fitting assembly no. and specify the station's qty and position by manifold specifications.
∗ When mounting elbow fittings assembly on the edge of manifold station and a silencer on EXH port, select a silencer, AN203-KM8.
Silencer (AN200-KM8) is interfered with fittings.



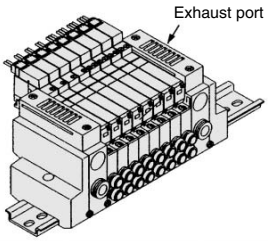


∗ When ordering assemblies incorporated with a manifold, indicate "L□" or "B□" for the manifold port size.

Built-in silencer, Direct exhaust [-S]

This is an exhaust port on the manifold end plate.
The built-in silencer exhibits an excellent noise suppression effect. (Silencing effect: 30 dB)
Note) A large quantity of drainage generated in the air source results in exhaust of air together with drainage.

• For maintenance, refer to page 2-4-214.

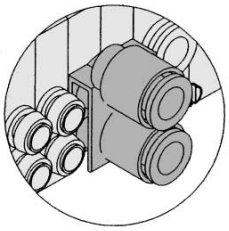


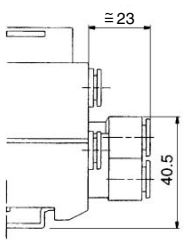
∗ When ordering assemblies incorporated with a manifold, add suffix "-S" to the manifold no.

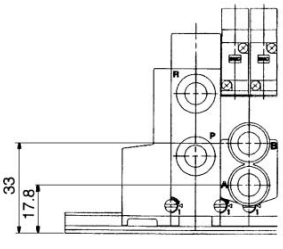
2 stations matching fitting assembly

VVQ1000-52A-C8

For driving a cylinder with a large bore, valves for two stations are operated to double the flow rate. This assembly for the cylinder port is used in that case. The assembly is equipped with One-touch fittings for a ø8 bore.
∗ The bore for the manifold no. is "CM".
Clearly indicate the 2 station matching fitting assembly no., and specify the number of stations and positions on the manifold specification sheet.

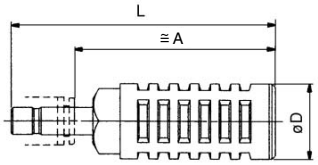






Silencer (For EXH port)

This is inserted into the centralized type EXH port (One-touch fitting).
∗ When mounting elbow fittings assembly (VVQ1000-F-L□) on the edge of manifold station, select a silencer, AN203-KM8.
Silencer (AN200-KM8) is interfered with fittings.



Dimensions

Series	Applicable fitting size ød	Model	A	L	D	Effective area (mm^2)	Noise reduction (dB)
VQ1000	8	AN200-KM8	59	78	22	20	30
		AN203-KM8	32	51	16	14	25 ∗

Manifold Option Parts for VQ0000/VQ1000

Double check block (Separated type)

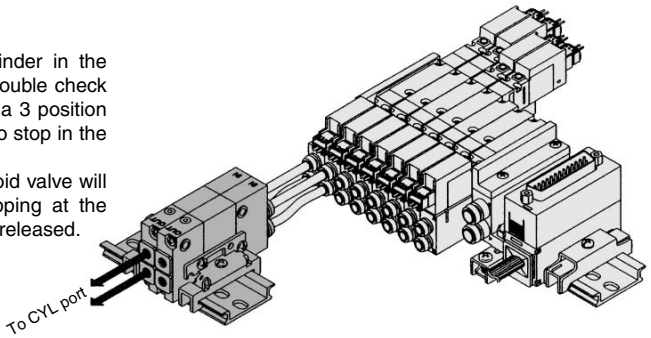
VQ1000-FPG-□□

It is used on the outlet side piping to keep the cylinder in the intermediate position for a long time. Combining the double check block with a built-in pilot type double check valve and a 3 position exhaust center solenoid valve will enable the cylinder to stop in the middle or maintain its position for a long time.

The combination with a 2 position single/double solenoid valve will permit this block to be used for preventing the dropping at the cylinder stroke end when the SUP residual pressure is released.

Specifications

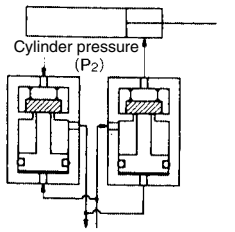
Max. operating pressure	0.8 MPa
Min. operating pressure	0.15 MPa
Ambient and fluid temperature	–5 to 50°C
Flow characteristics: C	0.60 dm³/(s·bar)
Max. operating frequency	180 CPM



VVQ1000-FPG-02 1 set
∗VQ1000-FPG-C6M5-D 2 pcs.

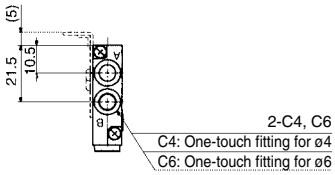
Note) Based on JIS B 8375-1981
(Supply pressure: 0.5 MPa)

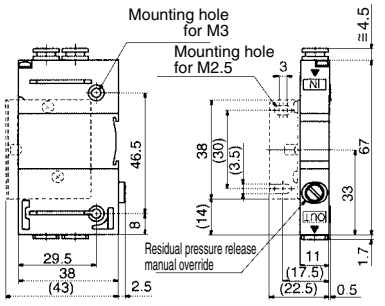
<Check valve operation principle>



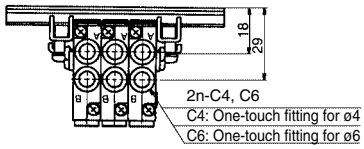
Dimensions

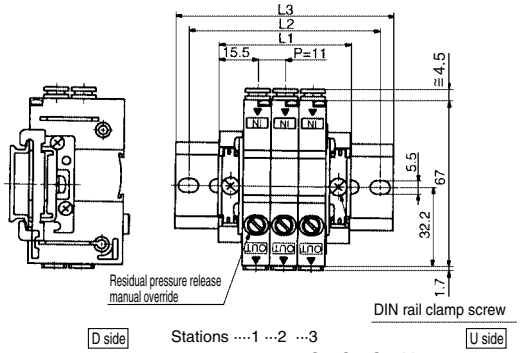
Single unit





Manifold





Dimensions

Formula L1=11n+20 n: Station (Maximum 24 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	31	42	53	64	75	86	97	108	119	130	141	152
L2	50	62.5	75	87.5	100	112.5	125	125	137.5	150	162.5	175
L3	60.5	73	85.5	98	110.5	123	135.5	135.5	148	160.5	173	185.5

L \ n	13	14	15	16	17	18	19	20	21	22	23	24
L1	163	174	185	196	207	218	229	240	251	262	273	284
L2	187.5	187.5	200	212.5	225	237.5	250	250	262.5	275	287.5	300
L3	198	198	210.5	223	235.5	248	260.5	260.5	273	285.5	298	310.5

How to Order

Double check block

VQ1000-FPG- C4 M5 — F

IN side port size

C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

OUT side port size

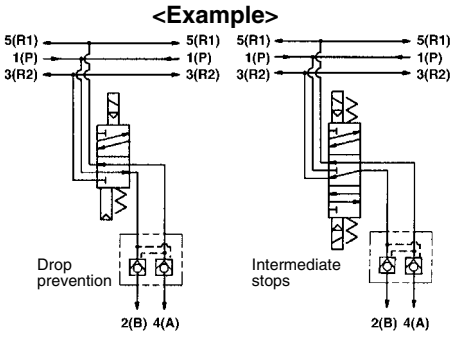
M5	M5 thread
C3	One-touch fitting for ø3.2
C4	One-touch fitting for ø4
C6	One-touch fitting for ø6

Option

Nil	None
F	With bracket
D	DIN rail mounting style (For manifold)
N	Name plate

Note) When two or more symbols are specified, indicate them alphabetically.
Example) -DN

<Example>



Manifold

VVQ1000-FPG- 06

Stations

01	1 station
⋮	⋮
16	16 stations

<Example>

VVQ1000-FPG-06 ··· 6 types of manifold
∗VQ1000-FPG-C4M5-D, 3 sets
∗VQ1000-FPG-C6M5-D, 3 sets
} Doublecheck block

Bracket Assembly

Part no.	Tightening torque
VQ1000-FPG-FB	0.22 to 0.25 N·m

⚠ Caution

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping for a long time. Check the leakage using neutral household detergent, such as dish washing soap. Also check the cylinder's tube gasket, piston packing and rod packing for air leakage.
- Since One-touch fittings allow slight air leakage, screw piping (with M5 thread) is recommended when stopping the cylinder in the middle for a long time.
- Combining double check block with 3 position closed center or pressure center solenoid valve will not work.
- M5 fitting assembly is attached, not incorporated into the double check block. After screwing in the M5 fittings, mount the assembly on the double check block. {Tightening torque: 0.8 to 1.2 N·m}
- If the exhaust of the double check block is throttled too much, the cylinder may not operate properly and may not stop intermediately.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

⚠ Precautions 1

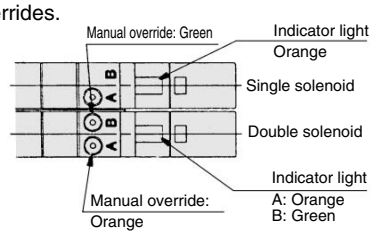
Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

Light/Surge Voltage Suppressor

⚠ Caution

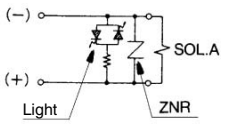
In the case of VQ1000, the standard model is equipped with an indicator light and surge voltage suppressor. The lighting positions are concentrated on one side for both single solenoid type and double solenoid type.

For the double solenoid type, A side and B side energization are indicated by two colors which match the colors of the manual overrides.



∗ In the case of VQ0000, solenoid and manual override on both sides.

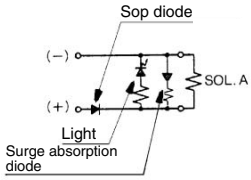
DC circuit diagram
VQ0000



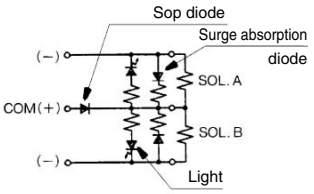
∗ In the case of VQ0000, solenoid and manual override on both sides.

Note) A side energization:
A light (orange) illuminates.
With wrong wiring preventing ability (stop diode)
B side energization:
B light (green) illuminates.
Equipped with a surge absorption (surge absorption diode) mechanism.

VQ1000 (DC)/Single solenoid



VQ1000/Double solenoid



Manual Override

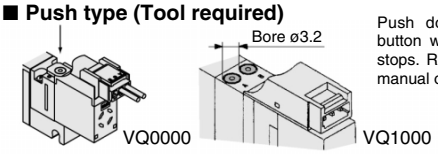
⚠ Warning

Without an electric signal for the solenoid valve the manual override is used for switching the main valve.

Push type is standard. (Tool required)

Option: Locking type (Tool required/Manual)

■ Push type (Tool required)

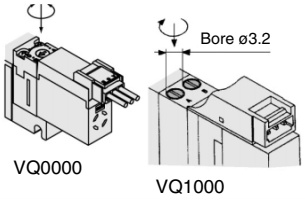


Push down on the manual override button with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

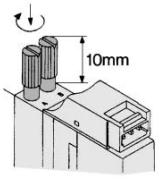
■ Locking type (Tool required) <Option>

If the manual override is turned by 180° clockwise and the ▶ mark is adjusted to 1, it will be locked in the ON state.
If the manual override is turned by 180° counterclockwise and the ▶ mark is adjusted to 0, locking will be released and the manual override will return.

Push down completely on the manualoverride button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.



■ Locking type (Manual) <Option>



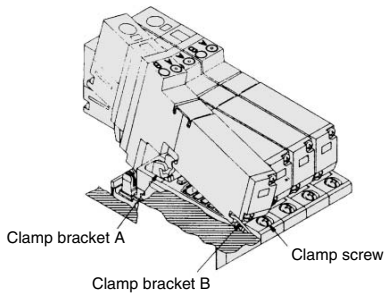
Push down on the manual override button with a small screwdriver or with your fingers until it stops. Turn clockwise by 90° to lock it. Turn it counterclockwise to release it.

⚠ Caution

Do not apply excessive torque when turning the locking type manual override. (0.1 N·m or less)

How to Mount/Remove Solenoid Valve

⚠ Caution



How to Remove

1. Loosen the clamp screw until it turns freely. (The screw is captive.)
2. Lift the coil side of the valve body while pressing down slightly on the screw head and remove it from the clamp bracket B. When the screw head cannot be pressed easily, gently press the area near the manual override of the valve.

How to Remove

1. Press down on the clamp screw. → Clamp bracket A opens. Diagonally insert the hook on the valve end plate side into clamp B.
2. Press the valve body downward. (When the screw is released, it will be locked by clamp bracket A.)
3. Tighten the clamp screw. (Proper tightening torque: 0.25 to 0.35 N·m)

Mounting

1. Dust on the sealing surface of the gasket or solenoid valve can cause air leakage.
2. In the case of VQ0000, valve mounting screw clamping torque is 0.18 to 0.25 N·m.

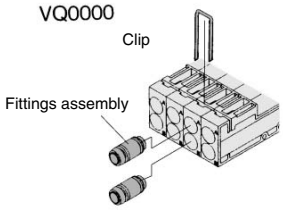
Replacement of Cylinder Port Fittings

⚠ Caution

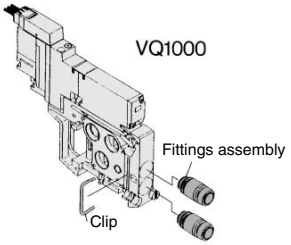
The cylinder port fittings are a cassette for easy replacement.

The fittings are blocked by a clip inserted from the top of manifold. Remove the clip with a screwdriver to remove fittings.

For replacement, insert the fitting assembly until it strikes against the inside walland then re-insert the clip to specified position.



Take off the valve and remove the clip.



Remove the clip after taking off the manifold.

Applicable tubing O.D.	Fitting assembly part no.	
	VQ0000	**VQ1000**
Applicable tubing ø3.2	VVQ1000-51A-C3	VVQ1000-50A-C3
Applicable tubing ø4	VVQ1000-51A-C4	VVQ1000-50A-C4
Applicable tubing ø6	—	VVQ1000-50A-C6
M5	—	VVQ1000-50A-M5

∗ Refer to “Option” on pages 2-4-208 to 2-4-211 for other types of fittings.

⚠ Caution

1. Use caution that O-rings must be free from scratches and dust. Otherwise, air leakage may result.
2. After screwing in the fittings, mount the M5 fitting assembly on the manifold base. (Tightening torque 0.8 to 1.2 N·m)
3. Purchasing order is available in units of 10 pieces.

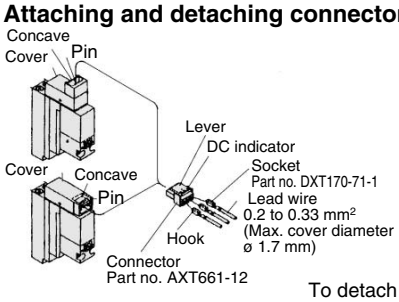
⚠ Precautions 2

Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

How to Use Plug Connector

⚠ Caution

Attaching and detaching connectors

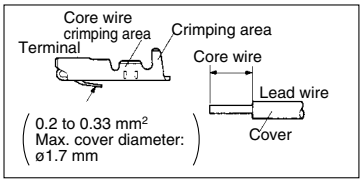


To attach a connector, hold the lever and connector unit between your fingers and insert straight onto the pins of the solenoid valve so that the lever's pawl is pushed into the groove and locks.

To detach a connector, remove the pawl from the groove by pushing the lever downward with your thumb, and pull the connector straight out.

Crimping the lead wire and socket

Peel 3.2 to 3.7 mm of the tip of lead wire, neatly into a socket and press contact it by a press tool.
Be careful so that the cover of lead wire does not enter into the core press contacting part.



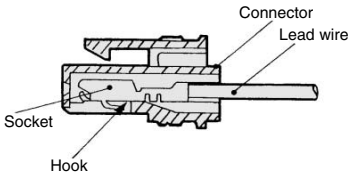
Attaching and detaching lead wires with sockets

Attaching

Insert a socket in the square hole (Indicated as ⊕ , ⊖) of connector, push in the lead wire and lock by hanging the hook of socket to the seat of connector. (Pushing-in can open the hook and lock it automatically.) Then confirm the lock by lightly pulling on the lead wire.

Detaching

For pulling-out the socket from the connector, pull out the lead wire while pushing the hook of the socket with a fine point (ca.1 mm) tool.
If the socket is to be re-used, spread the hook to the outside.

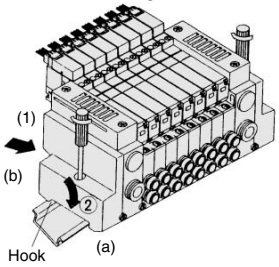


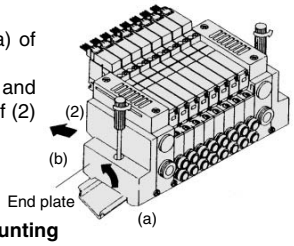
Mounting/Removing from the DIN Rail (VQ1000)

⚠ Caution

Removing

1. Loosen the clamp screw on side (a) of the end plate on both sides.
2. Lift side (a) of the manifold base and slide the end plate in the direction of (2) shown in the figure to remove.





Mounting

1. Hook side (b) of the manifold base on the DIN rail.
2. Press side (a) and mount the end plate on the DIN rail.
3. Tighten the clamp screw on side (a) of the end plate. The proper tightening torque for screws is 1.2 to 1.6 N·m.

Enclosure IP65

⚠ Caution

Wires, cables, connectors, etc. used for models conforming to IP65 should also have enclosures equivalent to or of stricter than IP65.

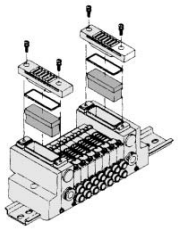
How to Calculate the Flow Rate

⚠ Caution

For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

Built-in Silencer Replacement

⚠ Caution



A silencer element is incorporated in the end plate on both sides of the manifold base. A dirty and choked element may reduce cylinder speed and cause malfunction. Clean or replace the dirty element.

Remove the cover from the top of the end plate and remove the old element with a screwdriver, etc.

Element part no.

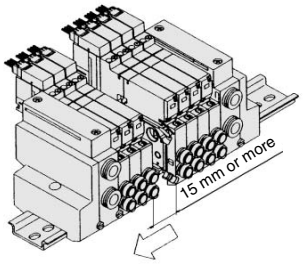
Type	Element part no.	
	VQ0000	**VQ1000**
Built-in silencer, direct exhaust (-S)	VVQ0000-82A-1	VVQ1000-82A-1

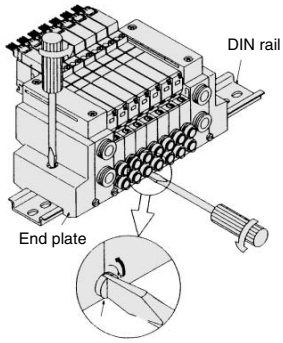
∗ The minimum order quantity is 10 pcs.

Manifold Base Station Increasing Procedure (VQ1000)

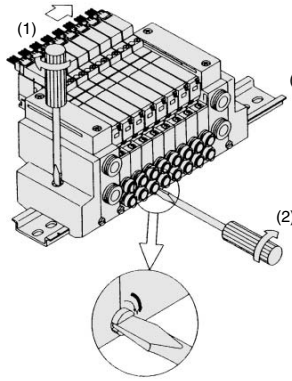
⚠ Caution

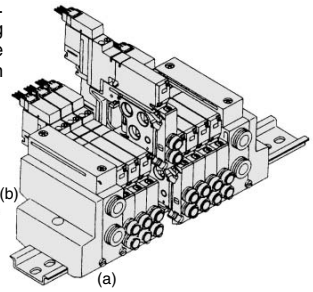
1. Loosen the clamp screw on the top surface of the end plate on one side.
2. Turn the manual override between the manifold blocks with a regular screwdriver, etc. in a couterclockwise direction.





3. Slide the manifold base to the side where the screw is loosened. Make a clearance of 15 mm or more.
4. Mount the station increasing manifold block assembly and solenoid valve on the DIN rail. Install it to the DIN rail by applying the hook on the (b) side of the manifold block and pushing down the (a) side.





5. Slide the manifold bases with a slight clearance in-between and lock them by turning the manual override between the manifold blocks clockwise.
6. Tighten the screw on the top surface of the end plate, and the station has been added.
(Proper tightening torque 1.2 to 1.6 N·m)

Manifold Block Assembly

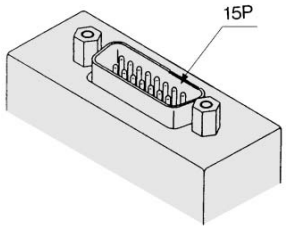
VQ1000	Port size
VVQ1000-1A-2-C3	With One-touch fitting for ø3.2
VVQ1000-1A-2-C4	With One-touch fitting for ø4
VVQ1000-1A-2-C6	With One-touch fitting for ø6
VVQ1000-1A-2-M5	M5 thread

Option

Different Number of Connector Pins

F and P kits with the following number of pins are available besides the standard number (F = 25; P = 26). Select the desired number of pins and cable length from the cable assembly list.
Place an order for the cable assembly separately.

F kit (D-sub connector) 15 pins



How to order manifold

VV5Q12 — 06 | F | SA — D

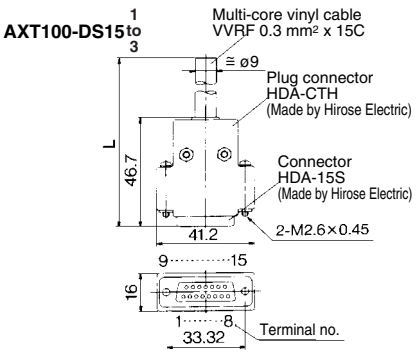
- 06 → Stations
- SA → Kit/Electrical entry
- D → Option

How to Order
D-sub connector, 15 pins
Connector location –
Side (horizontal)
Without cable

Pins \ Location	Top entry		Side entry	
15P (Max. 7 stations)	Kit F	UA	Kit F	SA

Wiring Specifications

∗ In the same way as the 25-pin models (standard), terminal no. 1 for is SOL.A at the 1st station, terminal no. 9 for SOL.B at the 1st station, and terminal no. 8 for COM.



Wire Color by Terminal No. of D-sub Connector Cable Assembly

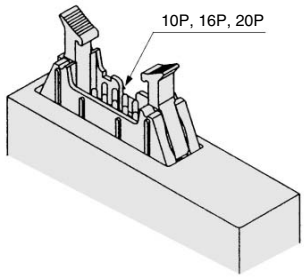
Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black

D-sub Connector Cable Assembly

Cable length (L) \ Pins	15P
1.5 m	AXT100-DS15-1
3 m	AXT100-DS15-2
5 m	AXT100-DS15-3

∗ For other commercial connectors, use a type conforming to MIL-C-24308.

P kit (Flat ribbon cable connector) 10 pins, 16 pins, 20 pins



How to order manifold

VV5Q12 — 06 | P | SC — D

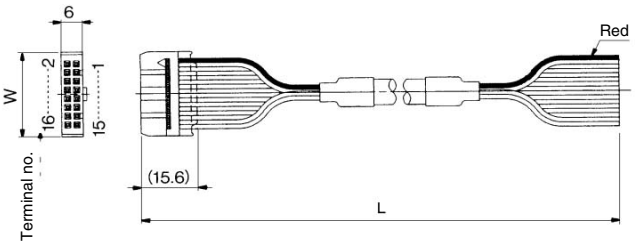
- 06 → Stations
- SC → Kit/Electrical entry
- D → Option

How to Order
Flat ribbon cable, 20 pins
Connector location –
Side (horizontal)
Without cable

Pins \ Location	Top entry		Side entry	
10P (Max. 4 stations)	Kit P	UA	Kit P	SA
16P (Max. 7 stations)		UB		SB
20P (Max. 9 stations)		UC		SC

Wiring Specifications

∗ In the same way as the 26-pin models (standard), terminal no. 1 is SOL.A at the 1st station, terminal no. 2 for SOL.B at the 1st station, and two pins from the max.



Flat Ribbon Cable Assembly

Cable length (L) \ Pins	10P	16P	20P
1.5 m	AXT100-FC10-1	AXT100-FC16-1	AXT100-FC20-1
3 m	AXT100-FC10-2	AXT100-FC16-2	AXT100-FC20-2
5 m	AXT100-FC10-3	AXT100-FC16-3	AXT100-FC20-3
Connector width (W)	17.2	24.8	30

∗ For other commercial connectors, use a type with strain relief conforming to MIL-C-83503.

Option

Special Wiring Specifications

In the internal wiring of F kit, P kit, T kit and S kit, double wiring (connected to SOL. A and SOL. B) is adopted for each station regardless of the valve and option types.
Mixed single and double wiring is available as an option.

1. How to Order

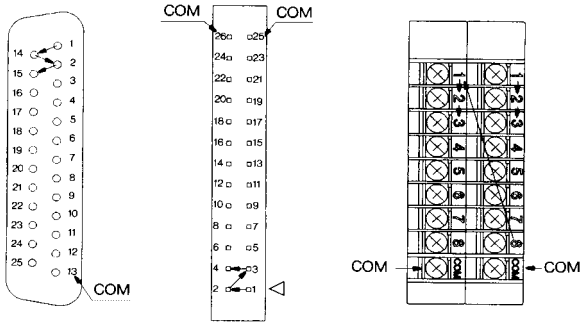
Indicate an option symbol "-K", for the manifold no. and be sure to specify the mounting position and number of stations of the single and double wiring by means of the manifold specification sheet.

Example) **VV5Q05-08C4FU1-D K S**

Others, option symbols: to be indicated alphabetically.

2. Wiring specifications

With the A side solenoid of the 1st station as no. 1 (meaning, to be connected to no. 1 terminal), without making any terminals vacant.



F kit
D-sub connector (25 P)

P kit
Flat ribbon cable connector (26 P)

T kit
Terminal block (16 terminals)

3. Max. number of stations

The maximum number of stations depends upon the number of solenoids. Assuming one for a single and two for a double, determine the number of stations so that the total number is not more than the max. number given in the following table.

Kit	F kit (D-sub connector)		P kit (Flat ribbon cable connector)				T kit (Terminal block)		S kit (Serial transmission)
Type	F S U □ 25P	F S U A 15P	P S U □ 26P	P S U C 20P	P S U B 16P	P S U A 10P	T1	T2	S□
Max. points	16 Note)	14	16 Note)	16 Note)	14	8	8	16	16

Note) Due to the limitation of internal wiring.

Negative Common Specifications [Series VQ1□10]

The following valve part numbers are for negative COM specifications. Manifold model no. is the same as the standard products.

How to order negative COM valves

VQ1110 N — 5M

Negative common specifications

∗ Series VQ0□50 has no polarity, so the negative common is applicable to standard models.

Inch-size One-touch Fittings

Valve with inch-size One-touch fittings is shown below.

VV5Q12 — 06 N7 PSO — D

Stations
Cylinder port
Kit/Electrical entry
Option

Symbol		N1	N3	N7	M5T	NM
Applicable tubing O.D. (Inch)		ø1/8"	ø5/32"	ø1/4"	10-32UNF (M5 thread)	Mixed
A, B port	VQ0000	○	○	—	○	○
	VQ1000	○	○	○	○	○

Note) When inch size fittings are selected for a cylinder port, use inch size fittings for both P and R port, too.

1(P), 3(R) port size
VQ0000 ·····ø1/4"
VQ1000 ·····ø5/16"

Plug Connector Assembly Model

Connector assembly will be required when the F, P, S kits add a valve. Specify the style of valve and connector assembly.

Connector Assembly Part No.

Specifications		Part no.
Single VQ0000 (2-wire)	Positive common	AXT661-14A-F
	Negative common	AXT661-14AN-F
Double (latching) (3-wire)	Positive common	AXT661-13A-F
	Negative common	AXT661-13AN-F

Note) Lead wire length: 300 mm
The part numbers above are applicable to 2 to 10 stations. 11 to 16 stations: "AXT661-$\frac{13}{14}$A(N)-F-425".

DIN Rail Mounting

Each manifold can be mounted on a DIN rail. Order it by indicating a DIN rail mounting option symbol, "-D". In this case, a DIN rail which is approx. 30 mm longer than the manifold with the specified number of stations is attached. Other than this, it is applicable for the following cases.

● **When DIN rail is unnecessary (C kit VQ0000 only)**
Indicate the option symbol, -DO, for the manifold no.

Example)

VV5Q05-08C4C-DOS

Others, option symbols: to be indicated alphabetically.

● **When using DIN rail longer than the manifold with specified number of stations (VQ0000/VQ1000)**
Clearly indicate the necessary number of stations next to the option symbol. "D" for the manifold no.

Example)

VV5Q05-08C4FU1-D09S

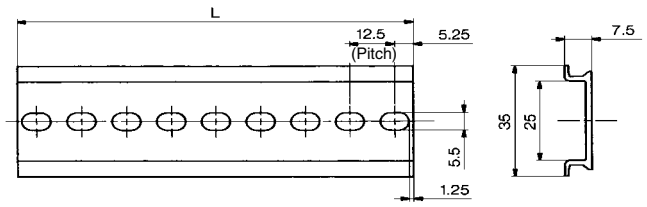
DIN rail for 9 stations

Others, option symbols: to be indicated alphabetically.

● **When changing the manifold style into a DIN rail mounting style (VQ0000 only)**
Order brackets for mounting a DIN rail. (Refer to "Option" on page 2-4-209.)
No. VVQ0000-57A-5 2 pcs. per one set.

● **When ordering DIN rail only (VQ0000 only)**
DIN rail no.: AXT100-DR-□

As for □, specify the number from the DIN rail table.
For L dimension, refer to the dimensions of each kit.



L Dimension

L = 12.5 x n + 10.5

No.	1	2	3	4	5	6	7	8	9	10
L dimension	23	35.5	48	60.5	73	85.5	98	110.5	123	135.5
No.	11	12	13	14	15	16	17	18	19	20
L dimension	148	160.5	173	185.5	198	210.5	223	235.5	248	260.5
No.	21	22	23	24	25	26	27	28	29	30
L dimension	273	285.5	298	310.5	323	335.5	348	360.5	373	385.5
No.	31	32	33	34	35	36	37	38	39	40
L dimension	398	410.5	423	435.5	448	460.5	473	485.5	498	510.5

Series VQ
Single Unit

Model

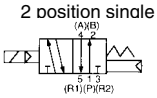
Series		Number of solenoid		Model		Flow characteristic (1)						Response time (ms) (2)			Weight (g)
						1 → 4/2 (P → A/B)			4/2 → 5/3 (A/B → R1/R2)			Standard: 1W H: 1.5W	Low wattage: 0.5 W	AC	
						C [dm³/(s·bar)]	b	Cv	C [dm³/(s·bar)]	b	Cv				
Base mounted	VQ0000 Plug lead	2 position	Single	Metal seal	**VQ0150**	0.41	0.20	0.10	0.44	0.26	0.11	12 or less	15 or less	29 or less	50 (3)
				Rubber seal	**VQ0151**	0.53	0.20	0.12	0.53	0.22	0.13	15 or less	20 or less	34 or less	
			Double	Metal seal	**VQ0250**	0.41	0.20	0.10	0.44	0.26	0.11	10 or less	13 or less	13 or less	
				Rubber seal	**VQ0251**	0.53	0.20	0.12	0.53	0.22	0.13	15 or less	20 or less	20 or less	
		3 position	Closed center	Metal seal	**VQ0350**	0.32	0.10	0.07	0.32	0.20	0.07	20 or less	26 or less	40 or less	65 (3)
				Rubber seal	**VQ0351**	0.43	0.21	0.10	0.44	0.24	0.11	25 or less	33 or less	47 or less	
			Exhaust center	Metal seal	**VQ0450**	0.32	0.10	0.07	0.44	0.26	0.11	20 or less	26 or less	40 or less	
				Rubber seal	**VQ0451**	0.43	0.21	0.10	0.53	0.22	0.13	25 or less	33 or less	47 or less	

Note 1) Cylinder port size C4: (VQ0000)
Note 2) Based on JIS B 8375-1981 (Supply pressure: 0.5 MPa; with indicator light and surge voltage suppressor; clean air) The response time is subject to the pressure and quality of the air. The valves at the time of ON are given for double types.
Note3) Weight including sub-plate.

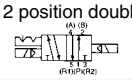
For individual use of a single valve.

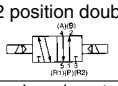
JIS Symbol

2 position single

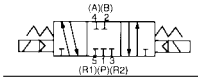


Metal / Rubber: 2 position double

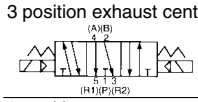




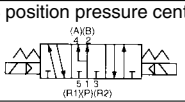
3 position closed center



3 position exhaust center



3 position pressure center



Standard Specifications

Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure		0.7 MPa (High pressure type: 0.8 MPa)	
	Min. operating pressure	Single	0.1 MPa	0.15 MPa
		Double	0.1 MPa	0.1 MPa
		3 position	0.1 MPa	0.2 MPa
	Ambient and fluid temperature		−10 to 50°C (1)	
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required, Manual type) Option	
	Impact/Vibration resistance (2)		150/30 m/s²	
	Enclosure		Dust tight	
Solenoid	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 1.5 W DC (63 mA) (3), 0.5 W DC (21 mA) (4)	
		12 VDC	1 W DC (83 mA), 1.5 W DC (125 mA) (3), 0.5 W DC (42 mA) (4)	
		100 VAC	Inrush 0.5 VA (5 mA), Holding 0.5 VA (5 mA)	
		110 VAC	Inrush 0.55 VA (5 mA), Holding 0.55 VA (5 mA)	
		200 VAC	Inrush 1.0 VA (5 mA), Holding 1.0 VA (5 mA)	
		220 VAC	Inrush 1.1 VA (5 mA), Holding 1.1 VA (5 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance ··· No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance ··· No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Values for high pressure type (1.5 W)
Note 4) Values for low wattage type (0.5 W)

How to Order Valves

VQ0 1 5 0 Y – 5 L – C4

Series VQ0000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center

Seal

0	Metal seal
1	Rubber seal

Function

Symbol	Specifications	DC	AC
Nil	Standard type	(1.0 W) ○	Note) ○
H	High pressure type	(1.5 W) ○	—
Y	Low wattage type	(0.5 W) ○	—

Note) For power consumption of AC type, refer to page 2-4-218.

Coil rated voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Electrical entry

G	Grommet (Except AC)
L	L plug connector with lead wire
LO	L plug connector without connector
M	M plug connector with lead wire
MO	M plug connector without connector

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required) *

* Option

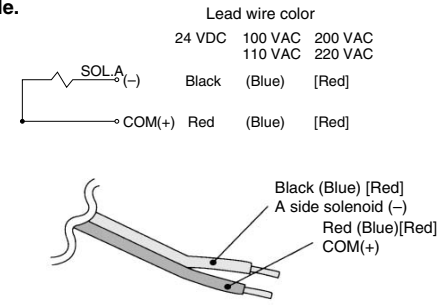
Sub-plate SUP, Cylinder port

Nil	Without sub-plate
C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
M5	M5 thread

Note) EXH port: M5 thread

Wiring Specifications

● **The lead wires are connected to the valve as shown below. Connect each to the power supply side.**



● **Plug connector lead wire length**

Note) The length of the lead wire provided is 300 mm. When ordering a valve with a lead wire of 600 mm or longer, be sure to indicate the model number of the valve without connector and connector assembly.

Example) Lead wire length 1000 mm
VQ0150-5LO ····· 3 pcs.
AXT661-14A-10 ····· 3 pcs.

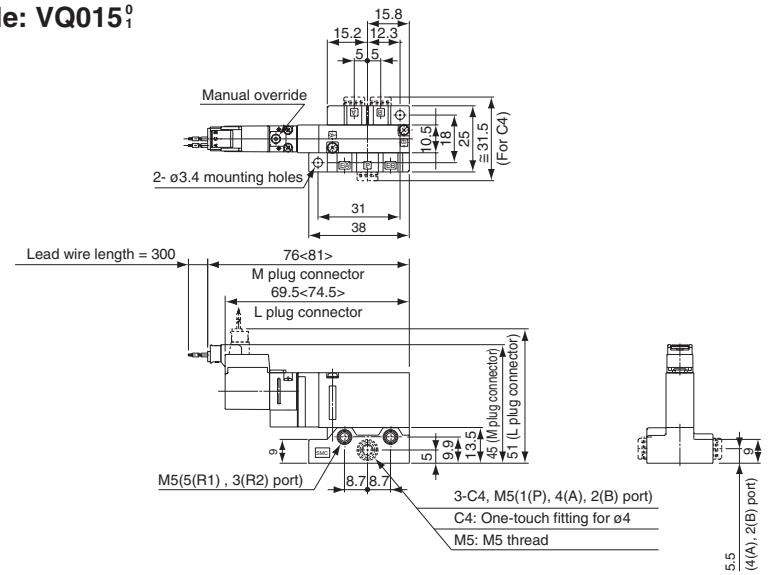
Connector Assembly Part No. (For DC)

Lead wire length	Part no.
Socket (3 pcs.)	AXT661-12A
300 mm	AXT661-14A
600 mm	AXT661-14A-6
1000 mm	AXT661-14A-10
2000 mm	AXT661-14A-20
3000 mm	AXT661-14A-30

Note)AXT661-31A-□, for 100/110 VAC.
AXT661-34A-□, for 200/220 VAC.

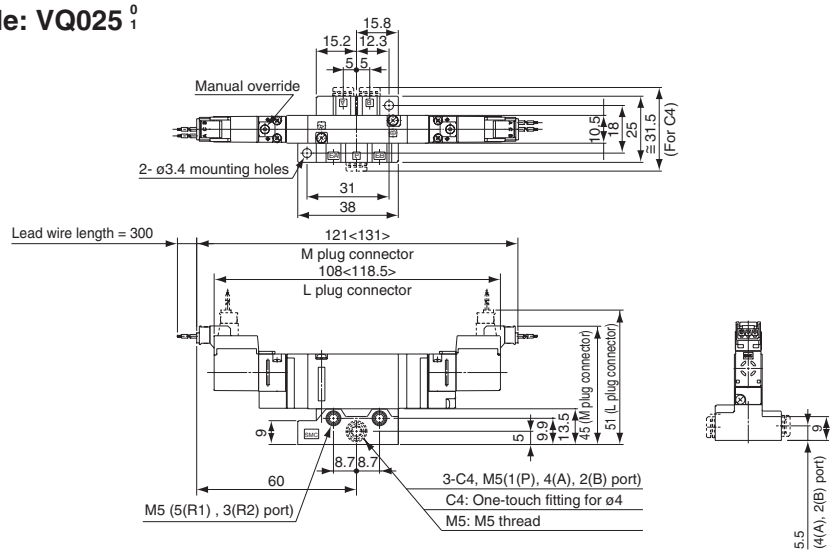
Dimensions

2 position single: VQ015$^{0}_{1}$



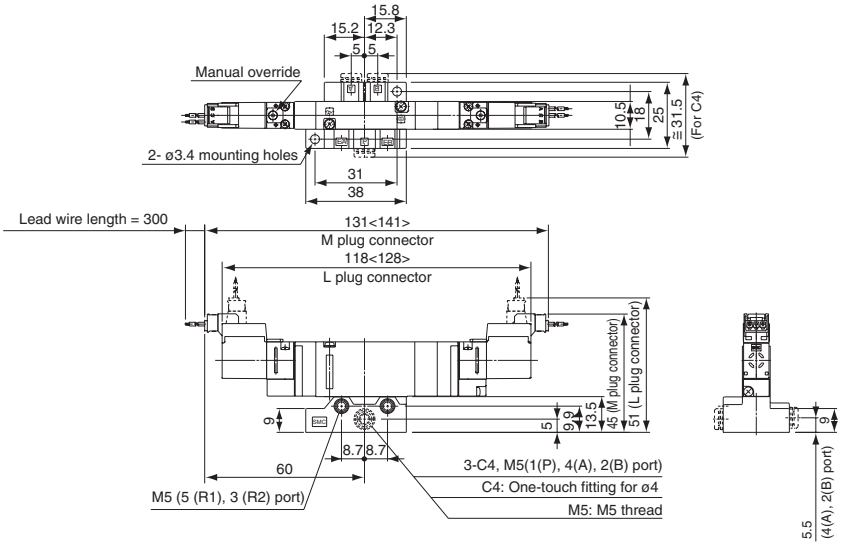
< >: AC

2 position double: VQ025$^{0}_{1}$



< >: AC

3 position exhaust center: VQ0$^{3}_{4}$5$^{0}_{1}$

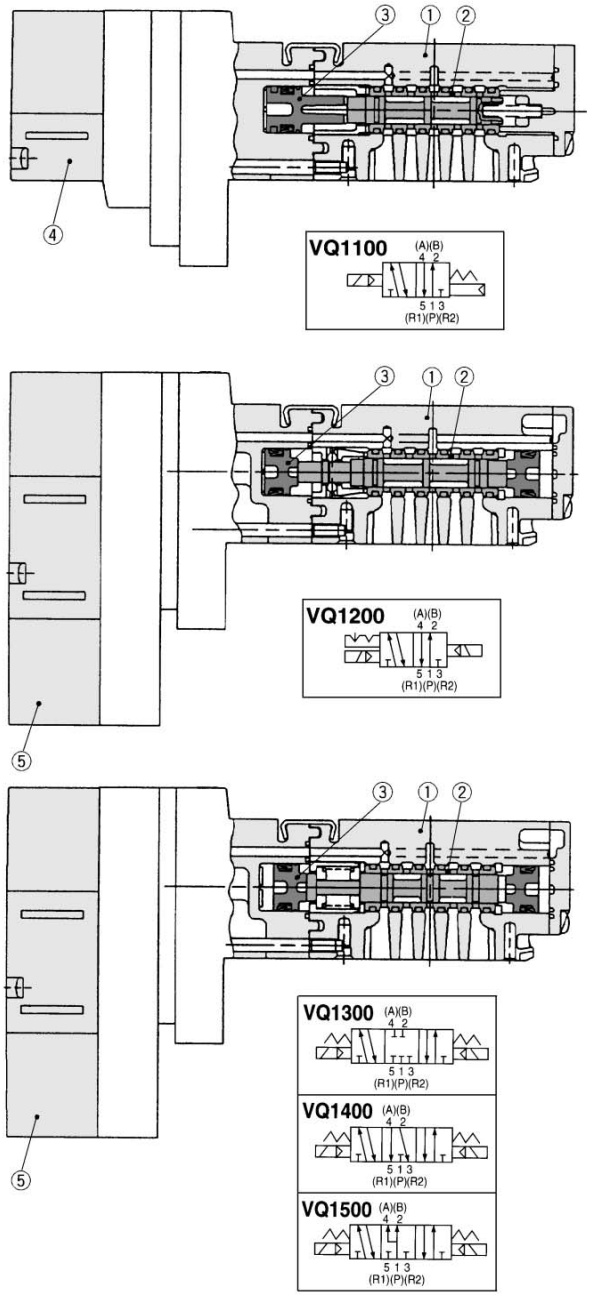


< >: AC

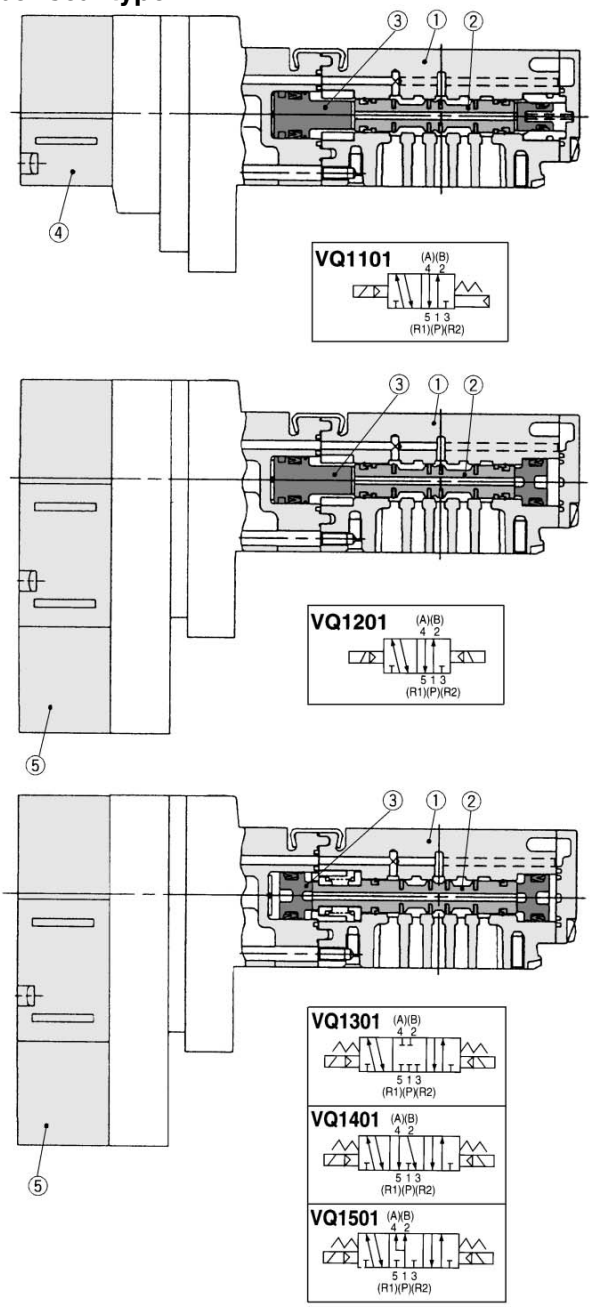
Construction
Main Parts, Replacement Parts

Construction: VQ1000/Plug-in Unit

Metal seal



Rubber seal type



Component Parts

No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQ111(H)(Y)-□-1 Note) Voltage1 to 6	Single
⑤	Pilot valve assembly	VQ131(H)(Y)-□-1 Note) Voltage1 to 6	Double/3 position

Note) (H): 1.5 W, (Y): 0.5 W

Component Parts

No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

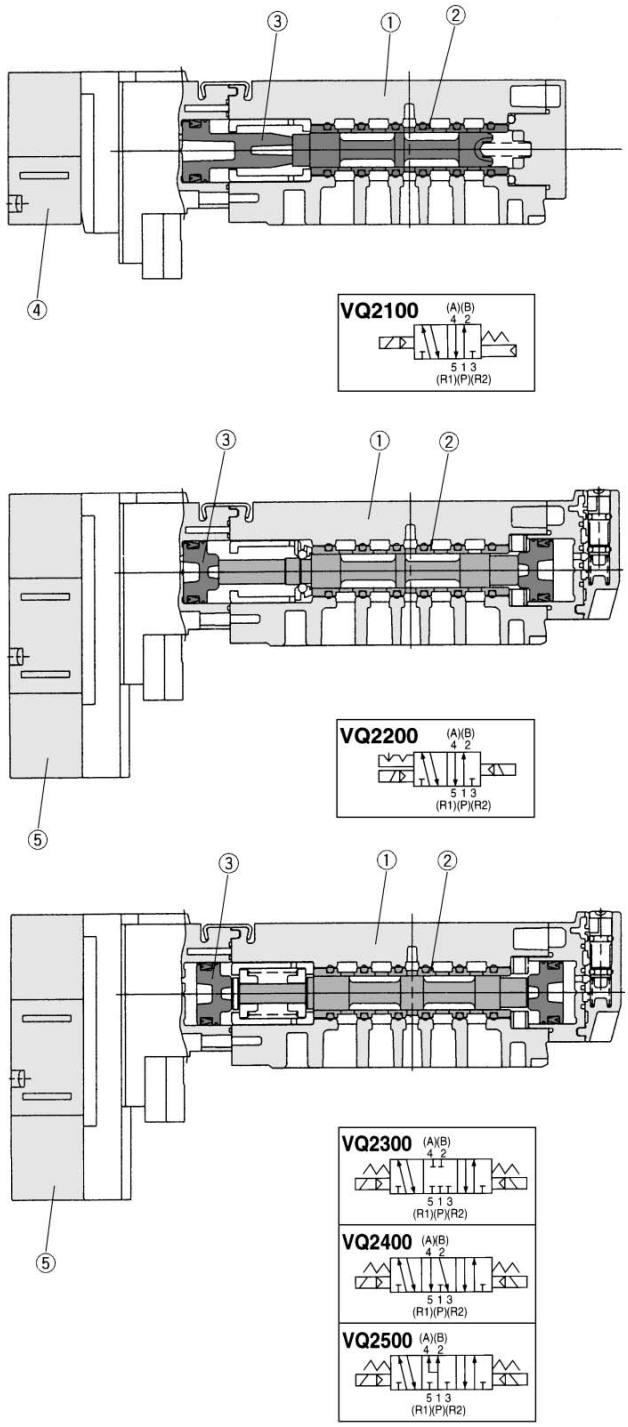
Replacement Parts

④	Pilot valve assembly	VQ111(H)(Y)-□-1 Note) Voltage1 to 6	Single
⑤	Pilot valve assembly	VQ131(H)(Y)-□-1 Note) Voltage1 to 6	Double/3 position

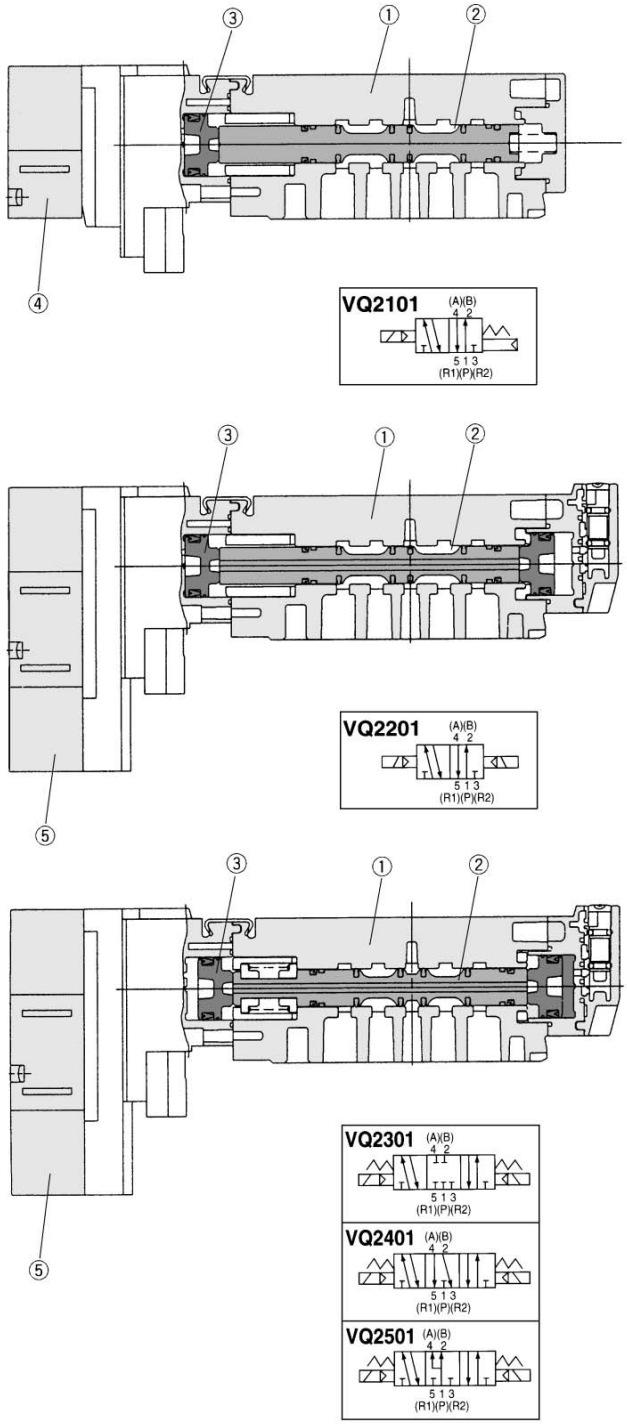
Note) (H): 1.5 W, (Y): 0.5 W

Construction: VQ2000/Plug-in Unit

Metal seal



Rubber seal type



Component Parts

No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQ111$^{(H)}_{(Y)}$-□-1 Note) Voltage1 to 6	Single
⑤	Pilot valve assembly	VQ131$^{(H)}_{(Y)}$-□-1 Note) Voltage1 to 6	Double/3 position

Note) (H): 1.5 W, (Y): 0.5 W

Component Parts

No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

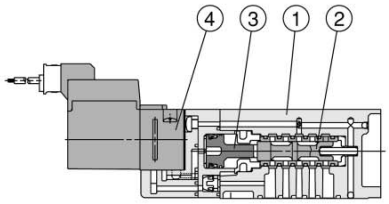
Replacement Parts

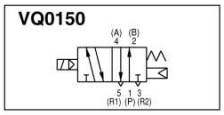
④	Pilot valve assembly	VQ111$^{(H)}_{(Y)}$-□-1 Note) Voltage1 to 6	Single
⑤	Pilot valve assembly	VQ131$^{(H)}_{(Y)}$-□-1 Note) Voltage1 to 6	Double/3 position

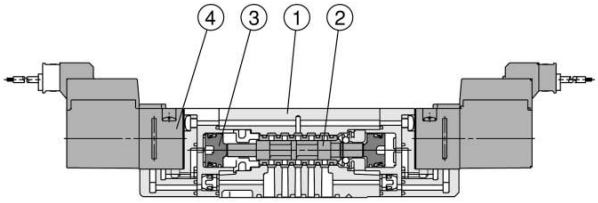
Note) (H): 1.5 W, (Y): 0.5 W

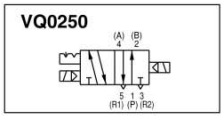
Construction: VQ0000/Plug Lead Unit

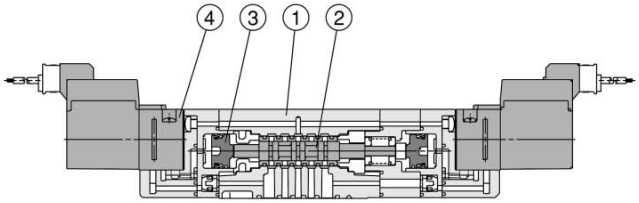
Metal seal

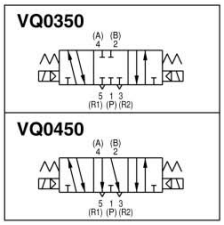




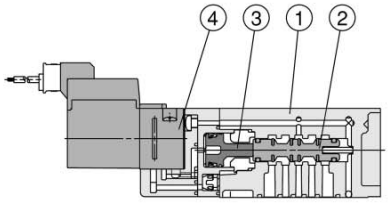


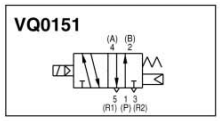


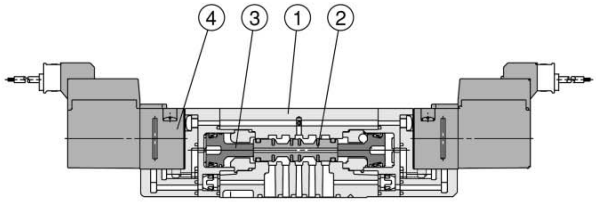


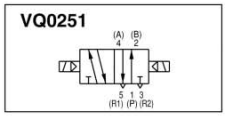


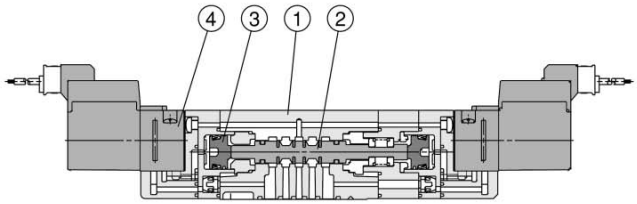
Rubber seal type

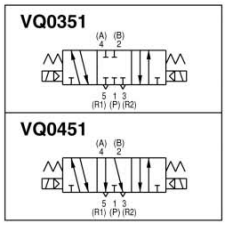












Component Parts

No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQ110 (H)(Y)-□ L M G Note) Voltage1 to 6	

Note) (Y): 0.5 W, (H): 1.5 W, (G): DC

Component Parts

No.	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

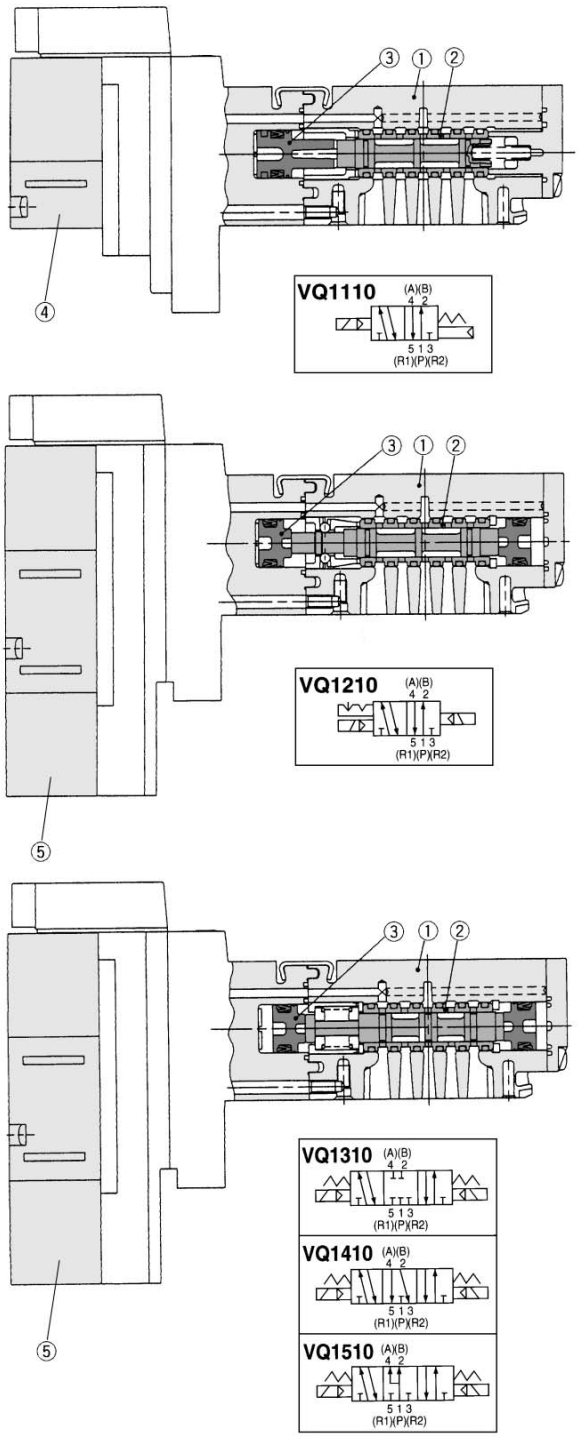
Replacement Parts

④	Pilot valve assembly	VQ110 (H)(Y)-□ L M G Note) Voltage1 to 6	

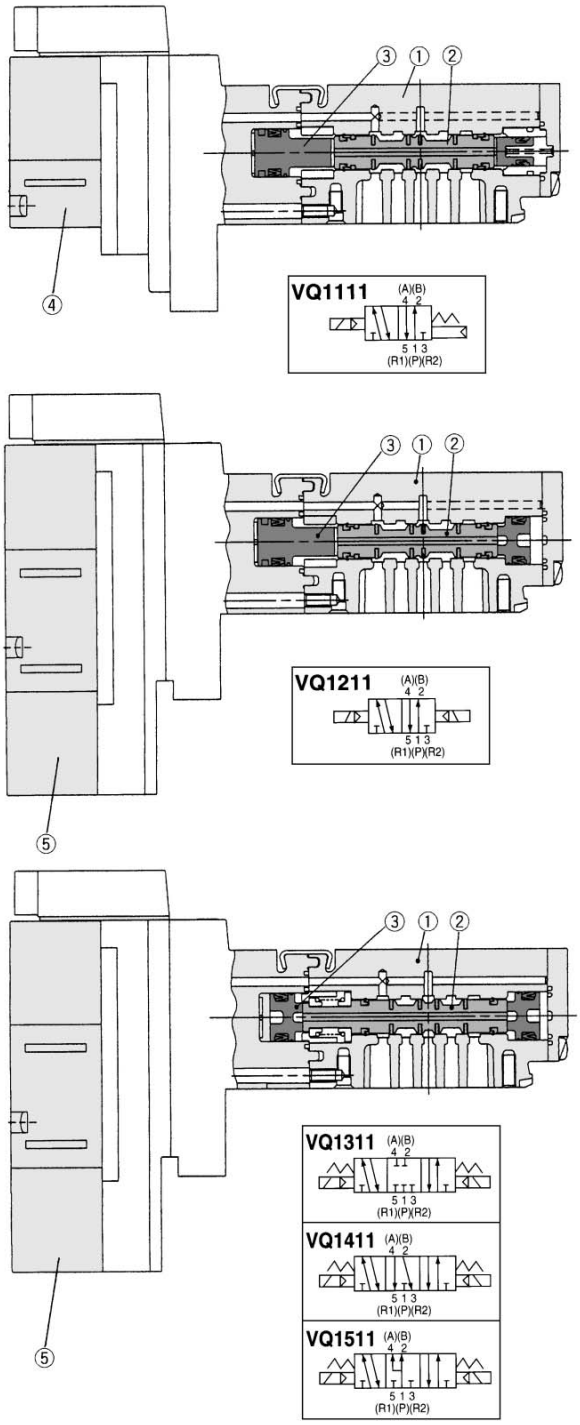
Note) (Y): 0.5 W, (H): 1.5 W, (G): DC

Construction: VQ1000/Plug Lead Unit

Metal seal



Rubber seal type



Component Parts

No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQ111(H/Y)-□-1 Note) Voltage1 to 6	Single
⑤	Pilot valve assembly	VQ131(H/Y)-□-1 Note) Voltage1 to 6	Double/3 position

Note) (H): 1.5 W, (Y): 0.5 W

Component Parts

No.	Description	Material	Note
①	Body	Zinc die-casted	
②	Spool valve	Aluminum/HNBR	
③	Piston	Resin	

Replacement Parts

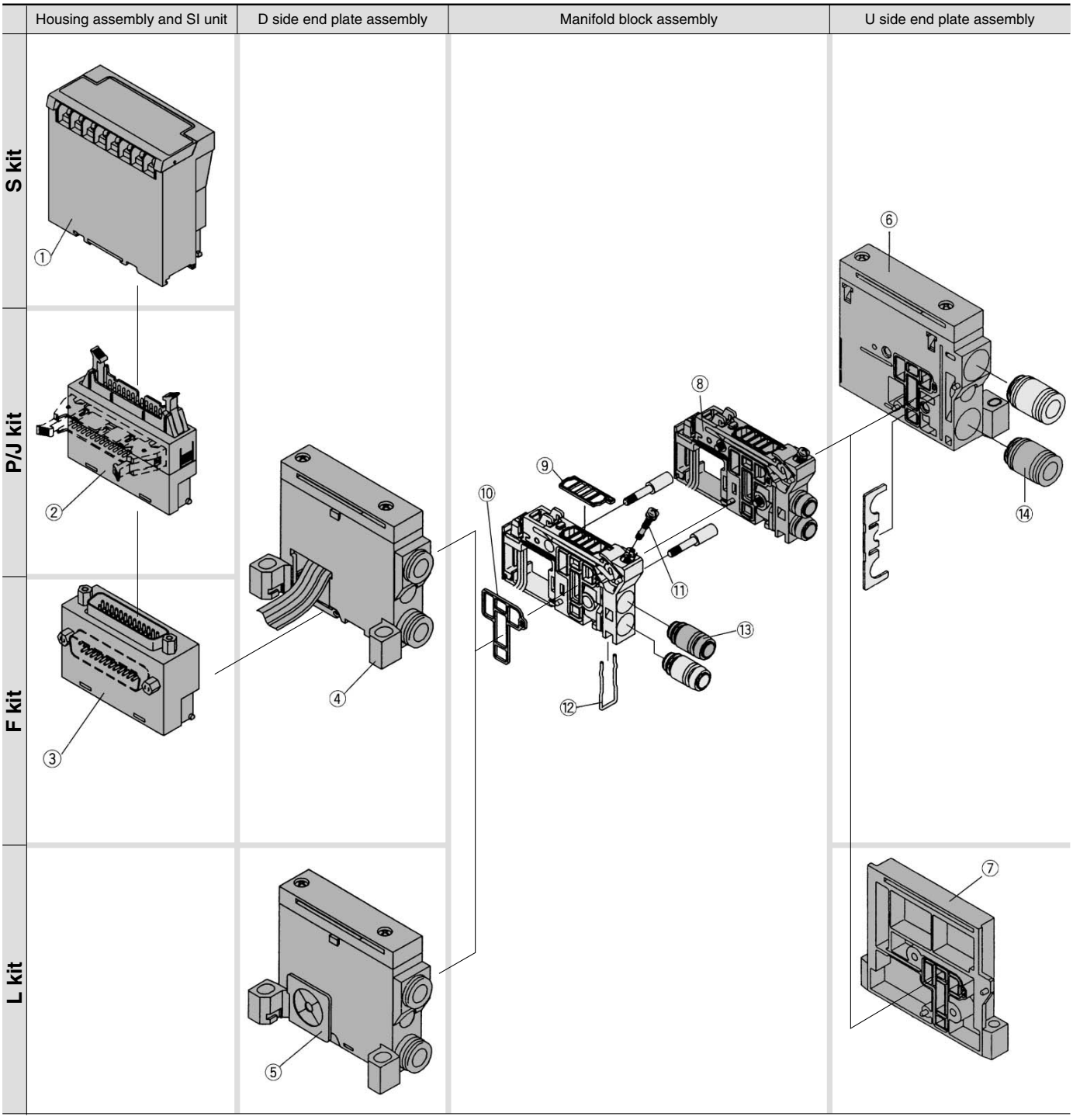
④	Pilot valve assembly	VQ111(H/Y)-□-1 Note) Voltage1 to 6	Single
⑤	Pilot valve assembly	VQ131(H/Y)-□-1 Note) Voltage1 to 6	Double/3 position

Note) (H): 1.5 W, (Y): 0.5 W

Exploded View of Manifold

Exploded view: VQ1000/Plug-in Unit

(F, P, J, L, Skit)



<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①	(SA kit)	EX320-S001(-XP) (2)	General type SI unit (Series EX300)
	(SB kit)	EX120-SMB1(-XP) (2)	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX120-STA1(-XP) (2)	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX120-SSH1(-XP) (2)	SI unit for Satellite I/O Link System (SHARP Corporation)
	(SE kit)	EX120-SPA1	SI unit for MEWNET-F System (Matsushita Electric Works, Ltd.)
	(SF1kit)	EX120-SUW1(-XP) (2)	SI unit for 16 point Uni-wire System (NKE Corporation)
	(SG kit)	EX120-SAB1(-XP) (2)	SI unit for Allen Bradley Remote I/O (RIO) System (Rockwell Automation, Inc.)
	(SH kit)	EX120-SUH1(-XP) (2)	SI unit for 16 point Uni-wire H System (NKE Corporation)
	(SJ1 kit)	EX120-SSL1(-XP) (2)	16 point S-LINK System (SUNX Corporation)
	(SJ2 kit)	EX120-SSL2(-XP) (2)	8 point S-LINK System (SUNX Corporation)
	(SK kit)	EX120-SFU1(-XP) (2)	T-LINK Mini System (Fuji Electric Co.,Ltd.)
	(SQ kit)	EX120-SDN1	DeviceNet, CompoBus/D (OMRON Corporation)
	(SR1 kit)	EX120-SCS1(-XP) (2)	OMRON Corporation: CompoBus/S (16 output points)
	(SR2 kit)	EX120-SCS2(-XP) (2)	OMRON Corporation: CompoBus/S (8 output points)
	(SV kit)	EX120-SMJ1(-XP) (2)	Mitsubishi Electric Corporation: CC-LINK System
②	P $^{U}_{S}$ kit	AXT100-1-P $^{U}_{S}$ □ (1)	Flat cable housing assembly □ = Number of pins: 26, 20, 16, 10
	J $^{U}_{S}$ kit	AXT100-1-J $^{U}_{S}$ 20 (1)	Flat cable housing assembly
③	F $^{U}_{S}$ kit	AXT100-1-F $^{U}_{S}$ □ (1)	D-sub connector housing assembly □ = Number of pins: 25, 15

Note 1) Top (vertical) entry connector for FU, PU and JU while side (horizontal) entry connector for FS, JS and PS.
Note 2) Enter suffix "-XP" at the end of the part number for dust proof type SI unit.

<D Side End Plate Assembly>

④⑤ D side end plate assembly no.

VVQ1000-3A-1-□-□

Electrical entry

F	For F kit
P	For P kit
J	For J kit
L	For L kit
S	For S kit

Option

Nil	Common exhaust type
R (1)	External pilot
S (1)	Built-in silencer, direct exhaust

Note 1) When both options are specified, indicate as RS.
Note 2) The housing assembly and SI unit of F/P/S kit are not included.
Separately place an order for ①, ②, and ③.

<U Side End Plate Assembly>

⑥ U side end plate assembly no. (For F, P, J, S kit)

VVQ1000-2A-1-□

Option

Nil	Common exhaust type
R	External pilot
S	Built-in silencer, direct exhaust

Note) The ⑭'s fitting assembly is included.

<Manifold Block Assembly>

⑧ Manifold block assembly no.

Tie-rod (2 pcs.) and lead wire assembly for extensions are attached

VVQ1000-1A-□□

Electrical entry

F1	F kit for 2 to 12 stations/Double wiring
F2	F kit for 13 to 24 stations/Double wiring
F3	F kit for 2 to 24 stations/Single wiring
P1	P, J, S kit for 2 to 12 stations/Double wiring
P2	P, J, S kit for 13 to 24 stations/Double wiring
P3	P, J, S kit for 2 to 24 stations/Single wiring
L0□	L0 kit □Stations (1 to 8)
L1□	L1 kit □Stations (1 to 8)
L2□	L2 kit □Stations (1 to 8)

Port size

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

⑦ U side end plate assembly no. (For L kit)

VVQ1000-2A-1-L

<Replacement Parts for Manifold Block>

Replacement Parts

No.	Part no.	Description	Material	Number
⑨	VVQ1000-80A-1	Gasket	NBR	12
⑩	VVQ1000-80A-2	Packing	NBR	12
⑪	VVQ1000-80A-3	Clamp screw	Carbon steel	12
⑫	VVQ1000-80A-4	Clip	Stainless steel	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Fitting Assembly>

⑬ Fitting assembly part no. (For cylinder port)

VVQ1000-50A-□

Port size

C3	Applicable tubing ø3.2
C4	Applicable tubing ø4
C6	Applicable tubing ø6
M5	M5 thread

Note) Purchasing order is available in units of 10 pieces.

⑭ Fitting assembly part no. (For P, R port)

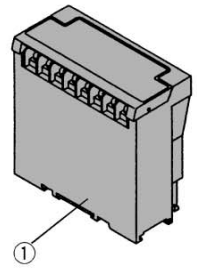
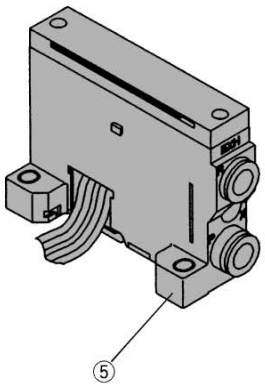
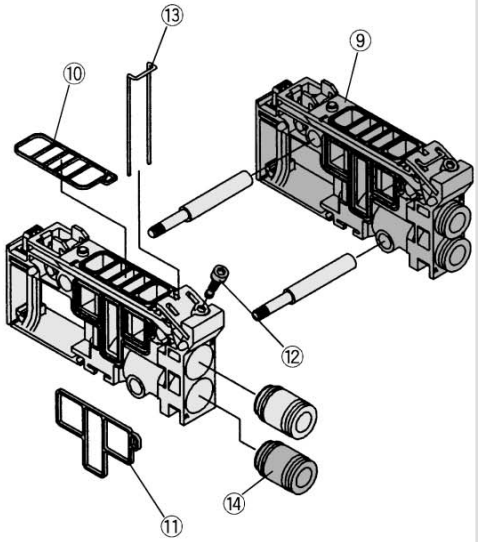
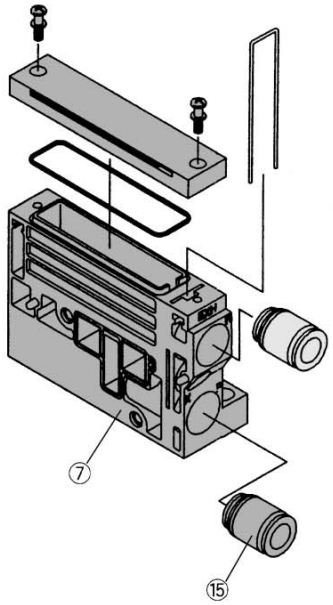
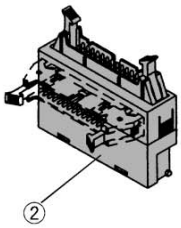
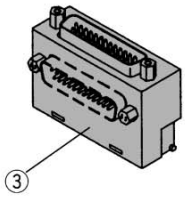
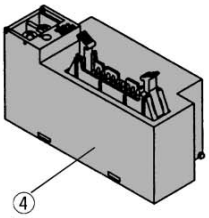
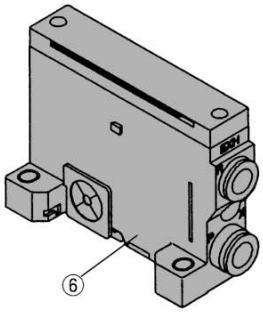
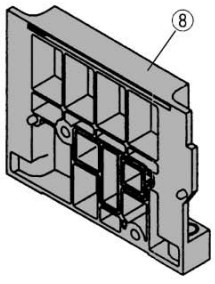
VVQ1000-51A-C8

Applicable tubing ø8

Note) Purchasing order is available in units of 10 pieces.

Exploded View: VQ2000/Plug-in Unit

(F, P, J, L, G, S kit)

	Housing assembly and SI unit	D side end plate assembly	Manifold block assembly	U side end plate assembly
S kit				
P/J kit				
F kit				
G kit				
L kit				

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①	(SA kit)	EX320-S001(-XP)(1) [EX323-S001] (2)	General type SI unit (Series EX300)
	(SB kit)	EX120-SMB1(-XP)(1) [EX123-SMB1] (2)	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric)
	(SBB kit)	[EX124-SMB1] (3)	SI unit for MELSECNET/MINI-S3 Data Link System (2 power supply lines) (Mitsubishi Electric Corp.)
	(SC kit)	EX120-STA1(-XP)(1) [EX123-STA1] (2)	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX120-SSH1(-XP)(1) [EX123-SSH1](2)	SI unit for Satellite I/O Link System (SHARP Corporation)
	(SE kit)	EX120-SPA1	SI unit for MEWNET-F System (Matsushita Electric Works, Ltd.)
	(SF1kit)	EX120-SUW1(-XP)(1) [EX123-SUW1] (2)	SI unit for 16 point Uni-wire System (NKE Corporation)
	(SG kit)	EX120-SAB1	SI unit for Allen Bradley Remote I/O (RIO) System (Rockwell Automation, Inc.)
	(SH kit)	EX120-SUH1(-XP)(1) [EX123-SUH1] (2)	SI unit for 16 point Uni-wire H System (NKE Corporation)
	(SJ1 kit)	EX120-SSL1(-XP)(1) [EX123-SSL1] (2)	16 point S-LINK System (SUNX Corporation)
	(SJ2 kit)	EX120-SSL2(-XP)(1) [EX123-SSL2] (2)	8 point S-LINK System (SUNX Corporation)
	(SK kit)	EX120-SFU1(-XP)(1) [EX123-SFU1] (2)	T-LINK Mini System (Fuji Electric Co., Ltd.)
	(SQ kit)	EX120-SDN1 [EX124-SDN1] (2)	SI unit for DeviceNet, CompoBus/D (OMRON Corporation)
	(SR1 kit)	EX120-SCS1(-XP)(1) [EX124-SCS1] (2)	SI unit for 16 point Compo Bus/S System (OMRON)
	(SR2 kit)	EX120-SCS2(-XP)(1) [EX124-SCS2] (2)	SI unit for 8 point Compo Bus/S System (OMRON)
	(SV kit)	EX120-SMJ1(-XP)(1) [EX124-SMJ1] (2)	SI unit for CC-LINK System (2 power supply systems) (Mitsubishi Electric Corporation)
②	P^{U}_{S}kit	AXT100-1-P^{U}_{S}□ (4)	Flat ribbon cable housing assembly □ = Number of pins: 26, 20, 16, 10
	J^{U}_{S}kit	AXT100-1-J^{U}_{S}□ (4)	Flat ribbon cable housing assembly
③	G kit	AXT100-1-GU20	Flat ribbon cable housing assembly with terminal block
④	F^{U}_{S}kit	AXT100-1-F^{U}_{S}□ (4)	D-sub connector housing assembly □ = Number of pins: 25, 15

Note 1) Suffix "-XP" for dust-protected type SI unit.
Note 2) Dusttight/Low jetproof type (IP65)
Note 3) SBB kit is usable only for dust tight/low jetproof type (IP65).
Note 4) Top entry connector for FU and PU while side entry connector for FS and PS.

<D Side End Plate Assembly>

⑤⑥D side end plate assembly no.

VVQ2000-3A-1-□-□

Electrical entry

F	For F kit
P	For P kit
J	For J kit
L	For L kit
G	For G kit
S	For S kit

Option

Nil	Common EXH
R (1)	External pilot
S (1)	Built-in silencer, direct exhaust

Note 1) When both options are specified, indicate as RS.
Note 2) The housing assembly and SI unit of F/P/J/G/S kit are not included.
Note 3) Separately place an order for ①, ②, ③, and ④.
For Dusttight/Low jetproof type (IP65), please consult with SMC.

<U Side End Plate Assembly>

⑦ U side end plate assembly no. (For F/P/G/S kits)

VVQ2000-2A-1-□

Option

Nil	Common EXH
R	External pilot
S	Built-in silencer, direct exhaust

Note 1) The ⑮'s fitting assembly is included.
Note 2) The housing assembly and SI unit of F/P/J/G/S kit are not included.
Note 3) Separately place an order for ①, ②, ③, and ④.
For Dusttight/Low jetproof type (IP65), please consult with SMC.

⑧ U side end plate assembly no. (For L kit)

VVQ2000-2A-1-L

<Manifold Block Assembly>

Tie-rod (2 pcs.) and lead wire assembly for extensions are attached

⑨ Manifold block assembly no.

VVQ2000-1A-□-□-□

Electrical entry

F1	F kit for 2 to 12 stations/Double wiring
F2	F kit for 13 to 24 stations/Double wiring
F3	F kit for 2 to 24 stations/Single wiring
P1	P, J, G, S kit for 2 to 12 stations/Double wiring
P2	P, J, G, S kit for 13 to 24 stations/Double wiring
P3	P, J, G, S kit for 2 to 24 stations/Single wiring
L0□	L0 kit □ Stations (1 to 8)
L1□	L1 kit □ Stations (1 to 8)
L2□	L2 kit □ Stations (1 to 8)
T1	T kit for 2 to 20 stations/Double wiring
T3	T kit for 2 to 20 stations/Single wiring
M1	M kit for 2 to 12 stations/Double wiring
M2	M kit for 13 to 24 stations/Double wiring
M3	M kit for 2 to 24 stations/Single wiring

Port size

C4	One-touch fitting for ø4
C6	One-touch fitting for ø6
C8	One-touch fitting for ø8

Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type (IP65)

Note) F, P, J, G kits are available with "Nil" only.
M kit is available with [W] only.
S, L, T kits are selectable, depending upon the manifold type.

<Fitting Assembly>

⑭ Fitting assembly part no. (For cylinder port)

VVQ1000-51A-□

Port size

C4	Applicable tubing ø4
C6	Applicable tubing ø6
C8	Applicable tubing ø8

Note) Purchasing order is available in units of 10 pieces.

⑮ Fitting assembly part no. (For P, R ports)

VVQ2000-51A-C10

Applicable tubing ø10

Note) Purchasing order is available in units of 10 pieces.

Note) A set of parts containing 12 pcs. each is enclosed.

<Replacement Parts for Manifold Block>

Replacement Parts

No.	Part no.	Description	Material	Number
⑩	VVQ2000-80A-1	Gasket	HNBR	12
⑪	VVQ2000-80A-2	Packing	HNBR	12
⑫	VVQ2000-80A-3	Clamp screw	Carbon steel	12
⑬	VVQ2000-80A-4	Clip	Stainless steel	12

Exploded View: VQ0000/Plug Lead Unit

(F, P, C, S kit)

∗ For how to increase the stations, refer to the instruction manual.

	Tie-rod	U side end block assembly	Manifold block assembly	D side end block assembly	Housing assembly and SI unit Note 3)	
S kit					Note 2) Connector assembly ① ② Note 1) Note 4)	S kit
P kit	⑬	⑦	⑩ ⑨ ⑪ ⑧	⑥ ⑫	Note 2) Connector assembly ② The drawing shows PU. (Top entry connector)	P kit
F kit					Note 2) Connector assembly ③ The drawing shows FU. (Top entry connector)	F kit
T kit					Note 2) Connector assembly ⑤ ④ Note 4)	T kit

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins).
Note 2) Since no connector assembly is included, order it separately. (Refer to page 2-4-216.)
Note 3) A housing assembly is not used for a C kit.
Note 4) A DIN rail clamping bracket is attached to each.

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①[(1)]	(SA kit)	EX330-S001	General type SI unit (Series EX300)
	(SB kit)	EX130-SMB1	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corp.)
	(SC kit)	EX130-STA1	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX130-SSH1	SI unit for Satellite I/O Link System (SHARP Corporation)
	(SF1 kit)	EX130-SUW1	16 point Uni-wire System (NKE Corporation)
	(SH kit)	EX130-SUH1	SI unit for 16 point Uni-wire H System (NKE Corporation)
②	P^{U}_{S} kit	AXT100-2-P^{U}_{S} □ [(2)]	Flat ribbon cable housing assembly l = Number of pins: 26, 20, 16, 10
③	F^{U}_{S} kit	AXT100-2-F^{U}_{S} □ [(2)]	D-sub connector housing assembly l = Number of pins: 25, 15
④	T kit	AXT100-2-TB1 [(4)]	Terminal block assembly (8 terminals)
⑤	T kit	AXT100-2-TB2 [(4)]	Terminal block assembly (8 terminals)

Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins). Place an order for AXT100-2-PS20 separately.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.
Note 3) Since no connector assembly is included, order it separately. (Refer to page 2-4-216.)
Note 4) In the case of standard specifications and double wring, ④ is for 1 to ⑤ stations and t is for 5 to 8 stations.

<D Side End Plate Assembly>

⑥ D side end plate assembly no.

VVQ0000-3A-5-□

Option

Nil	Common exhaust type
S	Built-in silencer, direct exhaust

Note) The ⑫'s fitting assembly is included.

<U Side End Plate Assembly>

⑦ U side end plate assembly no.

VVQ0000-2A-5-□

Option

Nil	Common exhaust type
S	Built-in silencer, direct exhaust

<Manifold Block Assembly>

⑧ manifold block assembly no.

VVQ0000-1A-5-□

Port size

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
M5	M5 thread

<Replacement Parts for Manifold Block>

Replaceable Parts

No.	Part no.	Description	Material	Number
⑨	VVQ0000-80A-5-2	Seal	HNBR	12
⑩	VVQ0000-80A-5-4	Clip	HNBR	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Fitting Assembly>

⑪ Fittings assembly part no. (For cylinder port)

VVQ0000-50A-□

Port size

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4

Note) Purchasing order is available in units of 10 pieces.

⑫ Fitting assembly part no. (For P, R port)

VVQ1000-50A-C6

Applicable tubing ø6

Note) Purchasing order is available in units of 10 pieces.

<Tie-rod Bolt>

⑬ Tie-rod bolt

VVQ0000-103A-5-□

Stations

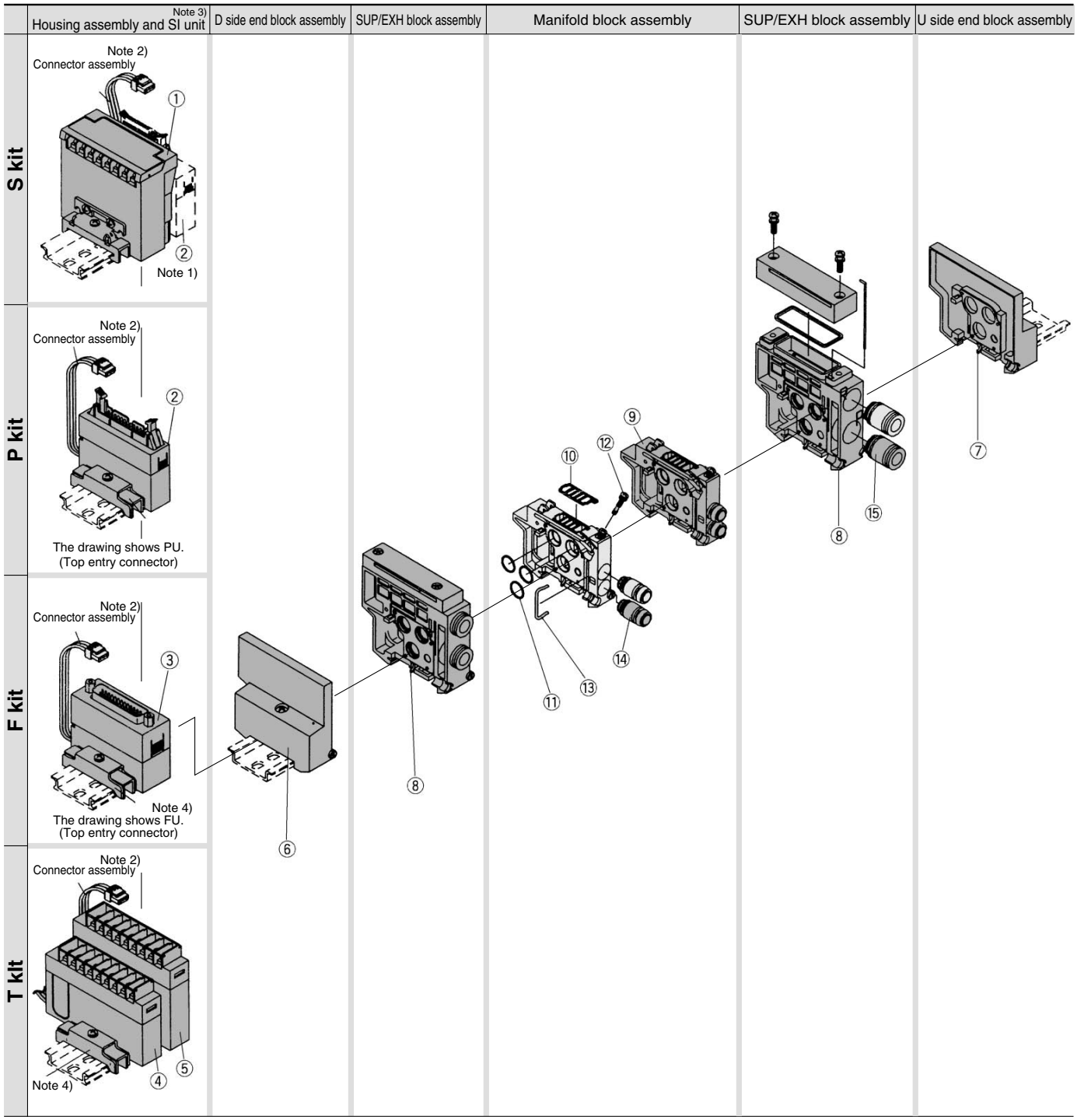
1	For 1 station
2	For 2 station
⋮	⋮
16	For 16 station

Note) 2 bolts per one set.

Exploded View: VQ1000/Plug Lead Unit

(F, P, T, S kit)

∗ For how to increase the stations, refer to the instruction manual.



Note 1) S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PU20) of ① SI unit and ② P kit (20 pins).
Note 2) Since no connector assembly is included, order it separately. (Refer to page 2-4-216.)
Note 3) A housing assembly is not used for a C kit.
Note 4) A DIN rail clamping bracket is attached to each.

<Housing Assembly and SI Unit>

Housing assembly and SI unit no.

No.	Manifold	Part no.	Description
①	(SA kit)	EX321-S001(-XP) (5)	General type SI unit (Series EX300)
	(SB kit)	EX121-SMB1(-XP) (5)	SI unit for MELSECNET/MINI-S3 Data Link System (Mitsubishi Electric Corporation)
	(SC kit)	EX121-STA1(-XP) (5)	SI unit for SYSBUS Wire System (OMRON Corporation)
	(SD kit)	EX121-SSH1(-XP) (5)	SI unit for Satellite I/O Link System (SHARP Corpoation)
	(SE kit)	EX121-SPA1	SI unit for MEWNET-F System (Matsushita Electric Works, Ltd.)
	(SF1kit)	EX121-SUW1(-XP) (5)	SI unit for 16 point Uni-wire System (NKE Corporation)
	(SG kit)	EX121-SAB1(-XP) (5)	SI unit for Allen Bradley Remote I/O (RIO) System (Rockwell Automation, Inc.)
	(SH kit)	EX120-SUH1(-XP) (5)	SI unit for 16 point Uni-wire H System (NKE Corporation)
	(SJ1 kit)	EX121-SSL1(-XP) (5)	16 point S-LINK System (SUNX Corporation)
	(SJ2 kit)	EX121-SSL2(-XP) (5)	8 point S-LINK System (SUNX Corporation)
	(SK kit)	EX121-SFU1(-XP) (5)	T-LINK Mini System (Fuji Electric Co., Ltd.)
	(SQ kit)	EX121-SDN1	DeviceNet, CompoBus/D (OMRON Corporation)
	(SR1 kit)	EX121-SCS1(-XP) (5)	OMRON Corporation: CompoBus/S System (16 output points)
	(SR2 kit)	EX121-SCS2(-XP) (5)	OMRON Corporation: CompoBus/S System (8 output points)
	(SV kit)	EX120-SMJ1(-XP) (5)	Mitsubishi Electric Corporation: CC-LINK System
②	P $^{U}_{S}$ kit	AXT100-2-P $^{U}_{S}$ □ (2)	Flat ribbon cable housing assembly □ = Number of pins: 26, 20, 16, 10
③	F $^{U}_{S}$ kit	AXT100-2-F $^{U}_{S}$ □ (2)	D-sub connector housing assembly □ = Number of pins: 25, 15
④	T kit	AXT100-2-TB1 (4)	Terminal block assembly (8 terminals)
⑤	T kit	AXT100-2-TB2 (4)	Terminal block assembly (8 terminals)

Note 1) A S kit is composed of a flat ribbon cable housing assembly (AXT100-2-PS20) of ① SI unit and ② P kit (20 pins).
Place an order for AXT100-2-PU20 separately.
Note 2) Top/vertical entry connector for FU and PU while side (horizontal) entry connector for FS and PS.
Note 3) Since no connector assembly is included, order it separately. (Refer to page 2-4-216.)
Note 4) In the case of standard specifications and double wring, ④ is for 1 to 4 stations and ⑤ is for 5 to 8 stations.
Note 5) Suffix "-XP" for dust-protected type SI unit.

<D Side End Plate Assembly>

⑥ D side end plate assembly no.

VVQ1000-3A-2

<U Side End Plate Assembly>

⑦ U side end plate assembly no.

VVQ1000-2A-2

<SUP/EXH block Assembly>

⑧ SUP/EXH block assembly no.

VVQ1000-PR-2-C8-□

Option

Nil	Common exhaust type
S	Built-in silencer, direct exhaust

Note) The ⑮'s fitting assembly is included.

<Manifold Block Assembly>

⑧ Manifold block assembly no.

VVQ1000-1A-2-□

Port size

C3	With One-touch fitting for ø3.2
C4	With One-touch fitting for ø4
C6	With One-touch fitting for ø6
M5	M5 thread

<Replacement Parts for Manifold Block>

Replaceable Parts

No.	Part no.	Description	Material	Number
⑩	VVQ1000-80A-1	Gasket	HNBR	12
⑪	VVQ1000-80A-2-2	O-ring	HNBR	12
⑫	VVQ1000-80A-3	Clamp screw	Carbon steel	12
⑬	VVQ1000-80A-2-4	Clip	Stainless steel	12

Note) A set of parts containing 12 pcs. each is enclosed.

<Fitting Assembly>

⑭ Fitting assembly part no. (For cylinder port)

VVQ1000-50A-□

Port size

C3	Applicable tubing ø3.2
C4	Applicable tubing ø4
C6	Applicable tubing ø6
M5	With M5 thread

Note) Purchasing order is available in units of 10 pieces.

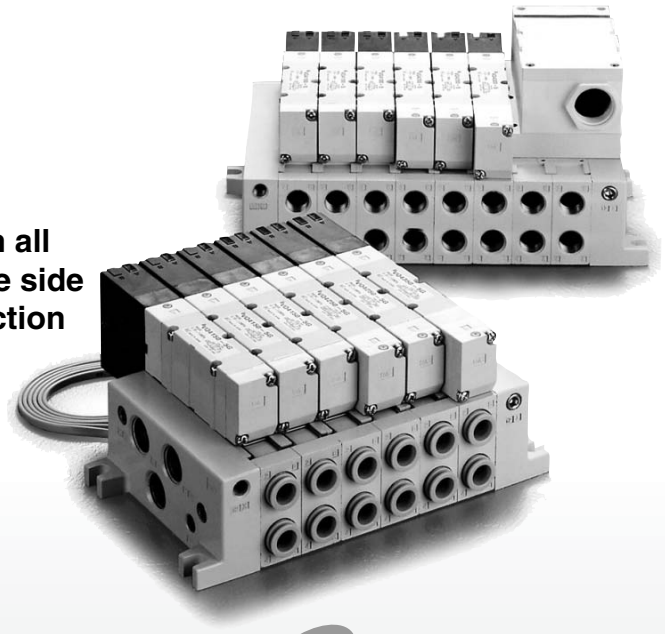
⑮ Fitting assembly part no. (For P, R port)

VVQ1000-51A-C8

Applicable tubing ø8

Note) Purchasing order is available in units of 10 pieces.

5 Port Solenoid Valve
Metal Seal/Rubber Seal
Base Mounted
Series VQ4000



Space-saving profile

Clean space-saving design with all pilot valves concentrated to one side with no protrusions in any direction

Space-saving —— 40% less
Capacity-saving — 50% less
(In-house comparison)

Compact with large flow capacity
(Ideal for driving cylinders up to ø140)

Built-in One-touch fittings for easier piping

Enclosure IP65 compliant Dusttight/Low jetproof type

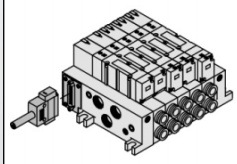
Outstanding response times and long service life

(Metal seal with indicator light/surge suppressor)
VQ4100 17 mS (Single)
VQ4200 12 mS (Double)
Accuracy ±3 mS
100 million cycles
* According to SMC life test conditions

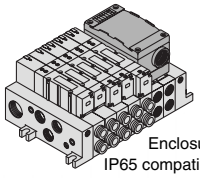
A variety of common wiring methods are standardized.

<Plug-in type>

F kit (D-sub connector)

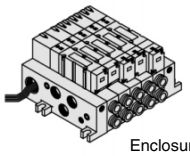


T kit (Terminal block box)



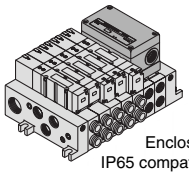
Enclosure IP65 compatible

L kit (Lead wire)



Enclosure IP65 compatible

S kit (Serial transmission)

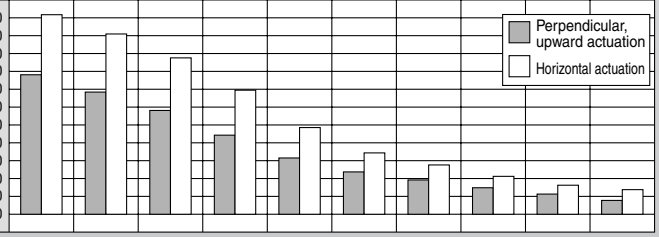


Enclosure IP65 compatible

Cylinder Speed Chart

Use as a guide for selection. Please confirm the actual conditions with SMC Sizing Program.

Series	Average speed (mm/s)	Bore size: Series MB/CA1 Pressure 0.5 MPa Load rate: 50% Stroke 500 mm					Series CS1 Pressure 0.5 MPa Load rate: 50% Stroke 1000 mm				
		ø40	ø50	ø60	ø80	ø100	ø125	ø140	ø160	ø180	ø200
VQ4100-□-03 VQ4101-□-03	1100 1000 900 800 700 600 500 400 300 200 100 0										



* It is when the cylinder is extending that is meter-out controlled by speed controller which is directly connected with cylinder, and its needle valve with being fully open.
* The average velocity of the cylinder is what the stroke is divided by the total stroke time.
* Load factor:((Load weight x 9.8)/Theoretical force) x 100%

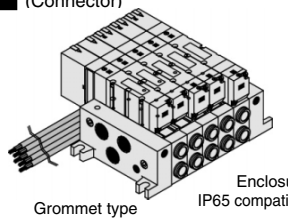
System Components

Speed controller	Silencer	SPG (Steel pipe) dia. x Length
AS420-03	AN300-03	10A x 1 m

Individual wiring type

<Plug lead type>

C kit (Connector)



Enclosure IP65 compatible
Grommet type

⚠ Precautions 1

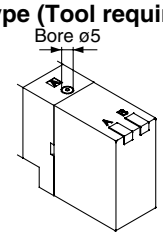
Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

Manual Override Operation

⚠ Warning

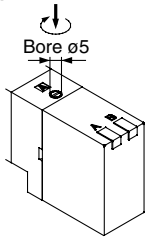
Since connected equipment will be actuated when the manual override is operated, first confirm that conditions are safe.
Non-locking push type (tool required) is standard. As an option, slotted locking type (tool required) is available.

Push type (Tool required)

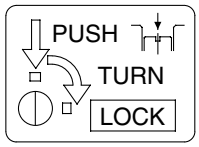


Push down on the manual override button with a small screwdriver until it stops.
Release the screwdriver and the manual override will return.

Locking type (Tool requied) <Option>



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.

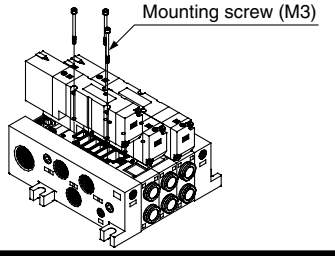


Mounting of Valves

⚠ Caution

After confirming the gasket is correctly placed under the valve, securely tighten the bolts with the proper torque shown in the table below.

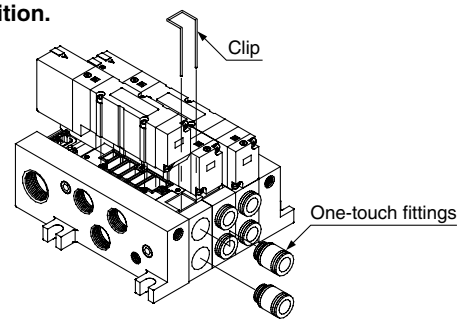
Proper tightening torque
0.8 to 1.2



Changing the One-touch Fittings

⚠ Caution

The built-in One-touch fittings on the cylinder port side are easily replaceable because of the cassette type. Clip prevents the fittings to come off. After removing the corresponding valve and take out the clip with a screwdriver, etc., then replace the fittings. About mounting the fittings, after inserting the fitting until it stops, then put the clip into the prescribed position.

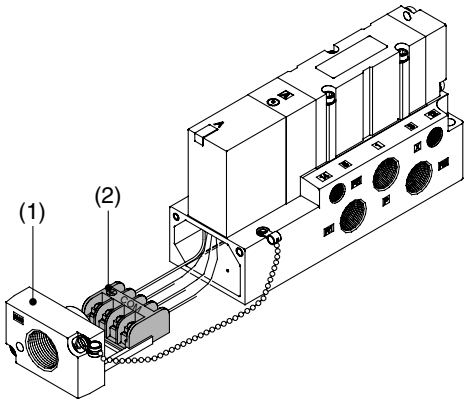


Lead Wire Connection

⚠ Caution

Plug-in sub-plate (With terminal block)

● If the junction cover (1) of the sub-plate is removed, you can see the plug-in type terminal block (2) mounted inside the sub-plate.



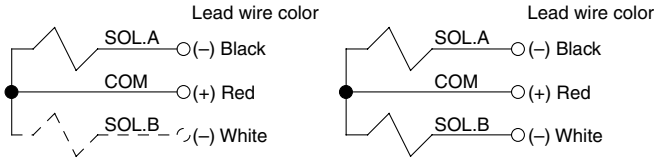
● The terminal block is marked as follows. Connect wiring to each of the power supply terminals.

Model \ Terminal block marking	A	COM	B	⏚
VQ410$^{0}_{1}$	A side	COM	—	—
VQ420$^{0}_{1}$	A side	COM	B side	—
VQ4$^{3}_{5}$$^{4}_{6}0^{0}_{1}$	A side	COM	B side	—

Note 1) There is no polarity. It can also be used as –COM.
Note 2) Double wiring is used on sub-plate VQ410 $^{0}_{1}$.
• Applicable terminal 1.25-3S, 1.25Y-3, 1.25Y-3N, 1.25Y-3.5

Plug lead: Grommet type

Make connections to each corresponding wire.



	Single solenoid	Double solenoid
Standard	Black: A side solenoid (–) Red: COM (+)	Black: A side solenoid (–) Red: COM (+) White: B side solenoid (–)
Enclosure IP65 compliant	Black: A side solenoid (–) Red: COM (+) White: B side solenoid (–) (Not used for single solenoid) Green: (Not used for single or double.)	

Note) There is no polarity. It can also be used as –COM.

⚠ Precautions 2

Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to pages 2-9-2.

Installation and Removal of Light Cover

⚠ Caution

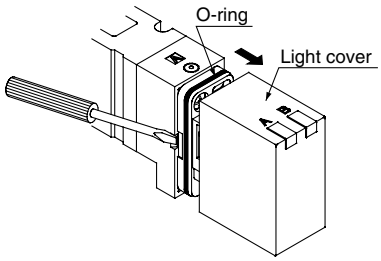
Installation/Removal of light cover

● **Removal**

Open the cover by inserting a small flat head screwdriver into the slot on the side of the pilot assembly (see drawing below), lift the cover out about 1 mm and then pull off. If it is pulled off at an angle, the pilot valve may be damaged or the protective O-ring may be scratched.

● **Installation**

Place the cover straight over the pilot assenmbly so that the pilot valve is not touched,and push it until the cover hook locks without twisting the protective O-ring. (When pushed in, the hook opens and locks automatically.)



Replacement of Pilot Valve

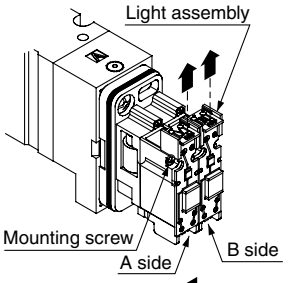
⚠ Caution

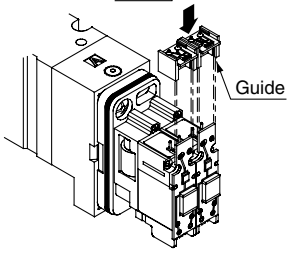
● **Removal**

1. Remove the mounting screw that holds the pilot valve using a small screwdriver.
2. When equipped with light, remove the light circuit board which is installed on the pilot valve by pulling it straight off the connector pins.

● **Installation**

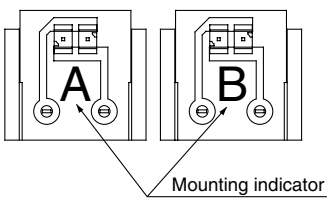
1. Insert the light circuit board straight onto the connector pins following the guide.
   If it is pushed in forcibly without following the guide, there is a danger of possibly bending the board contacts.
2. After confirming the gasket is correctly placed under the valve, securely tighten the bolts with the proper torque shown in the table below.





Proper tightening torque (N·m)
0.1 to 0.13

Note) The mounting of pilot valves is not directional with respect to the A and B sides.
However, the light circuit boards' A side is orange and the B side is green. It must be mounted on the pilot valve in accordance with the mounting indicators. The light will not go on if the mounting is reversed.



Light Circuit Board Part No.

SOL.A	VQZ100-47-A
SOL.B	VQZ100-47-B

Note) It can be used with all voltages.

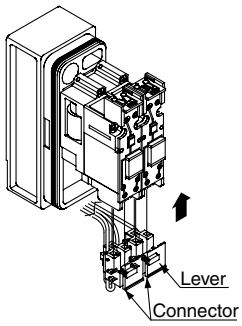
For Plug Lead Type

Attaching and detaching connectors

● To attach a connector, hold the lever and connector unit between your fingers and insert straight onto the pins of the solenoid valve so that the lever's pawl is pushed into the groove and locks.

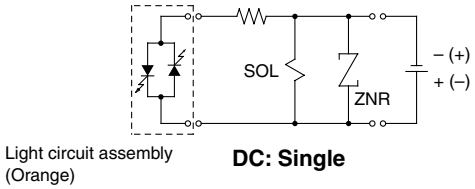
● To detach a connector, remove the pawl from the groove by pushing the lever downward with your thumb, and pull the connector straight out.

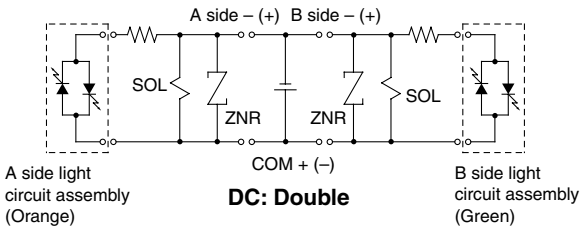
Note) Do not pull on the lead wires with excessive force. This can cause faulty and/or broken contacts.

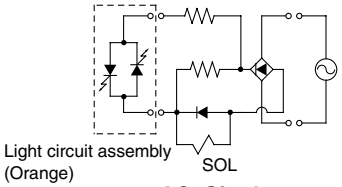


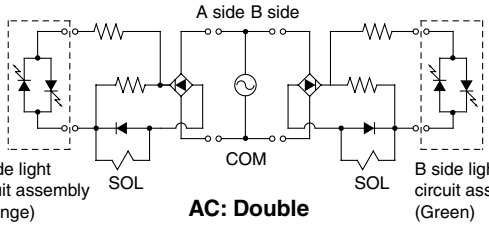
Internal Wiring Specifications

⚠ Caution









Enclosure IP65

⚠ Caution

Wires, cables, connectors, etc. used for models conforming to IP65 should also have enclosures equivalent to or stricter rating than IP65.

How to Calculate the Flow Rate

For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

Series VQ4000

Base Mounted

Plug-in/Plug Lead Single Unit

Model

Series	Configuration		Model		Port size	Flow characteristics						Response time (ms)			Weight (kg)
						1 → 4/2 (P → A/B)			4/2 → 5/3 (A/B → EA/EB)			Standard 1 W	Low wattage 0.5 W	AC	
						C [dm³/(s·bar)]	b	Cv	C [dm³/(s·bar)]	b	Cv				
VQ4000	2 position	Single	Metal seal	VQ41$^{0}_{5}$0	Rc 3/8	6.2	0.19	1.5	6.9	0.17	1.7	20 or less	22 or less	22 or less	0.23 (0.29)
			Rubber seal	VQ41$^{0}_{5}$1		7.2	0.43	2.1	7.3	0.38	2.0	25 or less	27 or less	27 or less	
		Double	Metal seal	VQ42$^{0}_{5}$0		6.2	0.19	1.5	6.9	0.17	1.7	12 or less	14 or less	14 or less	0.26 (0.32)
			Rubber seal	VQ42$^{0}_{5}$1		7.2	0.43	2.1	7.3	0.38	2.0	15 or less	17 or less	17 or less	
	3 position	Closed center	Metal seal	VQ43$^{0}_{5}$0		5.9	0.23	1.5	6.3	0.18	1.6	45 or less	47 or less	47 or less	0.28 (0.34)
			Rubber seal	VQ43$^{0}_{5}$1		7.0	0.34	1.9	6.4	0.42	1.9	50 or less	52 or less	52 or less	
		Exhaust center	Metal seal	VQ44$^{0}_{5}$0		6.2	0.18	1.5	6.9	0.17	1.7	45 or less	47 or less	47 or less	0.28 (0.34)
			Rubber seal	VQ44$^{0}_{5}$1		7.0	0.38	1.9	7.3	0.38	2.0	50 or less	52 or less	52 or less	
		Pressure center	Metal seal	VQ45$^{0}_{5}$0		6.2	0.18	1.6	6.4	0.18	1.6	45 or less	47 or less	47 or less	0.28 (0.34)
			Rubber seal	VQ45$^{0}_{5}$1		7.0	0.38	1.9	7.1	0.38	2.0	50 or less	52 or less	52 or less	
		Double check	Metal seal	VQ46$^{0}_{5}$0		2.7	—	—	3.7	—	—	55 or less	57 or les	57 or les	0.50 (0.56)
			Rubber seal	VQ46$^{0}_{5}$1		2.8	—	—	3.9	—	—	62 or less	64 or less	64 or less	

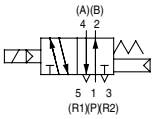
Note 1) Value for valve on sub-plate and cylinder port Rc 3/8
Note 2) Based on JIS B 8375-1981 Supply pressure: 0.5 MPa, with indicator light and surge voltage suppressor, clean air. This will change depending on pressure and air quality.) The value when ON for the double type.
Note 3) Values inside ( ) indicate the weight of plug lead units.
Table: Without sub-plate, With sub-plate: Add 0.41 kg for plug-in type, 0.30 kg for plug lead type.

Plug-in unit

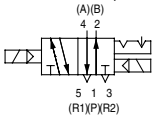
Plug lead unit

JIS Symbol

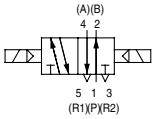
2 position single



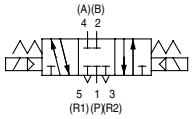
2 position double (Metal)



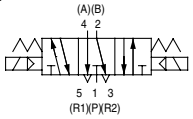
2 position double (Rubber)



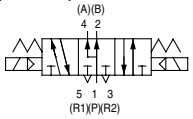
3 position closed center



3 position exhaust center



3 position pressure center



3 position double check

Standard Specifications

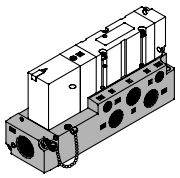
			Metal seal	Rubber seal
Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	Air/Inert gas
	Maximum operating pressure(3)		1.0 MPa (0.7 MPa)	
	Min. operating pressure	Single	0.15 MPa	0.20 MPa
		Double	0.15 MPa	0.15 MPa
		3 position	0.15 MPa	0.20 MPa
	Ambient and fluid temperature		–10 to 50°C (1)	–5 to 50°C(1)
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required) Option	
	Shock/Vibration resistance		150/30 m/s²	
	Enclosure		Dust tight (IP65 compatible)	
Solenoid specifications	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 0.5 W DC (21 mA)	
		12 VDC	1 W DC (83 mA), 0.5 W DC (42 mA)	
		100 VAC	Inrush 1.2 VA (12 mA), Holding 1.2 VA (12 mA)	
		110 VAC	Inrush 1.3 VA (11.7 mA), Holding 1.3 VA (11.7 mA)	
		200 VAC	Inrush 2.4 VA (12 mA), Holding 2.4 VA (12 mA)	
		220 VAC	Inrush 2.6 VA (11.7 mA), Holding 2.6 VA (11.7 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.
Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)
Note 3) Values inside ( ) denote the low wattage (0.5 W) specifications.

How to Order Valves

Body

0: Plug-in sub-plate



Port size

Nil	Without sub-plate (For manifold)
02	Rc 1/4
03	Rc 3/8

Note) For thread standard, refer to page 2-5-39.

Porting specifications

Nil	Side ported
B	Bottom ported

Plug-in	**VQ4** **1** **0** **0** □ — □ □ □ □ □ □
Plug lead	**VQ4** **2** **5** **1** □ — □ □ □ □ □ □

Type of actuation

1		2 position single
2	Metal	2 position double
	Rubber	2 position double
3		3 position closed center
4		3 position exhaust center
5		3 position pressure center
Note) **6**		3 position double check

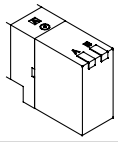
Note) For double check style, refer to page 2-5-36.

Enclosure

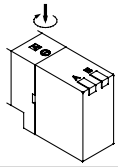
Nil	Dust-protected
W	Dusttight/Low jetproof type (IP65)

Manual override

Nil: Non-locking push type (Tool required)



B: Slotted locking type (Tool required)

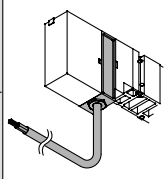


Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Electrical entry

Grommet	**G**	Lead wire length 0.6 m
	H	Lead wire length 1.5 m

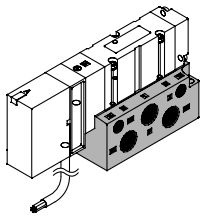


Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Body

5: Plug lead sub-plate



Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y(1)	Low wattage type (0.5 W)
R(2)	External pilot

Note 1) Applicable to DC specifications.
Note 2) For external pilot specifications, refer to page 2-5-39. Combination of external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Replacement of pilot valve assembly (Voltage)
- Refer to pages 2-5-44 and 2-5-45 for pilot valve assembly part numbers.
- For "How to Replace", refer to page 2-5-3.

How to Order Sub-plates

VQ4000 □ □ — □ □

Electrical entry

P	Plug-in conduit terminal
S	Plug lead

Enclosure

Nil	Dust-protected
W Note)	Dusttight/Low jetproof type

Note) It is not necessary for plug lead type.

Porting specifications

Nil	Side ported
B	Bottom ported(1)

Port size

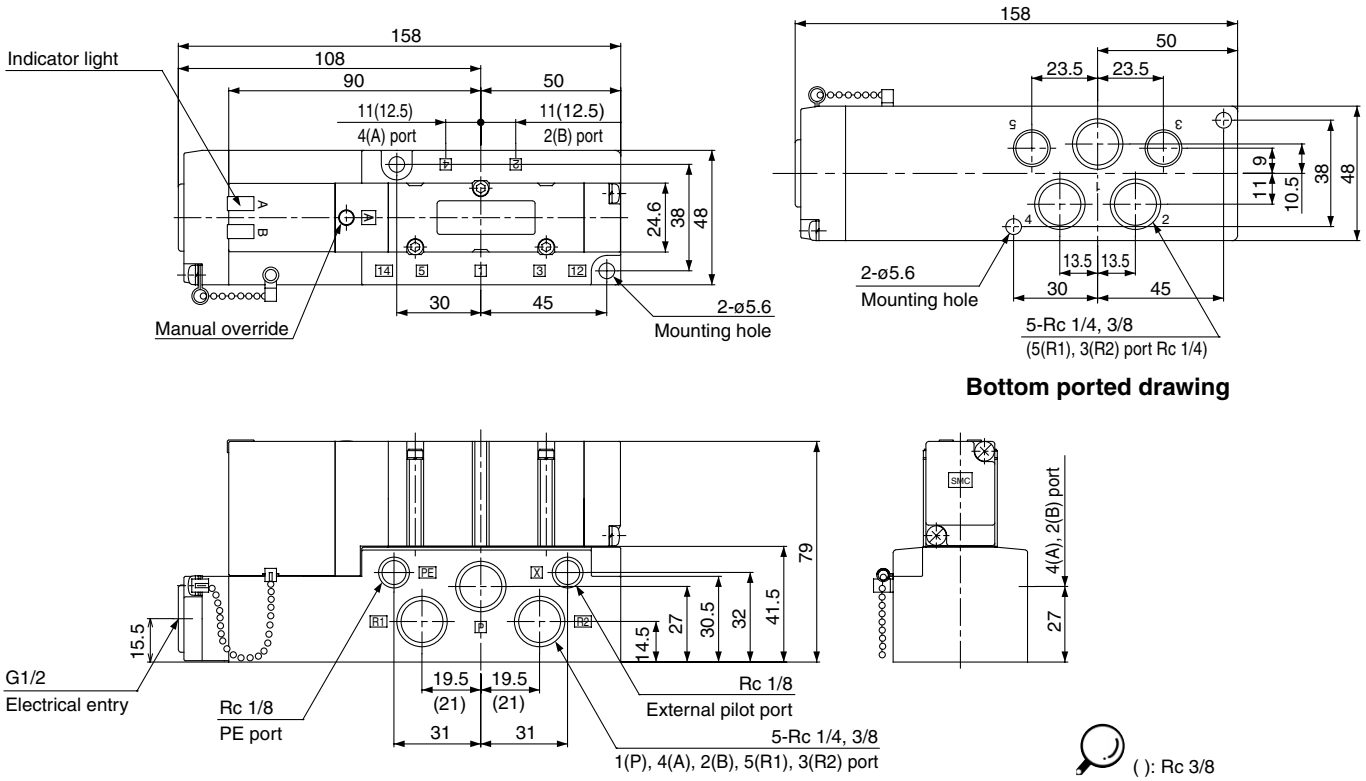
02	Rc 1/4
03	Rc 3/8

Note 1) For bottom ported port size is RC 1/4 only.
Note 2) For thread standard, refer to page 2-5-39.

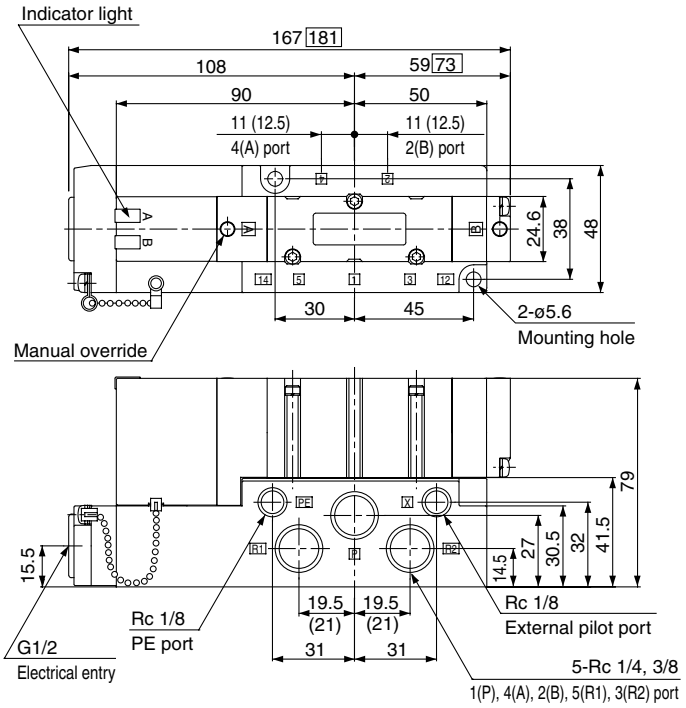
Plug-in Type

Conduit terminal

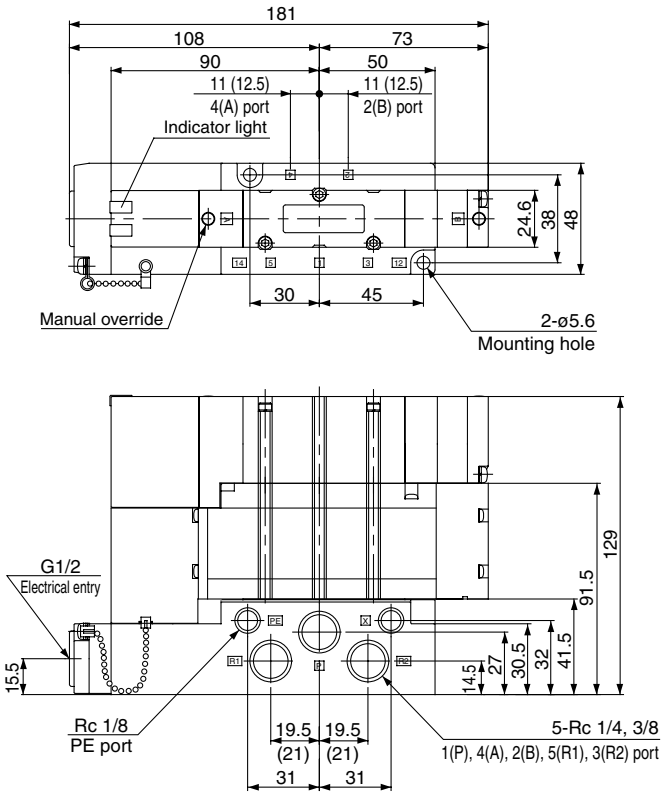
2 position single: VQ410$^{0}_{1}$-□



2 position double: VQ420$^{0}_{1}$-□
3 position closed center: VQ430$^{0}_{1}$-□
3 position exhaust center: VQ440$^{0}_{1}$-□
3 position pressure center: VQ450$^{0}_{1}$-□



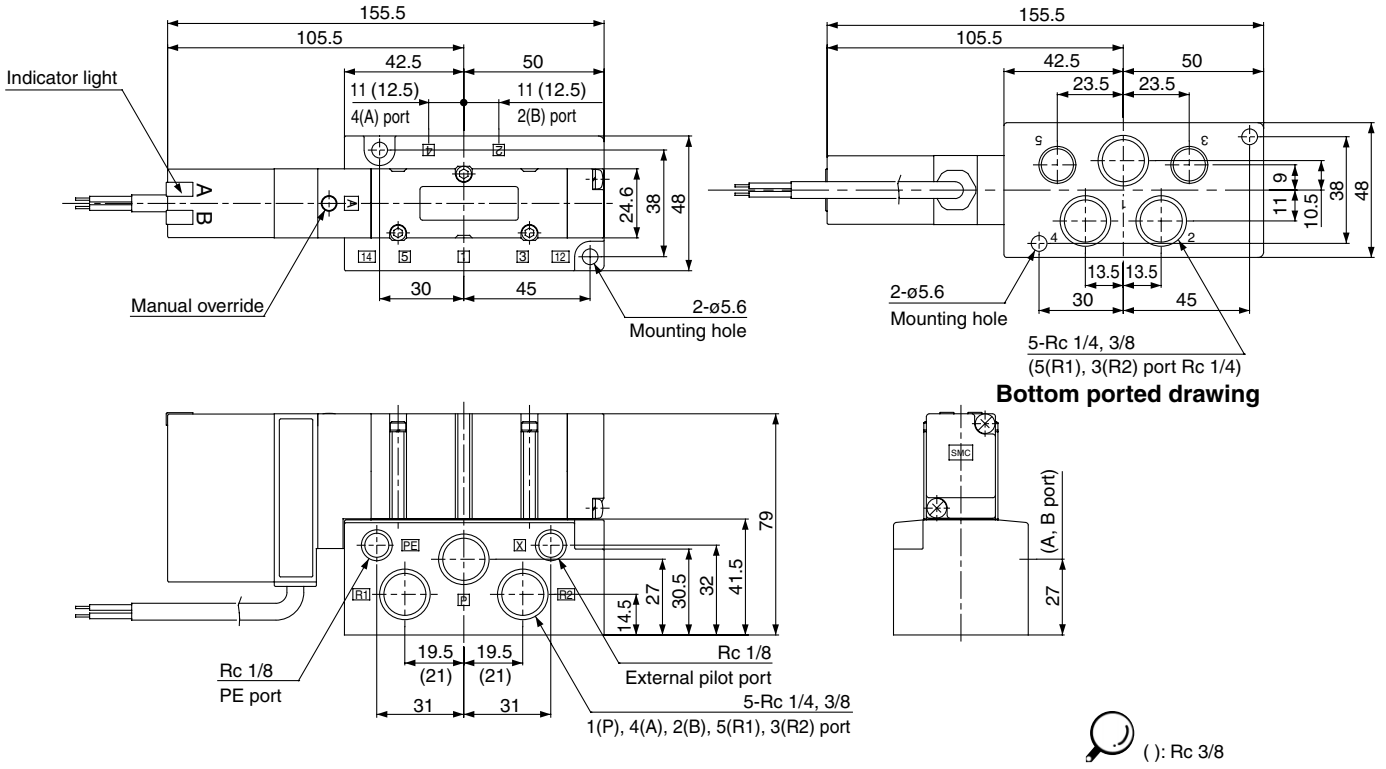
3 position double check: VQ460$^{0}_{1}$-□



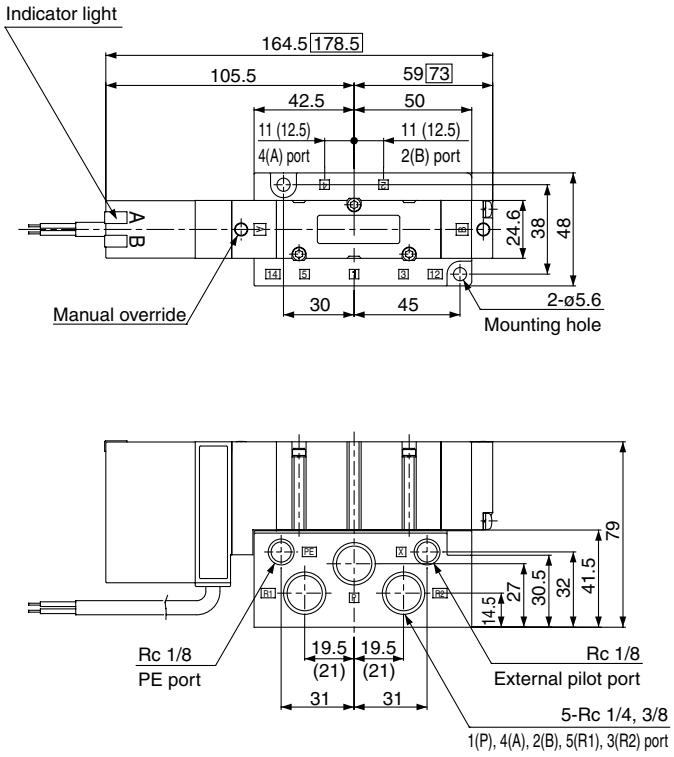
Plug Lead Type

Grommet

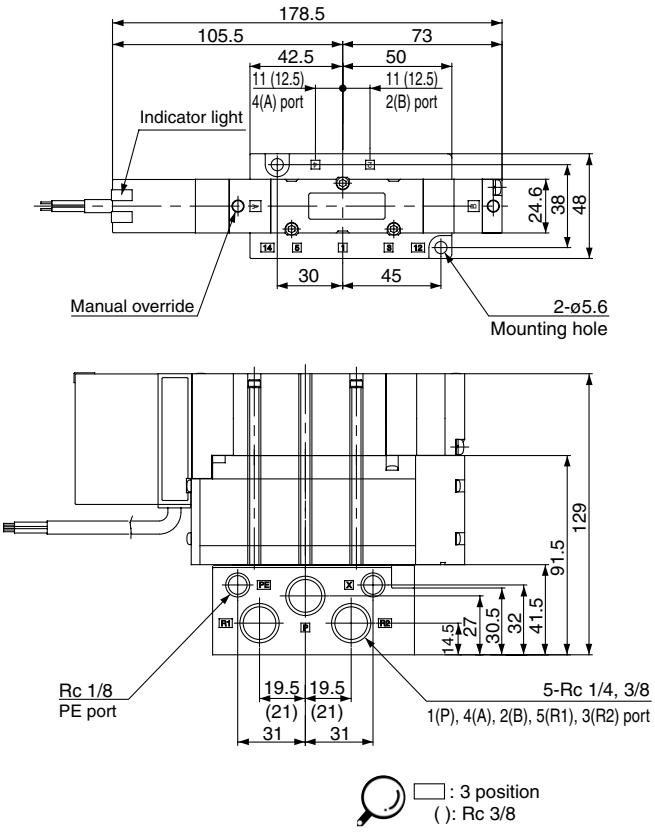
2 position single: VQ415$^{0}_{1}$-□$^{G}_{H}$



2 position double: VQ425$^{0}_{1}$-□$^{G}_{H}$
3 position closed center: VQ435$^{0}_{1}$-□$^{G}_{H}$
3 position exhaust center: VQ445$^{0}_{1}$-□$^{G}_{H}$
3 position pressure center: VQ455$^{0}_{1}$-□$^{G}_{H}$



3 position double check: VQ465$^{0}_{1}$



For details about certified products conforming to international standards, visit us at www.smcworld.com.

Series VQ4000

Base Mounted

Plug-in Unit

How to Order Manifold

VV5Q 4 1 – 08 C8 F U1 [ ] – K

Series

4	VQ4000

Manifold

1	Plug-in unit

Stations

01	1 station
⋮	⋮

The maximum and minimum number of stations are varied depending on kit. (Refer to the table below.)

Cylinder port

C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Kit type

Control unit

Refer to pages 2-5-40 to 2-5-43.

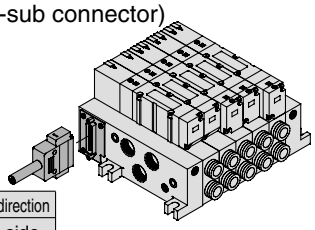
Option

Symbol	Option
Nil	None
CD (2)	Exhaust cleaner: For D side mounting
CU (2)	Exhaust cleaner: For U side mounting
K (3)	Special wiring specifications (Except double wiring)
N	Name plate (T kit only)
SB	Direct exhaust with silencer box: Exhaust from both sides (F/L kits only)
SD (2)	Direct exhaust with silencer box: D side exhaust
SU (2)	Direct exhaust with silencer box: U side exhaust
W	Enclosure IP65 (Except F kit)

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -CDK
Note 2) Combination of [C_D^U] and [S_D^U] is not possible.
Note 3) Specify the wiring specifications on the manifold specification sheet. (Except L kit)

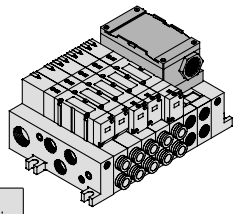
Kit/Electrical entry/Cable length

F kit (D-sub connector)



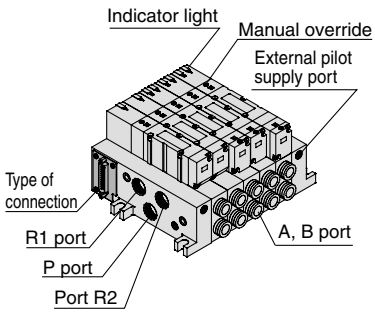
Connector entry direction					
D side		U side			
Kit F	D0	Kit F	U0	Without cable	1 to 18 stations
	D1		U1	Cable length 1.5 m	
	D2		U2	Cable length 3 m	
	D3		U3	Cable length 5 m	

T kit (Terminal block box kit)



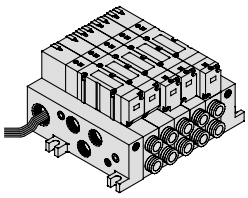
IP65 compatible

Terminal block mounting position			
D side	U side		
TD	TO	Terminal block box	3 to 18 stations



Note) Shown VV5Q41-05C12FD0

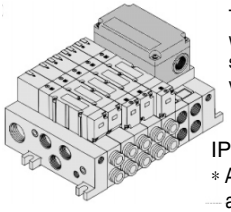
L kit (Lead wire cable)



Electrical entry					
D side		U side			
Kit L	D0	Kit L	U0	Cable length 0.6 m	1 to 16 stations
	D1		U1	Cable length 1.5 m	
	D2		U2	Cable length 3 m	

IP65 compatible

S kit (Serial transmission unit)



The valve is equipped with a lamp/surge suppressor, and the voltage is 24 VDC.

IP65 compatible
* Applicable to INPUT and OUTPUT type.

Unit mounting position			
D side	U side		
SD	S	0	Without SI unit
		A	With general type SI unit (Series EX300)
		B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System
		BB	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System (2 power supply systems)
		C	OMRON Corp.: SYSBUS Wire System
		D	SHARP Corp.: Satellite I/O Link System
		F1	NKE Corp.: Uni-wire System (16 output points)
		J1	SUNX Corp.: S-LINK System (16 output points)
		J2	SUNX Corp.: S-LINK System (8 output points)
		K	Fuji Electric Co.: T-LINK Mini System
		Q	DeviceNet, CompoBus/D (OMRON Corp.)
		R1	OMRON Corp.: CompoBus/S System (16 output points)
		R2	OMRON Corp.: CompoBus/S System (8 output points)
		U	JEMANET (JPCN-1)
		V	Mitsubishi Electric Corp.: CC-LINK System
		G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System
		H	NKE Corp.: Uni-wire H System

3 to 18 stations

* For INPUT and OUTPUT type, refer to pages 2-5-26 to 2-5-29.

Simple specials are available with SMC Simple Special System. For details about applicable models, please contact SMC.

Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Maximum applicable stations	Applicable solenoid valve	5 station weight (kg)
			4(A), 2(B) port location	Port size Note)				
				1(P), 5(R1), 3(R2)	4(A), 2(B)			
VQ4000	**VV5Q41-□□□**	■ F kit–D-sub connector ■ T kit–Terminal block box ■ L kit–Lead wire ■ S kit–Serial transmission	Side	Rc 1/2 Option Direct exhaust with silencer box	C8 (For ø8) C10 (For ø10) C12 (For ø12) Rc 1/4 Rc 3/8	F, T kit 12 stations L kit 16 stations S kit 10 stations	VQ4□00 VQ4□01	2.24 • L kit • Except solenoid valve weight
			Bottom		Rc 1/4			

Note) For details about inch-size One-touch fittings and other thread standards, refer to page 2-5-39.

Flow Characteristics at the Number of Manifold Stations (Operated individually)

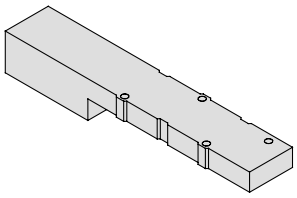
Model	Passage/Stations		Station 1	Station 5	Station 10	Station 15
2 position metal seal **VQ4$^{1}_{2}$00**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	5.9	5.9	5.9	5.9
		b	0.23	0.23	0.23	0.23
		Cv	1.5	1.5	1.5	1.5
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	6.2	6.2	6.2	6.2
		b	0.19	0.19	0.19	0.19
		Cv	1.5	1.5	1.5	1.5
2 position rubber seal **VQ4$^{1}_{2}$01**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	6.8	6.8	6.8	6.8
		b	0.31	0.31	0.31	0.31
		Cv	1.8	1.8	1.8	1.8
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	7.0	7.0	7.0	7.0
		b	0.38	0.38	0.38	0.38
		Cv	1.9	1.9	1.9	1.9

Note) Port size: Rc 3/8

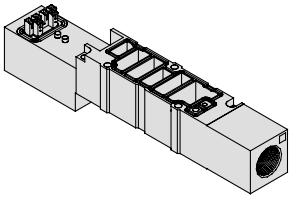
Manifold Option

- Refer to pages 2-5-34 to 2-5-38 for detailed dimensions of each option. For replacement parts, refer to page 2-5-47.
- Refer to pages 2-5-40 to 2-5-43 for control unit.

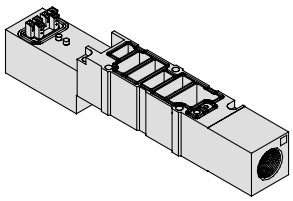
Blanking plate assembly
VVQ4000-10A-1



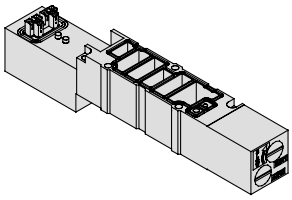
Individual SUP spacer
VVQ4000-P-1-$^{02}_{03}$



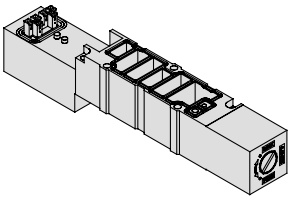
Individual EXH spacer
VVQ4000-R-1-$^{02}_{03}$



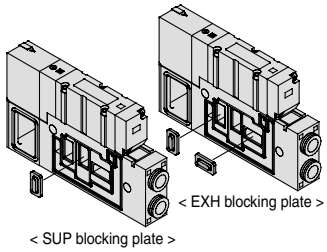
Throttle valve spacer
VVQ4000-20A-1



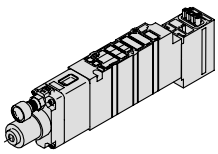
SUP stop valve spacer
VVQ4000-37A-1



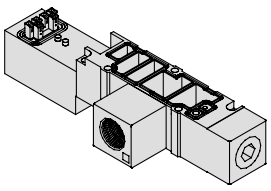
SUP/EXH block plate
VVQ4000-16A



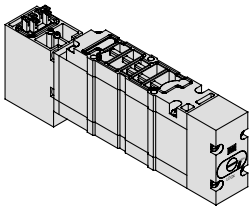
Interface regulator
ARBQ4000-00-$^{A}_{B}$$^{}_{P}$-1



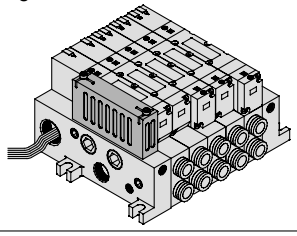
Release valve spacer
VVQ4000-24A-1D (1, 2)



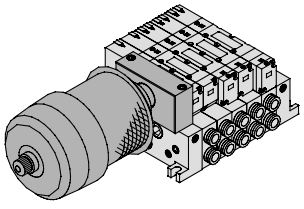
Double check spacer with residual pressure exhaust
VVQ4000-25A-1 (1)



Direct exhaust with silencer box
[-S$^{D}_{U}$](1)

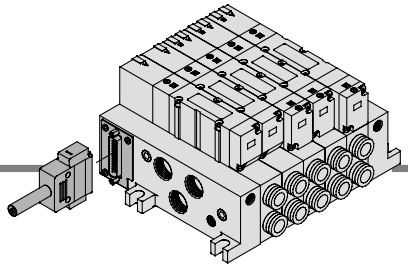


For exhaust cleaner mounting
[-C$^{D}_{U}$](1)



Note 1) Release valve spacer, built-in silencer (direct exhaust), exhaust cleaner mounting and double check spacer for residual pressure exhaust cannot be combined with external pilot.
Note 2) Can be mounted on L kit only. For other kits, order E type control unit. (Refer to pages 2-5-40 to 2-5-43.)

F Kit (D-sub connector kit)



- **Simplification and labor savings for wiring work can be achieved by using a D-sub connector for the electrical connection.**
- **Using connector for flat ribbon cable (25P) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.**
- **Connector entry can be selected on either the U side or the D side according to the mounting orientation.**
- **Maximum stations are 18.**

Manifold Specifications

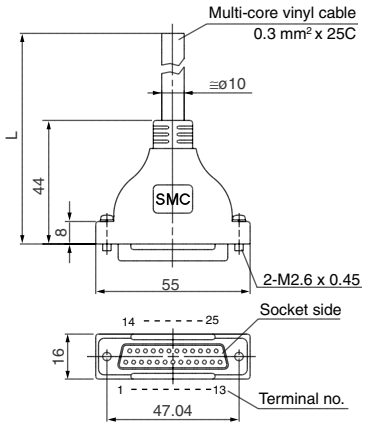
Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ4000	Side	Rc 1/2	C 8, 10, 12 Rc 1/4, 3/8	Max. 18 stations
	Bottom		Rc 1/4	

D-Sub Connector Kit (25 pins)

Cable assembly ●

AXT100-DS25- 015 / 030 / 050

(D-sub connector cable assemblies can be ordered by with manifolds. Refer to How to Order Manifold.)



D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25 cores x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

* For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Connector manufacturers' example
- Fujitsu, Ltd.
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Hirose Electric Co., Ltd.

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Voltage limit VAC, 1 min.	1000
Insulation resistance MΩkm, 20°C	5 or less

Note) The minimum bending radius for D-sub connector cables is 20 mm.

D-sub Connector Cable Assembly Terminal No.

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

How to Order Manifold

VV5Q 4 1 – 08 C8 F U 1 – ☐

Series
4	VQ4000

Manifold
1	Plug-in unit

Stations
01	1 station
⋮	⋮
18	18 stations

Cylinder port
C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Note) As an option, the maximum number of stations can be increased by special wiring specifications.
For details, refer to page 2-5-11.

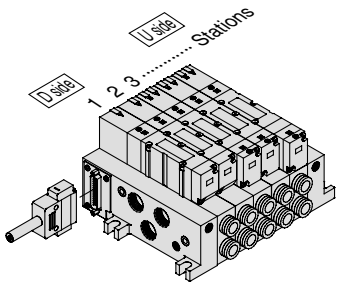
Connector entry direction
D	D side entry
U	U side entry

Cable (Length)
0	Without cable
1	Cable length 1.5 m
2	Cable length 3 m
3	Cable length 5 m

Option
Symbol	Option
Nil	None
CD(2)	Exhaust cleaner: For D side mounting
CU(2)	Exhaust cleaner: For U side mounting
K(3)	Special wiring specifications (Except double wiring)
SB	Direct exhaust with silencer box: Exhaust from both sides
SD(2)	Direct exhaust with silencer box: D side exhaust
SU(2)	Direct exhaust with silencer box: U side exhaust

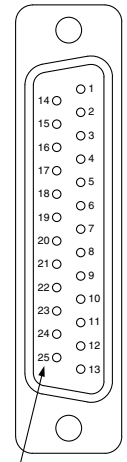
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CDK
Note 2) Combination of [C $\frac{U}{D}$] and [S $\frac{U}{D}$] is not possible.
Note 3) Specify the wiring specifications on the manifold specification sheet.
Note 4) Refer to pages 2-5-40 to 2-5-43 for with control unit.

● Electrical wiring specifications



Stations are counted starting from the first station on the D side.

D-sub connector



Connector terminal no.

Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types.
Mixed single and double wiring is available as an option. For details, refer to below.

	Standard wiring Terminal no.	Wiring with control unit Terminal no.	Polarity		D-sub connector assembly AXT100-DS25-015/030/050 Lead wire color	Dot marking
1 station	SOL.A 1	Release valve 1	(–)	(+)	Black	None
	SOL.B 14	14	(+)	(–)	Yellow	Black
2 stations	SOL.A 2	Pressure switch 2	(–)	(+)	Brown	None
	SOL.B 15	15	(+)	(–)	Pink	Black
3 stations	SOL.A 3	SOL.A 3	(–)	(+)	Red	None
	SOL.B 16	SOL.B 16	(–)	(+)	Blue	White
4 stations	SOL.A 4	SOL.A 4	(–)	(+)	Orange	None
	SOL.B 17	SOL.B 17	(–)	(+)	Purple	None
5 stations	SOL.A 5	SOL.A 5	(–)	(+)	Yellow	None
	SOL.B 18	SOL.B 18	(–)	(+)	Gray	None
6 stations	SOL.A 6	SOL.A 6	(–)	(+)	Pink	None
	SOL.B 19	SOL.B 19	(–)	(+)	Orange	Black
7 stations	SOL.A 7	SOL.A 7	(–)	(+)	Blue	None
	SOL.B 20	SOL.B 20	(–)	(+)	Red	White
8 stations	SOL.A 8	SOL.A 8	(–)	(+)	Purple	White
	SOL.B 21	SOL.B 21	(–)	(+)	Brown	White
9 stations	SOL.A 9	SOL.A 9	(–)	(+)	Gray	Black
	SOL.B 22	SOL.B 22	(–)	(+)	Pink	Red
10 stations	SOL.A 10	SOL.A 10	(–)	(+)	White	Black
	SOL.B 23	SOL.B 23	(–)	(+)	Gray	Red
11 stations	SOL.A 11	SOL.A 11	(–)	(+)	White	Red
	SOL.B 24	SOL.B 24	(–)	(+)	Black	White
12 stations	SOL.A 12	SOL.A 12	(–)	(+)	Yellow	Red
	SOL.B 25	SOL.B 25	(–)	(+)	White	None
	COM. 13	COM. 13	(+)	(–)	Orange	Red
			Positive common specifications	Negative common specifications Note)		

Note) There is no polarity.
It can also be used as a negative common.

Special Wiring Specifications

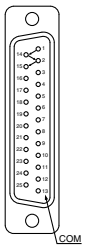
Double wiring (connected to SOL. A and SOL. B) is used for the internal wiring of each station regardless of valve and option types.
Mixed single and double wiring is available as an option.

1. How to order

Indicate option symbol "-K" in the manifold part number and be sure to specify station positions for single or double wiring on the manifold specification sheet.

2. Wiring specifications

Connections begin with the A side solenoid of the first station being connected to terminal no. 1, and continue in the order indicated by the arrows in the drawing without skipping any terminals.
Maximum stations are 18.



D-sub connector

How to Order Valves

VQ 4 1 0 0 ☐ — 5 ☐ ☐

Series

4	VQ4000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y(1)	Low wattage type (0.5 W)
R(2)	External pilot

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Note 1) Applicable to DC specifications.
Note 2) Refer to page 2-5-39 for external pilot specification. Combination of external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

How to Order Manifold Assembly

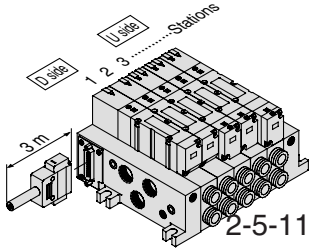
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
D-sub connector kit with cable (3 m)

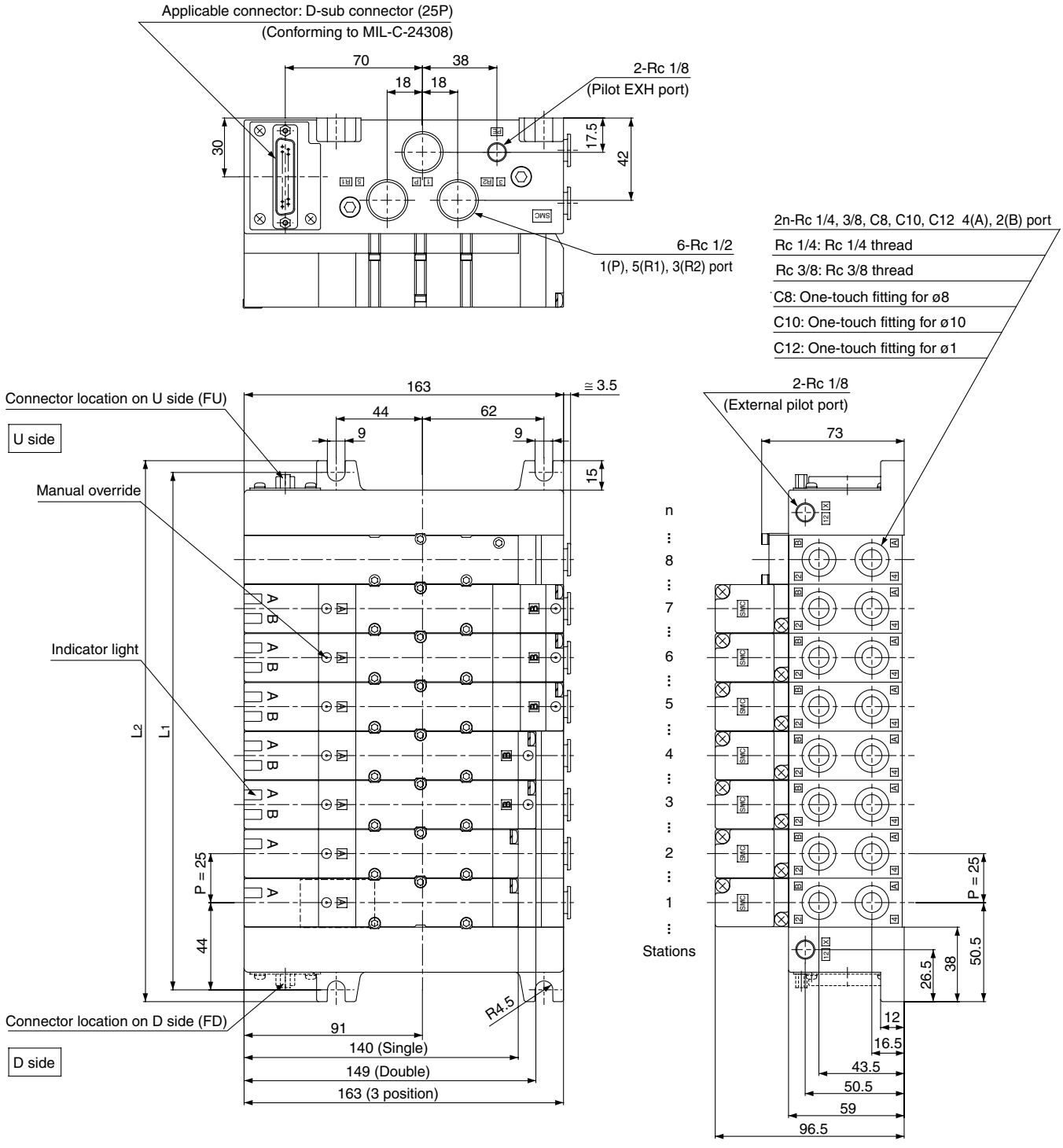
VV5Q41-05C8FD2····1 set — Manifold base part no.
∗VQ4100-5·····2 sets — Valve part no. (Stations 1 and 2)
∗VQ4200-5·····2 sets — Valve part no. (Stations 3 and 4)
∗VQ4300-5·····1 set — Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

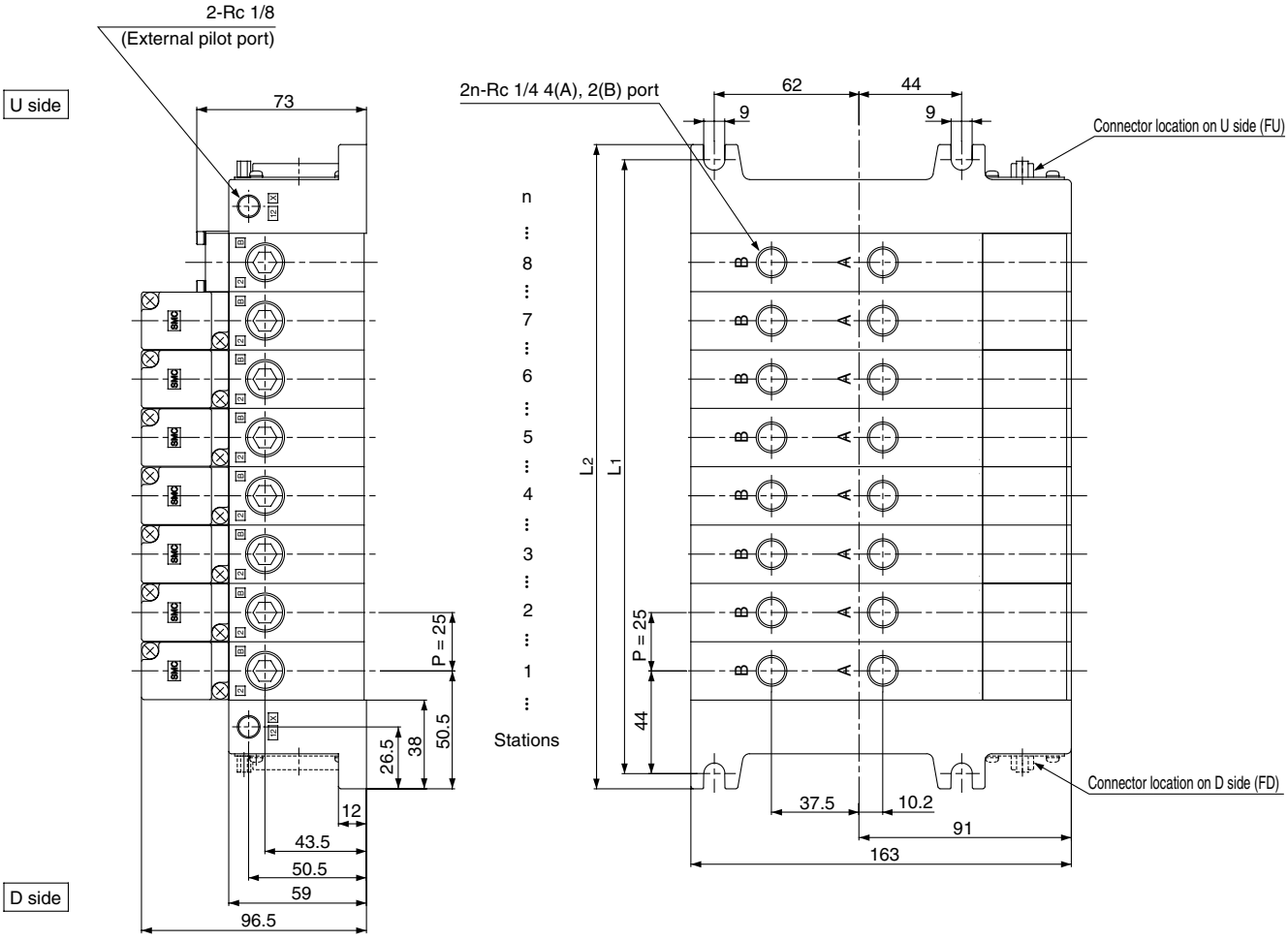
Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



F Kit (D-sub connector kit)



Bottom ported drawing

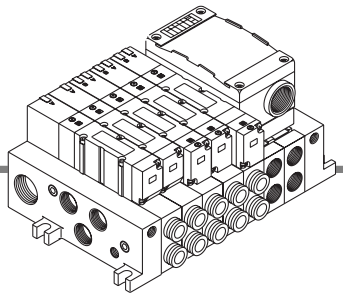


Dimensions

Formula L1 = 25n + 63, L2 = 25n + 76 n: Station (Maximum standard 18 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
L1	88	113	138	163	188	213	238	263	288	313	338	363	388	413	438	463	488	513
L2	101	126	151	176	201	226	251	276	301	326	351	376	401	426	451	476	501	526

T Kit (Terminal block box kit)



IP65 compliant

- **Enclosure IP65 compliant**
- **This type has a small terminal block inside a junction box. The provision of a G 3/4 electrical entry allows connection of conduit fittings.**
- **Maximum stations are 18.**
- **2 stations are used for terminal box mounting.**

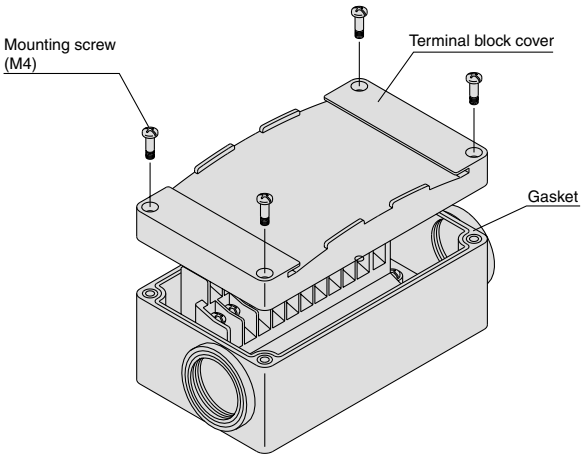
Manifold Specifications

Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ4000	Side	Rc 1/2	C 8, 10, 12 Rc 1/4, 3/8	Max. 18 stations
	Bottom		Rc 1/4	

Terminal Block Connections

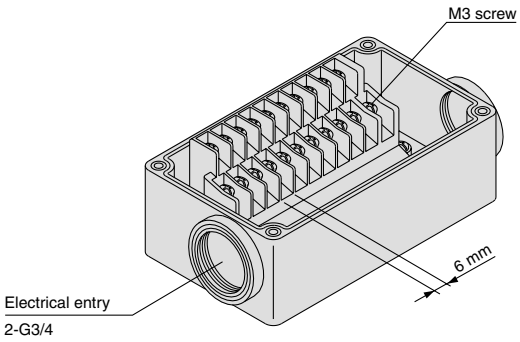
Step 1. How to remove terminal block cover

Loosen the 4 mounting screws (M4) and open the terminal block cover.



Step 2. The diagram on the right shows the terminal block wiring. All stations are provided with double wiring regardless of the valves which are mounted.

Connect each wire to the power supply side, according to the markings provided inside the terminal block.



Step 3. How to attach the terminal block cover

Securely tighten the screws with the torque shown in thetable below, after confirming that the gasket is installed correctly.

Proper tightening torque (N·m)
0.7 to 1.2

● Applicable terminal 1.25-3S, 1.25Y-3, 1.25Y-3N, 1.25Y-3.5

How to Order Manifold

VV5Q 4 1 − 08 C8 T 0 − ☐

Series

4	VQ4000

Manifold

1	Plug-in unit

Stations

03	3 stations
⋮	⋮
18	18 stations

Note) Add 2 stations for terminal block box mounting.

Cylinder port

C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Note) As an option, the maximum number of stations can be increased by special wiring specifications. For details, refer to page 2-5-15.

Stations

O	U side mounting
D	D side mounting

Option

Symbol	Option
Nil	None
CD(2)	Exhaust cleaner: For D side mounting
CU(2)	Exhaust cleaner: For U side mounting
K (3)	Special wiring specifications (Except double wiring)
N (4)	Name plate
SD(2)	Direct exhaust with silencer box: D side exhaust
SU(2)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

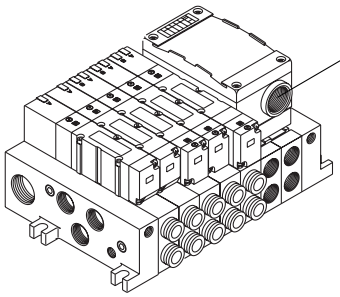
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CDK

Note 2) Combination of [CD] and [SD] is not possible.

Note 3) Specify the wiring specifications on the manifold specification sheet.

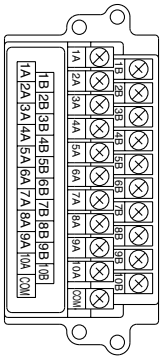
Note 4) Name plate is inlaid in the terminal block cover.

Note 5) Refer to pages 2-5-40 to 2-5-43 for with control unit.

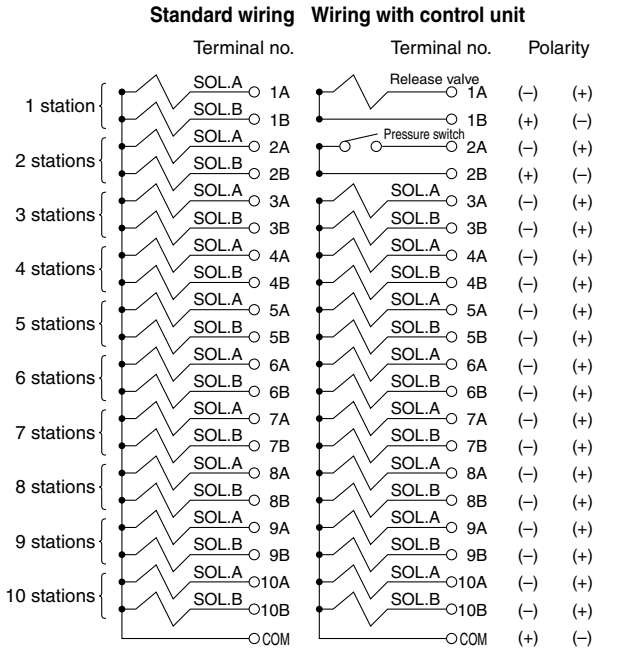


Stations are counted starting from the first station on the D side.

● Electrical wiring specifications



Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types.
Mixed single and double wiring is available as an option.



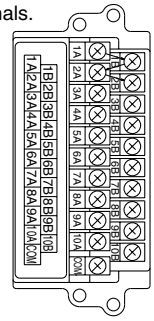
Note) There is no polarity. It can also be used as a negative common.

Special Wiring Specifications

Double wiring (connected to SOL. A and SOL. B) is used for the internal wiring of each station regardless of valve and option types. The optional specification permits mixture of single and double wiring. However, the maximum number of stations is 16.

1. How to Order
Indicate option symbol "-K" in the manifold part number and be sure to specify station positions for single or double wiring on the manifold specification sheet.

2. Wiring specifications
Connections begin with the A side solenoid of the first station being connected to terminal no. 1, and continue in the order indicated by the arrowsin the drawing without skipping any terminals.



How to Order Valves

VQ 4 1 0 0 — 5

Series

4	VQ4000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specifications.
Note 2) Refer to page 2-5-39 for external pilot specification. Combination of external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Enclosure

Nil	Dust tight
W	Dust tight/Low jetproof type (IP65)

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Ligh/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

How to Order Manifold Assembly

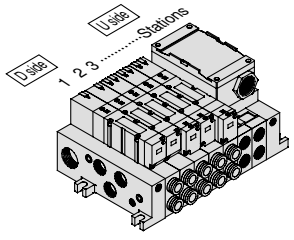
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Terminal block box kit

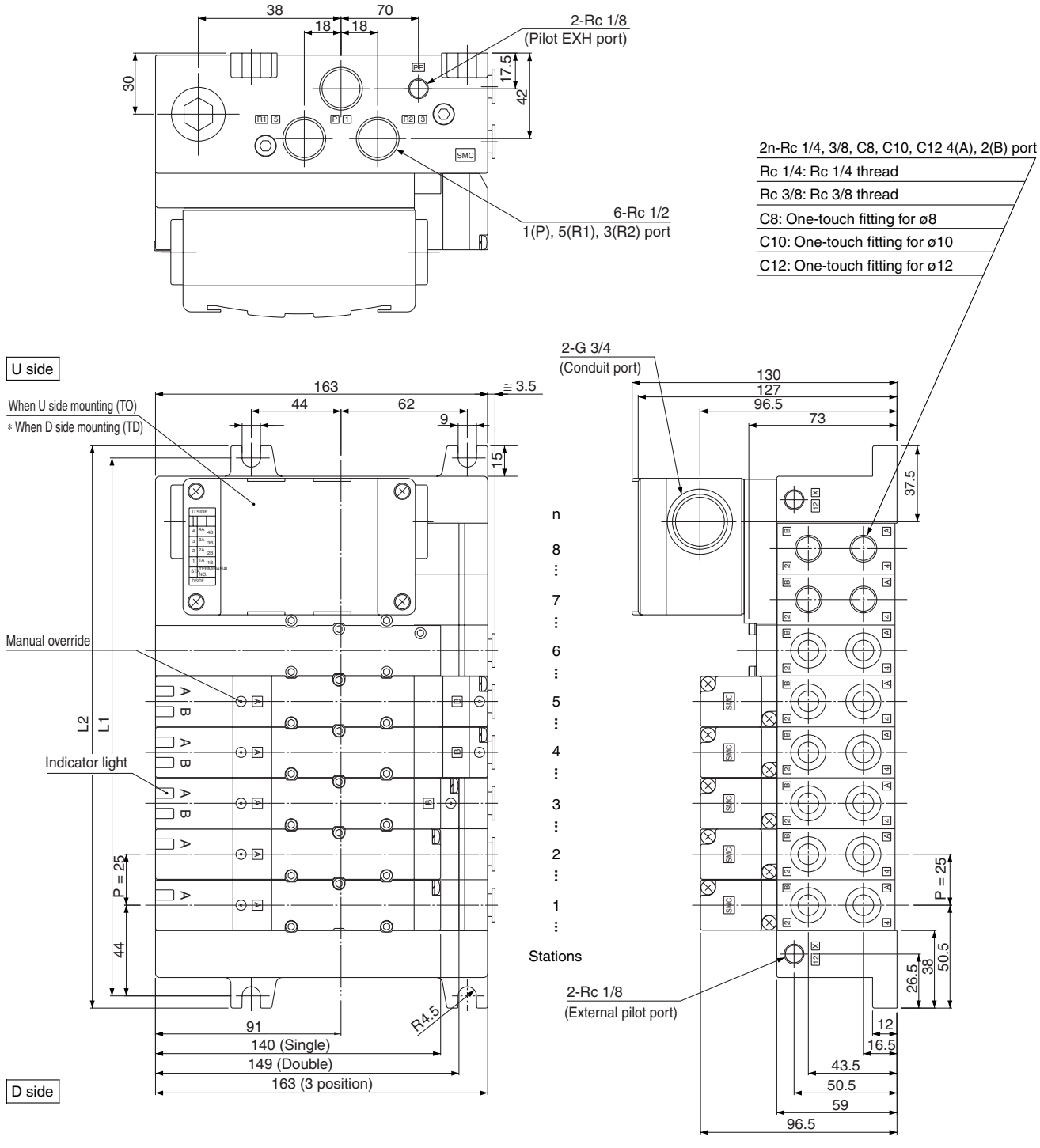
VV5Q41-07C8T0····1 set —Manifold base part no.
∗VQ4100-5·····2 sets —Valve part no. (Stations 1 and 2)
∗VQ4200-5·····2 sets —Valve part no. (Stations 3 and 4)
∗VQ4300-5·····1 set —Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.

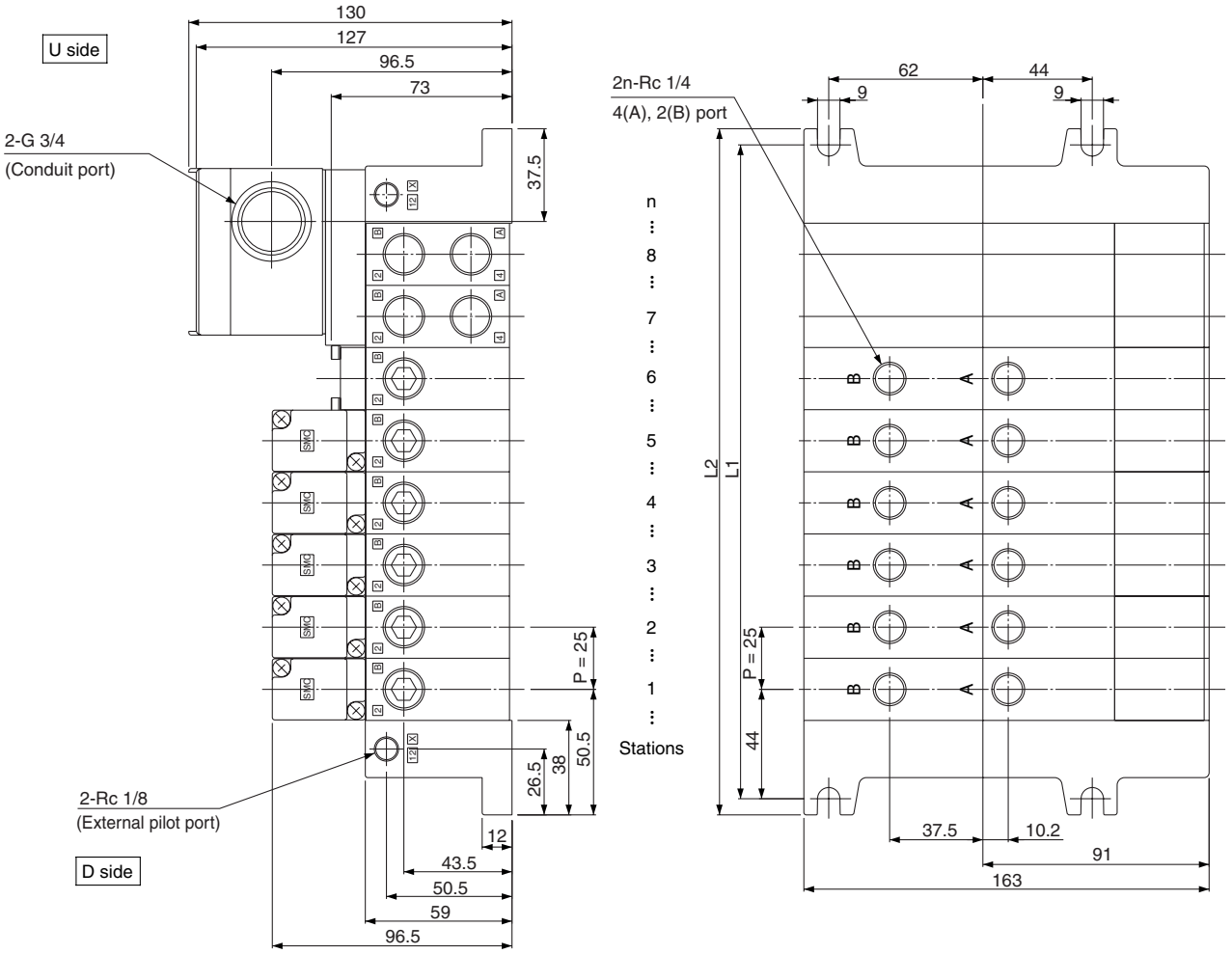


T Kit (Terminal block box kit)



Note) Shown VV5Q41-08C12TO-W

Bottom ported drawing



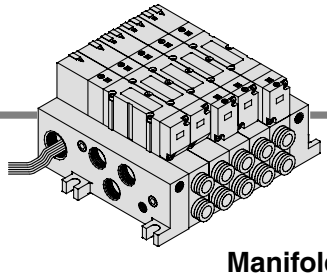
Formula L1 = 25n + 63, L2 = 25n + 76
n: Station (Maximum standard 18 stations)
∗ Including 2 stations for terminal box.

Dimensions

L \ n	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
L1	138	163	188	213	238	263	288	313	338	363	388	413	438	463	488	513
L2	151	176	201	226	251	276	301	326	351	376	401	426	451	476	501	526

L Kit (Lead wire cable)

IP65 compliant



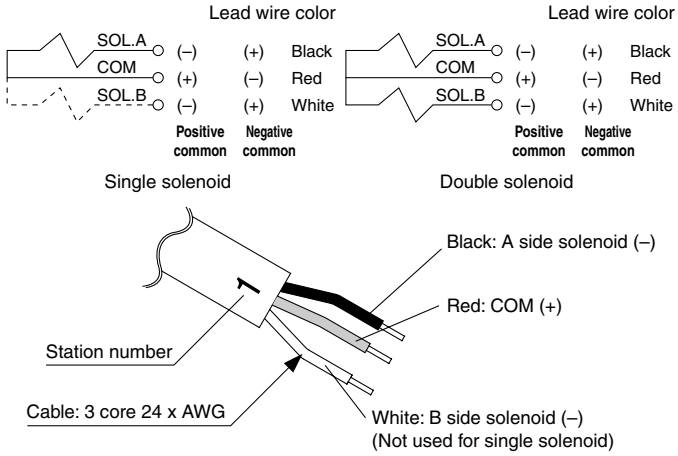
- Enclosure IP65 compliant
- Direct electrical entry. Models with two or more stations are available.
- Electrical entry can be selected on either the U side or the D side according to the mounting orientation.
- Maximum stations are 16.

Manifold Specifications

Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ4000	Side	Rc 1/2	C 8, 10, 12 Rc 1/4, 3/8	Max. 16 stations
	Bottom		Rc 1/4	

Wiring Specifications

Three lead wires are attached to each station regardless of the type of valve which is mounted.
The red wire is for COM connection.



Lead Wire Assembly with Connector

Lead wire length	Part no.
0.6 m	VVQ4000-44A-8-□
1.5 m	VVQ4000-44A-15-□
3 m	VVQ4000-44A-30-□

□: Number of stations 1 to 16.

For different lead wire lengths, order a lead wire assembly with connector shown in the table on the right.
Note 1) There is no polarity. It can also be used as a negative common.
Note 2) Connect the release valve and the pressure switch to SOL. A side on the manifold with control unit.

How to Order Manifold

VV5Q 4 1 – 08 C8 L U □ – □

Series

4	VQ4000

Manifold

1	Plug-in unit

Stations

01	1 station
⋮	⋮
16	16 stations

Cylinder port

C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Connector locations

D	D side entry
U	U side entry

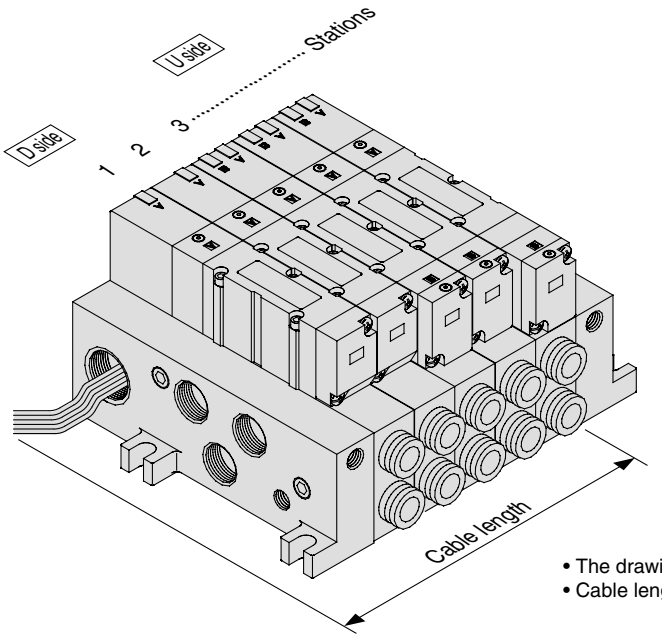
Cable (Length)

0	Cable length 0.6 m
1	Cable length 1.5 m
2	Cable length 3 m

Option

Symbol	Option
Nil	None
CD	Exhaust cleaner: For D side mounting
CU	Exhaust cleaner: For U side mounting
SB	Direct exhaust with silencer box: Exhaust from both sides
SD	Direct exhaust with silencer box: D side exhaust
SU	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

Note) When two or more symbols are specified, indicate them alphabetically.
Example) -CDW



• The drawing shows the electrical entry on the D side.
• Cable length is measured from the solenoid valve body.

How to Order Valves

VQ 4 | 1 | 0 | 0 | 0 — 5 | | | |

Series

4	VQ4000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specification.
Note 2) Refer to page 2-5-39 for external pilot specification. Combination of external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light /Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Enclosure

Nil	Dust tight
W	Dust tight/Low jetproof type (IP65)

How to Order Manifold Assembly

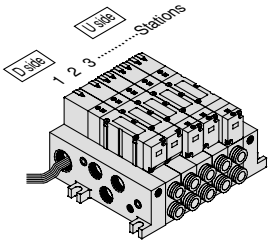
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Lead wire kit with cable (3 m)

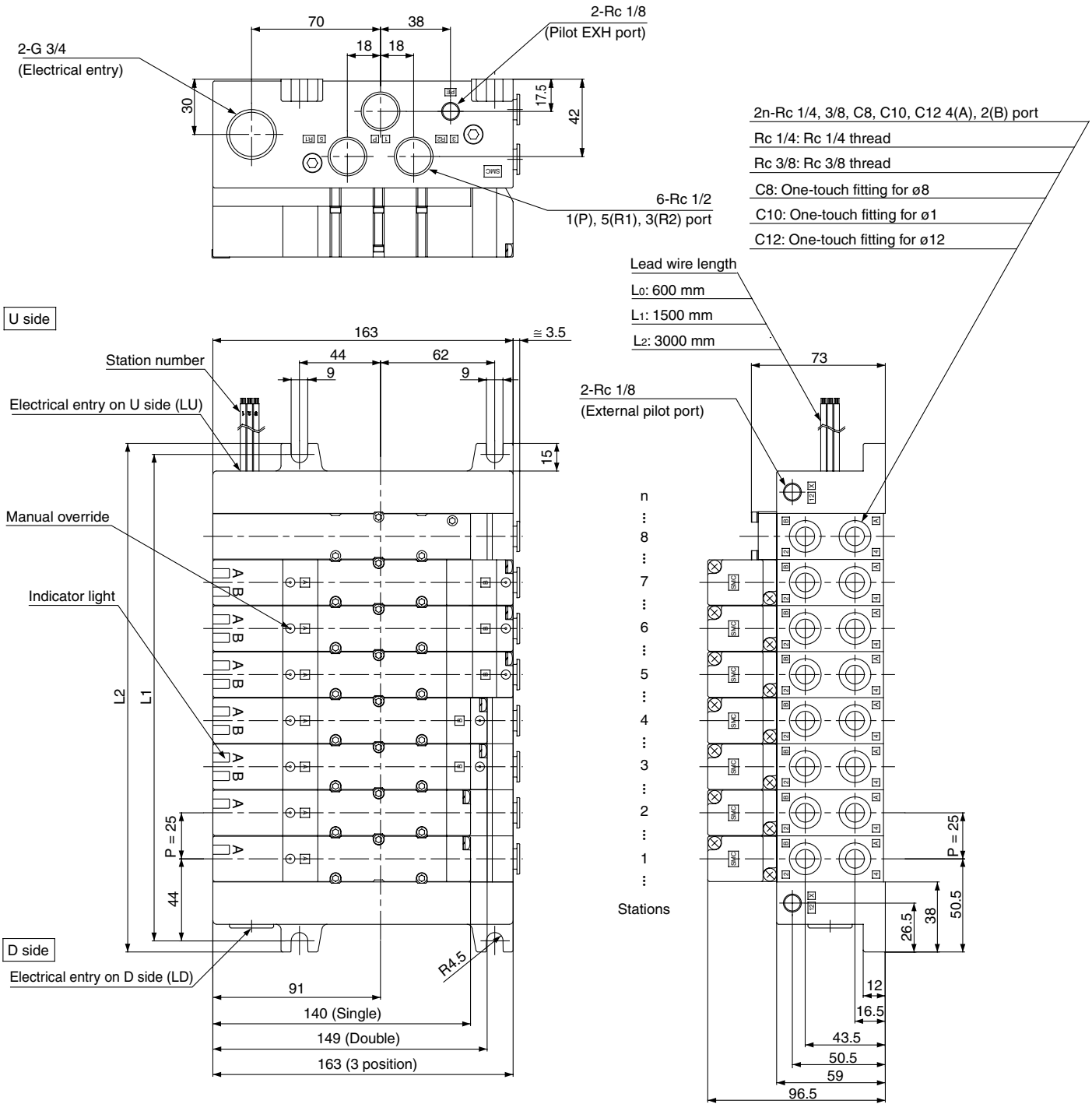
VV5Q41-05C8LD2···· 1 set —Manifold base part no.
∗VQ4100-5·····2 sets —Valve part no. (Stations 1 and 2)
∗VQ4200-5·····2 sets —Valve part no. (Stations 3 and 4)
∗VQ4300-5 ····· 1 set —Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

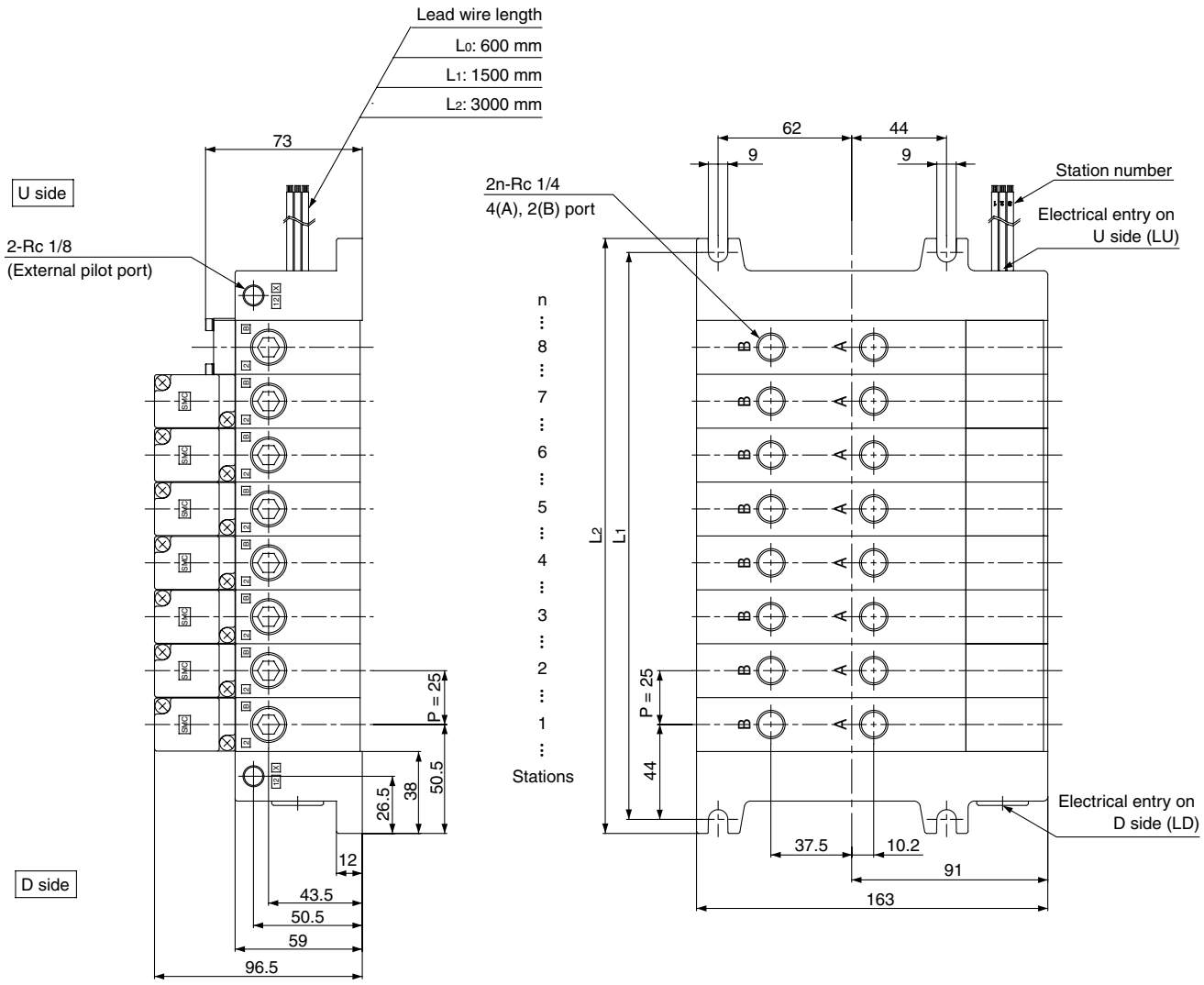
Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



L Kit (Lead wire cable)



Bottom ported drawing



Dimensions

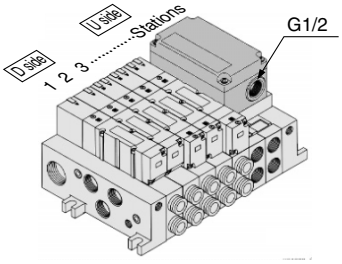
Formula L1 = 25n + 63, L2 = 25n + 76 n: Station (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	88	113	138	163	188	213	238	263	288	313	338	363	388	413	438	463
L2	101	126	151	176	201	226	251	276	301	326	351	376	401	426	451	476

S Kit (Serial transmission unit)

IP65 compliant

- **The serial transmission system reduces wiring work, while minimizing wiring and saving space.**
- **The system comes in an type SA (generic for small scale systems) for equipment with a small number of I/O points, or 32 points max., type SB (applicable to Mitsubishi Electric models) for controlling 512 I/O points max., type SC (applicable to OMRON models), type SD (applicable to SHARP models; 504 points max.), and type SF (applicable to NKE Uni-wire System; 128 points max.), type SJ (applicable to SUNX models), type SK (applicable to Fuji Electric models), type SQ (applicable to OMRON CompoBus/D), type SR (CompoBus/S).**
- **Maximum stations are 18.**
- **2 stations are used for serial unit mounting.**

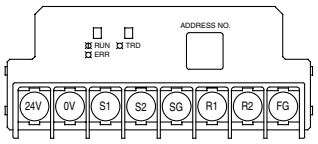
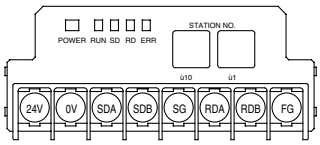


- **Stations are counted from station 1 on the D side.**
- **Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types.**

Item	Specifications
External power supply	24 VDC +10%, –5%
Current consumption (Internal unit)	SA, SB, SBB, SD, SF, SH, SJ, SK, SQ, SR, SV: 0.1A SC: 0.3A

Manifold Specifications

Series	Porting specifications			Applicable stations
	4(A), 2(B) port port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ4000	Side	Rc 1/2	C 8, 10, 12 Rc 1/4, 3/8	Max. 18 stations
	Bottom		Rc 1/4	

	Type SA With general type SI unit (Series EX300)	Type SB Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System
Name of terminal block (LED)		
	LED: TRD — Lighting during data reception LED: RUN/ERR — Blinking when received data is normal; Lighting when data reception	LED: POWER — Lighting when power is turned ON LED: RUN — Lighting when data transmission with the master station is normal LED: RD — Lighting during data reception LED: SD — Lighting during data transmission LED: ERR. — Lighting when reception data error occurs. Light turns off when the error is corrected.
Note	• T unit Can be connected with PLC I/O card for serial transmission. EX300-TMB1·····For models of Mitsubishi Electric Corporation EX300-TTA1·····For OMRON EX300-TFU1·····For Fuji Electric EX300-T001·····General purpose ∗ T units have 32 control points per unit • No. of output points, 16 points	• Master station PLC made by Mitsubishi Electric Corporation Series MELSEC-A AJ71PT32-S3, AJ71T32-S3 A1SJ71PT32-S3 ∗ Max. 64 stations, connected to remote I/O stations (Max. 512 points). • No. of output points, 16 points. No. of stations occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

How to Order Manifold

VV5Q 4 1 – 08 C8 S [ ] A – [ ]

Series

4	VQ4000

Manifold

1	Plug-in unit

Stations

03	3 stations
⋮	⋮
18	18 stations

Note) Add 2 stations for serial unit mounting.

Cylinder ports

C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

SI unit mounting position

Nil	U side mounting
D	D side mounting

Model

0	Without SI unit
A	With general type SI unit (Series EX300)
B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System
BB	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System (2 power supply systems)
C	OMRON Corp.: SYSBUS Wire System
D	SHARP Corp.: Satellite I/O Link System
F1	NKE Corp.: Uni-wire System (16 output points)
H	NKE Corp.: Uni-wire H System
J1	SUNX Corp.: S-LINK System (16 output points)
J2	SUNX Corp.: S-LINK System (8 output points)
K	Fuji Electric Co.: T-LINK Mini System
Q	DeviceNet, CompoBus/D (OMRON Corp.)
R1	OMRON Corp.: CompoBus/S System (16 output points)
R2	OMRON Corp.: CompoBus/S System (8 output points)
V	Mitsubishi Electric Corp.: CC-LINK System
G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System
U	JEMANET (JPCN-1)

Option

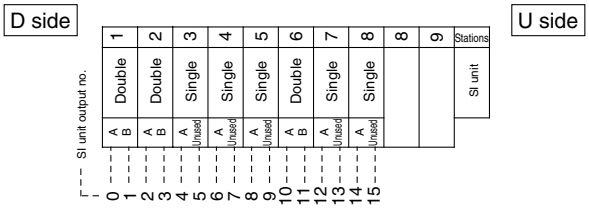
Symbol	Option
Nil	None
CD (2)	Exhaust cleaner: D side mounting
CU (2)	Exhaust cleaner for Rc 1: U side exhaust
K (3)	Special wiring specifications (Except double wiring)
SD (2)	Direct exhaust with silencer box: D side exhaust
SU (2)	Direct exhaust with silencer box: U side exhaust
W (2)	IP65 enclosure

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CDK
Note 2) Combination of [CD] and [SD] is not possible.
Note 3) Specify the wiring specifications in the manifold specification sheet.
Note 4) Refer to pages 2-5-40 to 2-5-43 for with control unit.consumption of AC type.
Note 5) The release valve and the pressure switch on the manifold with control unit are connected to another power supply. Cable length is 0.6 m for L kit.

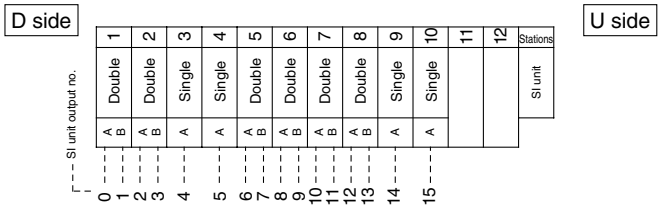
● **Correspondence of SI unit output numbers and solenoid valve coils**

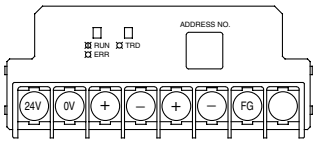
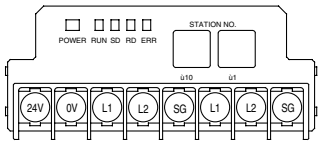
Mixed wiring is available as an option.
Use the manifold specification sheet to specify.

<Wiring example 1> Double wiring (Standard)



<Wiring example 2> Single/Double mixed wiring (Option)



	Type SC OMRON Corporation SYSBUS Wire System	Type SD SHARP Corporation Satellite I/O Link System
Name of terminal block (LED)		
	LED / Description RUN: Lights when transmission is normal and PLC is in operation mode T/R ERR: Blinks during data transmission/reception; ON when transmission is abnormal.	LED / Description POWER: ON when power supply is ON RUN: Lights when power is ON and slave stations are operating normally ERROR: Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit R.SET HOLD: ON for master unit control input
Note	• Master station unit OMRON PLC SYSMAC C(CV) series Types C500-RM201 and C200H-RM201 ∗ 32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit SHARP Corporation PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW-31LM ∗ Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ 4 [1] 0 [0] [ ] — 5 [ ] [ ]

Series

4	VQ4000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specifications.
Note 2) For external pilot specifications, refer to page 2-5-39. Combination of the external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

5	24 VDC

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type (IP65)

How to Order Manifold Assembly

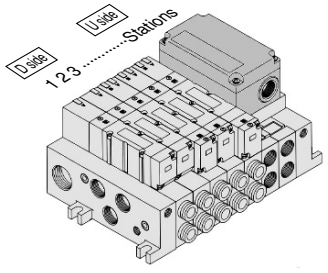
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Serial transmission unit

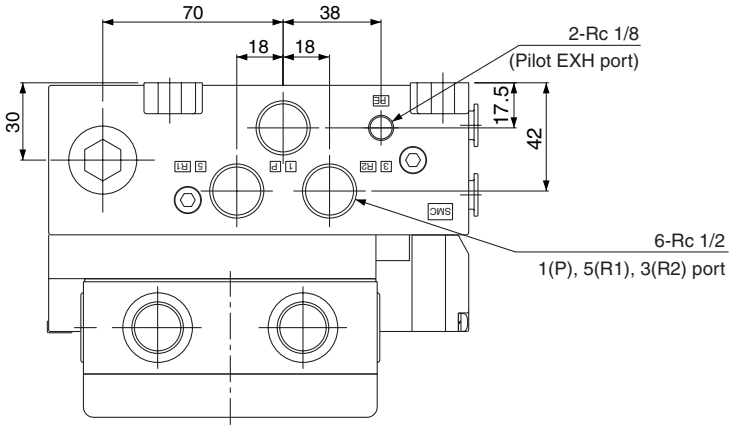
VV5Q41-07C8SA ····1 set —Manifold base part no.
∗VQ4100-5·····2 sets —Valve part no. (Stations 1 and 2)
∗VQ4200-5·····2 sets —Valve part no. (Stations 3 and 4)
∗VQ4300-5·····1 set —Valve part no. (Station 5)

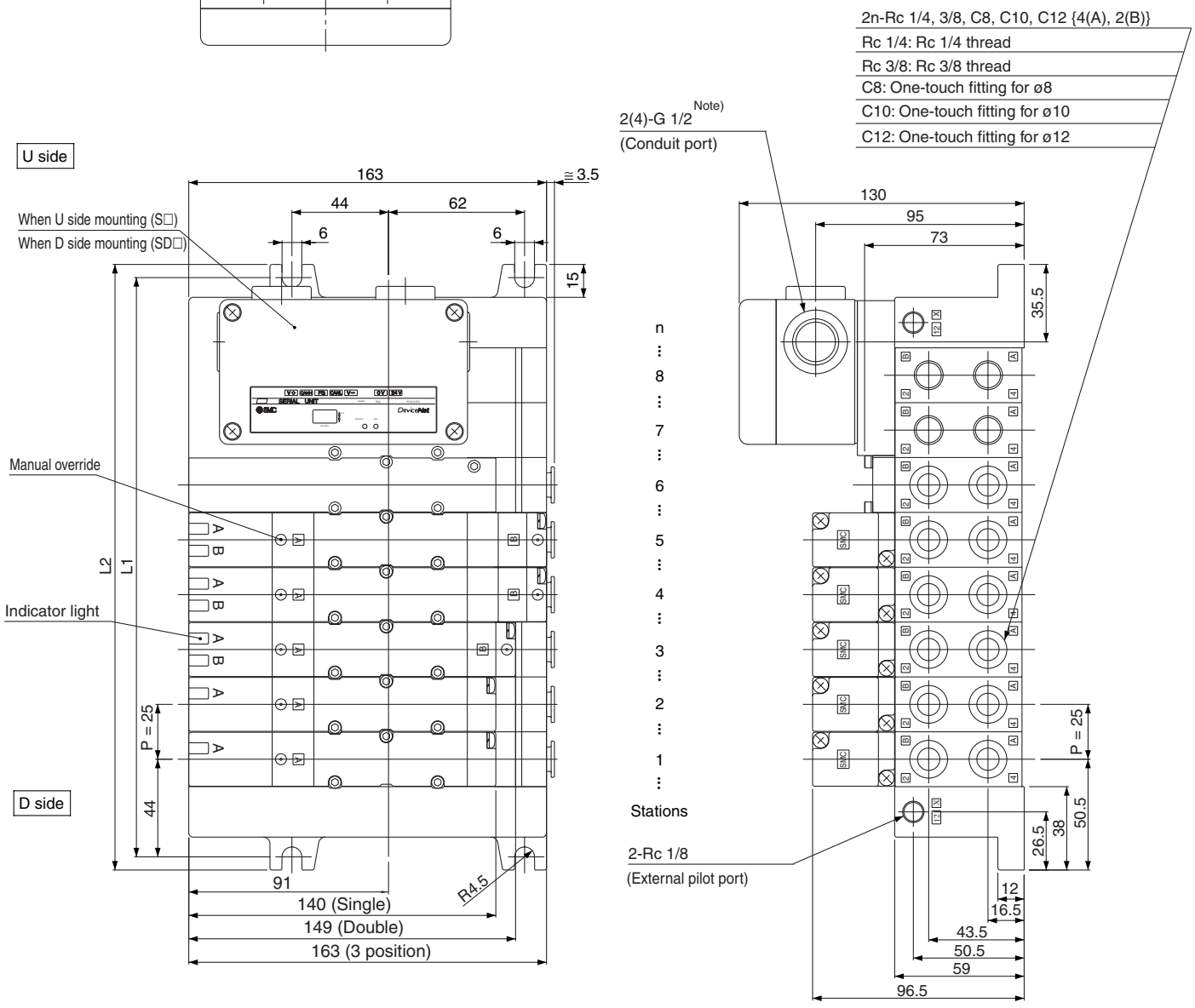
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side.
When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



S Kit (Serial transmission unit)





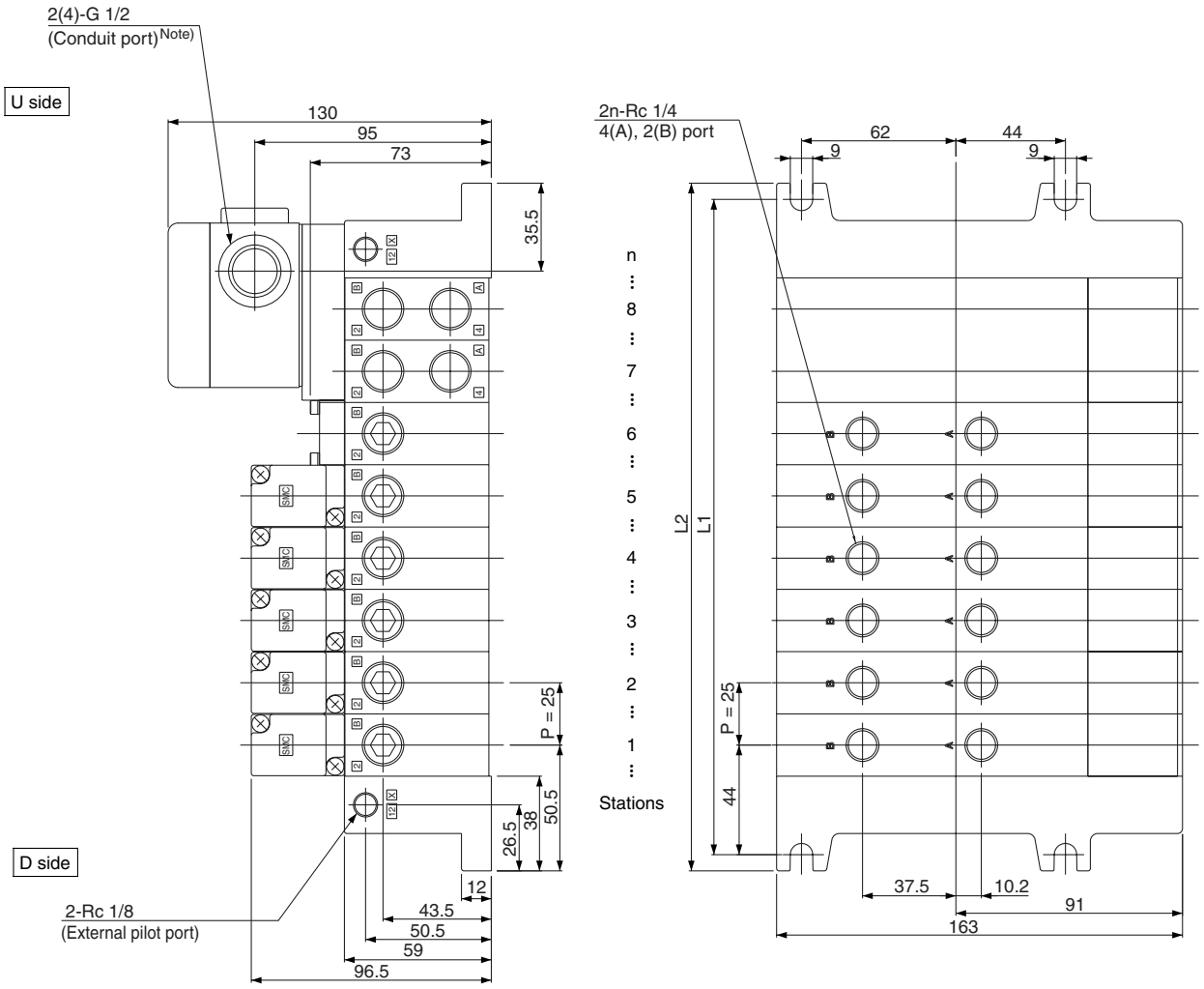
Note) In the case of EX124 for SI unit, conduit port (G 1/2) will be 4 locations.

Note) Shown VV5Q41-08C12SQ-W

Dimensions

Formula L1 = 25n + 63, L2 = 25n + 76
n: Station (Maximum standard 18 stations)
∗ Including 2 stations for mounting SI unit box.

L \ n	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
L1	138	163	188	213	238	263	288	313	338	363	388	413	438	463	488	513
L2	151	176	201	226	251	276	301	326	351	376	401	426	451	476	501	526



Dimensions

Formula L1 = 25n + 63, L2 = 25n + 76
n: Station (Maximum standard 18 stations)
∗ Including 2 stations for mounting SI unit box.

L \ n	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
L1	138	163	188	213	238	263	288	313	338	363	388	413	438	463	488	513
L2	151	176	201	226	251	276	301	326	351	376	401	426	451	476	501	526

S Kit (Serial transmission kit) for I/O

IP65 compliant

Applicable network: DeviceNet/PROFIBUS-DP

● **The serial transmission system reduces wiring work, while minimizing wiring and saving-space.**

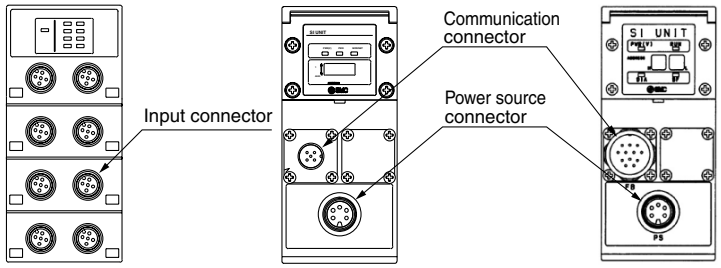
SI unit for DeviceNet/PROFIBUS

As a slave for DeviceNet/PROFIBUS, it is possible to control ON/OFF of a solenoid valve with the maximum of 32 points. Furthermore, by connecting a discrete input block, it is possible to input the sensor signal for 32 points at the maximum.

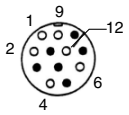
Input block

Meaning of an expansion block, connecting with SI unit, for sensor-inputting for auto switches, etc. Sensor-input is available up to 8 per one input block. By the NPN/PNP switch, it is able to adjust COM to sensor.

Details in Connector



● **Communication connector (PROFIBUS-DP):**
Made by CONINVERS GmbH RC-2RS1N12 12 pins
Cable side connector example:
Made by Siemens AG 6ES5 760-2CB11



Number	Description	Function
1	M5V	GND Terminal
2	A	Signal-N
4	B	Signal-P
6	+5V	Terminal + 5V
9	SIELD	Shield ground
12	RTS	Optical fiber (Reserve)

Pin no. 3, 5, 7, 8, 10 and 11 marked with ● are open.

∗ Connector's shape and pin assignment is interchangeable with ET200C made by Siemens AG.

How to Order Manifold

VV5Q 4 1 – 08 C8 S D QW □ 1 □ – □ W

Series

4	VQ4000

Manifold

1	Plug-in unit

Stations

01	1 station
⋮	⋮
16	16 stations

Cylinder ports

Symbol	Port size
C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Kit
Serial transmission kit

Mounting SI unit

D	D side mounting
U	U side mounting

SI unit

OW	With no SI unit, nor input unit
QW	DeviceNet
NW	Profibus DP

SI unit COM

Nil	With no SI/Input unit (For SDOW)	
	+COM	DeviceNet (SDQW)
N	–COM	Profibus DP (SDNWN)

Note) Only +COM is available for DeviceNet. Order a mounting valve with +COM.
Since PROFIBUS is –COM only, order –COM for valves to be mounted.

Input unit

Nil	With no SI unit, or input unit (In the case of SDOW)
0	Without input unit
1	With 1 input unit
2	With 2 input units
3	With 2 input units
4	With 4 input units

Input unit COM

Nil	PNP (+) or with no SI unit (for SDOW)
N	NPN (–)

Option

Symbol	Option
Nil	None
CD (2) (3)	Exhaust cleaner: For D side mounting
CU (2) (3)	Exhaust cleaner: For U side mounting
K	Special wiring specification (Except double wiring)
SD (2) (3)	Direct exhaust with silencer box: D side exhaust
SU (2) (3)	Direct exhaust with silencer box: U side exhaust

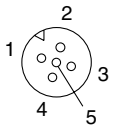
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CDK
Note 2) Combination of [C^{U}_{D}] and [S^{U}_{D}] is not possible.
Note 3) Mounting side for exhaust cleaner, silencer box is available only in the opposite side from SI unit mounting side.

Enclosure
IP65 (Dusttight/Low jetproof type)

Details in Connector

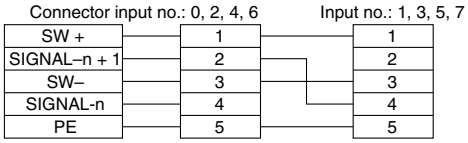
● **Input connector: M12 5 pins (XS2F compatible made by OMRON Corp.) x 8 pcs.**

Cable side connector example: XS2G made by OMRON Corp.



Number	Description	Function
1	SW+	Sensor power supply +
2	N.C.	Open*
3	SW–	Sensor power supply –
4	SIGNAL	Sensor input signal
5	PE	Protective sensor ground

* No. 2 pin of the input no. 0, 2, 4, 6 connector (connectors aligned in the right side on the input block) is connected internally with no. 4 pin (sensor input no.) of the input no. 1, 3, 5, 7 respectively. Thereby, it is possible to directly input 2 points which is bundled into 1 cable by the cluster connector, etc.

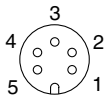


⚠ Caution

When an enclosure equivalent to IP65 is required, place a waterproof cover on the unused input connector. As for waterproof cover, order it separately.
Example: OMRON Corp. XS2Z-12

● **Power source connector: Series 723 (made by Franz Binder GmbH & Co. KG) 5 pins (72309-0115-80-05)**

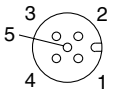
Cable side connector example: Franz Binder GmbH & Co. KG 72309-0114-70-15, etc.
* DIN type 5 pins



Number	Description	Function
1	SV24V	For solenoid valve +24 V
2	SV0V	For solenoid valve 0 V
3	PE	Protective ground
4	SW24V	<DeviceNet>For input block + 24 V, <Profibus or Interbus>For input unit and SI unit + 24 V
5	SW0V	<DeviceNet>For input block 0 V, <Profibus or Interbus>For input unit and SI unit 0 V

● **Communication connector (DeviceNet): M12 5 pins (for DeviceNet compliant)**

Example of corresponding cable assemblies with connector:
OMRON Corporation: DCA1-5CN05F1
Karl Lumberg GmbH & Co. KG: RKT5-56



Number	Description	Function
1	Drain	Drain/Shield
2	V+	Circuit power supply +
3	V–	Circuit power supply –
4	CAN_H	Signal H
5	CAN_L	Signal L

Item conforming to Micro style connector in DeviceNet specifications.

How to Order Valves

VQ 4 1 0 0 — 5

Series

4	VQ4000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y(1)	Low wattage type (0.5 W)
R(2)	External pilot

Note 1) Applicable to DC specifications.
Note 2) For external pilot specifications, refer to page 2-5-39. Combination of the external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

5	24 VDC

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Enclosure

Nil	Dusttight
W	Dusttight/ Low jetproof type (IP65)

How to Order Manifold Assembly

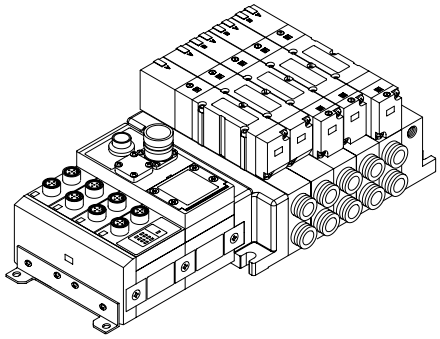
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Serial transmission unit

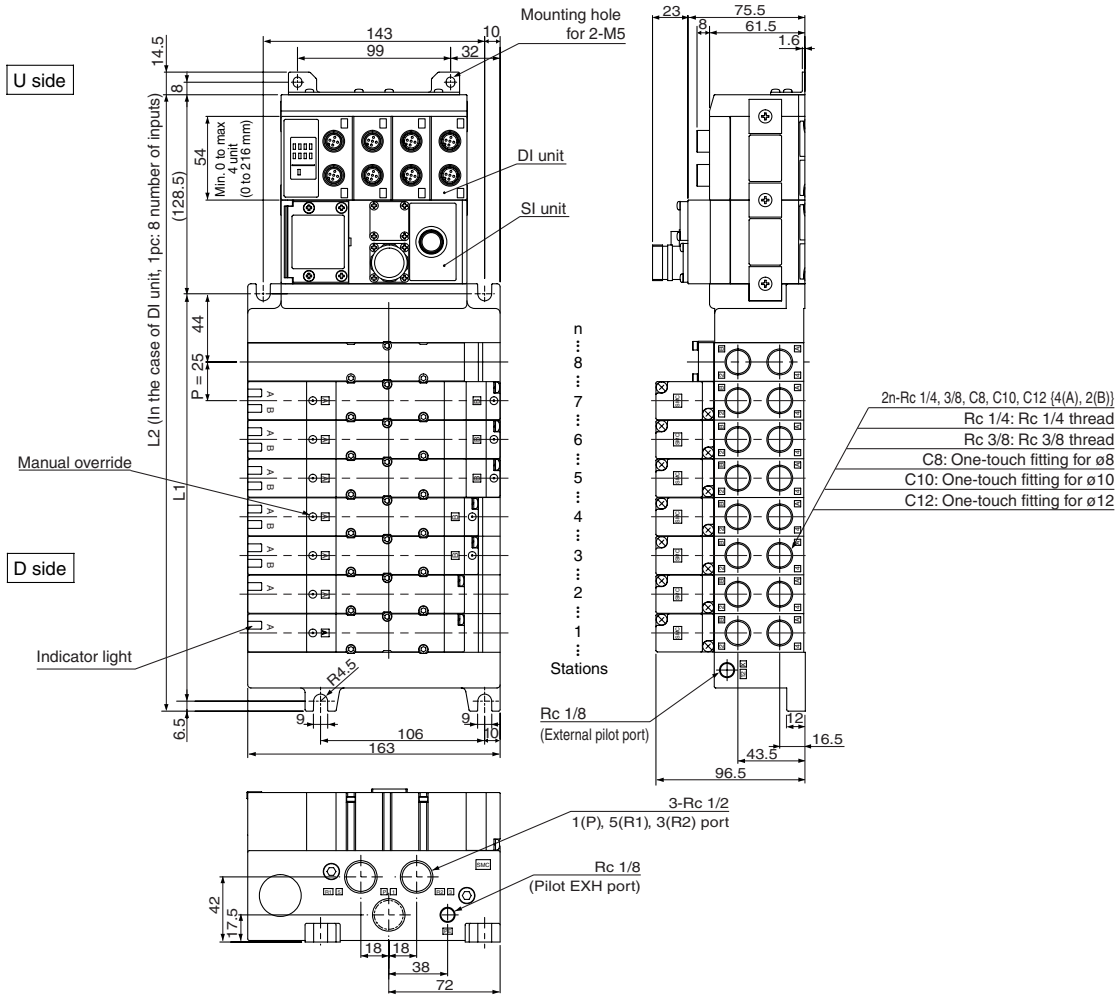
VV5Q41-05C8SDQW1-W····1 set —Manifold base part no.
*VQ4100-5W·····2 sets —Valve part no. (Stations 1 and 2)
*VQ4200-5W·····2 sets —Valve part no. (Stations 3 and 4)
*VQ4300-5W·····1 set —Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



S Kit (Serial transmission unit) for I/O



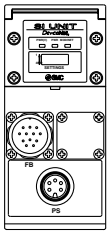
Dimensions

Formula L1 = 25n + 63, L2 = 25n + 198
n: Stations ∗ In the case of DI unit, 1 pc., 54 mm is added per 1 pc.

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	113	138	163	188	213	238	263	288	313	338	363	388	413	438	463
L2	248	273	298	323	348	373	398	423	448	473	498	523	548	573	598

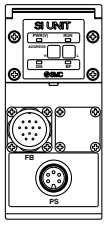
Indicator Unit (LED) Descriptions and Functions

■ SI Unit (DeviceNet)



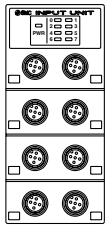
Description	Function
PWR(V)	ON when solenoid valve power supply is turned ON
PWR	ON when DeviceNet circuit power supply input is turned ON
MOD/NET	OFF: Power supply off, off line, or when checking duplication of MAC_ID
	Green blinking: Waiting for connection (On line)
	Green ON: Connection established (On line)
	Red blinking: Connection time out (Minor communication abnormality occurs)
	Red ON: MAC_DI duplication error, or BUSOFF error (Major communication abnormality occurs)

■ SI Unit (PROFIBUS-DP)

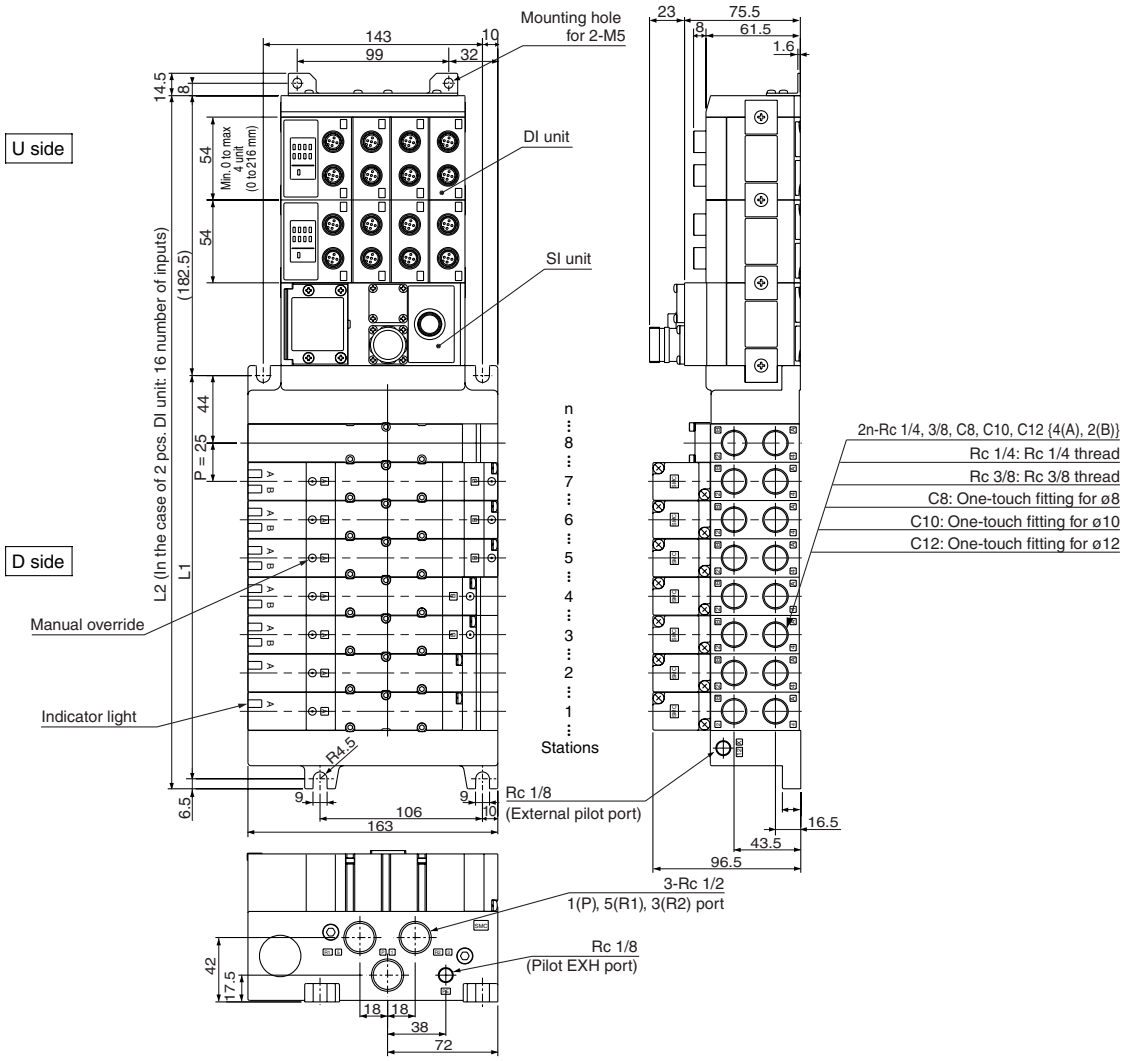


Description	Function
PWR	ON when solenoid valve power supply is turned ON OFF when the power supply voltage is less than 19 V
RUN	ON when operating (SI unit power supply is ON)
DIA	ON when self-diagnosis device detects abnormality
BF	ON for BUS abnormality

■ Input block



Description	Function
PWR	ON when sensor power is turned ON OFF when short circuit protection is working
0 to 7	ON when each sensor input goes ON



Formula L1 = 25n + 63, L2 = 25n + 252
n: Stations

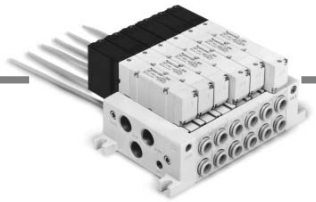
Dimensions

∗ In the case of 2 pcs. DI unit, 105 mm will be added per 2 pcs.

L \ n	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	113	138	163	188	213	238	263	288	313	338	363	388	413	438	463
L2	302	327	352	377	402	427	452	477	502	527	552	577	602	627	652

Series VQ4000
Base Mounted
Plug Lead Unit: C Kit (Connector kit)

How to Order Manifold



VV5Q 4 5 — 08 C8 C □□ — W

Series

4	VQ4000

Manifold

5	Plug lead unit

Stations

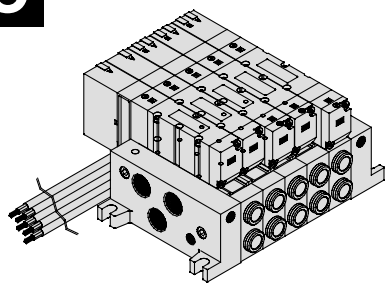
01	1 station
⋮	⋮
16	16 stations

Cylinder port

C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Kit type

C kit (Connector)



C	Connector kit	Max. 16 stations

Control unit

Refer to pages 2-5-40 to 2-5-43.

Option

Symbol	Option
Nil	None
CD(2)	Exhaust cleaner: For D side mounting
CU(2)	Exhaust cleaner: For U side mounting
SB	Direct exhaust with silencer box: Exhaust from both sides
SD(2)	Direct exhaust with silencer box: D side exhaust
SU(2)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CDW
Note 2) Combination of [C^{U}_{D}] and [S^{U}_{D}] is not available.

Refer to page 2-5-2 (Grommet type) for wiring specifications.

How to Order Valves

VQ 4 1 5 0 □ — 5 G □ □ □

Series

4	VQ4000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y(1)	Low wattage type (0.5 W)
R(2)	External pilot

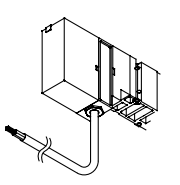
Note 1) Applicable to DC specifications.
Note 2) For external pilot specifications, refer to page 2-5-39. Combination of the external pilot and perfect interface is not possible.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

1	100 VAC (50/60 Hz)	4	220 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)	5	24 VDC
3	110 VAC (50/60 Hz)	6	12 VDC

Electrical entry

Grommet	G	Lead wire length 0.6 m
	H	Lead wire length 1.5 m

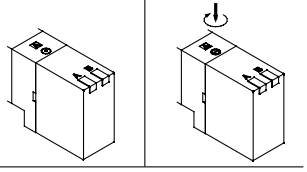


Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Manual override

Nil:	B:
Non-locking push type (Tool required)	Locking type (Tool required)



Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type (IP65)

How to Order Manifold Assembly

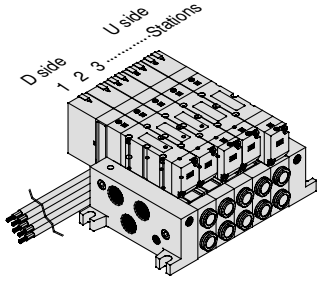
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Connector kit

VV5Q45-05C12C·····1 set — Manifold base part no.
∗VQ4150-5G·····2 sets — Valve part no. (Stations 1 and 2)
∗VQ4250-5G·····2 sets — Valve part no. (Stations 3 and 4)
∗VQ4350-5G·····1 set — Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



Simple specials are available with SMC Simple Special System.
For details about applicable models, please contact SMC.

Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Maximum applicable stations	Applicable solenoid valve	5 station weight (kg)
			4(A), (B) port location	Port size Note)				
				1(P), 5(R1), 3(R2)	4(A), 2(B)			
VQ4000	**VV5Q45-□□□**	■ C kit–Grommet	Side	Rc 1/2 Option Direct exhaust with silencer box	C8 (For ø8) C10 (For ø10) C12 (For ø12) Rc 1/4 Rc 3/8	2 to 16 stations	VQ4□50 VQ4□51	2.0 • Except solenoid valve weight
			Bottom		Rc 1/4			

Note) For details about inch-size One-touch fittings and other thread standards, refer to page 2-5-39.

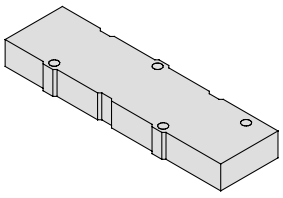
Flow Characteristics at the Number of Manifold Stations (Operated individually)

Model	Passage/Stations		Station 1	Station 5	Station 10	Station 15
2 position metal seal **VQ4$^{1}_{2}$50**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	5.9	5.9	5.9	5.9
		b	0.23	0.23	0.23	0.23
		Cv	1.5	1.5	1.5	1.5
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	6.2	6.2	6.2	6.2
		b	0.19	0.19	0.19	0.19
		Cv	1.5	1.5	1.5	1.5
2 position rubber seal **VQ4$^{1}_{2}$51**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	6.8	6.8	6.8	6.8
		b	0.31	0.31	0.31	0.31
		Cv	1.8	1.8	1.8	1.8
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	7.0	7.0	7.0	7.0
		b	0.38	0.38	0.38	0.38
		Cv	1.9	1.9	1.9	1.9

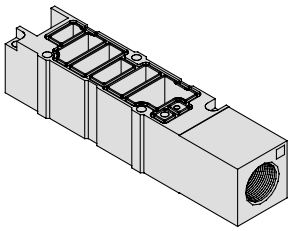
Note) Port size: Rc 3/8

Manifold Option

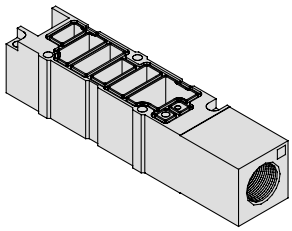
Blanking plate assembly
VVQ4000-10A-5



Individual SUP spacer
VVQ4000-P-5-$^{02}_{03}$

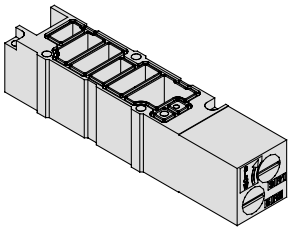


Individual EXH spacer
VVQ4000-R-5-$^{02}_{03}$

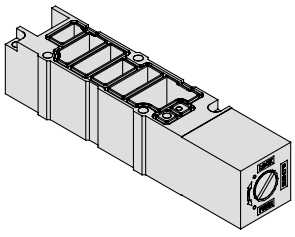


- Refer to pages 2-5-34 to 2-5-38 for detail dimensions of each option.
  For replacement parts, refer to page 2-5-47.
- Refer to pages 2-5-40 to 2-5-43 for control unit.

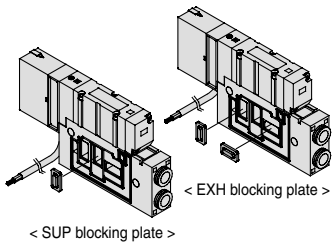
Throttle valve spacer
VVQ4000-20A-5



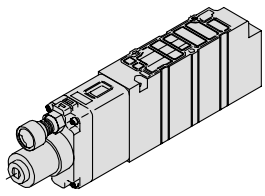
SUP stop valve spacer
VVQ4000-37A-5



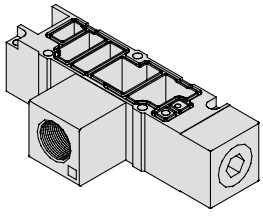
SUP/EXH block plate
VVQ4000-16A



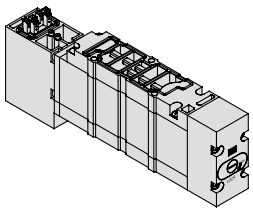
Interface regulator
ARBQ4000-00-$^{A}_{B}$$^{}_{P}$-5



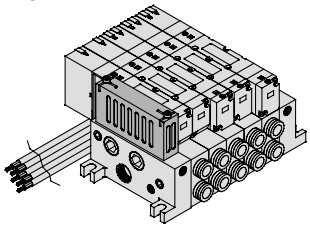
Release valve spacer
VVQ4000-24A-5D Note)



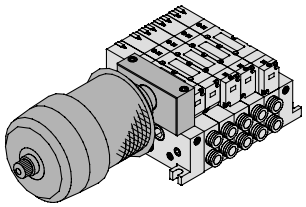
Double check spacer with residual pressure exhaust
VVQ4000-25A-5 Note)



Direct exhaust with silencer box
[-S$^{D}_{U}$] Note)

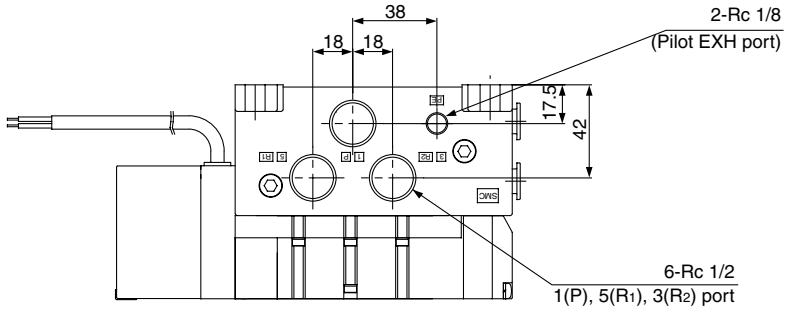


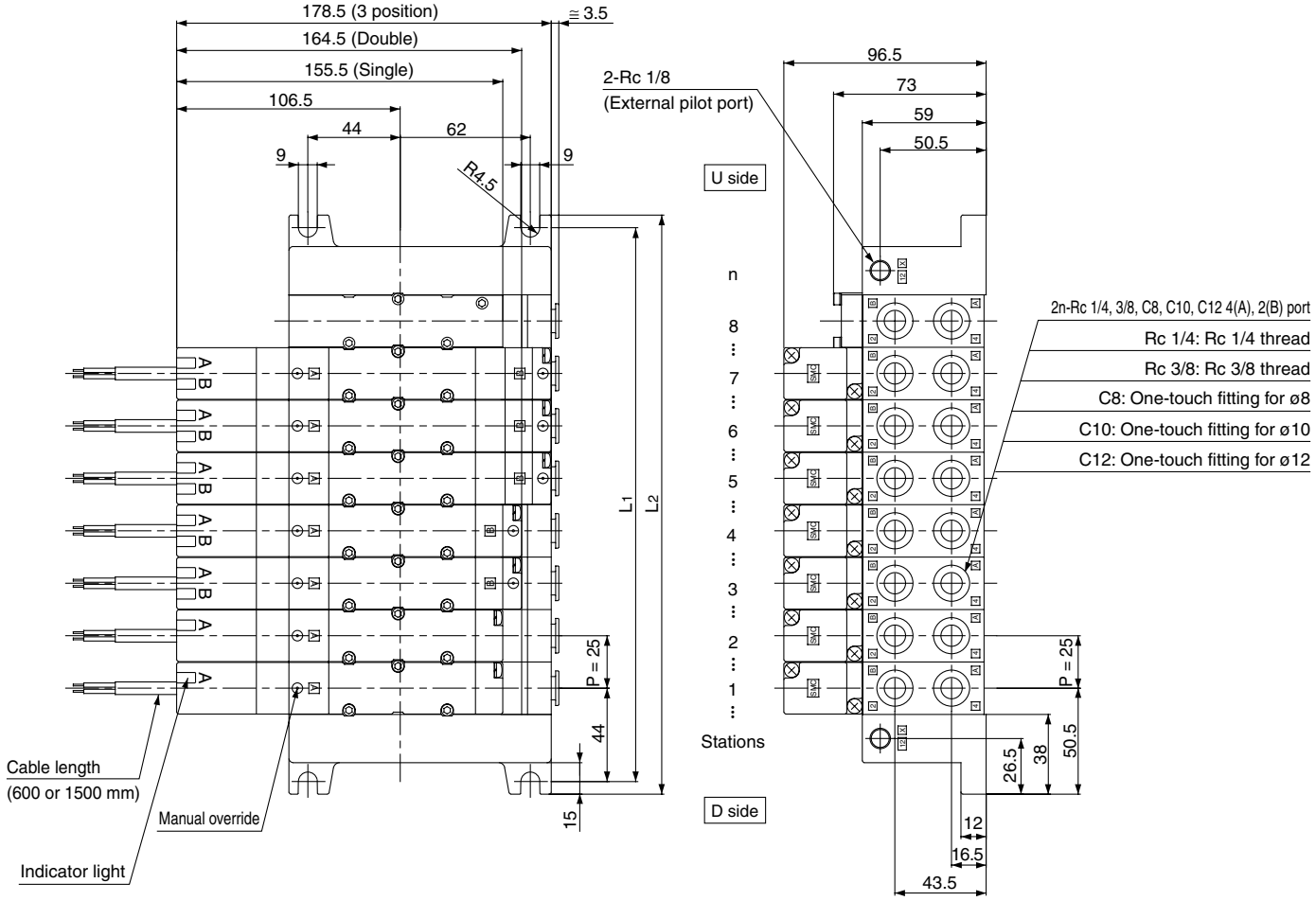
For exhaust cleaner mounting
[-C$^{D}_{U}$] Note)



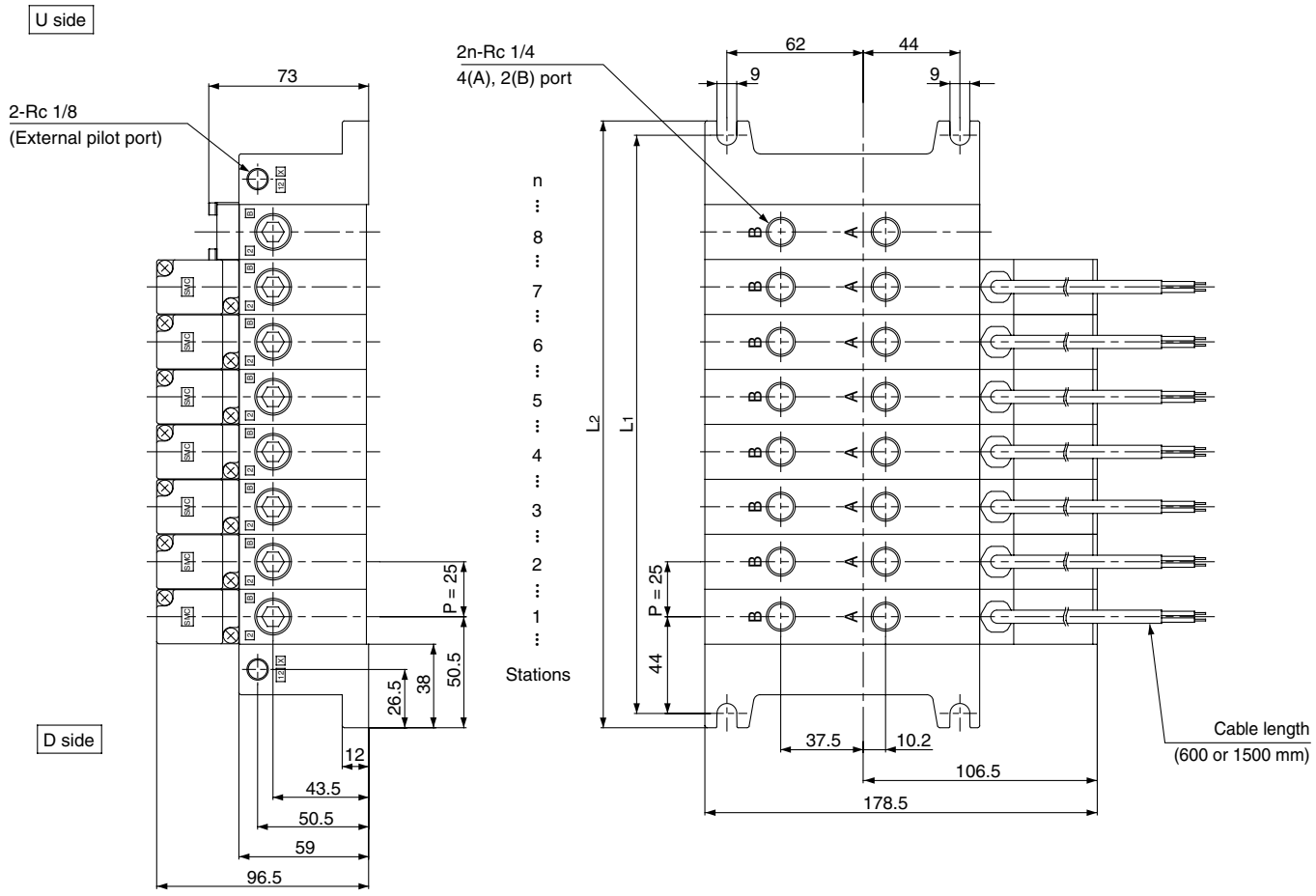
Note) Release valve spacer, built-in silencer (direct exhaust), exhaust cleaner mounting style and perfect double check spacer for residual pressure exhaust cannot be combined with external pilot.

C Kit (Connector kit)





Bottom ported drawing



Dimensions

Formula L1 = 25n + 63, L2 = 25n + 76 n: Station (Maximum 16 stations)

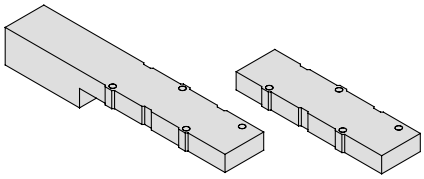
L \ n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
L1	88	113	138	163	188	213	238	263	288	313	338	363	388	413	438	463
L2	101	126	151	176	201	226	251	276	301	326	351	376	401	426	451	476

Manifold Option Parts

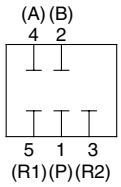
Blanking plate assembly

VVQ4000-10A-1 (Plug-in type)
VVQ4000-10A-5 (Plug lead type)

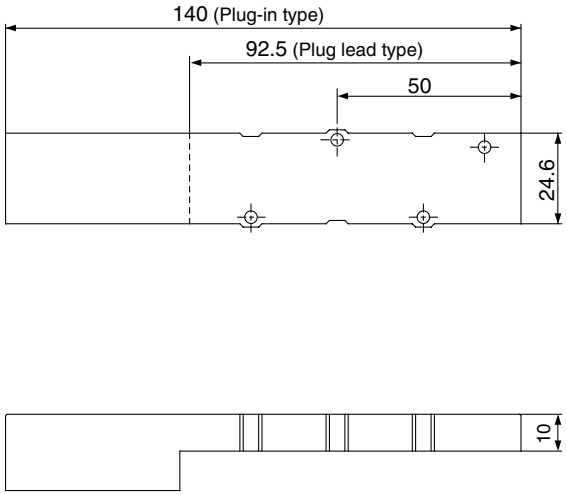
It is used by attaching on the manifold block for being prepared for removing a valve for maintenance reasons or planning to mount a spare valve, etc.



Plug-in type　　Plug lead type



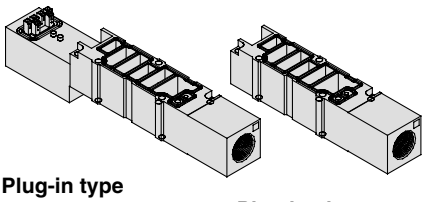
Circuit diagram



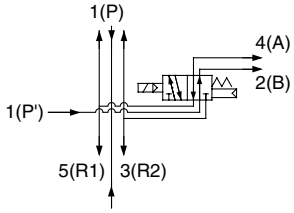
Individual SUP spacer

VVQ4000-P-1-$\frac{02}{03}$ (Plug-in type)
VVQ4000-P-5-$\frac{02}{03}$ (Plug lead type)

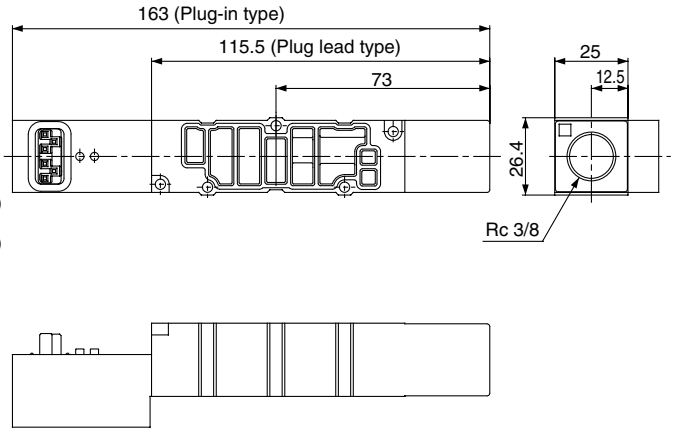
By mounting individual SUP spacers on a manifold block, it is possible to provide individual supply ports for each valve.



Plug-in type
Plug lead type



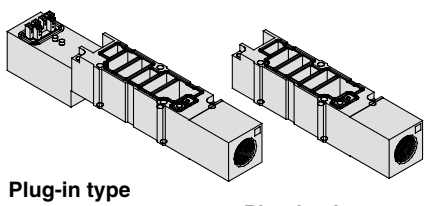
Circuit diagram



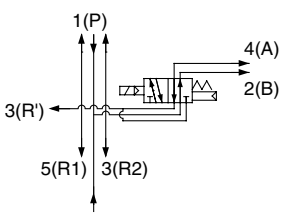
Individual EXH spacer

VVQ4000-R-1-$\frac{02}{03}$ (Plug-in type)
VVQ4000-R-5-$\frac{02}{03}$ (Plug lead type)

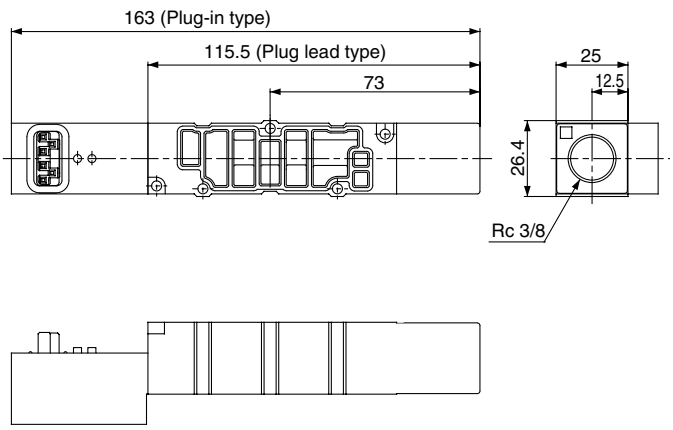
By mounting individual EXH spacers on a manifold block, exhaust ports can be provided individually for each valve. (Common EXH type)



Plug-in type
Plug lead type



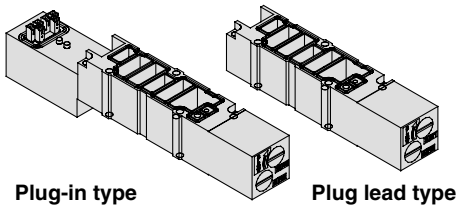
Circuit diagram



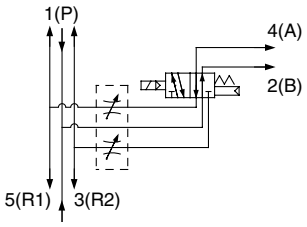
Throttle valve spacer

VVQ4000-20A-1 (Plug-in type)
VVQ4000-20A-5 (Plug-lead type)

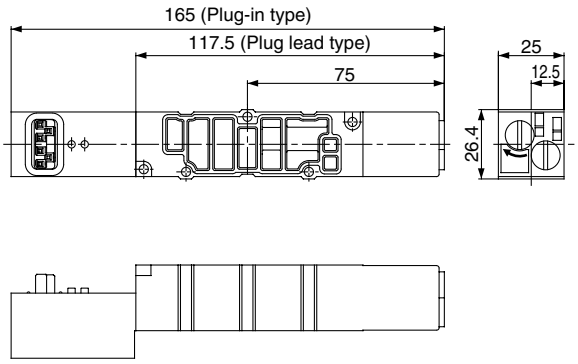
A throttle valve spacer is mounted on a manifold block to control cylinder speed by throttling exhaust air flow.



Plug-in type　　Plug lead type



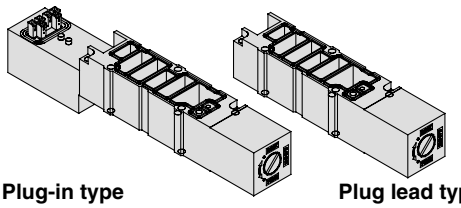
Circuit diagram



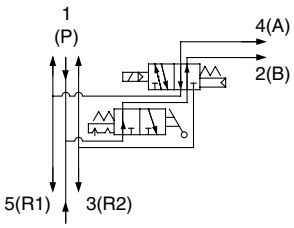
SUP stop valve spacer

VVQ4000-37A-1 (Plug-in type)
VVQ4000-37A-5 (Plug-lead type)

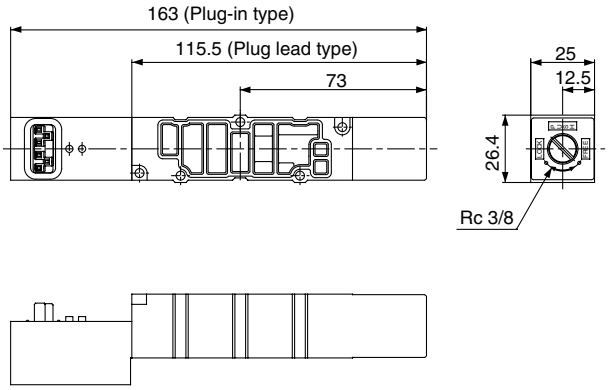
A SUP stop valve spacer is mounted on a manifold block, making it possible to individually shut off supply air to each valve.



Plug-in type　　Plug lead type



Circuit diagram



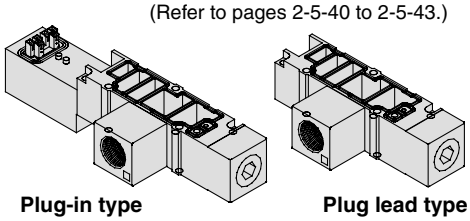
Release valve spacer: For D side mounting

VVQ4000-24A-1D (Plug-in type)
VVQ4000-24A-5D (Plug-lead type)

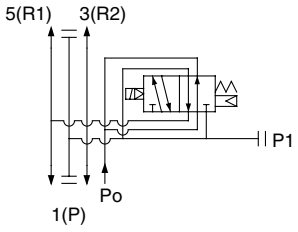
Combination of VQ41□□ (Single) and release valve spacer can be used as air release valve

Note 1) Mounting on 2 position double and 3 position valve is not possible.

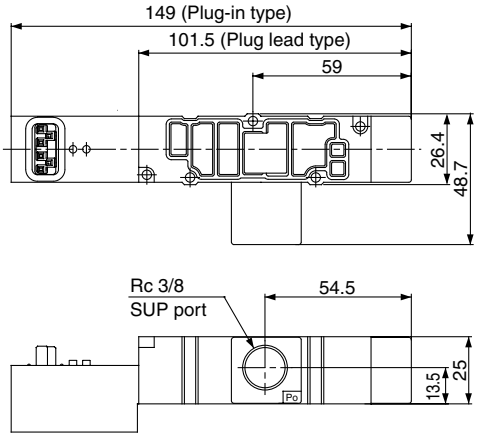
Note 2) Can be mounted on L kit only. For other kits, order E type control unit. (Refer to pages 2-5-40 to 2-5-43.)



Plug-in type　　Plug lead type



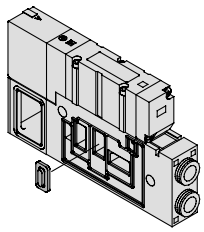
Circuit diagram



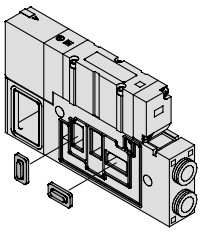
SUP/EXH block plate

VVQ4000-16A

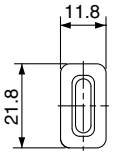
When different pressures, high and low, are supplied to manifold, a SUP block plate is inserted between the stations under different pressures.

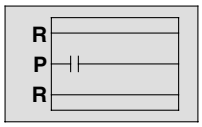


<SUP blocking plate>

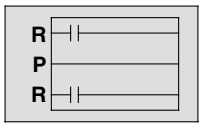


<EXH blocking plate>

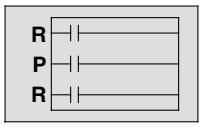




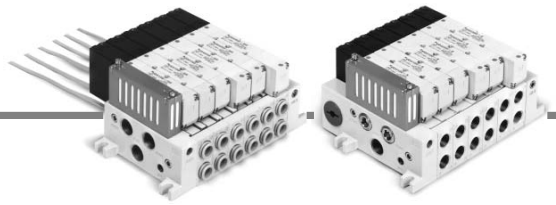
SUP passage blocked



EXH passage blocked



SUP/EXH passage blocked



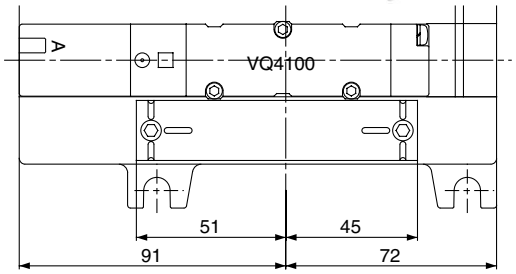
Manifold Option Parts

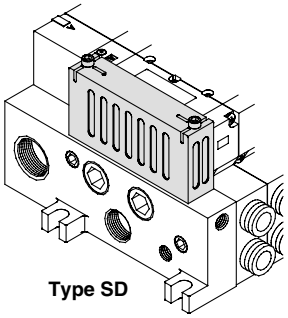
Direct exhaust with silencer box

VV5Q4$\frac{1}{5}$–□□□–SB (Exhaust from both sides)
VV5Q4$\frac{1}{5}$–□□□–SD (D side exhaust)
VV5Q4$\frac{1}{5}$–□□□–SU (U side exhaust)

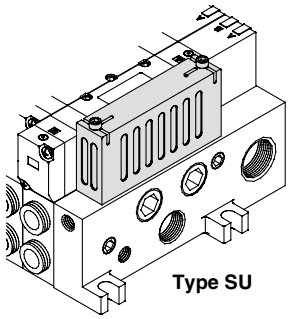
The EXH outlet is placed on the top side of the manifold end plate. The built-in silencer provides highly effective noise reduction.
(Noise reduction of 35 dB or more)

Note) If a lot of drainage is generated at air supply source, both of exhaust air and drainage are exhausted.

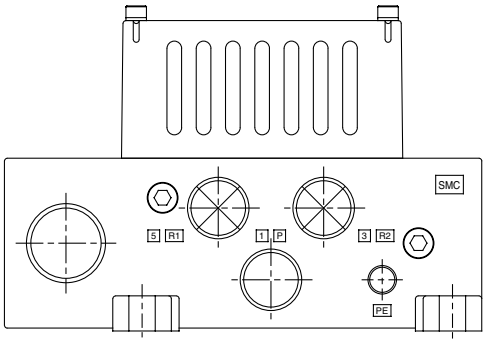


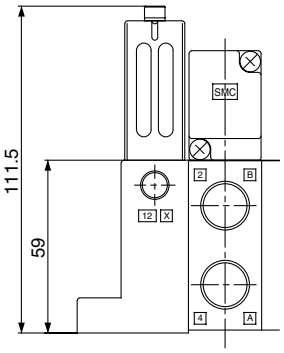


Type SD



Type SU





Note) Figure shows VV5Q41–□□□–SD.

Double check spacer with residual pressure exhaust

VVQ4000–25A–1 (Plug-in type)
VVQ4000–25A–5 (Plug lead type)

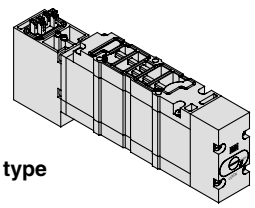
Can hold an intermediate cylinder position for an extended time.

If the double check spacer with a built-in double check valve is combined, it will enable the cylinder to stop in the intermediate stroke and maintain its position for a long time without being affected by the leakage between the spools.
Besides, combination between 2 position solenoid valve (VQ4$\frac{1}{2}$□□) and double check spacer can't hold an intermediate position, but can prevent dropping at the cylinder stroke end.

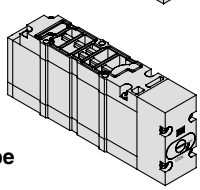
Specifications

Double check spacer part no.	VVQ4000-25A-1			
	Intermediate stop		Drop prevention	
Applicable solenoid valve	VQ44□□		VQ4$\frac{1}{2}$□□	
Leakage* N cm³/min	Solenoid one side energized	1(P)	5(R1)	230 or less
			3(R2)	
	Both solenoids unenergized	1(P)	5(R1)	230 or less
			3(R2)	
		4(A)	5(R1)	0
		2(B)	3(R2)	

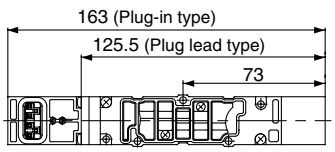
* Supply pressure: 0.5 MPa

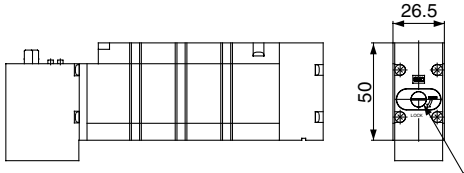


Plug-in type



Plug lead type



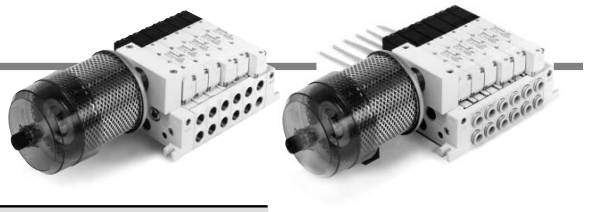


Manual override for residual pressure exhaust
Slotted locking type (Tool required)

⚠ Caution

Handling Precautions

- Air leakage from the pipe between the valve and cylinder or from the fittings will prevent the cylinder from stopping in the middle for a long time. Check for leakage using a neutral household detergent, such as dish washing soap. Also, check the cylinder sealing and piston seal for leakage.
- Since One-touch fittings allow slight air leakage, screw piping is recommended when stopping the cylinder in the middle for a long time.
- If exhaust side of double check spacer is narrowed down, this causes a decrease in intermediate stop accuracy and may malfunction.
- Combining perfect interface with 3 position valves "VQ4$\frac{3}{5}$□□" will not work.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.
- Combining double check spacer with external pilot will not work.



Manifold mounted exhaust cleaner

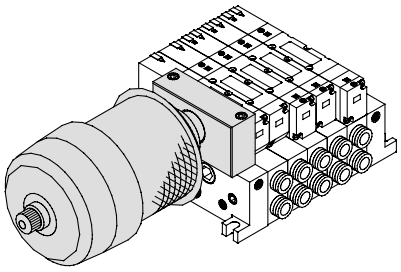
VV5Q4$\frac{1}{5}$-□□□-CD (D side mounting)
VV5Q4$\frac{1}{5}$-□□□-CU (U side mounting)

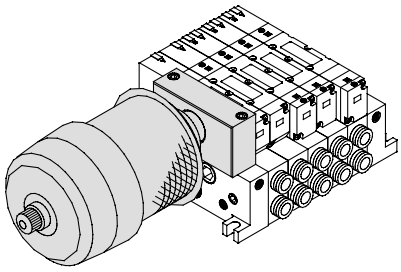
An adapter plate for exhaust cleaner mounting is provided on the top of the manifold end plate. The exhaust cleaner collects drainage and oil mist (99.9% or more) and is highly effective for noise reduction.
(Noise reduction of 35 dB or more)

Applicable exhaust cleaners

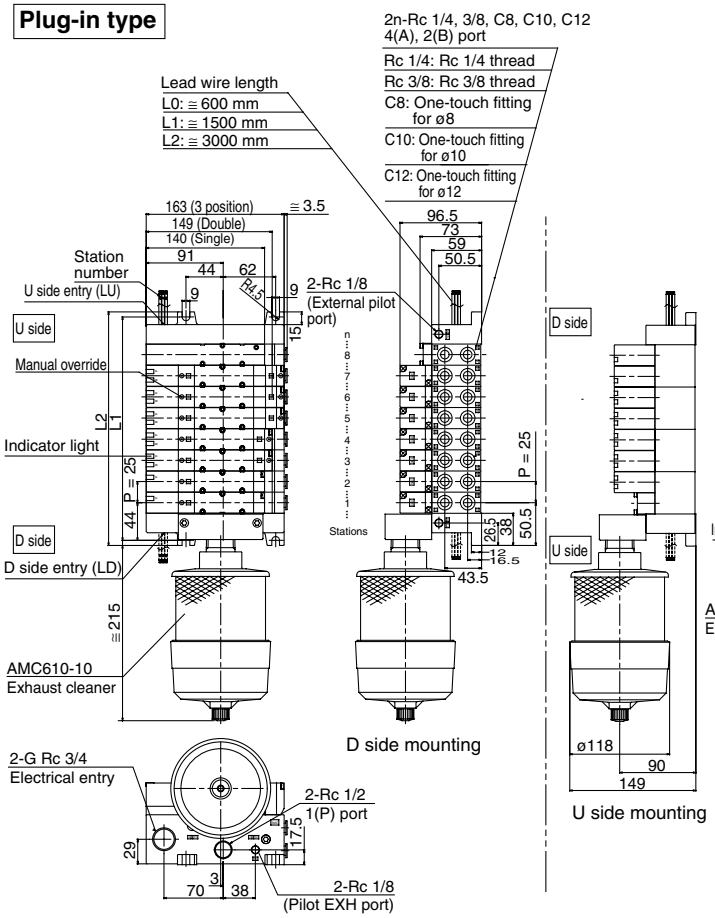
AMC610-10 (Port size Rc 1)

Note 1) Exhaust cleaner AMC610-10 is not attached. (Order it separately.)
Note 2) Mount so that the exhaust cleaner is at the lower side.
Note 3) For details about the exhaust cleaner, refer to Best Pneumatics vol.5.

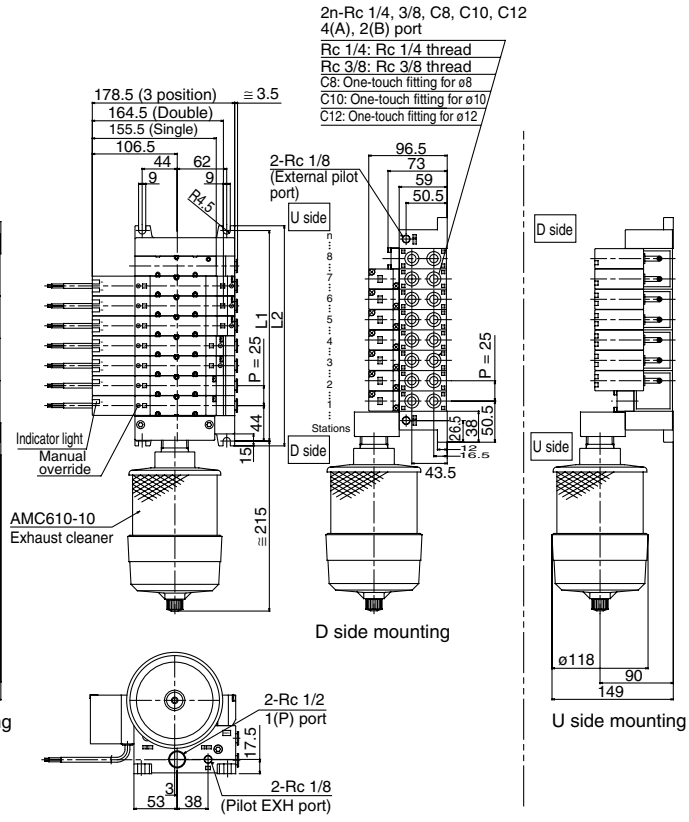




Plug-in type



Plug lead type



Dimensions

Formula $L_1 = 25n + 63$, $L_2 = 25n + 76$
n: Stations (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8
L_1	88	113	138	163	188	213	238	263
L_2	101	126	151	176	201	226	251	276

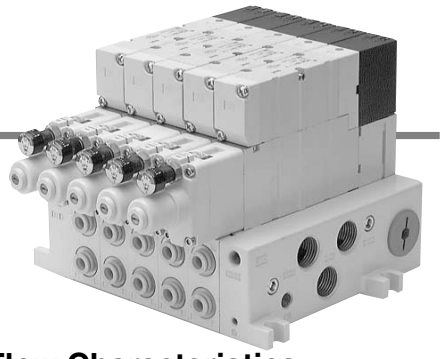
L \ n	9	10	11	12	13	14	15	16
L_1	288	313	338	363	388	413	463	463
L_2	301	326	351	376	401	426	476	476

Dimensions

Formula $L_1 = 25n + 63$, $L_2 = 25n + 76$
n: Stations (Maximum 16 stations)

L \ n	1	2	3	4	5	6	7	8
L_1	88	113	138	163	188	213	238	263
L_2	101	126	151	176	201	226	251	276

L \ n	9	10	11	12	13	14	15	16
L_1	288	313	338	363	388	413	463	463
L_2	301	326	351	376	401	426	476	476



Manifold Option Parts

Interface regulator (P, A, B port regulation)

ARBQ4000-00-□-1 (Plug-in type)
ARBQ4000-00-□-5 (Plug lead type)

Spacer Interface regulators can be placed on top of the manifold block to reduce the pressure of each of the valves.

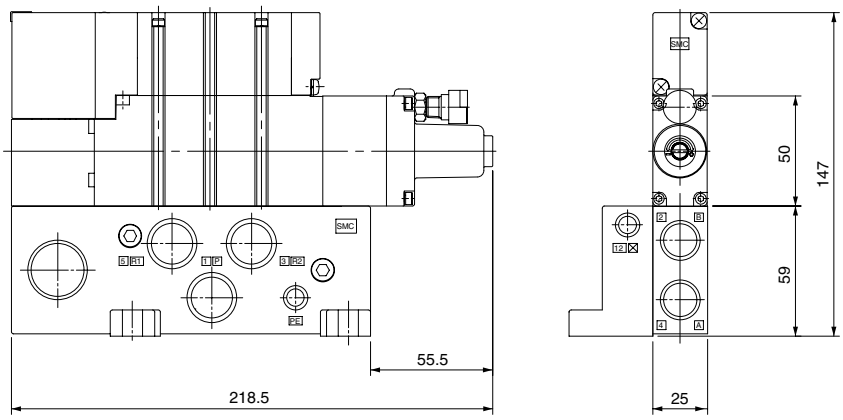
Specifications

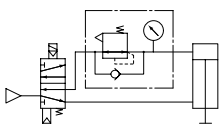
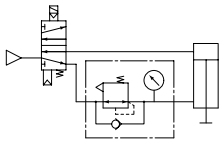
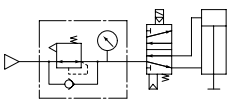
Interface regulator		ARBQ4000					
Regulating port		A		B		P	
Applicable solenoid valve		Plug-in	Plug lead	Plug-in	Plug lead	Plug-in	Plug lead
Maximum operating pressure		1.0 MPa					
Set pressure range		0.05 to 0.85 MPa					
Fluid		Air					
Ambient and fluid temperature		–5 to 60°C (No freezing)					
Port size for connection of pressure gauge		M5 x 0.8					
Weight (kg)		0.33	0.30	0.33	0.30	0.33	0.30
Effective area at supply side (mm^2) S at P_1 = 0.7 MPa/P_2 = 0.5 MPa	P→ A	15		31		14	
	P→ B	35		16		15	
Effective area at exhaust side (mm^2) S at P_2 = 0.5 MPa	A → EA	18		40		40	
	B → EB	37		19		37	

Note 1) Set the pressure within the operating pressure range of the solenoid valve.
Note 2) Operate an interface regulator only by applying pressure from the "P" port of the base, except when using it as a reverse pressure valve. Further, it cannot be used with reduced pressure at port P.
Note 3) When using a perfect spacer, assemble a valve, a spacer regulator and a perfect spacer in this order to use it.
Note 4) When using in A port regulation, B port regulation by closed center, since there is a problem in its operation, please contact SMC.
Note 5) Dust tight/Low jetproof enclosure (IP65) is not available with interface regulator.

How to Order

Solenoid Valve	Interface regulator	Regulating port
VQ4□0□ (Plug-in type)	ARBQ4000-00-A-1	A
	ARBQ4000-00-B-1	B
	ARBQ4000-00-P-1	P
VQ4□5□ (Plug lead type)	ARBQ4000-00-A-5	A
	ARBQ4000-00-B-5	B
	ARBQ4000-00-P-5	P

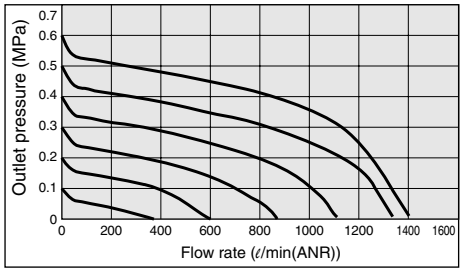


Regulating port: A	Regulating port: B	Regulating port: P
		

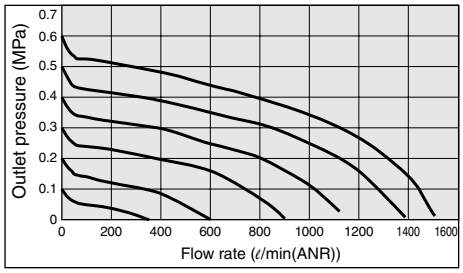
Flow Characteristics

Conditions Inlet pressure: 0.7 MPa

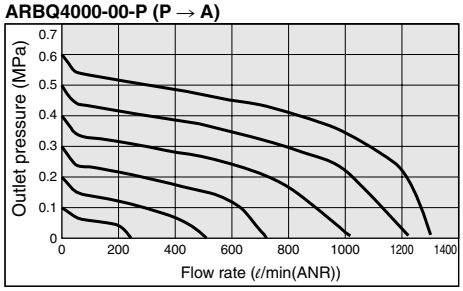
ARBQ4000-00-A



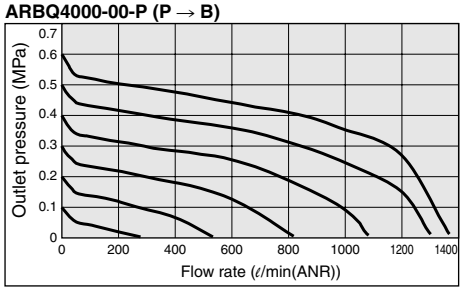
ARBQ4000-00-B



ARBQ4000-00-P (P → A)

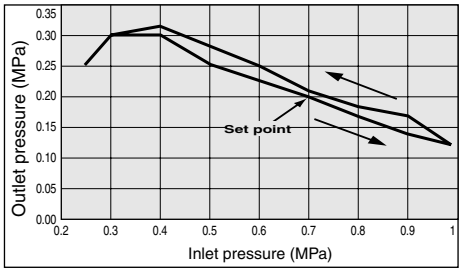


ARBQ4000-00-P (P → B)



Pressure Characteristics

Conditions
Inlet pressure: 0.7 MPa
Outlet pressure: 0.2 MPa
Flow rate: 20 ℓ/min (ANR)



Option

External Pilot Specifications

● When the supply air pressure is:
- lower than the required minimum operating pressure 0.15 to 0.2 MPa,
- opposite air supply (R port supply), cylinder supply (A and B port supply),
- used for vacuum specifications (please contact SMC),

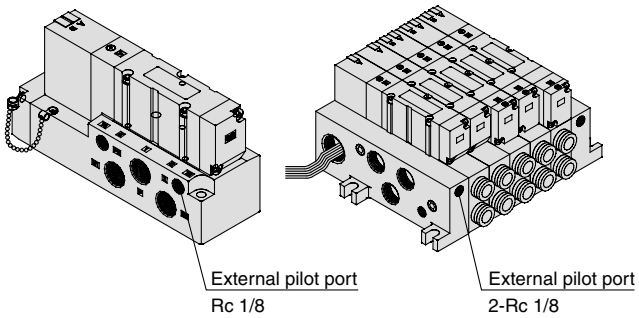
it can be used for external pilot specifications.
Order a valve by adding the external pilot specification [R] to the part number.
External pilot is available as standard for manifolds and options.

● Internal/external pilot can be mounted in a manifold.

How to Order Manifold

VQ4100 R — 5 — 03

External pilot specifications



<Sub-plate> **<Manifold>**

Note) Possible to mix mounting of internal and external pilot

Pressure Specifications

Valve construction		Metal seal	Rubber seal
Operating pressure range		Vacuum to 1.0 MPa	
External pilot pressure range Note)	Single	0.15 to 1.0 MPa (0.15 to 0.7 MPa)	0.2 to 1.0 MPa (0.2 to 0.7 MPa)
	Double		0.15 to 1.0 MPa (0.15 to 0.7 MPa)
	3 position		0.2 to 1.0 MPa (0.2 to 0.7 MPa)

Note) Values inside ( ) denote the low wattage (0.5 W) specifications.

Combination of manifold options shown below and external pilot specification is not possible.

Release valve spacer	VVQ4000-24A-□D
Direct exhaust with silencer box	VV5Q4□–□□□–S□
For exhaust cleaner mounting	VV5Q4□–□□□–C$^{U}_{D}$
Manifold with control unit	VV5Q4□–□□□ Control unit model no.
Double check spacer with residual pressure exhaust	VVQ4000–25A–$\frac{1}{5}$

Inch-size One-touch Fittings

Valve with inch size One-touch fittings is shown below.

How to Order Manifold

VV5Q41 — 06 N11 SA — K

Cylinder port

N7	ø1/4"
N9	ø5/16"
N11	ø3/8"

International Thread Standards Other than Rc

Rc specifications are standard for all ports, however, NPT, NPTF and G are available for international markets.
Add the appropriate symbol following the port size in the standard part number.

How to Order Single Valves (Example)

VQ4100 — 5 — 03 T

Cylinder port Port size

Thread type (P, R and A, B port)

Nil	Rc
N	NPT
T	NPTF
F	G

How to Order Manifold

VV5Q41 — 08 03 T FU1

Cylinder port Port size

Thread type (P, R and A, B port)

Nil	Rc
N	NPT
T	NPTF
F	G

VV5Q41 — 08 C8 T FU1

Cylinder port Port size

Thread type (P, R port)

Nil	Rc
N	NPT
T	NPTF
F	G

How to Order Sub-plates and Options (Example)

VQ4000 — P — B 02 N (Sub-plate)

VVQ4000 — P — 1 — 03 T (Option)

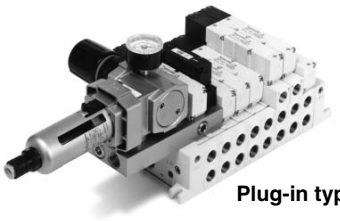
Port size

Thread type

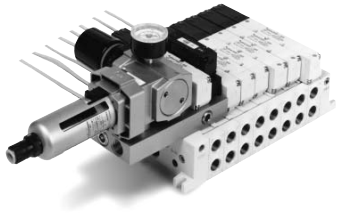
Nil	Rc
N	NPT
T	NPTF
F	G

Manifold with Control Unit

- **Mounting air filter, regulator, pressure switch for air release valve on manifold as unit is possible and permits piping labor savings.**
- **Maximum number of stations depends on each kit.**
  Refer to manifold specifications.
- **2 stations are used for control unit mounting.**
  (1 station is used for E type.)



Plug-in type



Plug Lead Type

⚠Caution

In the case of air filters with auto-drain or manual drain, mount so that the air filter is at the bottom.

Manifold Specifications

Base model	Type of connection	Porting specifications			Applicable max. stations Note)	Applicable solenoid valve
		4(A), 2(B) port location	Port size			
			1(P), 5(R1), 3(R2)	4(A), 2(B)		
VV5Q41 -□□□	F kit – D-sub connector T kit – Terminal block box L kit – Lead wire	Side	Rc 1/2 Option (Direct exhaust with silencer box)	C8 (For ø8) C10 (For ø10) C12 (For ø12) Rc 1/4, Rc 3/8	F, T kit 14 stations (13 stations) L, C kit 18 stations (17 stations)	VQ4□00 VQ4□01
VV5Q45 -□□□	C kit – Connector	Bottom		Rc 1/4		VQ4□50 VQ4□51

Note) Manifold for mounting is included. ( ): E type

Control Unit Specifications

Air filter (With auto-drain/With manual drain)	
Filtration	5 μm
Regulator	
Set pressure (Outlet pressure)	0.05 to 0.85 MPa
Pressure switch Note)	
Set pressure range: OFF	0.1 to 0.6 MPa
Differential	0.08 MPa or less
Contact	1a
Light	LED (RED)
Max. switch capacity	2 VA (AC), 2 W (DC)
Max. operating current	50 mA at 24 VAC, DC or less 20 mA at 100 VAC, DC
Air release valve (Single only)	
Operating pressure range	0.15 to 1 MPa (0.15 to 0.7 MPa)

Note) Values inside ( ) denote the low wattage (0.5 W) specifications.

Control Unit/Option

Air release valve spacer (2)	<Plug-in type> VVQ4000-24A-1D	
	<Plug lead type> VVQ4000-24A-5D	
Pressure switch	IS1000P-2-1	
Blanking plate (3)	Regulator with filter	MP2-3
	Pressure switch	MP3-2
	Release valve: Plug-in	VVQ4000-24A-10
	Release valve: Plug lead	VVQ4000-24A-15
Filter element	INA-13-854-12-5B	

Note1) Rated voltage: 24 VDC to 100 VAC
Internal voltage drop: 4 V
Note 2) Combination of VQ41□□ (Single) and release valve spacer can be used as air release valve.
Note 3) Plug lead type can not be mounted later.

How to Order Manifold

VV5Q 4 1 – 08 C8 F U1 [ ] [ ] – [ ]

Series

4	VQ4000

Manifold

1	Plug-in unit
5	Plug Lead unit

Stations

02	2 stations
⋮	⋮

Maximum and minimum number of stations depend on the kit.

Cylinder port

C8	One-touch fitting for ø8
C10	One-touch fitting for ø10
C12	One-touch fitting for ø12
02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
CM	Mixed

Kit (5)

Air release valve coil rating

Nil	Without air release valve (Only F,G type)
1	100 VAC, 50/60 Hz
5	24 VDC
9	Other

Control unit type

Symbol / Control equipment	Nil	A	AP	M	MP	F	G	C	E
Air filter with auto-drain		●	●			●			
Air filter with manual drain				●	●		●		
Regulator		●	●	●	●	●	●		
Air release valve		●	●	●	●			●	●
Pressure switch			●		●				
Blanking plate (Air release valve)						●	●		
Blanking plate (Filter, Regulator)								●	
Blanking plate (Pressure switch)		●		●		●	●	●	
Necessary number of manifold blocks from mounting required for mounting (Stations)		2 stations	2 stations	2 stations	2 stations	2 stations	2 stations	2 stations	1 station

Note) Electrical entry: Control unit can not be removed except L and C kits.

Option

Symbol	Option
Nil	None
K (2)	Special wiring specifications (Except double wiring)
N	Name plate (Applicable to T kit)
SU (3)	Direct exhaust with silencer box: U side exhaust
W (4)	IP65 enclosure

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -KN
Note 2) Specify wiring on the manifold specification sheet.
Note 3) Mounting on S and T kits is not possible.
Note 4) Combination with pressure switch (AP and MP type) is not possible.
Note 5) The release valve and the pressure switch on S kit are connected to another power supply. Cable length is 0.6 m.

Use of Control Unit

<Construction and piping >

1. The supply pressure (Po) passes through the filter regulator (1) and is adjusted to the prescribed pressure. Next, it goes through the release valve (2) (outlet residual pressure switching function used as normally ON) and is supplied to the manifold base side (P).

2. Supply pressure from Po port is blocked when release valve (2) is OFF. Air supplied to manifold side P port is exhausted to R1 port through release valve (2).

3. Pressure switch is piped at outlet side of release valve (2). (Release valve (2) is operated at energizing.)
Also, since there is an internal voltage drop of 4 V, it may not be possible to confirm the OFF and ON states with a tester, etc.

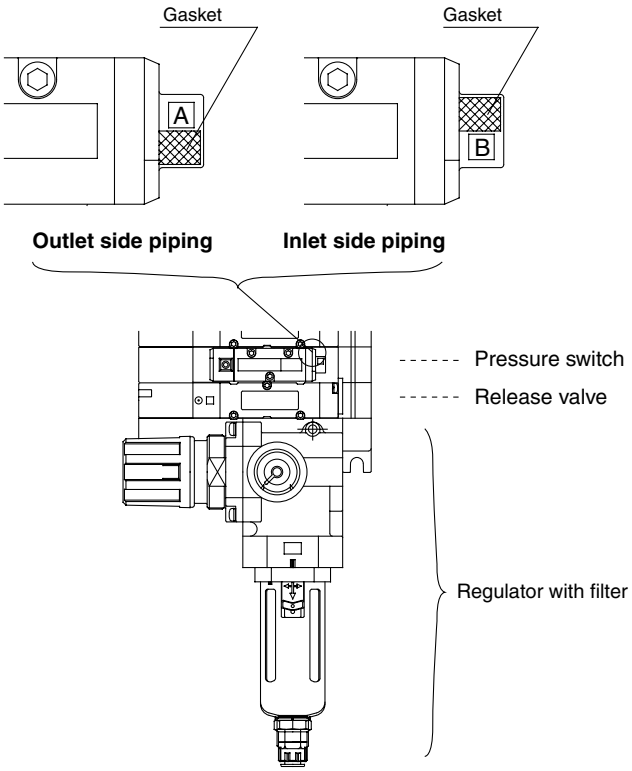
<Wiring>

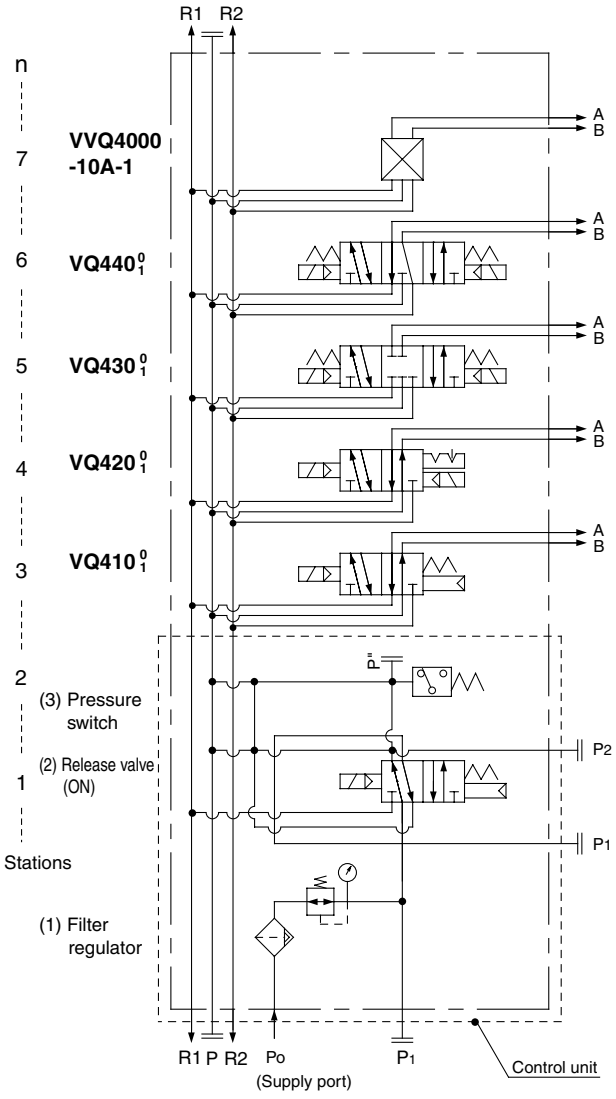
1. Electrical entry of manifold (except L and C kit) is individual wiring. For details, refer to internal wiring figure of each kit. Cable length is 0.6 m for L kit.

<Change of pressure switch piping>

1. Pressure switch (3) is changed to piping on inlet side of release valve (2), remove the pressure switch, reverse the gasket up and down, and fix B mark.

2. When pressure switch is mounted, tightening torque of bolt is 0.8 to 1.2 N·m.

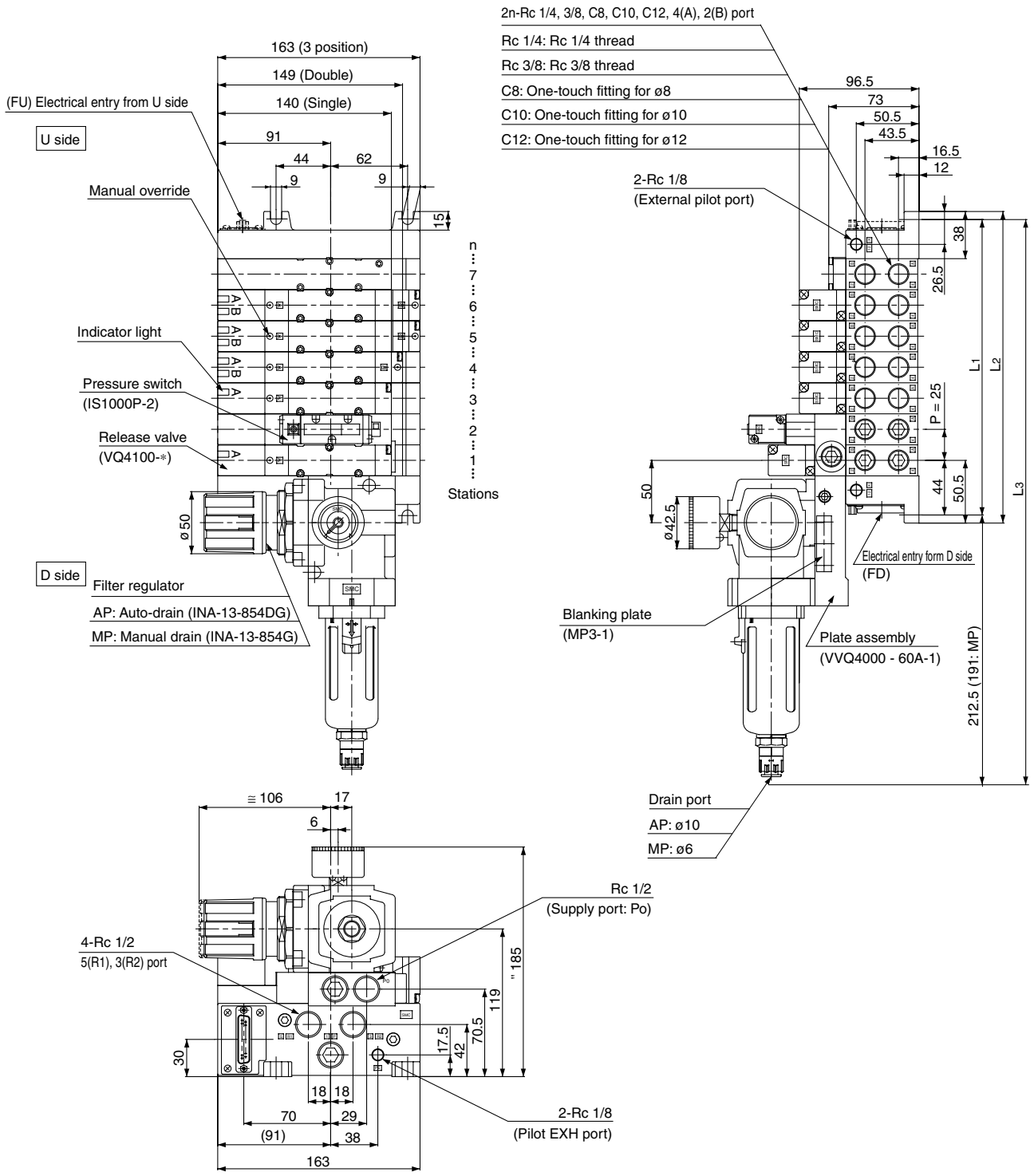




Circuit of control unit manifold

Manifold with Control Unit

Plug-in type



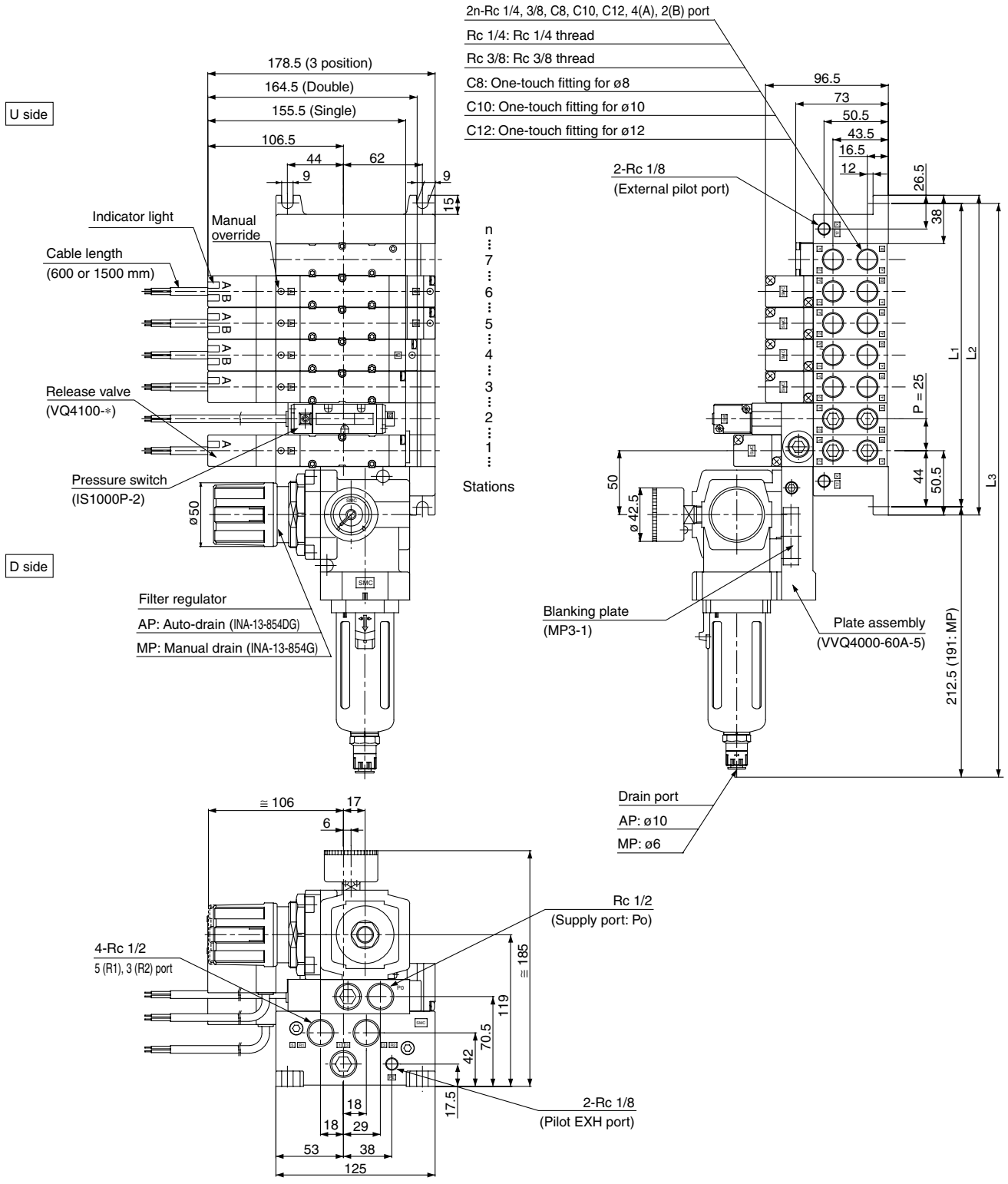
Dimensions

Formula L1 = 25n + 63, L2 = 25n + 76, L3 = 25n + 269.5 (262.5) n: Stations

L \ n	2	3	4	5	6	7	8	9	10	11	12
L1	113	138	163	188	213	238	263	288	313	338	363
L2	126	151	176	201	226	251	276	301	326	351	376
L3	332	357	382	407	432	457	482	507	532	557	582
	(310.5)	(335.5)	(360.5)	(385.5)	(410.5)	(435.5)	(460.5)	(485.5)	(510.5)	(535.5)	(560.5)

∗ L3 ( ): Type MP

Plug lead type



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Formula L1 = 25n + 63, L2 = 25n + 76, L3 = 25n + 269.5 (262.5) n: Stations

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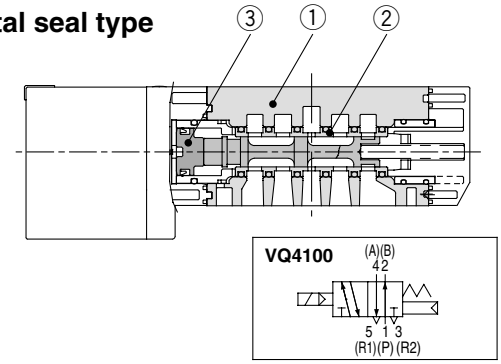
L3	332	357	382	407	432	457	482	507	532	557	582
	(310.5)	(335.5)	(360.5)	(385.5)	(410.5)	(435.5)	(460.5)	(485.5)	(510.5)	(535.5)	(560.5)

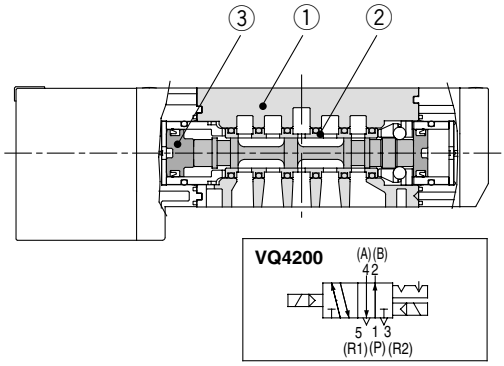
∗ L3 ( ): Type MP

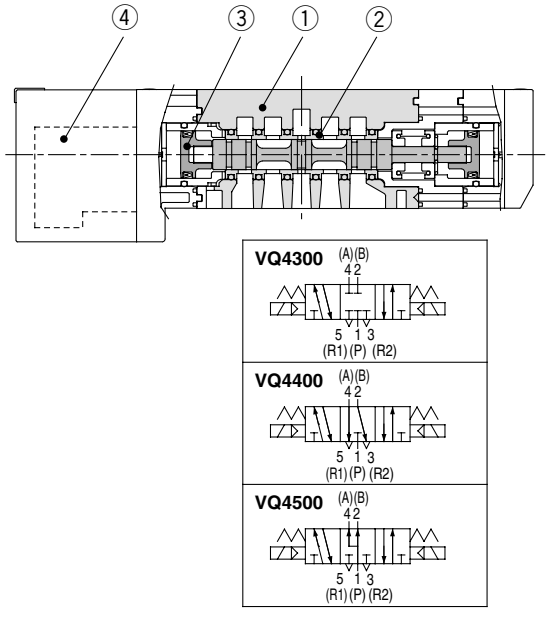
Construction

Plug-in Unit

Metal seal type







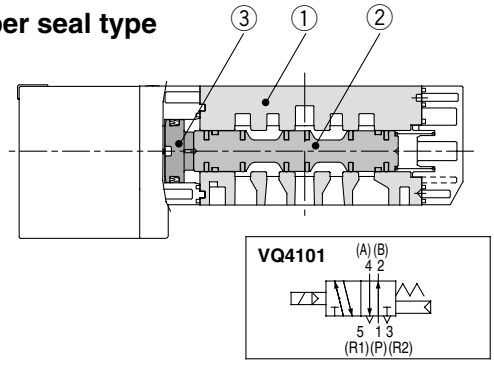
Component Parts

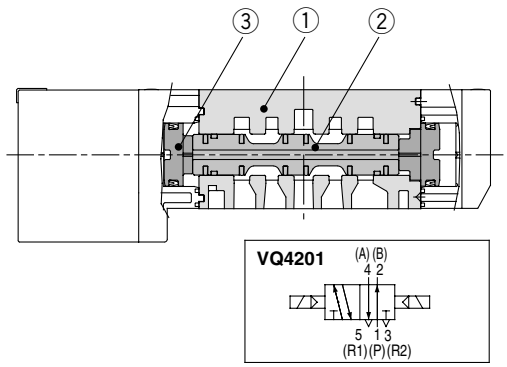
Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

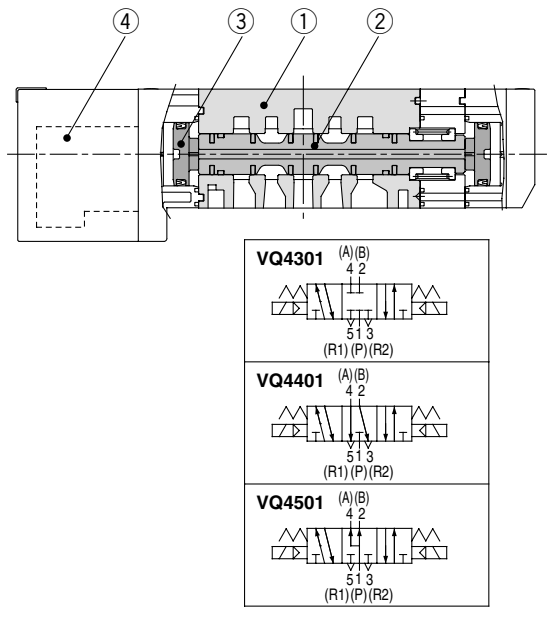
Replacement Parts

④	Pilot valve assembly	VQZ111P-□	∗: Coil rated voltage Example) 24 VDC: 5

Rubber seal type







Component Parts

Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum, NBR	
③	Piston	Resin	

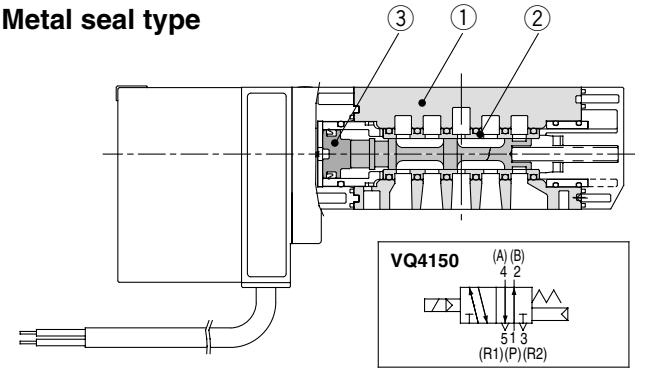
Replacement Parts

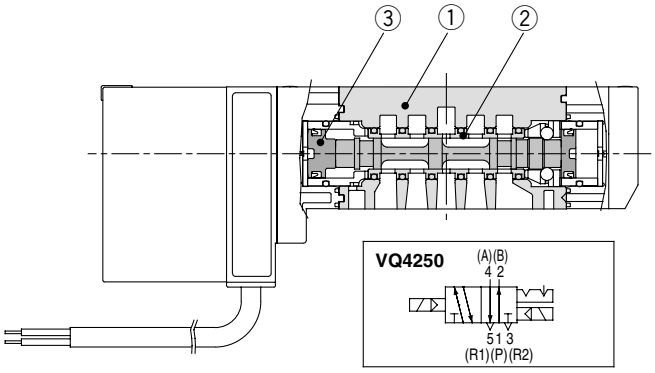
④	Pilot valve assembly	VQZ111P-□	∗: Coil rated voltage Example) 24 VDC: 5

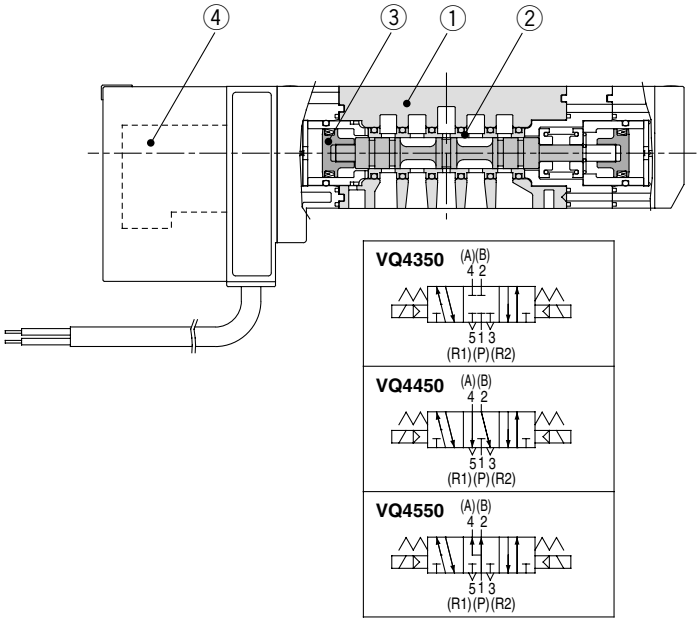
Construction

Plug Lead Unit

Metal seal type







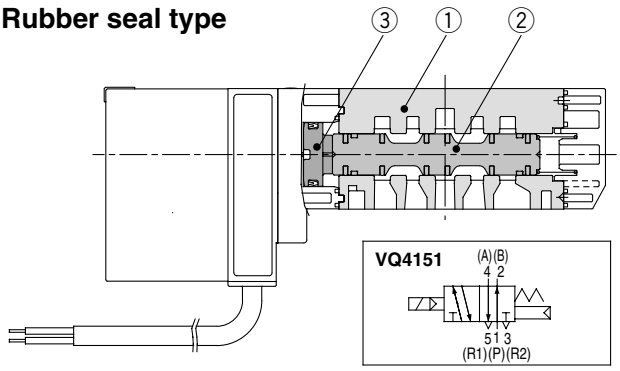
Component Parts

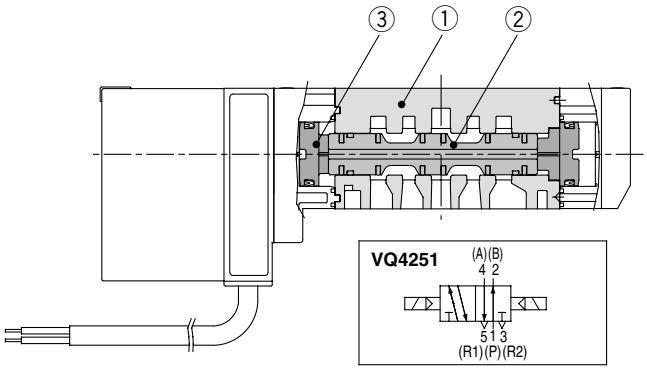
Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

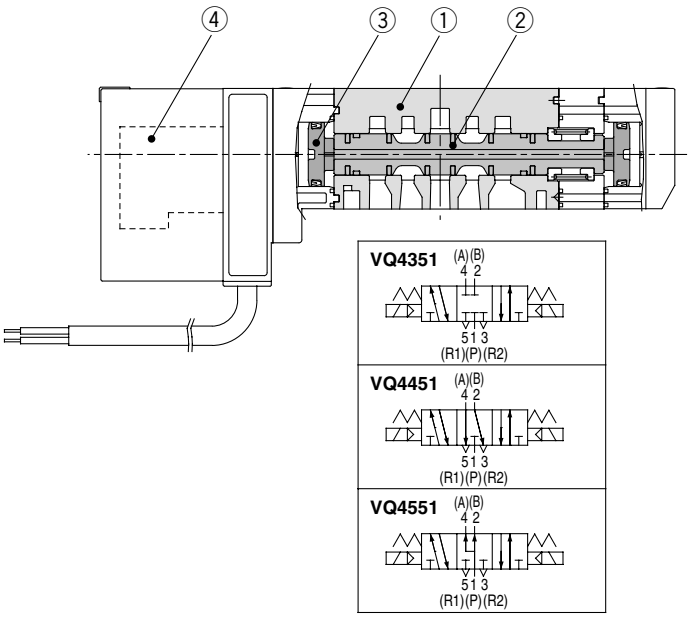
Replacement Parts

④	Pilot valve assembly	VQZ111P-□	∗: Coil rated voltage Example) 24 VDC: 5

Rubber seal type







Component Parts

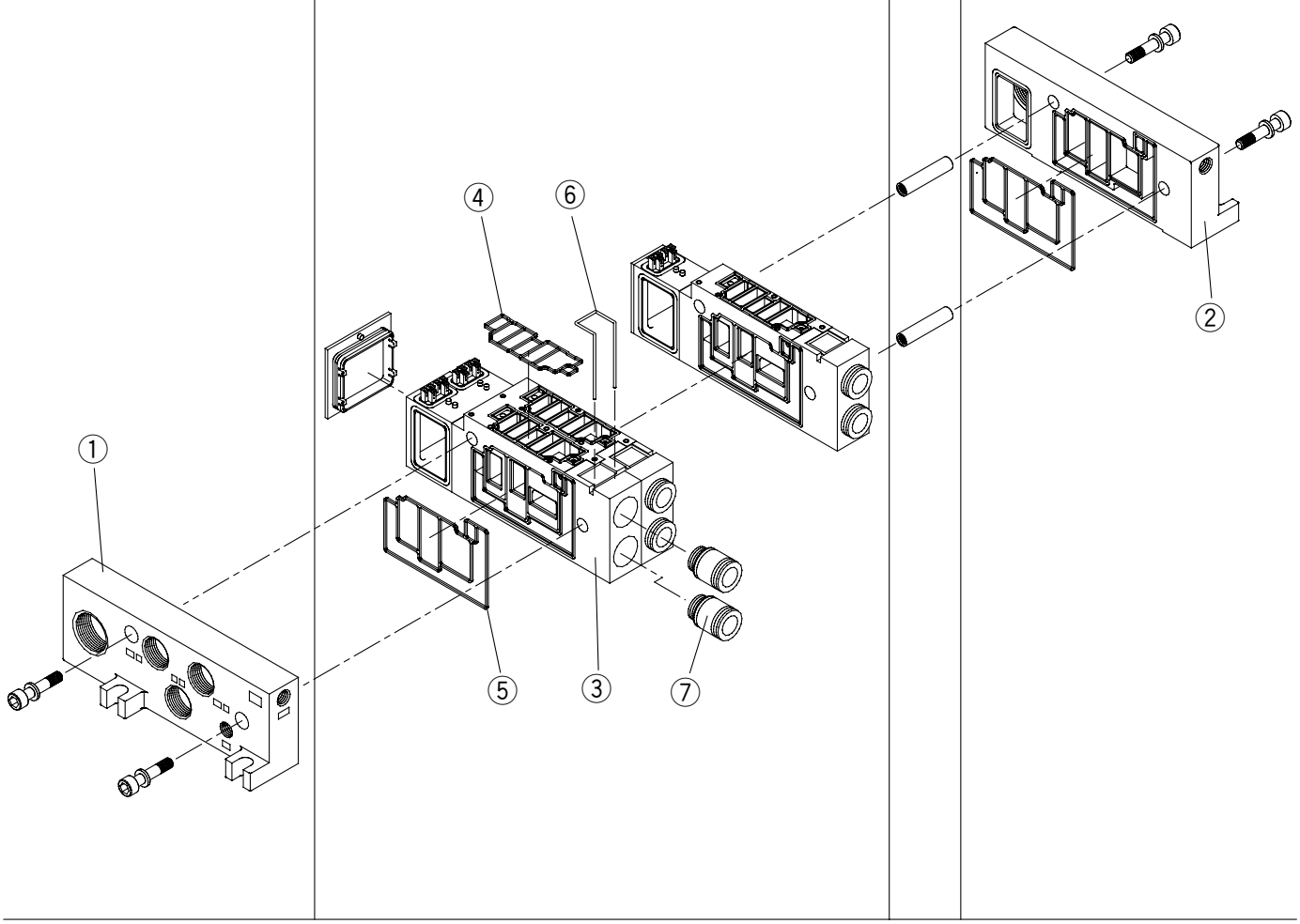
Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum, NBR	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQZ111P-□	∗: Coil rated voltage Example) 24 VDC: 5

Exploded View of Manifold

D side end plate assembly	Manifold block assembly	Tie-rod	U side end plate assembly



Note 1) The electrical entry cannot be changed. The drawing shows a plug-in type.
Note 2) Manifold block used is 2-station integrated type. For odd number of stations, 1 pc. of one-station manifold block is combined at U side; for even number of stations, 2 pcs. are combined, therefore making the increase/decrease of stations possible.

	D side					U side	
Example)	1	2	3	4	5	6	Stations
5 stations (Odd number)	2 stations		2 stations		1 station		
6 stations (Even number)	2 stations		2 stations		1 station	1 station	

<D Side End Plate Assembly>

1. D side end plate assembly no. (For F, L, S, T kit)

VVQ4000 — 3A — 1 — □ — □

Electrical entry

L	F, L, T, S kit
F (1)	F kit (Connector side)
C	C kit (Plug lead type)

Option

Nil	Standard
W (2)	IP65 enclosure
CD	For exhaust cleaner mounting
SD	Direct exhaust with silencer box

Note 1) D-sub connector is not included.
Note 2) Dripproof F kit is not available.

<U Side End Plate Assembly Part No.>

2. U side end plate assembly no. (For F, L, S, T kit)

VVQ4000 — 2A — 1 — □ — □

Electrical entry

L	F, L, T, S kit
F (1)	F kit (Connector side)
C	C kit (Plug lead type)

Option

Nil	Standard
W (2)	IP65 enclosure
CU	For exhaust cleaner mounting
SU	Direct exhaust with silencer box

Note 1) D-sub connector is not included.
Note 2) Dripproof F kit is not available.

D side end plate assembly part no. (For input/output type for S kit)

VVQ4000 — 3A — 12

∗ With connector on the SI unit

U side end plate assembly part no. (For input/output type for S kit)

VVQ4000 — 2A — 12

∗ With connector on the SI unit

<Manifold Block Assembly>

3. Manifold block assembly part no.

VVQ4000 — 1 — □ — □ — □ — □

A	For 1 station
C	For 2 stations (3)

Option

Nil	Standard
W (2)	IP65 enclosure is dust

Electrical entry

F1	F kit Double wiring
F2	F kit Single wiring
T1	T kit Double wiring
T2	T kit Single wiring
S1	S kit Double wiring
S2	S kit Single wiring
L0□	L0 kit □: Stations (1 to 16)
L1□	L1 kit □: Stations (1 to 16)
L2□	L2 kit □: Stations (1 to 16)
C	C kit (Plug lead type)

Port size

02	Rc 1/4
03	Rc 3/8
B	Bottom ported Rc 1/4
C8	With One-touch fitting for ø8
C10	With One-touch fitting for ø10
C12	With One-touch fitting for ø12
N7	With One-touch fitting for ø1/4
N9	With One-touch fitting for ø5/16
N11	With One-touch fitting for ø3/8

Note 1) Tie-rods (2 pcs.) and lead wire assembly for station addition included.
Note 2) Dripproof F kit is not available.
Note 3) When ordering block assembly for L kit 2 stations, the lead wire should be ordered by the smaller numbers of the D side (no. of station).

<Manifold Block Replacement Parts>

Replacement Parts

No.	Part no.	Description	Material	Number
④	VVQ4000-80A-1	Gasket	NBR	10
⑤	VVQ4000-80A-2	Gasket	NBR	10
⑥	VVQ4000-80A-4	Clip	Stainless steel	10

Note) Spare parts consist of sets containing 10 pcs. each.

<Fitting Assembly>

7. Fitting assembly part no. (For cylinder port)

VVQ4000 — 50B — □

Port size

C8	Applicable tubing ø8
C10	Applicable tubing ø10
C12	Applicable tubing ø12
N7	Applicable tubing ø1/4
N9	Applicable tubing ø5/16
N11	Applicable tubing ø3/8

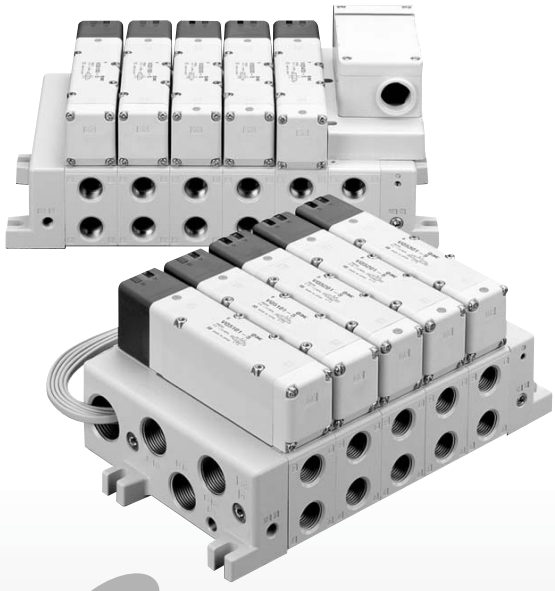
Note) Purchasing order is available in units of 10 pieces.

<SI Unit>

SI Unit Part No.

Type	Model symbol	SI unit part no.	Description	Note
Dedicated output model	O	—	Without SI unit	
	A	EX323$^{U}_{D}$-S001	General type SI unit (Series EX300)	
	B	EX123$^{U}_{D}$-SMB1	Mitsubishi Electric Corporation: MELSECNET/MINI-S3 Data Link System	
	BB	EX124$^{U}_{D}$-SMB1	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System (2 power supply systems)	
	C	EX123$^{U}_{D}$-STA1	OMRON Corporation: SYSBUS Wire System	
	D	EX123$^{U}_{D}$-SSH1	SHARP Corporation: Satellite I/O Link System	
	F1	EX123$^{U}_{D}$-SUW1	16 output points Uni-wire System (NKE Corporation)	
	G	EX124$^{U}_{D}$-SAB1	Allen Bradley Remote I/O (RIO) System (2 power supply systems) (Rockwell Automation, Inc.)	
	H	EX123$^{U}_{D}$-SUH1	SI unit for 16 output points Uni-wire H System (NKE)	
	J1	EX123$^{U}_{D}$-SSL1	16 output points S-LINK System (Sunx)	
	J2	EX123$^{U}_{D}$-SSL2	8 output points S-LINK System (Sunx)	
	K	EX123$^{U}_{D}$-SFU1	T-LINK Mini System (Fuji Electric Co.)	
	Q	EX124$^{U}_{D}$-SDN1	SI unit for DeviceNet and CompoBus/D (OMRON)	
	R1	EX124$^{U}_{D}$-SCS1	SI unit for 16 output points CompoBus/S (OMRON)	
	R2	EX124$^{U}_{D}$-SCS2	SI unit for 8 output points CompoBus/S (OMRON)	
	U	EX124$^{U}_{D}$-SJN1	JEMANET (2 power supply systems)	
	V	EX124$^{U}_{D}$-SMJ1	SI unit for CC-LINK System (2 power supply systems) (Mitsubishi Electric Corp.)	
For in/output model	QW	EX240-SDN2	CC-LINK System	
	NW	EX240-SPR1	PROFIBUS-DP (–COM)	
		EX240-IE1	DI unit (For input) M12 8 number of inputs	

5 Port Solenoid Valve
Metal Seal/Rubber Seal
Base Mounted
Series VQ5000



Space-saving profile

Clean space saving design with all pilot valves concentrated to one side with no protrusions in any direction

Space-saving —— 40% less
Capacity-saving — 50% less
(In-house comparison)

Compact with large flow capacity
(Ideal for driving cylinders up to ø180)

Enclosure IP65 compliant Dust tight/Low jetproof type

Outstanding response times and long service life

(Metal seal with light/surge suppressor)

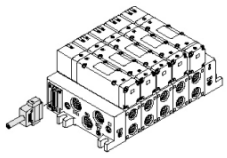
VQ5100 (Single)	32 mS	100 million cycles ∗ According to SMC life test conditions
VQ5200 (Double)	17 mS	
Accuracy	±3 mS	

∗ For applications which demand high speed, high frequency, long life and a precise response time.

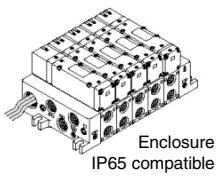
A variety of common wiring methods are standardized.

<Plug-in type>

F kit (D-sub connector)

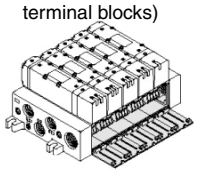


L kit (Lead wire)

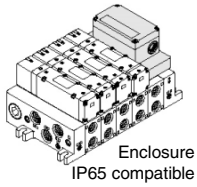


Enclosure IP65 compatible

T1 kit (With individual terminal blocks)

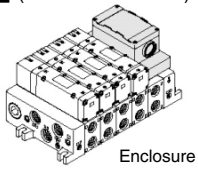


S kit (Serial transmission)



Enclosure IP65 compatible

T kit (Terminal block box)



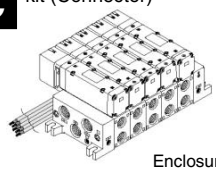
Enclosure IP65 compatible

• 5 wiring types have been standardized to facilitate easy wiring work and maintenance.
In addition, 3 of the wiring types are available with IP65 enclosures.

Individual wiring type

<Plug lead type>

C kit (Connector)



Grommet type — Enclosure IP65 compatible

Cylinder Speed Chart

Use as a guide for selection. Please confirm the actual conditions with SMC Sizing Program.

Series	Average speed (mm/s)	Bore size: Series MB, CA1 Pressure 0.5 MPa Load factor 50% Stroke 500 mm				Series CS1 Pressure 0.5 MPa Load factor 50% Cylinder stroke 1000 mm					
		ø50	ø63	ø80	ø100	ø125	ø140	ø160	ø180	ø200	ø250
VQ5100-□-04 VQ5101-□-04	1100 1000 900 800 700 600 500 400 300 200 100 0										

Perpendicular, upward actuation
Horizontal actuation

∗ It is when the cylinder is extending that is meter-out controlled by speed controller which is directly connected with cylinder, and its needle valve with being fully open.
∗ The average velocity of the cylinder is what the stroke is divided by the total stroke time.
∗ Load factor: ((Load weight x 9.8)/Theoretical force) x 100%

System Components

Speed controller	Silencer	SGP (Steel pipe) dia. x Length
AS420-04	AN400-04	10A x 1 m

⚠Precautions

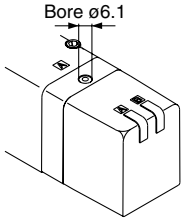
Be sure to read before handling. For Safety Instructions and Solenoid Valve Precautions, refer to page 2-9-2.

Manual Override Operation

⚠Warning

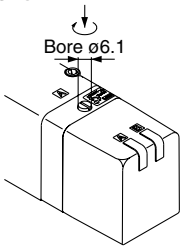
Since connected equipment will be actuated when the manual override is operated, first confirm that conditions are safe.
Non-locking push type (Tool required) is standard. As an option, slotted locking type (Tool required) is available.

Push type (Tool required)

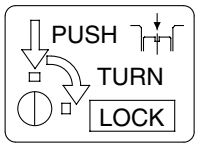


Push down the manual override button with a small screwdriver, etc.
Release the screwdriver and the manual override will return.

Locking type (Option)



Push down completely on the manual override button with a small screwdriver. While down, turn clockwise 90° to lock it. Turn it counterclockwise to release it.

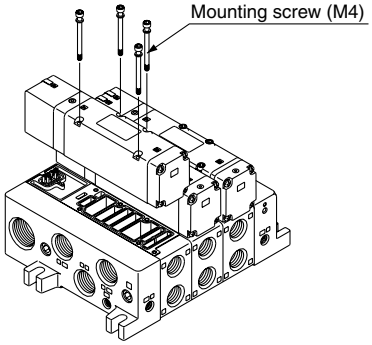


Mounting of Valves

⚠Caution

After confirming the gasket is correctly placed under the valve, securely tighten the bolts with the proper torque shown in the table below.

Proper tightening torque (N·m)
1 to 1.8

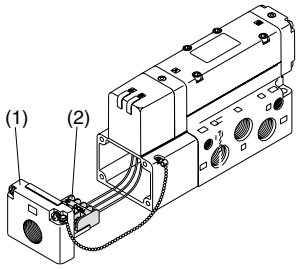


Lead Wire Connection

⚠Caution

Plug-in sub-plate (With terminal block)

● If the junction cover (1) of the sub-plate is removed, you can see the plug-in type terminal block (2) mounted inside the sub-plate.



● The terminal block is marked as follows. Connect wiring to each of the power supply terminals.

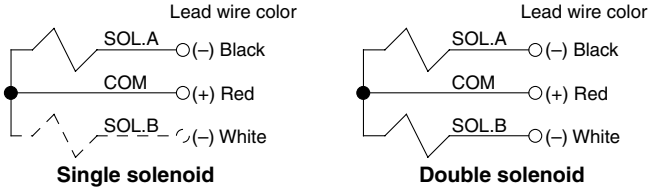
Model \ Terminal block marking	A	COM	B	⏚
VQ510$^{0}_{1}$	A side	COM	—	—
VQ520$^{0}_{1}$	A side	COM	B side	—
VQ5$^{3}_{4}_{6}$0$^{0}_{1}$	A side	COM	B side	—

Note 1) There is no polarity. It can also be used as –COM.
Note 2) The sub-plate is double wired even for the VQ510$^{0}_{1}$.

● Applicable terminal 1.25-3s, 1.25Y-3, 1.25Y-3N, 1.25Y-3.5.

Plug lead: Grommet type

Make connections to each corresponding wire.



	Single solenoid	Double solenoid
Standard	Black: A side solenoid (–) Red: COM (+)	Black: A side solenoid (–) Red: COM (+) White: B side solenoid (–)
Enclosure IP65 compliant	Black: A side solenoid (–) Red: COM (+) White: B side solenoid (–) (Not used for single solenoid) Green: (Not used for single or double.)	

Note) There is no polarity. It can also be used as –COM.

Installation and Removal of Light Cover

⚠ Caution

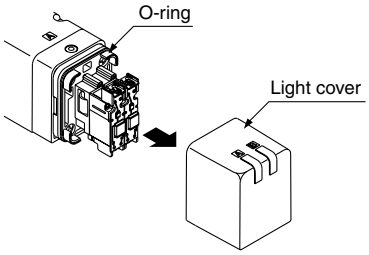
Installation/Removal of light cover

● **Removal**

To remove the pilot cover pull it straight off.
If it is pulled off at an angle, the pilot valve may be damaged or the protective O-ring may be scratched.

● **Installation**

Place the cover straight over the pilot assembly so that the pilot valve is not touched, and push it until the cover hook locks without twisting the protective O-ring. (When pushed in, the hook opens and locks automatically.)



Replacement of Pilot Valve

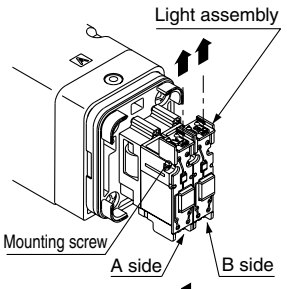
⚠ Caution

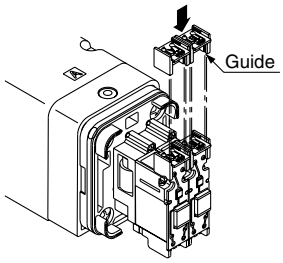
● **Removal**

1. Remove the mounting screw that holds the pilot valve using a small screwdriver.
2. When equipped with light, remove the light circuit board which is installed on the pilot valve by pulling it straight off the connector pins.

● **Installation**

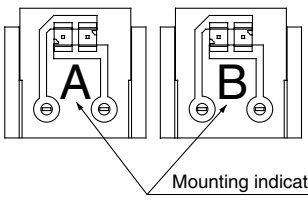
1. Insert the light circuit board straight onto the connector pins following the guide. If it is pushed in forcibly without following the guide, there is a danger of possibly bending the board contacts.
2. After confirming the gasket is correctly placed under the valve, securely tighten the bolts with the proper torque shown in the table below.





Proper tightening torque (N·m)
0.1 to 0.13

Note) The mounting of pilot valves is not directional with respect to the A and B sides. However, the light circuit boards' A side is orange and the B side is green. It must be mounted on the pilot valve in accordance with the mounting indicators. The light will not go on if the mounting is reversed.



Light Circuit Board Part No.

SOL.A	VQZ100-47-A
SOL.B	VQZ100-47-B

Note) It can be used with all voltages.

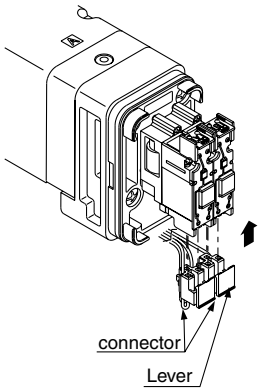
For Plug Lead Type

Attaching and detaching connectors

● To attach a connector, hold the lever and connector unit between your fingers and insert straight onto the pins of the solenoid valve so that the lever's pawl is pushed into the groove and locks.

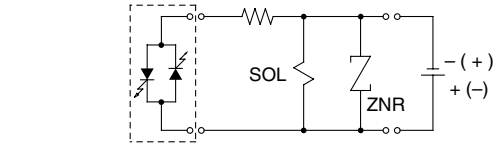
● To detach a connector, remove the pawl from the groove by pushing the lever downward with your thumb, and pull the connector straight out.

Note) Do not pull on the lead wires with excessive force. This can cause faulty and/or broken contacts.



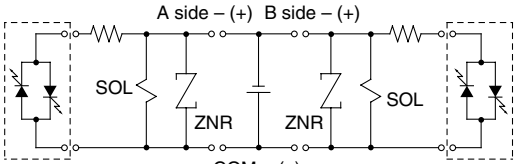
Internal Wiring Specifications

⚠ Caution



Light circuit assembly (Orange)

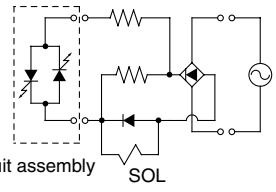
DC: Single



A side light circuit assembly (Orange)

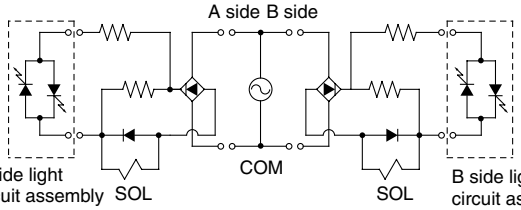
DC: Double

B side light circuit assembly (Green)



Light circuit assembly (Orange)

AC: Single



A side light circuit assembly (Orange)

AC: Double

B side light circuit assembly (Green)

How to Calculate the Flow Rate

For obtaining the flow rate, refer to pages 2-1-8 to 2-1-11.

CAD

Series VQ5000

Base Mounted

Plug-in/Plug Lead: Single Unit

Model

Series	Number of solenoids		Model		Port size	Flow Characteristics						Response time (ms)			Weight (kg)
						1 → 4/2 (P → A/B)			4/2 → 5/3 (A/B → EA/EB)			Standard 1 W	Low wattage 0.5 W	AC	
						C[dm³/(s·bar)]	b	Cv	C[dm³/(s·bar)]	b	Cv				
VQ5000	2 position	Single	Metal seal	VQ51⁰₅0	Rc 1/2	12	0.14	2.9	14	0.18	3.4	35 or less	38 or less	38 or less	0.59 (0.67)
			Rubber seal	VQ51⁰₅1		16	0.33	4.4	17	0.31	4.7	40 or less	43 or less	43 or less	0.58 (0.66)
		Double	Metal seal	VQ52⁰₅0		12	0.14	2.9	14	0.18	3.4	20 or less	23 or less	23 or less	0.62 (0.70)
			Rubber seal	VQ52⁰₅1		16	0.33	4.4	17	0.31	4.7	25 or less	28 or less	28 or less	0.60 (0.68)
	3 position	Closed center	Metal seal	VQ53⁰₅0		11	0.24	2.6	11	0.23	2.8	50 or less	53 or less	53 or less	0.65 (0.73)
			Rubber seal	VQ53⁰₅1		12	0.33	3.4	13	0.37	3.7	60 or less	63 or less	63 or less	0.58 (0.66)
		Exhaust center	Metal seal	VQ54⁰₅0		12	0.13	2.9	14	0.18	3.4	50 or less	53 or less	53 or less	0.65 (0.73)
			Rubber seal	VQ54⁰₅1		14	0.39	3.9	16	0.35	4.5	60 or less	63 or less	63 or less	0.58 (0.66)
		Pressure center	Metal seal	VQ55⁰₅0		12	0.23	2.9	13	0.24	3.3	50 or less	53 or less	53 or less	0.65 (0.73)
			Rubber seal	VQ55⁰₅1		13	0.32	3.4	14	0.40	3.9	60 or less	63 or less	63 or less	0.58 (0.66)
		Double check	Metal seal	VQ56⁰₅0		8.0	—	—	8.5	—	—	62 or less	65 or less	65 or less	1.17 (1.25)
			Rubber seal	VQ56⁰₅1		8.3	—	—	9.0	—	—	75 or less	78 or less	78 or less	1.10 (1.18)

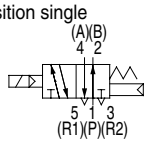
Note) Value for valve on sub-plate.

Plug-in unit

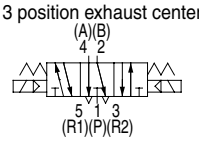
Plug lead unit

JIS Symbol

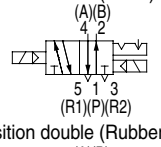
2 position single



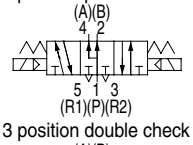
3 position exhaust center



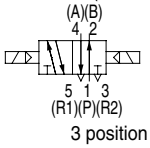
2 position double (Metal)



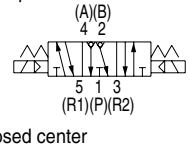
3 position pressure center



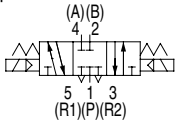
2 position double (Rubber)



3 position double check



3 position closed center



Standard Specifications

Valve specifications	Valve construction		Metal seal	Rubber seal
	Fluid		Air/Inert gas	
	Maximum operating pressure (3)		1.0 MPa	
	Min. operating pressure	Single	0.10 MPa	0.20 MPa
		Double	0.10 MPa	0.15 MPa
		3 position	0.15 MPa	0.20 MPa
	Proof pressure		1.5 MPa	
	Ambient and fluid temperatnre		–5 to 50°C (1)	
	Lubrication		Not required	
	Manual override		Push type/Locking type (Tool required) Option	
	Shock/Vibration resistance		150/30 m/s² (2)	
	Protection structure		Dust tight (IP65 compatible)	
Solenoid specifications	Coil rated voltage		12, 24 VDC, 100, 110, 200, 220 VAC (50/60 Hz)	
	Allowable voltage fluctuation		±10% of rated voltage	
	Coil insulation type		Class B or equivalent	
	Power consumption (Current)	24 VDC	1 W DC (42 mA), 0.5 W DC (21 mA) (3)	
		12 VDC	1 W DC (83 mA), 0.5 W DC (42 mA) Note (3)	
		100 VAC	Inrush 1.2 VA (12 mA), Holding 1.2 VA (12 mA)	
		110 VAC	Inrush 1.3 VA (11.7 mA), Holding 1.3 VA (11.7 mA)	
		200 VAC	Inrush 2.4 VA (12 mA), Holding 2.4 VA (12 mA)	
		220 VAC	Inrush 2.6 VA (11.7 mA), Holding 2.6 VA (11.7 mA)	

Note 1) Use dry air to prevent condensation when operating at low temperatures.

Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)

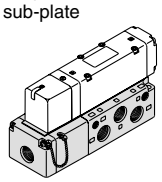
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)

Note 3) Values inside ( ) denote the low wattage (0.5 W) specifications.

How to Order Valves

Body

0: Plug-in sub-plate



Port size

Nil	Without sub-plate (For manifold)
04	Rc 1/2

Note) For thread standard, refer to page 2-6-39.

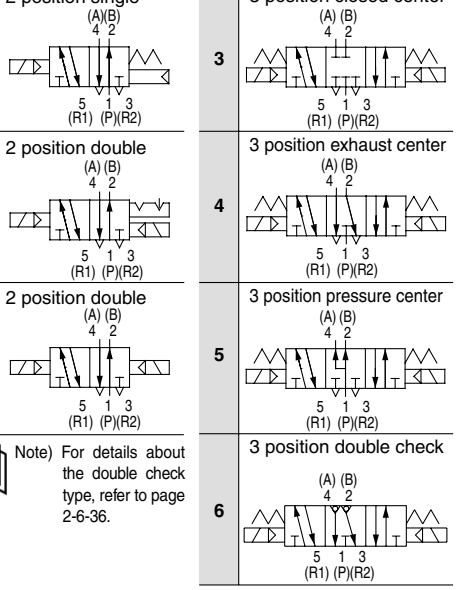
Porting specifications

Nil	Side ported
B	Bottom ported

Plug-in	**VQ5**	**1**	**0**	**0**		—	**5**							
Plug lead	**VQ5**	**2**	**5**	**1**		—	**5**	**G**						

Type of actuation

1		2 position single
2	Metal	2 position double
	Rubber	2 position double
3		3 position closed center
4		3 position exhaust center
5		3 position pressure center
6		3 position double check



Note) For details about the double check type, refer to page 2-6-36.

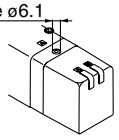
Enclosure

Nil	Dust-protected
W	Dusttight/Low jetproof type (IP65)

Manual override

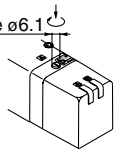
Nil: Non-locking push type (Tool required)

Bore ø6.1



B: Slotted locking type (Tool required)

Bore ø6.1

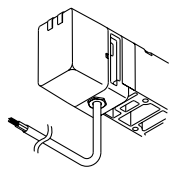


Light/Surge voltage suppressor

Nil	Yes
E	Without light, With surge voltage suppressor

Electrical entry

Grommet	**G**	Lead wire length 0.6 m
	H	Lead wire length 1.5 m

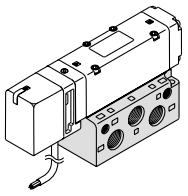


Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Body

5: Plug lead sub-plate



Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specifications.
Note 2) For details about external pilot specifications, refer to page 2-6-39.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Replacement of pilot valve assembly (Voltage)

- Refer to pages 2-6-40 to 2-6-41 for pilot valve assembly part numbers.
- Refer to page 2-6-3 for replacement method.

How to Order Sub-plates

VQ5000 — P □ — □ 04

Electrical entry

P	Plug-in conduit terminal
S	Plug lead

Porting specifications

Nil	Side ported
B	Bottom ported

Port size

04	Rc 1/2

Note1) For bottom ported, port size is Rc 1/2.
Note2) For thread standard, refer to page 2-6-39.

Enclosure

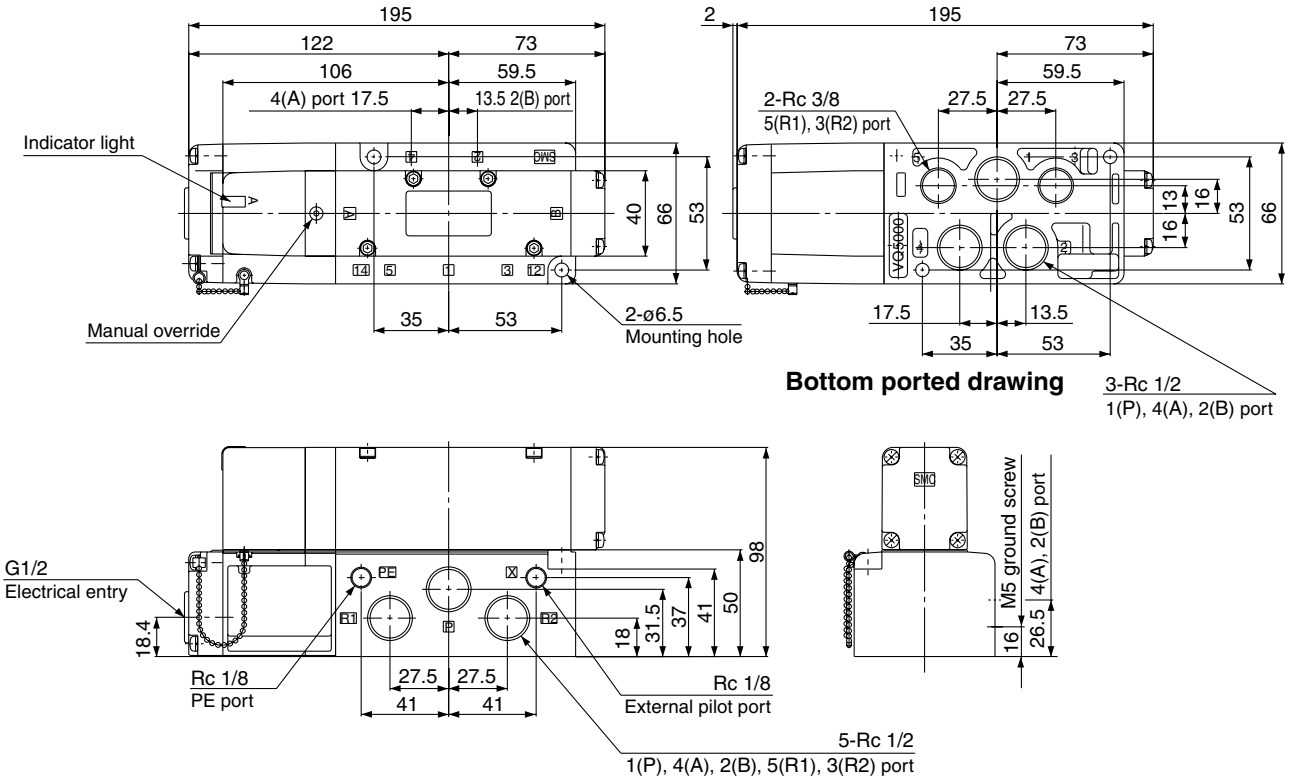
Nil	Dust-protected
W Note)	Dusttight/Low jetproof type

Note) Not required for plug lead type.

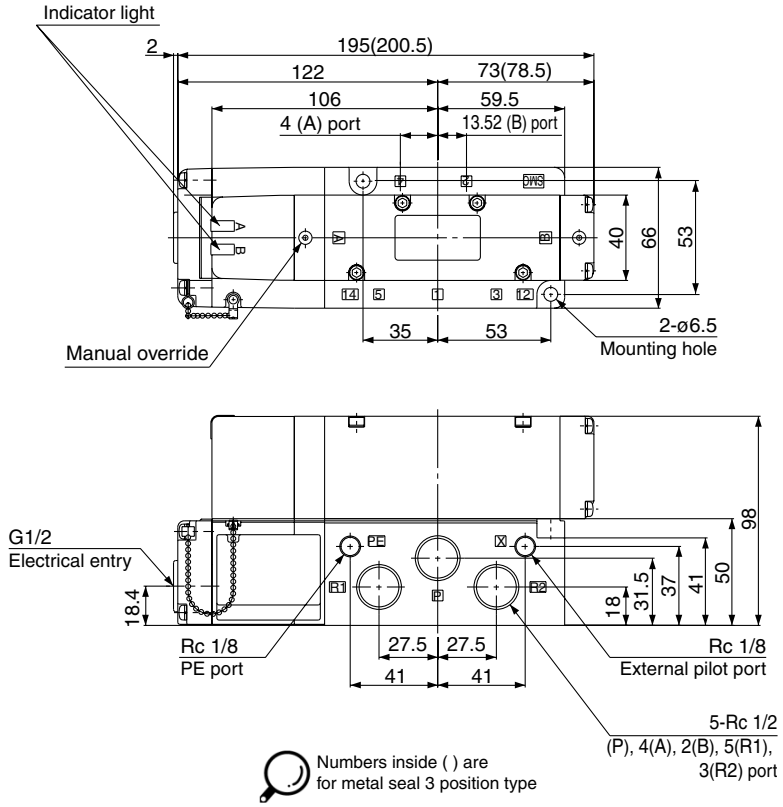
Plug-in Type

Conduit terminal

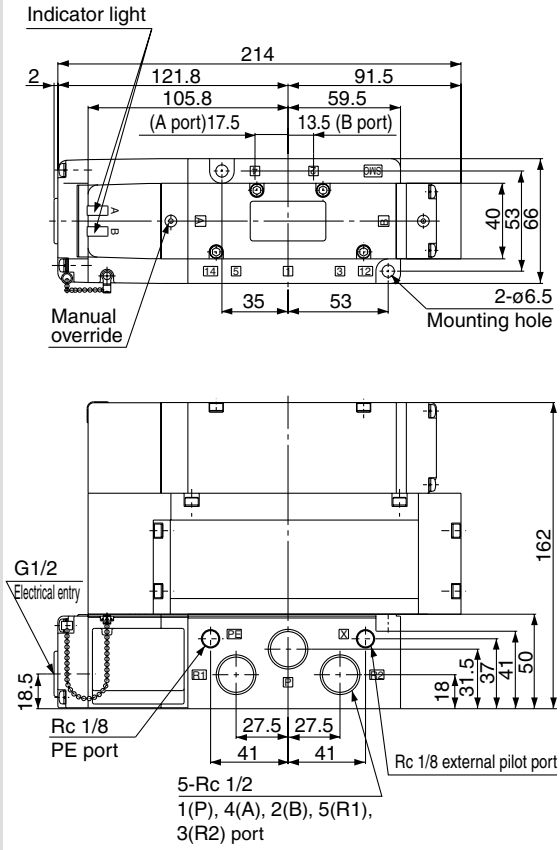
2 position single: VQ510$^{0}_{1}$



2 position double: VQ520$^{0}_{1}$
3 position closed center: VQ530$^{0}_{1}$
3 position exhaust center: VQ540$^{0}_{1}$
3 position pressure center:VQ550$^{0}_{1}$



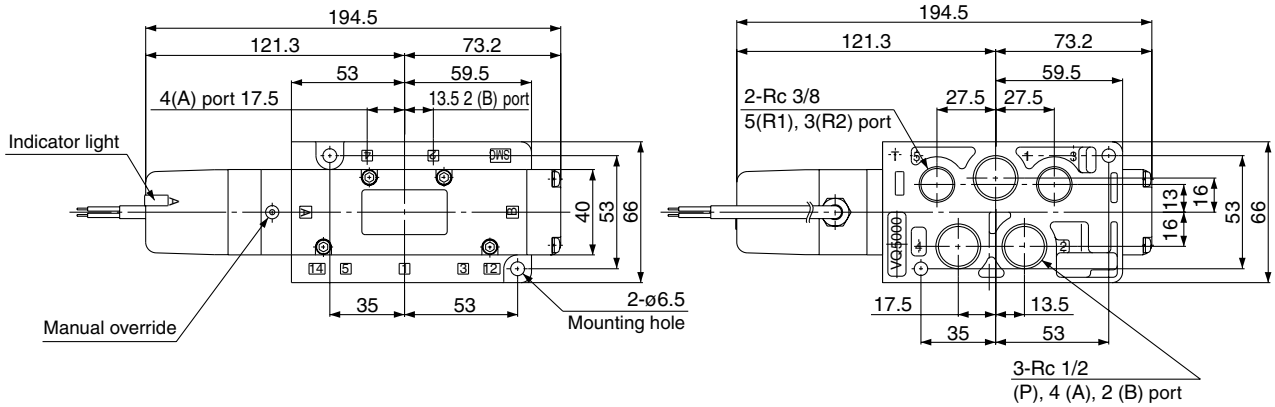
3 position double check: VQ560$^{0}_{1}$



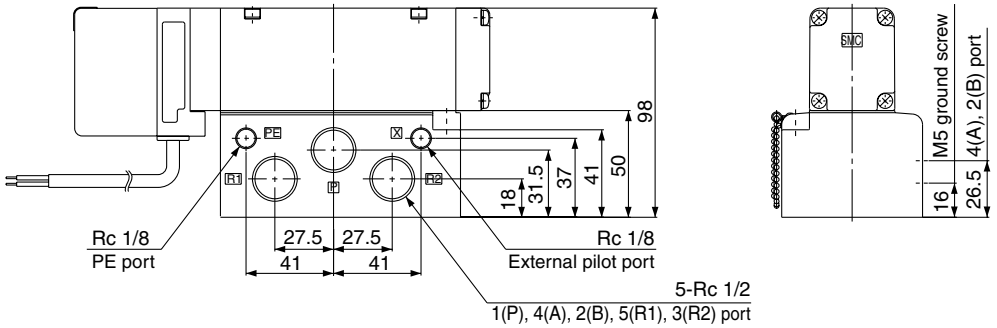
Plug Lead Type

Grommet

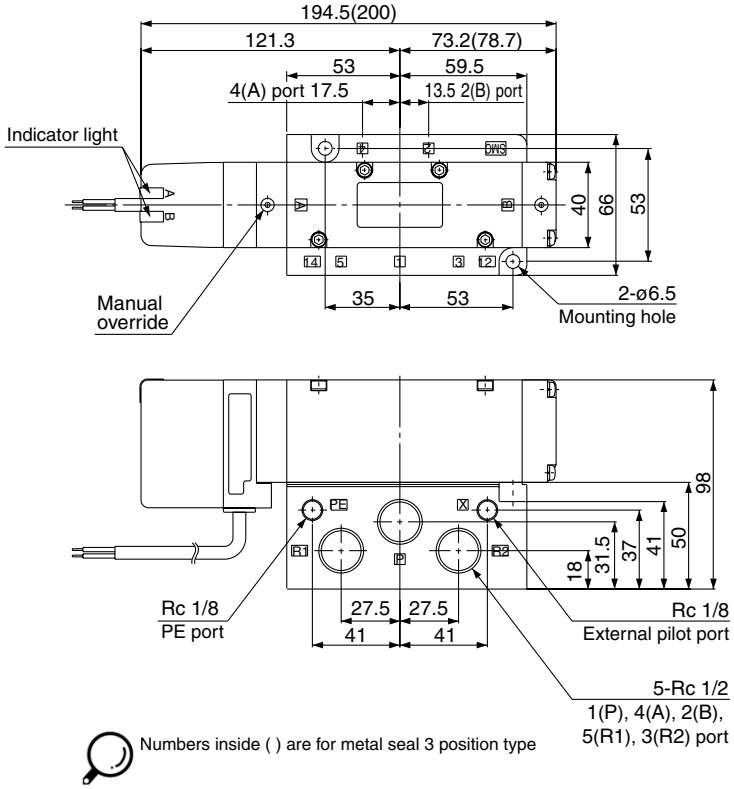
2 position single: VQ515$^{0}_{1}$-□$^{G}_{H}$



Bottom ported drawing

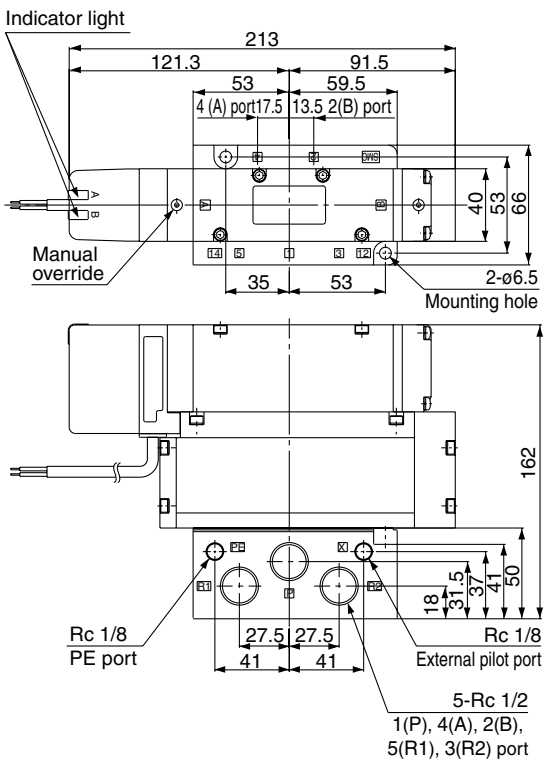


2 position double: VQ525$^{0}_{1}$-□$^{G}_{H}$
3 position closed center: VQ535$^{0}_{1}$-□$^{G}_{H}$
3 position exhaust center: VQ545$^{0}_{1}$-□$^{G}_{H}$
3 position pressure center: VQ555$^{0}_{1}$-□$^{G}_{H}$



Numbers inside ( ) are for metal seal 3 position type

3 position double check: VQ565$^{0}_{1}$-□$^{G}_{H}$



Series VQ5000
Base Mounted
Plug-in Unit

How to Order Manifold

VV5Q 5 1 – 08 03 F U1 □

Series

5	VQ5000

Manifold

1	Plug-in Unit

Station

01	1 station
⋮	⋮

Minimum number of stations depends on the kit.
(Refer to the table below.)

Cylinder port

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed Note)

Note) In case of mixed specification, indicate on the manifold specification sheet.

Kit type

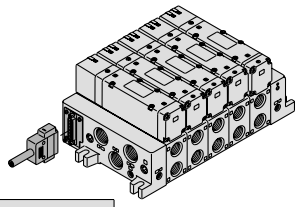
Option

Symbol	Option
Nil	None
CD1 (2)	Exhaust cleaner for Rc 1: D side exhaust
CD2 (2)	Exhaust cleaner for Rc 1 1/2: D side exhaust
CU1 (2)	Exhaust cleaner for Rc 1: U side exhaust
CU2 (2)	Exhaust cleaner for Rc 1 1/2: U side exhaust
K (4)	Special wiring specifications (Except double wiring)
N	Name plate (T kit only)
SB (3)	Direct exhaust with silencer box: Exhaust from both D and U sides
SD (2)	Direct exhaust with silencer box: D side exhaust
SU (2)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure (except F and T1 kits)

Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CD1K
Note 2) Combination of [C$^{U}_{D}$□] and [S$^{U}_{D}$] is not possible.
Note 3) Available only with F, L and T1 kits.
Note 4) Specify the wiring specifications on the manifold specification sheet. (Except L kit)

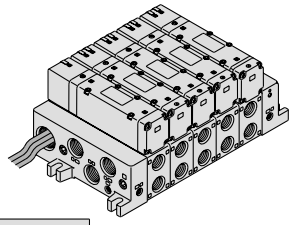
Kit/Electrical entry/Cable length

F kit
(D-sub connector)



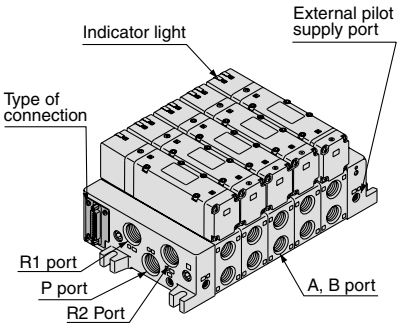
Connector entry direction					
D side		U side			
Kit F	D0	Kit F	U0	Without cable	1 to 12 stations
	D1		U1	Cable length 1.5 m	
	D2		U2	Cable length 3 m	
	D3		U3	Cable length 5 m	

L kit
(Lead wire cable)



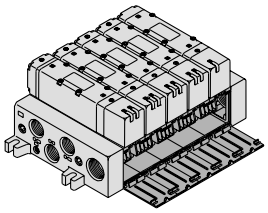
Electrical entry					
D side		U side			
Kit L	D0	Kit L	U0	Cable length 0.6 m	1 to 12 stations
	D1		U1	Cable length 1.5 m	
	D2		U2	Cable length 3 m	

IP65 compatible



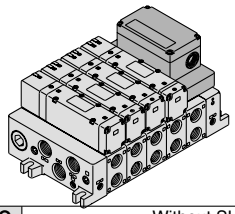
Note) The drawing shows a VV5Q51-0504FDO.

T1 kit
(Individual terminal block kit)



Kit T1	With terminal blocks	1 to 12 stations

S kit
(Serial transmission unit)



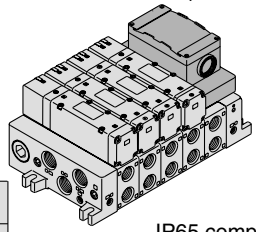
The valve voltage is 24 VDC and it is equipped with light/surge voltage suppressor.

IP65 compatible

Unit mounting position			
D side	U side		
SD	SU	O	Without SI unit
		A	With general type SI unit (Series EX300)
		B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System
		BB	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System (2 power supply systems)
		C	OMRON Corp.: SYSBUS Wire System
		D	SHARP Corp.: Satellite I/O Link System
		F1	NKE Corp.: Uni-wire System (16 output points)
		J1	SUNX Corp.: S-LINK System (16 output points)
		J2	SUNX Corp.: S-LINK System (8 output points)
		K	Fuji Electric Co.: T-LINK Mini System
		Q	DeviceNet, CompoBus/D (OMRON Corp.)
		R1	OMRON Corp.: CompoBus/S System (16 output points)
		R2	OMRON Corp.: CompoBus/S System (8 output points)
		U	JEMANET (JPCN-1)
		V	Mitsubishi Electric Corp.: CC-LINK System
		G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System
		H	NKE Corp.: Uni-wire H System

2 to 12 stations

T kit
(Terminal block box kit)



IP65 compatible

Box mounting position			
D side	U side		
TD	TU	Terminal block box	2 to 12 stations

Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Maximum applicable stations	Applicable solenoid valve	5 station weight (kg)
			4(A), 2(B) port location	Port size Note)				
				1(P) , 5(R1) , 3(R2)	4(A), 2(B)			
VQ5000	**VV5Q51-□□□**	■ F kit–D-sub connector ■ T kit–Terminal block box ■ T1 kit–Individual terminal block kit ■ L kit–Lead wire ■ S kit–Serial transmission	Side	Rc 3/4 Option (Direct exhaust with silencer box)	Rc 3/8 Rc 1/2	F, L, T1 kits 12 stations T kit 11 stations S kit 9 stations	VQ5L00 VQ5L01	4.1 • L kit • Not including solenoid valve weight.
			Bottom		Rc 1/2			

Note) For details about international standard threads other than Rc threads, refer to "Option" on page 2-6-39.

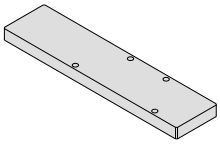
Flow Characteristics at the Number of Manifold Stations (Operated individually)

Model	Passage/Stations		Station 1	Station 5	Station 10
2 position metal seal **VQ5$^{1}_{2}$00**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	11	11	11
		b	0.24	0.24	0.24
		Cv	2.7	2.7	2.7
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	12	12	12
		b	0.14	0.14	0.14
		Cv	2.9	2.9	2.9
2 position rubber seal **VQ5$^{1}_{2}$01**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	12	12	12
		b	0.33	0.33	0.33
		Cv	3.4	3.4	3.4
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	16	16	16
		b	0.33	0.33	0.33
		Cv	4.4	4.4	4.4

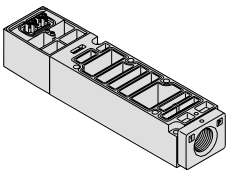
Note) For port size Rc 1/2

Manifold Option

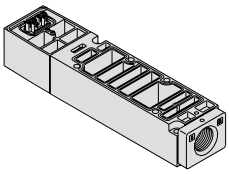
Blanking plate assembly
VVQ5000-10A-1



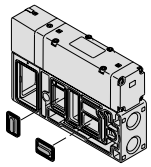
Individual SUP spacer
VVQ5000-P-1-$^{03}_{04}$



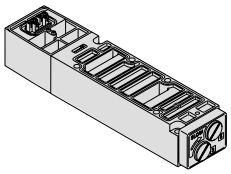
Individual EXH spacer
VVQ5000-R-1-$^{03}_{04}$



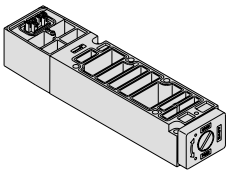
EXH block plate
VVQ5000-16A-2



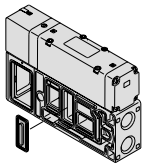
Throttle valve spacer
VVQ5000-20A-1



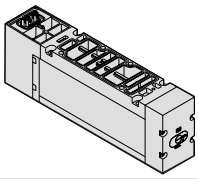
SUP stop valve spacer
VVQ5000-37A-1



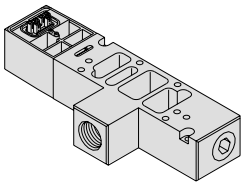
SUP block plate
VVQ5000-16A-1



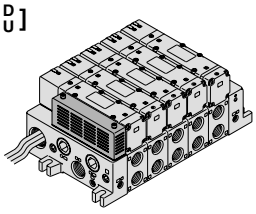
Double check spacer with residual pressure release valve
VVQ5000-25A-1



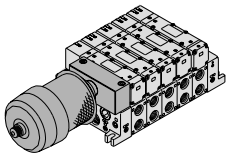
Release valve spacer
VVQ5000-24A-1D



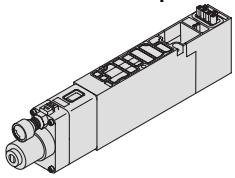
Direct exhaust with silencer box
[-S$^{D}_{U}$]



For exhaust cleaner mounting
[-C$^{D}_{U}$□]

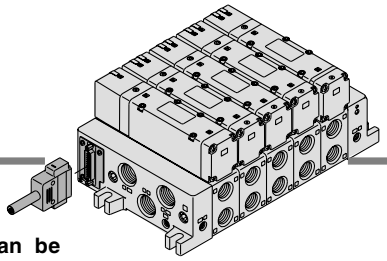


Interface regulator
ARBQ5000-00-$^{A}_{P}$-1



• Refer to pages 2-6-34 to 2-6-38 for detailed dimensions of each option.
• For replacement parts, refer to page 2-6-43.

F Kit (D-sub Connector kit)



- **Simplification and labor savings for wiring work can be achieved by using a D-sub connector for the electrical connection.**
- **Using connector for flat ribbon cable (25P) conforming to MIL standard permits the use of connectors put on the market and gives a wide interchangeability.**
- **Connector entry can be selected on either the U side or the D side according to the mounting orientation.**
- **Maximum stations are 12.**

Manifold Specifications

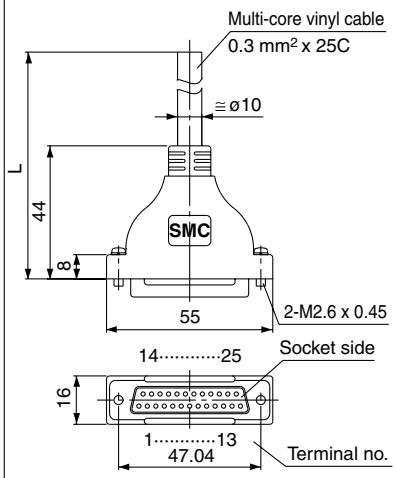
Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ5000	Side	Rc 3/4	Rc 3/8 Rc 1/2	Max. 12 stations
	Bottom		Rc 1/2	

D-Sub Connector Kit (25Pins)

Cable assembly ●

AXT100-DS25- 015 / 030 / 050

(D-sub connector cable assemblies can be ordered with manifolds. Refer to How to Order Manifold.)



D-sub Connector Cable Assembly (Option)

Cable length (L)	Assembly part no.	Note
1.5 m	AXT100-DS25-015	Cable 25 cores x 24AWG
3 m	AXT100-DS25-030	
5 m	AXT100-DS25-050	

* For other commercial connectors, use a 25 pins type with female connector conforming to MIL-C-24308.

Connector manufacturers' example
- Fujitsu, Ltd.
- Japan Aviation Electronics Industry, Ltd.
- J.S.T. Mfg. Co., Ltd.
- Hirose Electric Co., Ltd.

Electric Characteristics

Item	Characteristics
Conductor resistance Ω/km, 20°C	65 or less
Voltage limit VAC, 1 min.	1000
Insulation resistance MΩkm, 20°C	5 or less

Note) The min. bending radius of D-sub cable is 20 mm.

D-sub Connector Cable Assembly Terminal No.

Terminal no.	Lead wire color	Dot marking
1	Black	None
2	Brown	None
3	Red	None
4	Orange	None
5	Yellow	None
6	Pink	None
7	Blue	None
8	Purple	White
9	Gray	Black
10	White	Black
11	White	Red
12	Yellow	Red
13	Orange	Red
14	Yellow	Black
15	Pink	Black
16	Blue	White
17	Purple	None
18	Gray	None
19	Orange	Black
20	Red	White
21	Brown	White
22	Pink	Red
23	Gray	Red
24	Black	White
25	White	None

How to Order Manifold

VV5Q 5 1 – 08 03 F U 1 – □

Series
5	VQ5000

Manifold
1	Plug-in unit

Stations
02	2 stations
⋮	⋮
12	12 stations

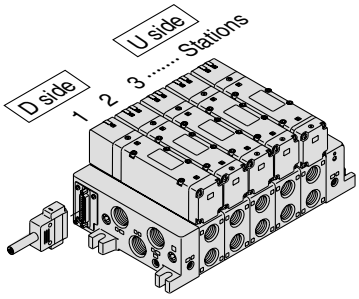
Cylinder port
03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed

Connector entry direction
D	D side entry
U	U side entry

Cable (Length)
0	Without cable
1	Cable length 1.5 m
2	Cable length 3 m
3	Cable length 5 m

Option
Symbol	Option
Nil	None
CD1	Exhaust cleaner for Rc 1: D side exhaust
CD2	Exhaust cleaner for Rc 1 1/2: D side exhaust
CU1	Exhaust cleaner for Rc 1: U side exhaust
CU2	Exhaust cleaner for Rc 1 1/2: U side exhaust
K (3)	Special wiring specifications (Except double wiring)
SB	Direct exhaust with silencer box: For mounting on both D and U sides
SD	Direct exhaust with silencer box: D side exhaust
SU	Direct exhaust with silencer box: U side exhaust

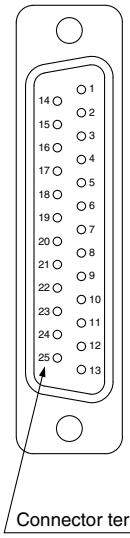
Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -CD1K.
Note 2) Combination of [C_D^U□] and [S_D^U] is not possible.
Note 3) Specify the wiring specifications on the manifold specification sheet.



Stations are counted starting from the first station on the D side.

● Electrical wiring specifications

D-sub connector



Connector terminal no.

Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types.
Mixed single and double wiring is available as an option. For details, refer to below.

Note) There is no polarity.
It can also be used as a negative common.

Standard wiring

D-sub connector assembly (AXT100-DS25-$^{015}_{030}$$_{050}$) Wire colors

	Terminal no.	Polarity		Lead wire color	Dot marking
1 station	SOL.A 1	(–)	(+)	Black	None
	SOL.B 14	(–)	(+)	Yellow	Black
2 stations	SOL.A 2	(–)	(+)	Brown	None
	SOL.B 15	(–)	(+)	Pink	Black
3 stations	SOL.A 3	(–)	(+)	Red	None
	SOL.B 16	(–)	(+)	Blue	White
4 stations	SOL.A 4	(–)	(+)	Orange	None
	SOL.B 17	(–)	(+)	Purple	None
5 stations	SOL.A 5	(–)	(+)	Yellow	None
	SOL.B 18	(–)	(+)	Gray	None
6 stations	SOL.A 6	(–)	(+)	Pink	None
	SOL.B 19	(–)	(+)	Orange	Black
7 stations	SOL.A 7	(–)	(+)	Blue	None
	SOL.B 20	(–)	(+)	Red	White
8 stations	SOL.A 8	(–)	(+)	Purple	White
	SOL.B 21	(–)	(+)	Brown	White
9 stations	SOL.A 9	(–)	(+)	Gray	Black
	SOL.B 22	(–)	(+)	Pink	Red
10 stations	SOL.A 10	(–)	(+)	White	Black
	SOL.B 23	(–)	(+)	Gray	Red
11 stations	SOL.A 11	(–)	(+)	White	Red
	SOL.B 24	(–)	(+)	Black	White
12 stations	SOL.A 12	(–)	(+)	Yellow	Red
	SOL.B 25	(–)	(+)	White	None
	COM. 13	(+)	(–)	Orange	Red
		Positive common specifications	**Negative common specifications** Note)		

Special Wiring Specifications

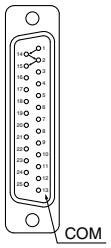
Double wiring (connected to SOL. A and SOL. B) is used for the internal wiring of each station regardless of valve and option types.
Mixed single and double wiring is available as an option.

1. How to Order

Indicate option symbol "-K" in the manifold part number and be sure to specify station positions for single or double wiring on the manifold specification sheet.

2. Wiring specifications

Connections begin with the A side solenoid of the first station being connected to terminal no. 1, and continue in the order indicated by the arrows in the drawing without skipping any terminals.
However, the maximum number of stations is 12.



D-sub connector

How to Order Valves

VQ 5 1 0 0 – 5

Series

5	VQ5000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specifications.
Note 2) Refer to page 2-6-39 for details on external pilot specifications.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

How to Order Manifold Assembly

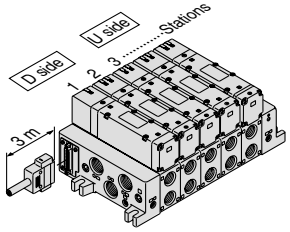
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
D-sub connector kit with cable (3 m)

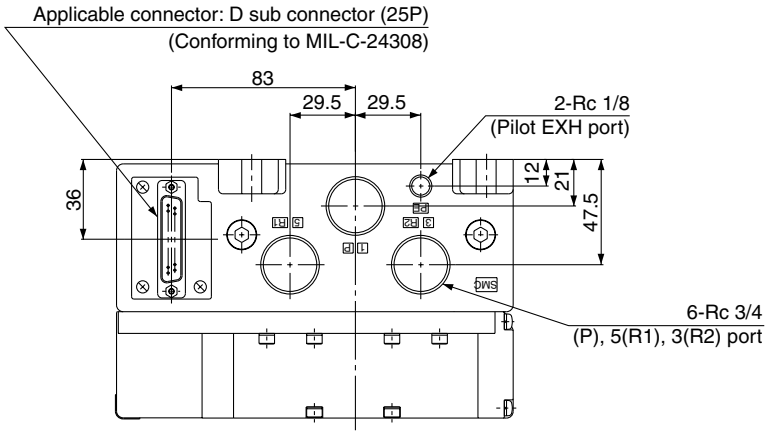
VV5Q51-0503FD2 ··1 set – Manifold base part no.
∗VQ5100-5 ····· 2 sets – Valve part no. (Stations 1 and 2)
∗VQ5200-5 ····· 2 sets – Valve part no. (Stations 3 and 4)
∗VQ5300-5 ····· 1 set – Valve part no. (Station 5)

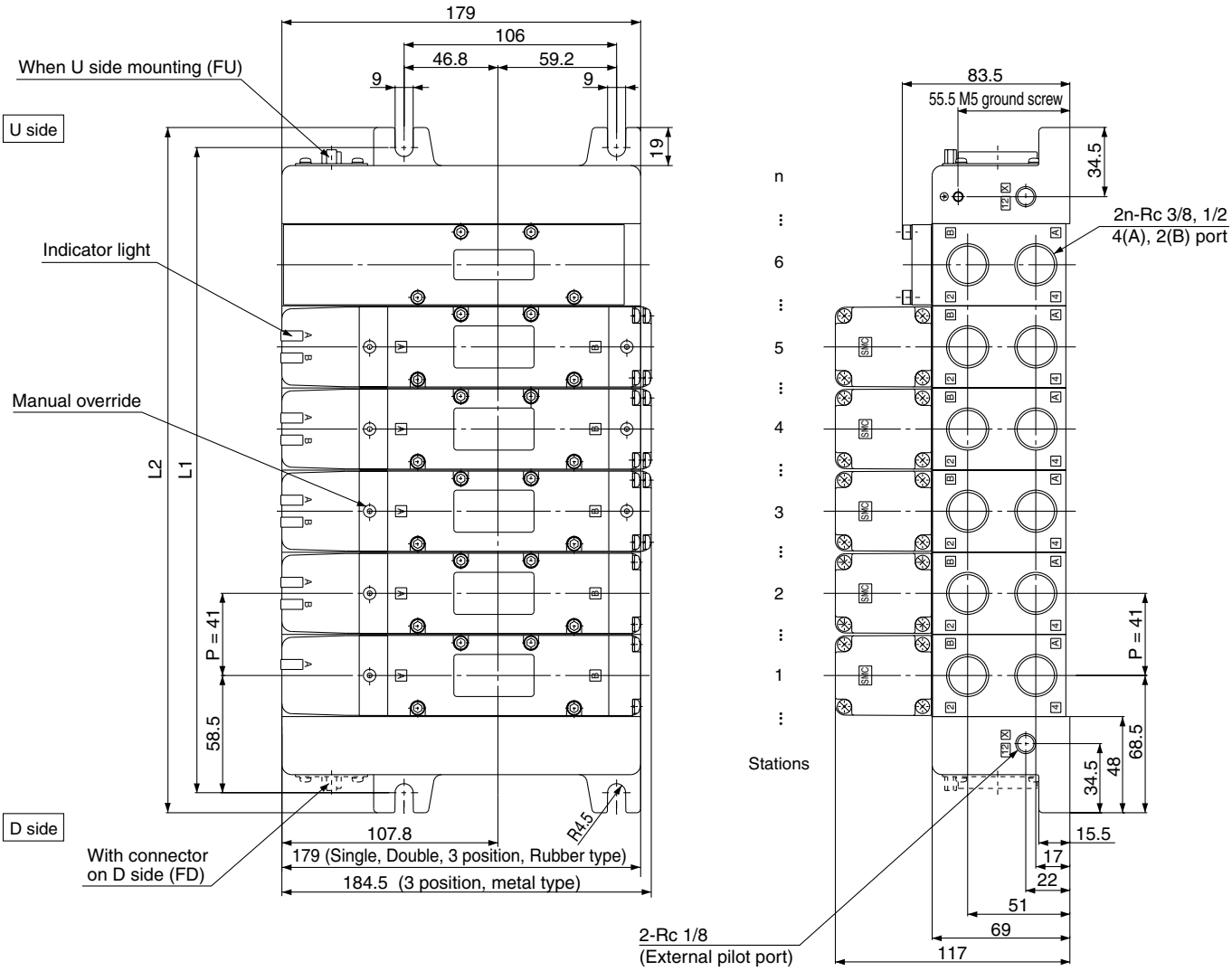
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.

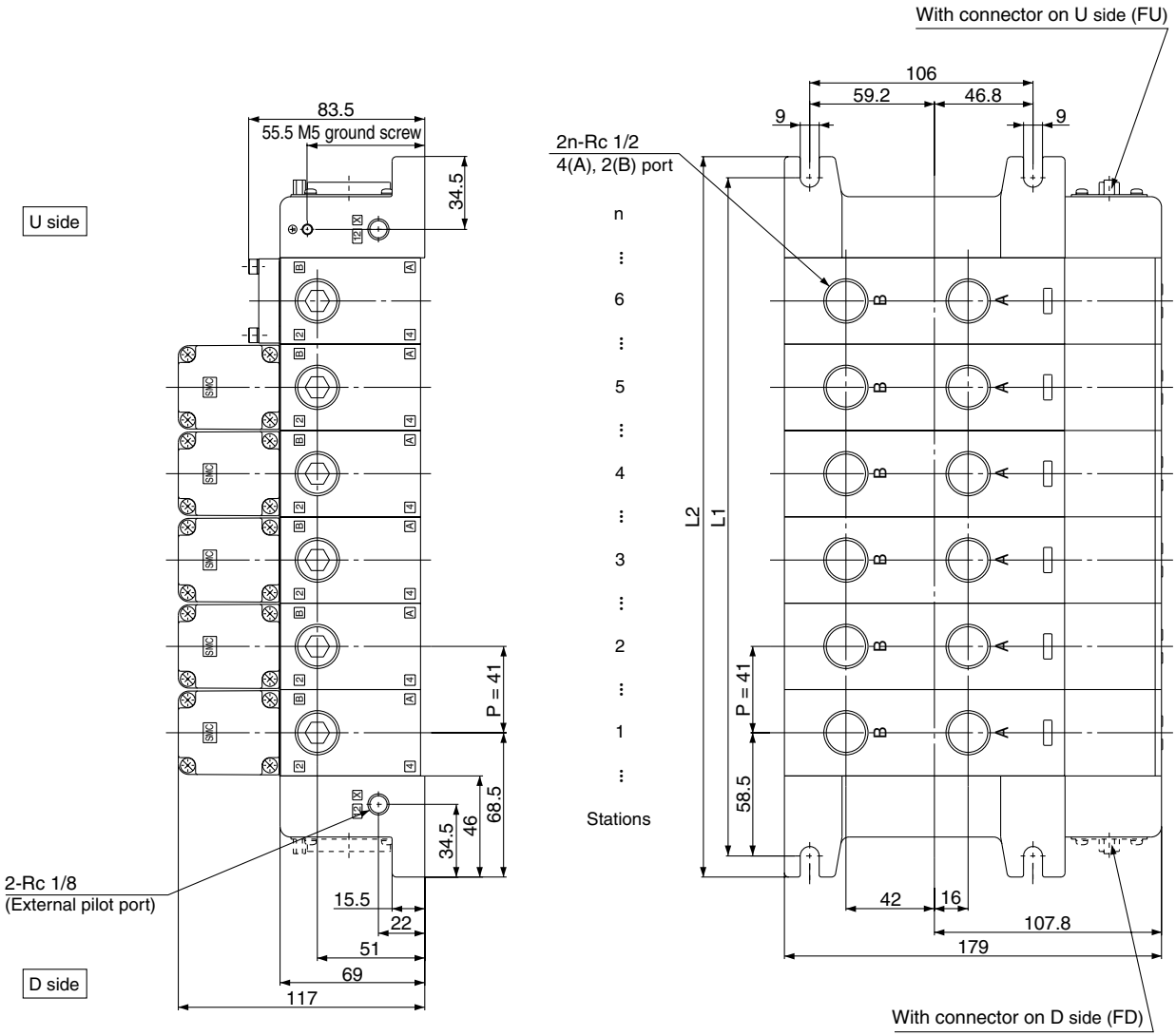


F Kit (D-sub Connector kit)





Bottom ported drawing

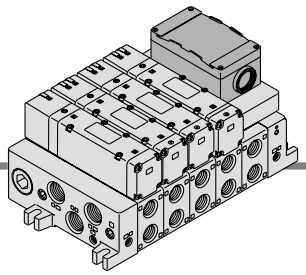


Dimensions

Formula: L1 = 41n + 76, L2 = 41n + 96
n: Stations (Maximum 12 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	117	158	199	240	281	322	363	404	445	486	527	568
L2	137	178	219	260	301	342	383	424	465	506	547	588

T Kit (Terminal block box kit)



IP65 compliant

- **Enclosure IP65 compliant**
- **This type has a small terminal block inside a junction box. The provision of a G 3/4 electrical entry allows connection of conduit fittings.**
- **Maximum stations are 11. (12 stations as an option)**
- **1 station is used for terminal block box mounting.**

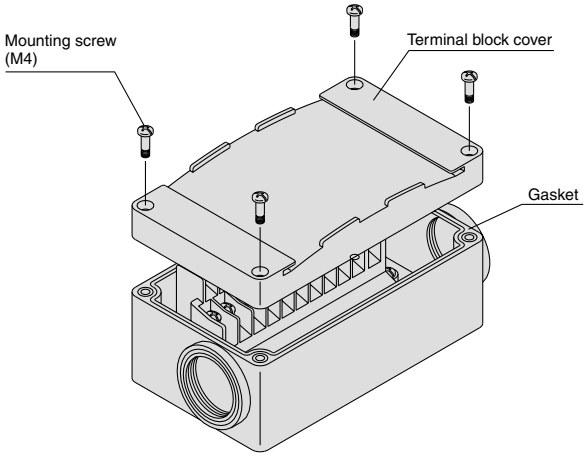
Manifold Specifications

Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P) , 5(R1) , 3(R2)	4(A) , 2(B)	
VQ5000	Side	Rc 3/4	Rc 3/8 Rc 1/2	Max. 12 stations
	Bottom		Rc 1/2	

Terminal Block Connections

Step 1. How to remove terminal block cover

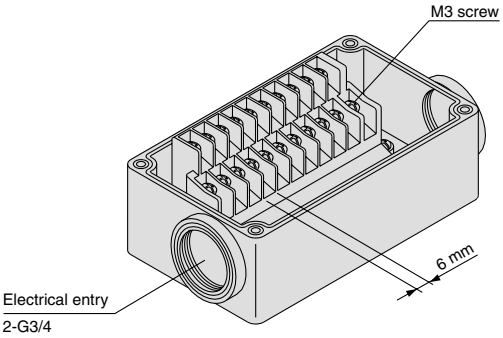
Loosen the 4 mounting screws (M4) and open the terminal block cover.



Step 2. The diagram on the right shows the terminal block wiring.

All stations are provided with double wiring regardless of the valves which are mounted.

Connect each wire to the power supply side, according to the markings provided inside the terminal block.



Step 3. How to attach the terminal block cover

Securely tighten the screws with the torque shown in the table below, after confirming that the gasket is installed correctly.

Proper tightening torque (N·m)
0.7 to 1.2

- Applicable terminal 1.25-3s, 1.25Y-3, 1.25Y-3N, 1.25Y-3.5

How to Order Manifold

VV5Q 5 1 – 08 03 T □ – K

Series

5	VQ5000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
12	12 stations

Note 1) Add 1 station for terminal block box.
Note 2) The maximum number of stations can be expanded with optional special wiring specifications. Refer to page 2-6-15 for details.

Cylinder port

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed

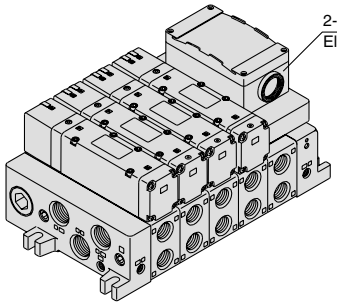
Box mounting position

D	D side mounting
U	U side mounting

Option

Symbol	Option
Nil	None
CD1 (2)	Exhaust cleaner for Rc 1: D side exhaust
CD2 (2)	Exhaust cleaner for Rc 1 1/2: D side exhaust
CU1 (2)	Exhaust cleaner for Rc 1: U side exhaust
CU2 (2)	Exhaust cleaner for Rc 1 1/2: U side exhaust
K (4)	Special wiring specification (Except double wiring)
N	Name plate
SD (2)	Direct exhaust with silencer box: D side exhaust
SU (2)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

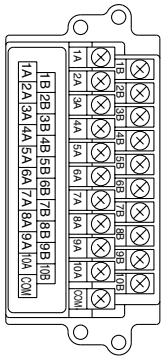
Note 1) When two or more symbols are specified, indicate them alphabetically.
Example) -CD1K.
Note 2) Combination of [C^{D}_{U}□] and [S^{D}_{U}] is not possible.
Note 3) Specify the wiring specifications on the manifold specification sheet.



Stations are counted starting from the first station on the D side.

● Electrical wiring specifications (IP65 available)

Standard wiring



Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types.
Mixed single and double wiring is available as an option.

	Terminal no.	Polarity	
1 station	SOL.A 1A	(–)	(+)
	SOL.B 1B	(–)	(+)
2 stations	SOL.A 2A	(–)	(+)
	SOL.B 2B	(–)	(+)
3 stations	SOL.A 3A	(–)	(+)
	SOL.B 3B	(–)	(+)
4 stations	SOL.A 4A	(–)	(+)
	SOL.B 4B	(–)	(+)
5 stations	SOL.A 5A	(–)	(+)
	SOL.B 5B	(–)	(+)
6 stations	SOL.A 6A	(–)	(+)
	SOL.B 6B	(–)	(+)
7 stations	SOL.A 7A	(–)	(+)
	SOL.B 7B	(–)	(+)
8 stations	SOL.A 8A	(–)	(+)
	SOL.B 8B	(–)	(+)
9 stations	SOL.A 9A	(–)	(+)
	SOL.B 9B	(–)	(+)
10 stations	SOL.A 10A	(–)	(+)
	SOL.B 10B	(–)	(+)
	COM	(+)	(–)
		Positive common	**Negative common**

Note) There is no polarity. It can also be used as a negative common.

Special Wiring Specifications

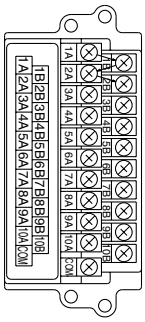
Double wiring (connected to SOL. A and SOL. B) is used for the internal wiring of each station regardless of valve and option types. The optional specification permits mixture of single and double wiring. However, the maximum number of stations is 12.

1. How to Order

Indicate option symbol ("–K") in the manifold part number and be sure to specify station positions for single or double wiring on the manifold specification sheet.

2. Wiring specifications

Connections begin with the A side solenoid of the first station being connected to terminal no. 1, and continue in the order indicated by the arrows in the drawing without skipping any terminals.



How to Order Valves

VQ 5 1 0 0 — 5

Series

5	VQ5000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC sepecifications.
Note 2) Refer to page 2-6-39 for details on external pilot specifications.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type (IP65)

How to Order Manifold Assembly

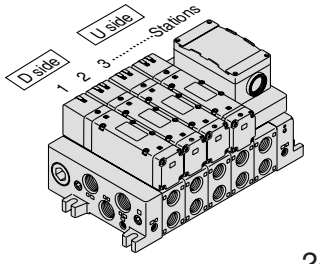
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Terminal block box kit

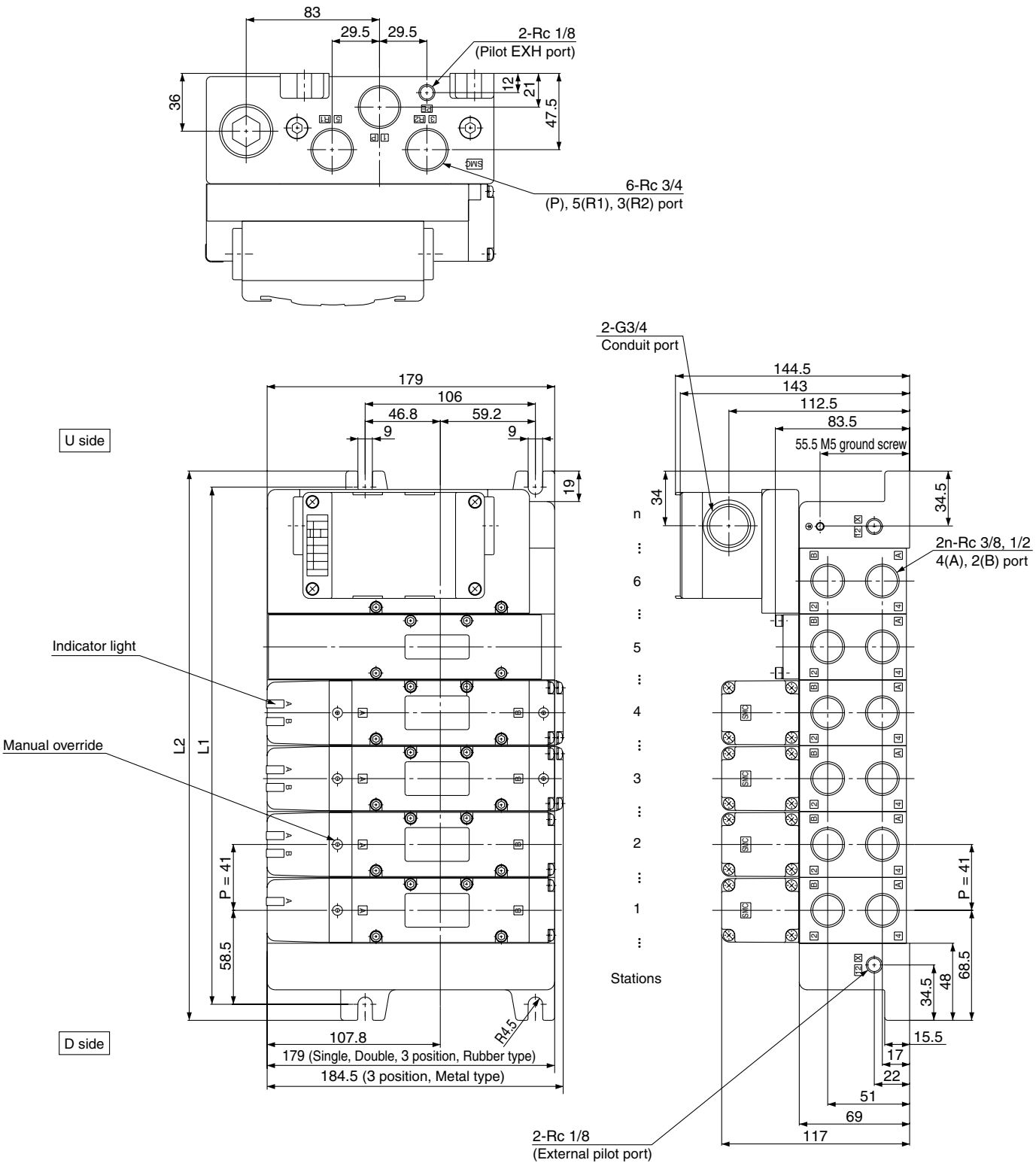
VV5Q51-0603TU ···· 1 set —Manifold base part no.
∗ VQ5100-5 ····· 2 sets—Valve part no. (Stations 1 and 2)
∗ VQ5200-5 ····· 2 sets—Valve part no. (Stations 3 and 4)
∗ VQ5300-5 ····· 1 set —Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

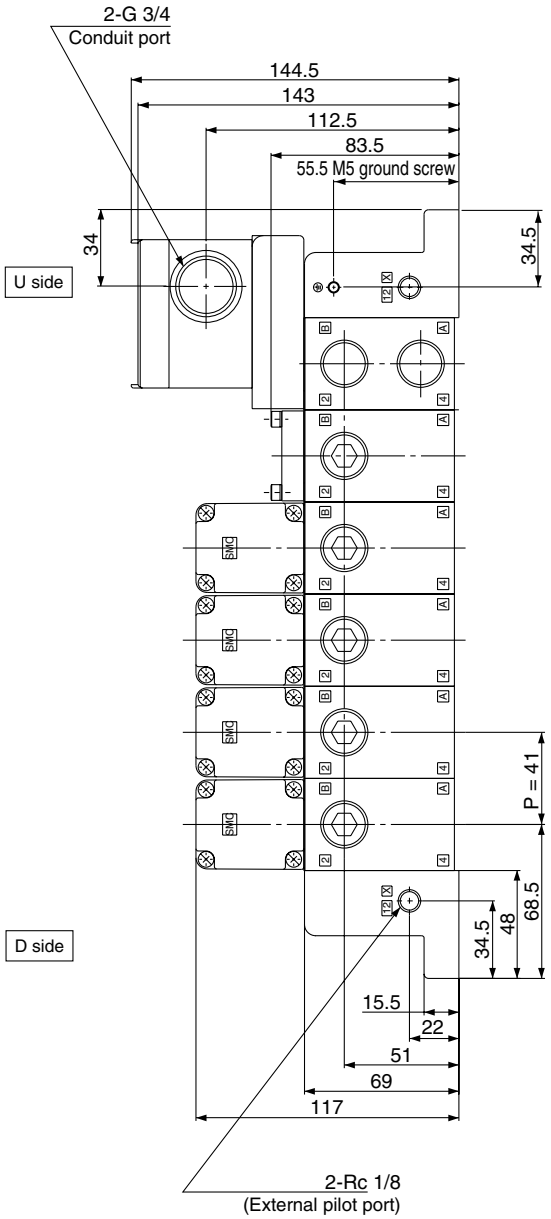
Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.

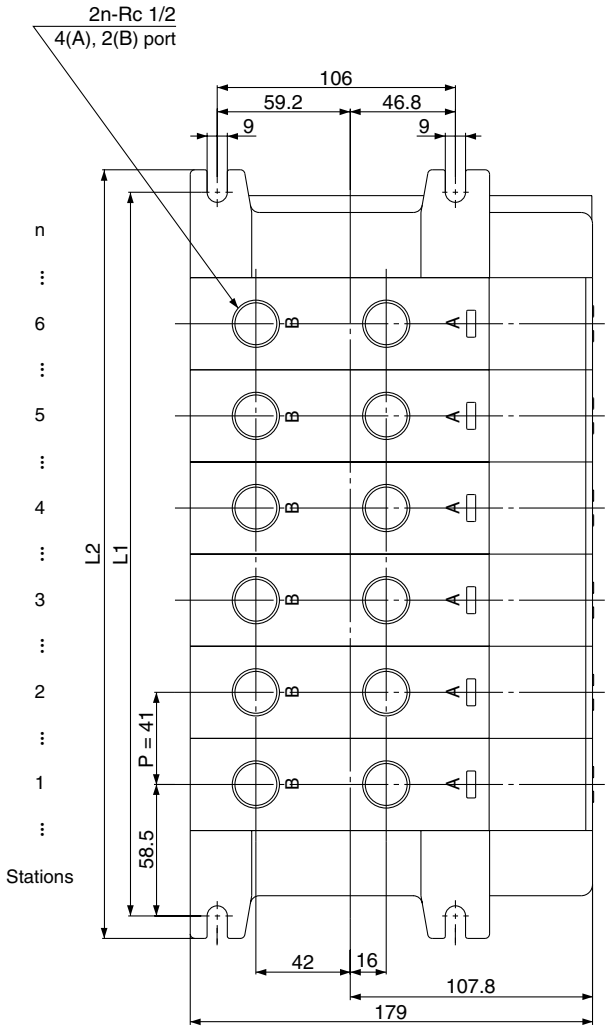


T Kit (Terminal block box kit)



Bottom ported drawing



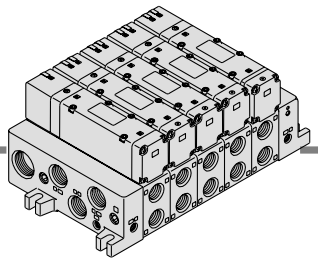


Formula: L1 = 41n + 76, L2 = 41n + 96
n: Stations (Maximum 12 stations)
∗ Including 1 station for terminal box mounting.

Dimensions

L \ n	2	3	4	5	6	7	8	9	10	11	12
L1	158	199	240	281	322	363	404	445	486	527	568
L2	178	219	260	301	342	383	424	465	506	547	588

T1 Kit (Individual terminal block kit)



- **When the junction cover on the manifold is opened, terminal box is installed in the manifold block. Lead wire from a solenoid is connected with the terminals on the terminal box in the bottom side. (The terminal box is connected with lead wire for both SOL. A and SOL. B and they correspond with the marking 1, 2, 3, 4 on the terminal box. Refer to how to connect with the terminal box.)**
- **Maximum stations are 12.**

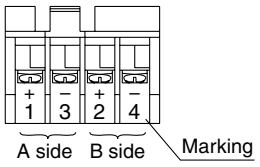
Manifold Specifications

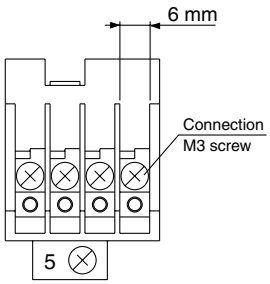
Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ5000	Side	Rc 3/4	Rc 3/8, 1/2	Max. 12 stations
	Bottom		Rc 1/2	

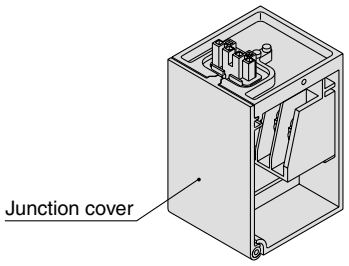
Terminal Block Connections

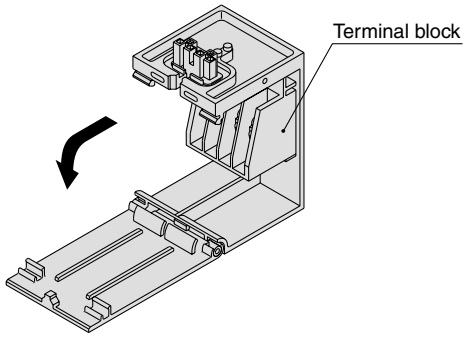
Model \ Terminal block marking	1	3	2	4
VQ510$^{0}_{1}$	A side +	A side –		
VQ520$^{0}_{1}$	A side +	A side –	B side +	B side –
VQ5$^{3}_{4}$^{5}0$^{0}_{1}$	A side +	A side –	B side +	B side –

· Compatible crimp terminals: 1.25-3S, 1.25Y-3, 1.25Y-3N, 1.25Y-3.5
· There is no polarity (+, –).









How to Order Manifold

VV5Q 5 1 – 08 03 T1 – SD

Series

5	VQ5000

Manifold

1	Plug-in unit

Stations

1	1 station
⋮	⋮
12	12 stations

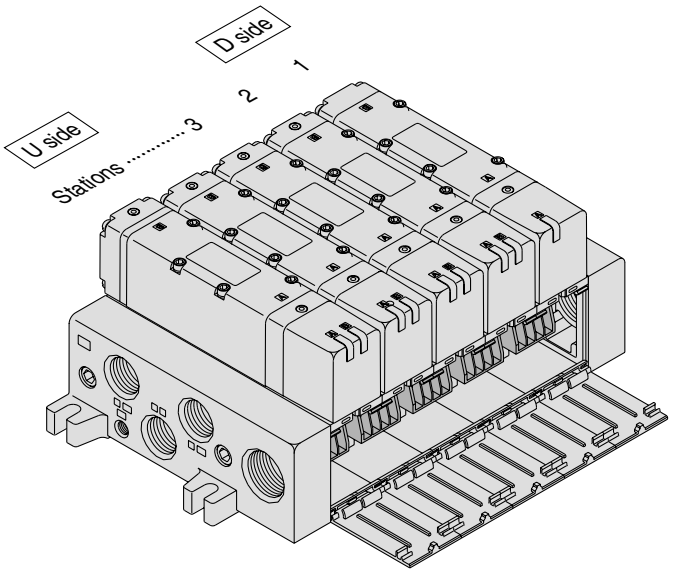
Cylinder port

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed

Option

Symbol	Option
Nil	None
CD1 Note)	Exhaust cleaner for Rc 1: D side exhaust
CD2 Note)	Exhaust cleaner for Rc 1 1/2: D side exhaust
CU1 Note)	Exhaust cleaner for Rc 1: U side exhaust
CU2 Note)	Exhaust cleaner for Rc 1 1/2: U side exhaust
SB Note)	Direct exhaust with silencer box: Exhaust from both U and D side
SD Note)	Direct exhaust with silencer box: D side exhaust
SU	Direct exhaust with silencer box: U side exhaust

Note) Combination of [C^{D}_{U}□] and [S^{D}_{U}] is not possible.



How to Order Valves

VQ 5 1 0 0 — 5

Series

5	VQ5000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specification.
Note 2) Refer to page 2-6-39 for details on external pilot specifications.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

How to Order Manifold Assembly

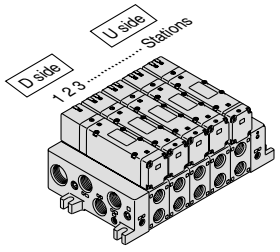
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Individual terminal block kit

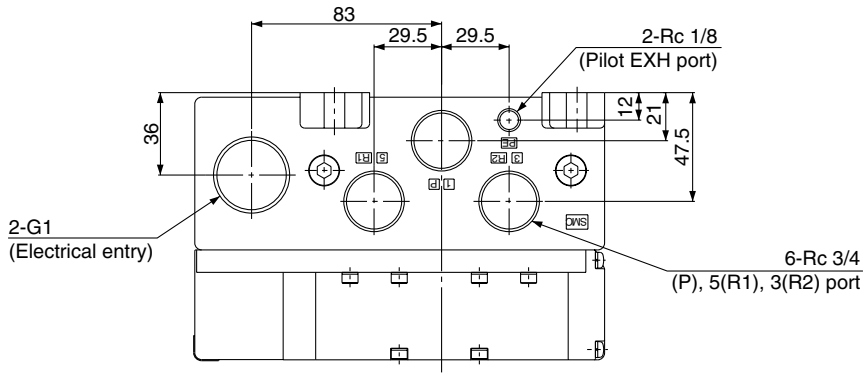
VV5Q51-0503T1··· 1 set —Manifold base part no.
∗VQ5100-5 ····· 2 sets—Valve part no. (Stations 1 and 2)
∗VQ5200-5 ····· 2 sets—Valve no. (Stations 3 and 4)
∗VQ5300-5 ····· 1 set —Valve part no. (Station 5)

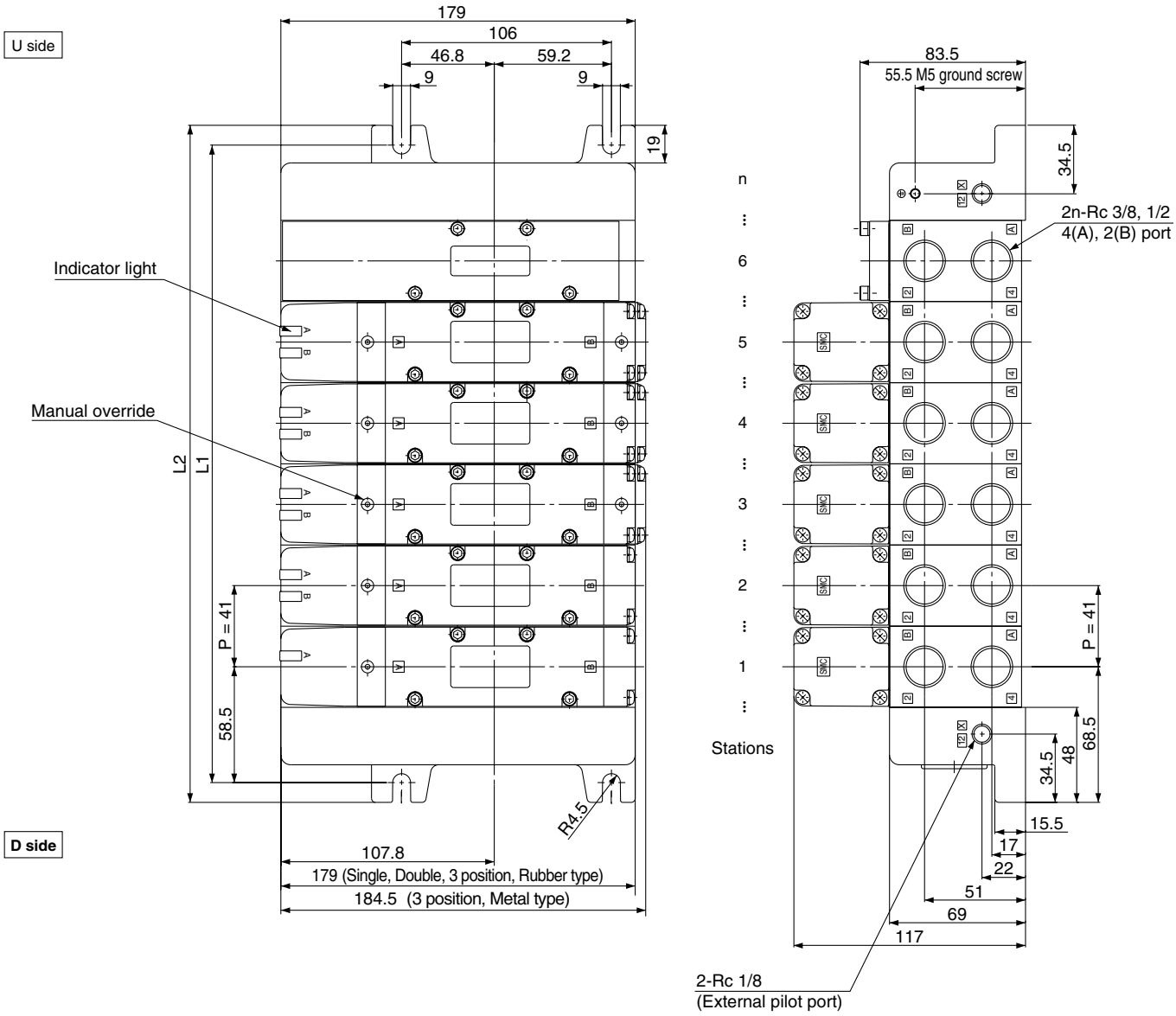
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.

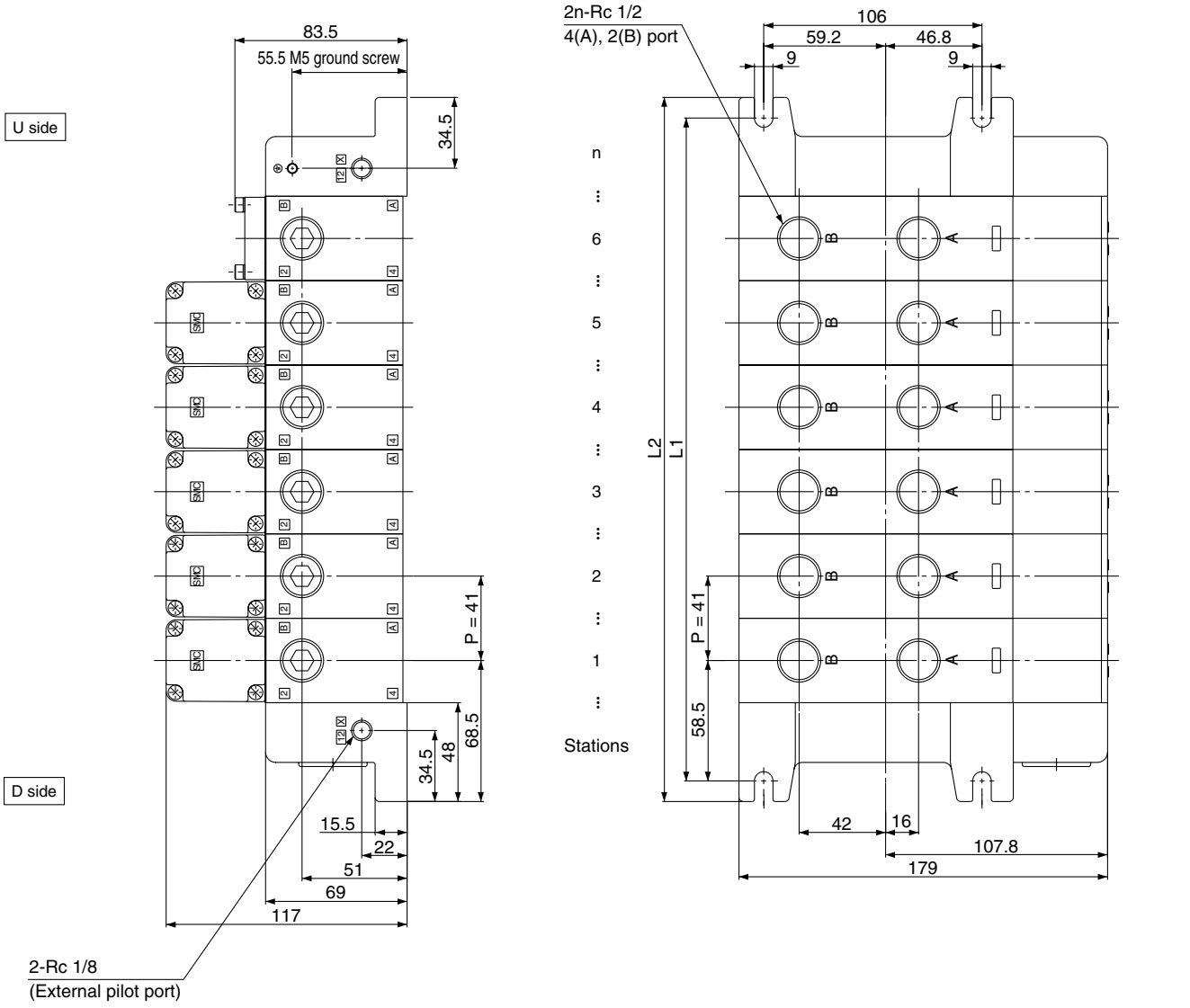


T1 Kit (Individual terminal block kit)





Bottom ported drawing



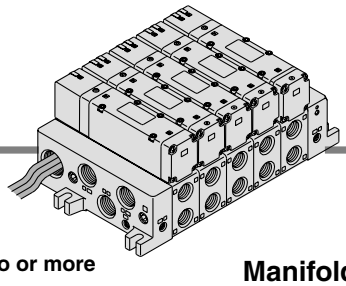
Dimensions

Formula: L1 = 41n + 76, L2 = 41n + 96
n: Stations (Maximum 12 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L1	117	158	199	240	281	322	363	404	445	486	527	568
L2	137	178	219	260	301	342	383	424	465	506	547	588

L Kit (Lead wire cable)

IP65 compliant



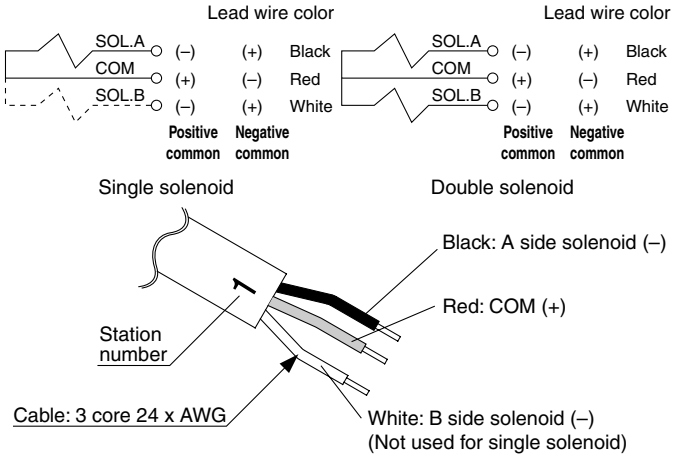
- **Enclosure IP65 compliant**
- **Direct electrical entry type available with two or more stations.**
- **Electrical entry can be selected on either the U side or the D side according to the mounting orientation.**
- **Maximum stations are 12.**

Manifold Specifications

Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ5000	Side	Rc 3/4	Rc 3/8 Rc 1/2	Max. 12 stations
	Bottom		Rc 1/2	

Wiring Specifications

Three lead wires are attached to each station regardless of the type of valve which is mounted.
The red wire is for COM connection.



Lead Wire Assembly with Connector

Lead wire length	Part no.
0.6 m	VVQ5000-44A-8-□
1.5 m	VVQ5000-44A-15-□
3 m	VVQ5000-44A-30-□

□: Number of stations 1 to 12

For different lead wire lengths, order a lead wire assembly with connector shown in the table on the right.
Note) There is no polarity. It can also be used as a negative common.

How to Order Manifold

VV5Q 5 1 – 08 03 L U □ – □

Series

5	VQ5000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
12	12 stations

Cylinder port

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed

Electrical entry

D	D side entry
U	U side entry

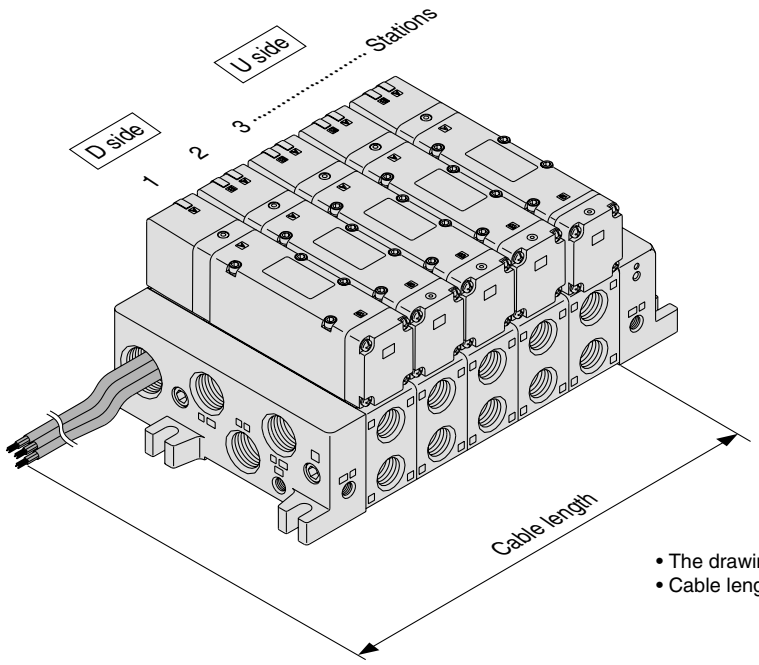
Cable (Length)

0	Cable length 0.6 m
1	Cable length 1.5 m
2	Cable length 3 m

Option

Symbol	Option
Nil	None
CD1 Note)	Exhaust cleaner for Rc 1: D side exhaust
CD2 Note)	Exhaust cleaner for Rc 1 1/2: D side exhaust
CU1 Note)	Exhaust cleaner for Rc 1: U side exhaust
CU2 Note)	Exhaust cleaner for Rc 1 1/2: U side exhaust
SB	Direct exhaust with silencer box: Exhaust from both U and D sides
SD Note)	Direct exhaust with silencer box: D side exhaust
SU Note)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

Note) Combination of [C^{D}_{U}□] and [S^{D}_{U}] is not possible.



- The drawing shows the electrical entry on the D side.
- Cable length is measured from the solenoid valve body.

How to Order Valves

VQ 5 1 0 0 — 5

Series

5	VQ5000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specification.
Note 2) Refer to page 2-6-39 for details on external pilot specifications.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	110 VAC (50/60 Hz)
4	220 VAC (50/60 Hz)
5	24 VDC
6	12 VDC

Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type(IP65)

How to Order Manifold Assembly

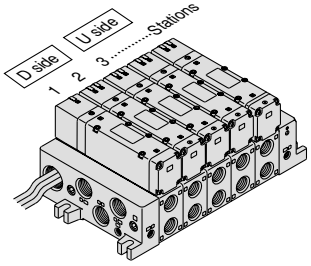
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Lead wire kit with cable (3 m)

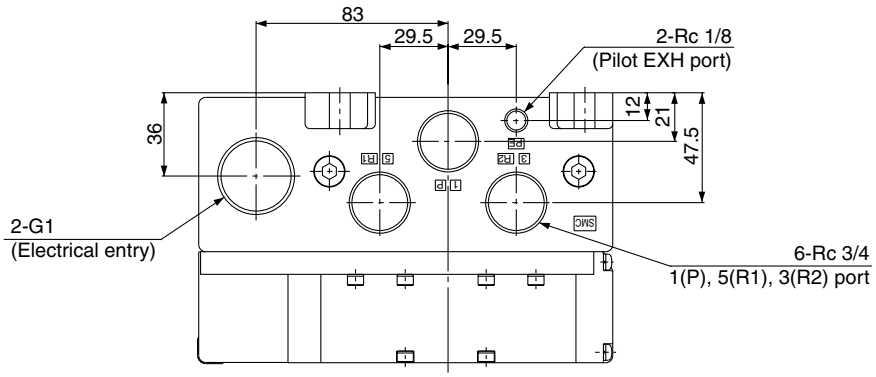
VV5Q51-0503LD2 ···1 set—Manifold base part no.
∗VQ5100-5 ·····2sets—Valve part no. (Stations 1 and 2)
∗VQ5200-5 ·····2 sets—Valve part no. (Stations 3 and 4)
∗VQ5300-5 ·····1 set—Valve part no. (Station 5)

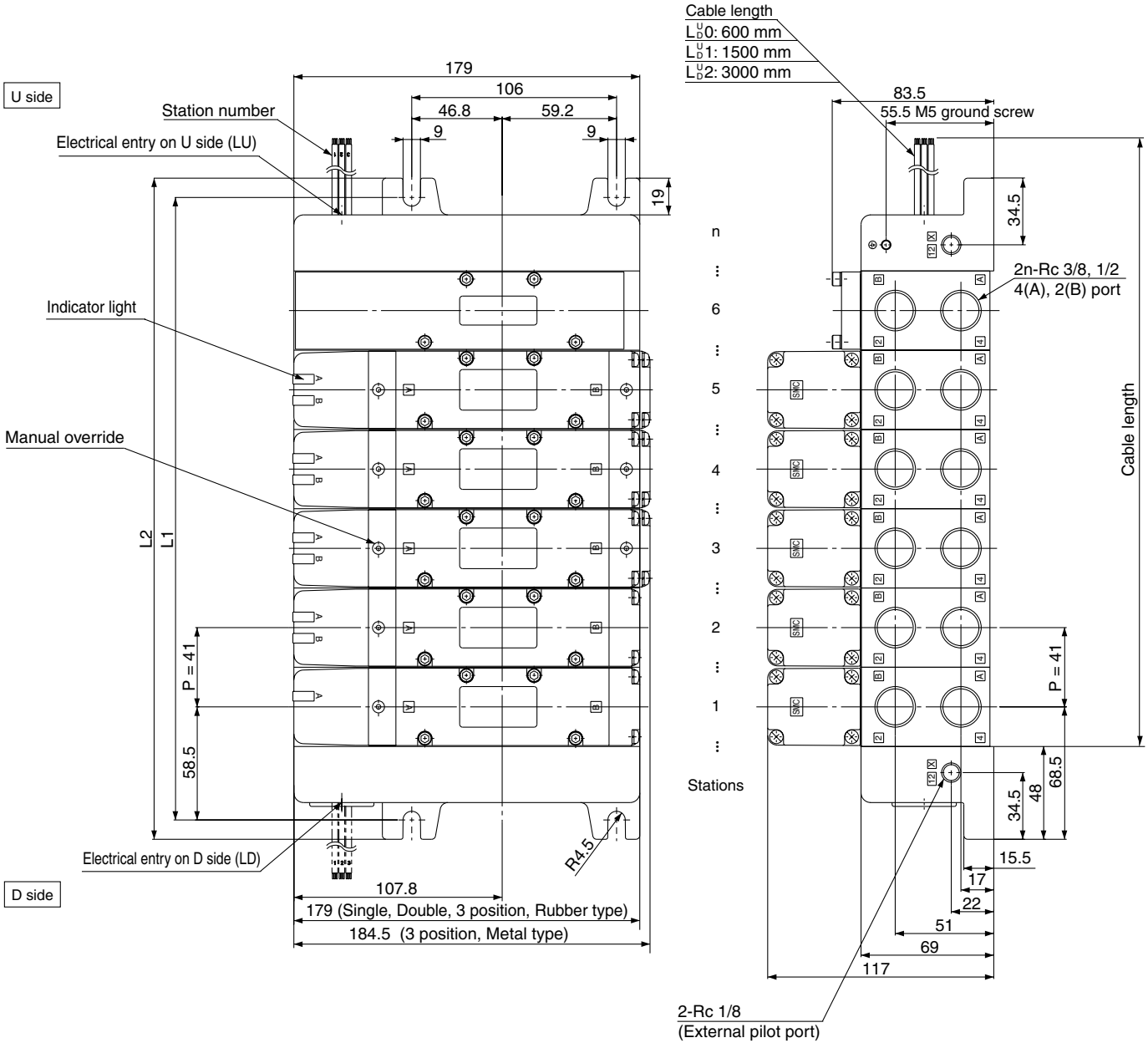
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.

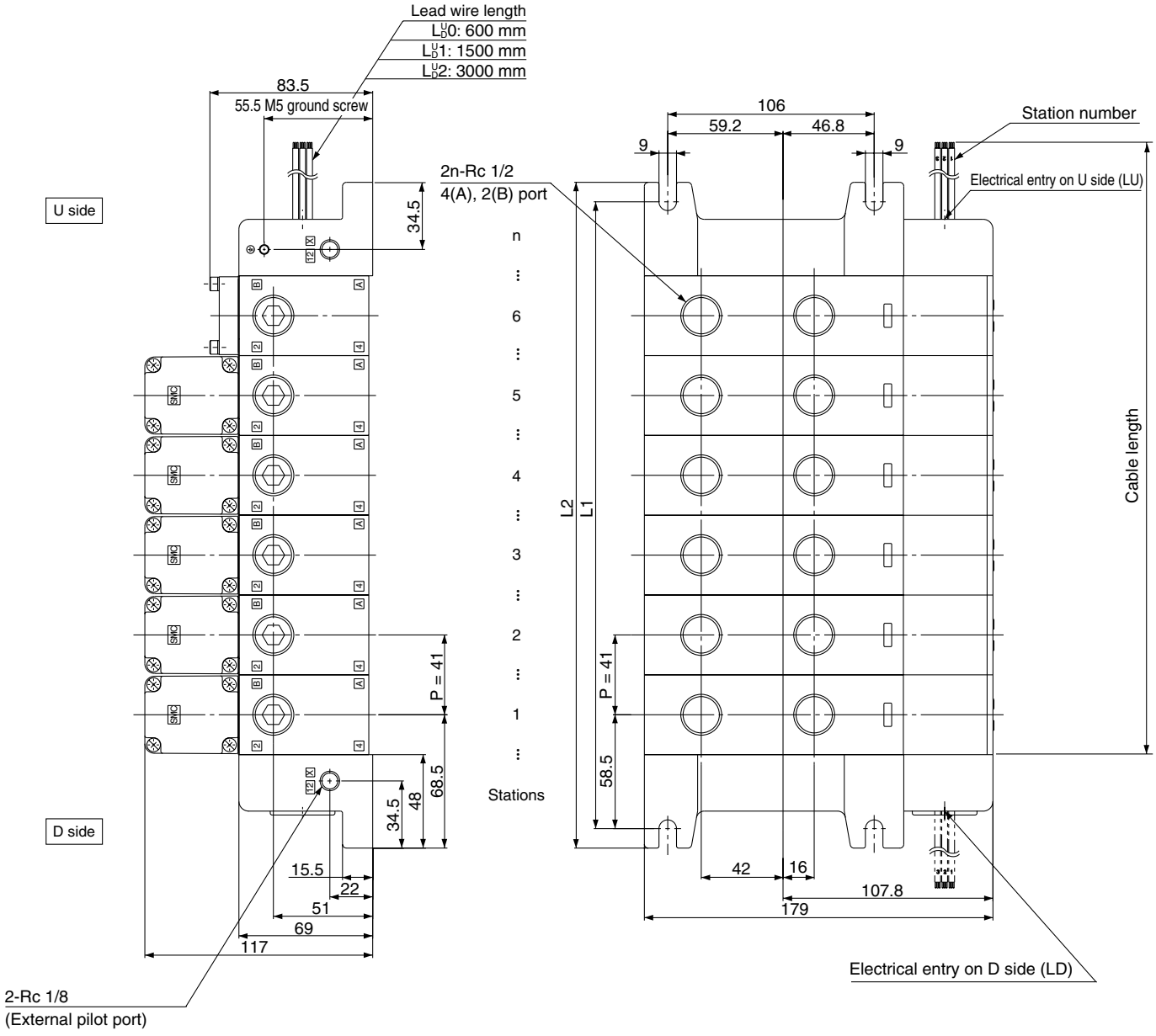


L Kit (Lead wire cable)





Bottom ported drawing



Dimensions

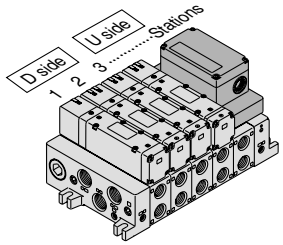
Formula: $L_1 = 41n + 76$, $L_2 = 41n + 96$
n: Stations (Maximum 12 stations)

L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L_1	117	158	199	240	281	322	363	404	445	486	527	568
L_2	137	178	219	260	301	342	383	424	465	506	547	588

S Kit (Serial transmission unit)

IP65 compliant

- **The serial transmission system reduces wiring work, while minimizing wiring and saving space.**
- **The system is available in types such as the type SA for equipment with a maximum of 32 input/output points (a general purpose type for small scale systems), the type SB capable of controlling up to 512 points of input/output (Mitsubishi Electric compatible), the type SC (OMRON compatible), the type SD (SHARP compatible, 504 points max.), the type SF (NKE compatible, 128 points max.), the type SJ (SUNX compatible), the type SK (Fuji Electric compatible), the type SQ (OMRON Compo Bus/D compatible), and the type SR (OMRON Compo Bus/S compatible).**
- **Maximum 9 stations (12 stations available as an option. Indicate 10 to 12 stations on the manifold specification sheet.)**
- **One station is used for serial unit mounting.**



- **Stations are counted from station 1 on the D side.**
- **Double wiring (connected to SOL. A and SOL. B) is adopted for the internal wiring of each station, regardless of valve and option types. Mixed single and double wiring is available as an option.**

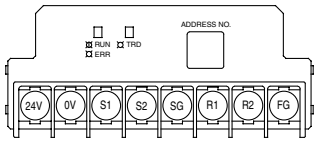
Item	Specifications
External power supply	24 VDC +10%, –5%
Current consumption (Internal unit)	SA, SB, SBB, SD, SF, SJ, SK, SQ, SR, SV: 0.1A SC: 0.3A

Manifold Specifications

Series	Porting specifications			Applicable stations
	4(A), 2(B) port location	Port size		
		1(P), 5(R1), 3(R2)	4(A), 2(B)	
VQ5000	Side	Rc 3/4	Rc 3/8 Rc 1/2	Max. 9 stations
	Bottom		Rc 1/2	

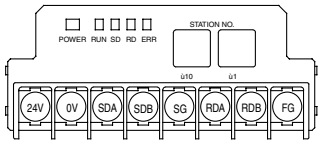
Name of terminal block (LED)

Type SA
With general type SI unit (Series EX300)



LED	Description
TRD	Lighting during data reception
RUN/ERR	Blinking when received data is normal; Lighting when data reception

Type SB
Mitsubishi Electric Corporation MELSECNET/MINI-S3 Data Link System



LED	Description
POWER	Lighting when power is turned ON
RUN	Lighting when data transmission with the master station is normal
RD	Lighting during data reception
SD	Lighting during data transmission
ERR.	Lighting when reception data error occurs. Light turns off when the error is corrected.

Note

- T unit
  Can be connected with PLC I/O card for serial transmission.
  EX300-TMB1····· For models of Mitsubishi Electric Corporation
  EX300-TTA1····· For OMRON
  EX300-TFU1····· For Fuji Electric
  EX300-T001····· General purpose
  ∗ T units have 32 control points per unit
- No. of output points, 16 points

- Master station
  PLC made by Mitsubishi Electric Corporation
  Series MELSEC-A
  AJ71PT32-S3, AJ71T32-S3
  A1SJ71PT32-S3
  ∗Max. 64 stations, connected to remote I/O stations (Max. 512 points).
- No. of output points, 16 points. No. of sta. occupied, 2 stations

∗ For details on specifications and handling, refer to the separate technical instruction manual.

How to Order Manifold

VV5Q 5 1 – 08 03 S U Q – ☐

Series

5	VQ5000

Manifold

1	Plug-in unit

Stations

02	2 stations
⋮	⋮
12	12 stations

Note) Add 1 station for serial unit mounting.

Cylinder port

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed

Model

O	Without SI unit
A	With general type SI unit (Series EX300)
B	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System
BB	Mitsubishi Electric Corp.: MELSECNET/MINI-S3 Data Link System (2 power supply systems)
C	OMRON Corp.: SYSBUS Wire System
D	SHARP Corp.: Satellite I/O Link System
F1	NKE Corp.: Uni-wire System (16 output points)
J1	SUNX Corp.: S-LINK System (16 output points)
J2	SUNX Corp.: S-LINK System (8 output points)
K	Fuji Electric Co.: T-LINK Mini System
Q	DeviceNet, CompoBus/D (OMRON Corp.)
R1	OMRON Corp.: CompoBus/S System (16 output points)
R2	OMRON Corp.: CompoBus/S System (8 output points)
U	JEMANET (JPCN-1)
V	Mitsubishi Electric Corp.: CC-LINK System
G	Rockwell Automation: Allen Bradley Remote I/O (RIO) System
H	NKE Corp.: Uni-wire H System

SI unit mounting position

D	D side mounting
U	U side mounting

Option

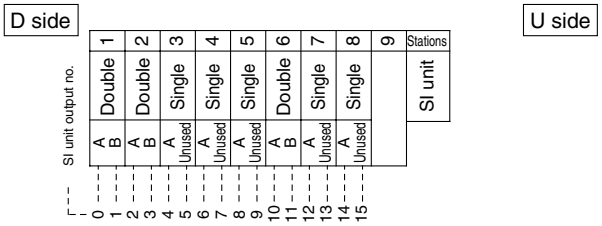
Symbol	Option
Nil	None
CD1 (2)	Exhaust cleaner for Rc 1: D side exhaust
CD2 (2)	Exhaust cleaner for Rc 11/2: D side exhaust
CU1 (2)	Exhaust cleaner for Rc 1: U side exhaust
CU2 (2)	Exhaust cleaner for Rc 11/2: U side exhaust
K (3)	Special wiring specifications (Except double wiring)
SD (2)	Direct exhaust with silencer box: D side exhaust
SU (2)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

Note 1) When two or more symbols are specified, indicate them alphabetically. Example) -CD1K.
Note 2) Combination of [C^{D}_{U}□] and [S^{D}_{U}] is not possible.
Note 3) Specify the wiring specifications on the manifold specification sheet.

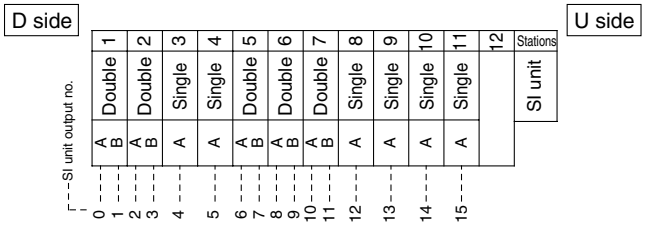
● **Correspondence of SI unit output numbers and solenoid valve coils**

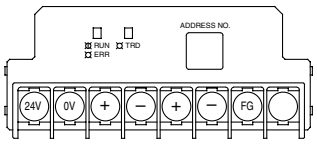
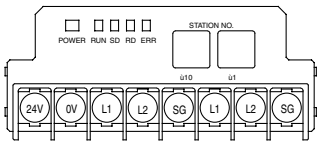
Mixed wiring is available as an option.
Use the manifold specification sheet to specify.

<Wiring example 1> Double wiring (Standard)



<Wiring example 2> Single/Double mixed wiring (Option)



	Type SC OMRON Corporation SYSBUS Wire System	Type SD SHARP Corporation Satellite I/O Link System
Name of terminal block (LED)		
	LED / Description RUN: Lights when transmission is normal and PLC is in operation mode T/R ERR: Blinks during data transmission/reception ON when transmission is abnormal.	LED / Description POWER: ON when power supply is ON RUN: Lights when power is ON and slave stations are operating normally ERROR: Lights when slave station switch setting is abnormal, communication is abnormal, PLC stopped and defective slave unit R.SET HOLD: ON for master unit control input
Note	• Master station unit OMRON PLC SYSMAC C(CV) series Types C500-RM201 and C200H-RM201 ∗32 units max., transmission terminal connection (512 points max.) • No. of output points, 16 points	• Master station unit SKARP Corporation PLC New Satellite Series W ZW-31LM New Satellite Series JW JW-23LM, JW-31LM ∗Max. 31 units, I/O slave stations connected (504 points max.) • No. of output points, 16 points

How to Order Valves

VQ 5 1 0 0 — 5

Series

5	VQ5000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y (1)	Low wattage type (0.5 W)
R (2)	External pilot

Note 1) Applicable to DC specification.
Note 2) Refer to page 2-6-39 for details on external pilot specifications.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Manual override

Nil	Non-locking push type (Tool required)
B	Locking type (Tool required)

Coil voltage

5	24 VDC

Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type (IP65)

How to Order Manifold Assembly

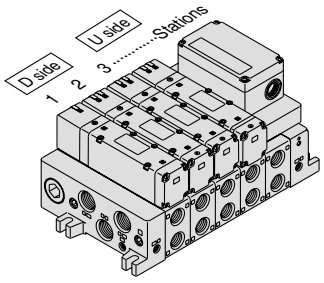
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Serial transmission unit

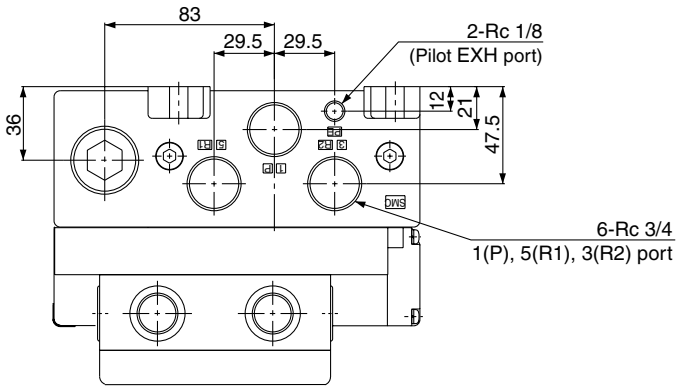
VV5Q51-0603SUA ··· 1 set —Manifold base part no.
∗VQ5100-5 ····· 2 sets —Valve part no. (Stations 1 and 2)
∗VQ5200-5 ····· 2 sets —Valve part no. (Stations 3 and 4)
∗VQ5300-5 ····· 1 set —Valve part no. (Station 5)

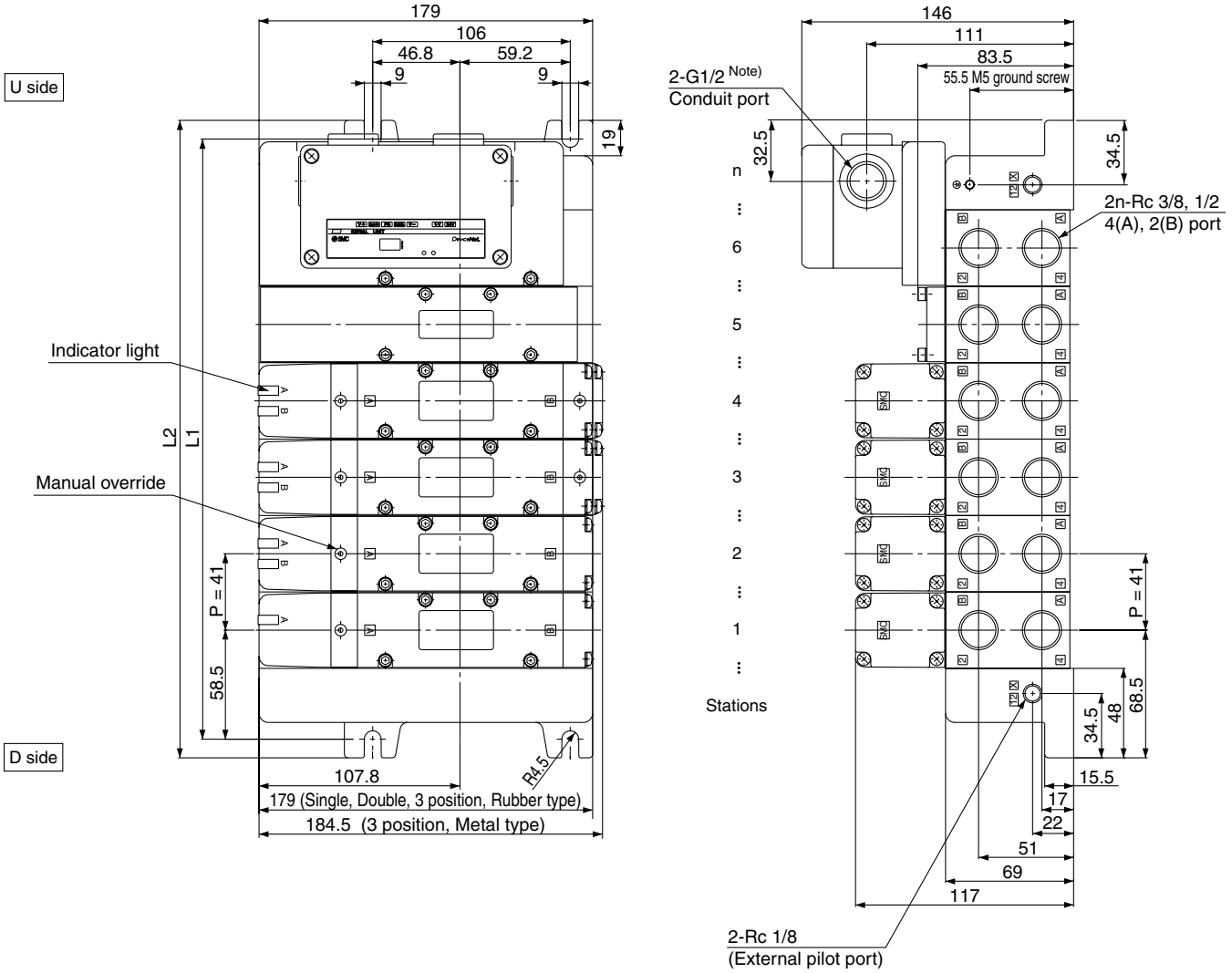
Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side. When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



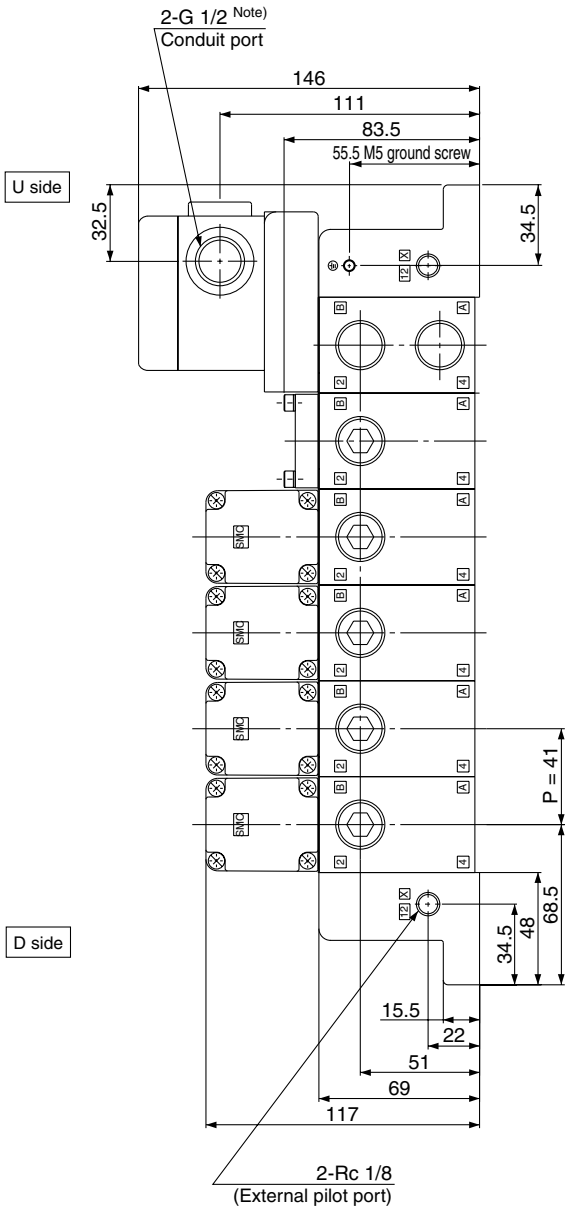
S Kit (Serial transmission unit)

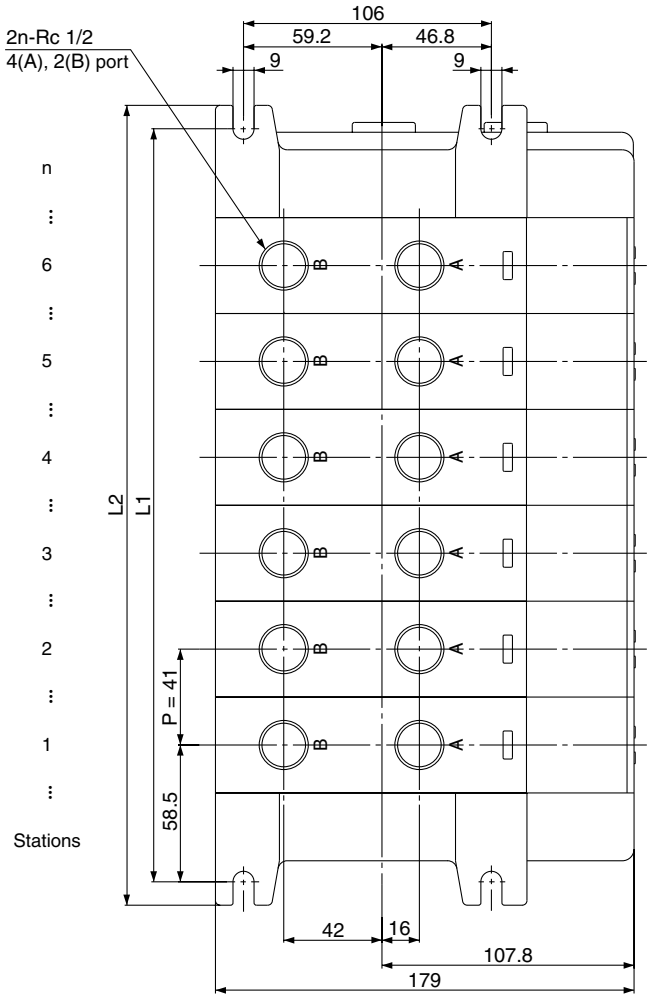




Note) In the case of two power supply systems (separate SI unit and solenoid drive power supplies), there are conduit ports (G 1/2) in four locations.
Other models have conduit ports in two locations.

Bottom port drawing





Formula: L1 = 41n + 76, L2 = 41n + 96
n: Stations (Maxium 12 stations)
∗ Including 1 station for SI unit box mounting

Dimensions

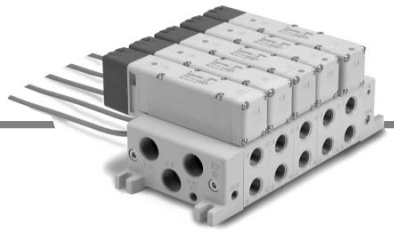
L \ n	2	3	4	5	6	7	8	9	10	11	12
L1	158	199	240	281	322	363	404	445	486	527	568
L2	178	219	260	301	342	383	424	465	506	547	588

CAD

Series VQ5000

Base Mounted

Plug Lead Unit: C Kit (Connector Kit)



How to Order Manifold

VV5Q 5 5 – 08 03 C – W

Series

5	VQ5000

Manifold

5	Plug lead unit

Stations

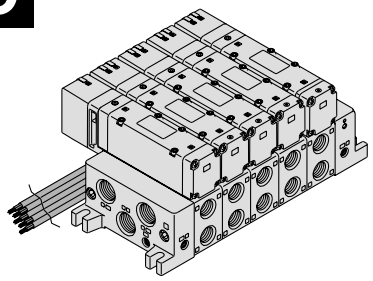
01	1 station
⋮	⋮
12	12 stations

Cylinder port

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2
CM	Mixed

Kit type

C kit (Connector)



C	Connector kit	Max. 12 stations

Option

Symbol	Option
Nil	None
CD1 Note)	Exhaust cleaner for Rc 1: D side exhaust
CD2 Note)	Exhaust cleaner for Rc 1 1/2: D side exhaust
CU1 Note)	Exhaust cleaner for Rc 1: U side exhaust
CU2 Note)	Exhaust cleaner for Rc 1 1/2: U side exhaust
SB	Direct exhaust with silencer box: Exhaust from both U and D sides
SD Note)	Direct exhaust with silencer box: D side exhaust
SU Note)	Direct exhaust with silencer box: U side exhaust
W	IP65 enclosure

Note) Combination of [C^{U}_{D}□] and [S^{U}_{D}] is not possible.

Refer to page 2-6-2 (Grommet style) for wiring specifications.

How to Order Valves

VQ 5 1 5 0 □ – 5 G □ □ □

Series

5	VQ5000

Type of actuation

1	2 position single
2	2 position double
3	3 position closed center
4	3 position exhaust center
5	3 position pressure center
6	3 position double check

Seal

0	Metal seal
1	Rubber seal

Function

Nil	Standard type (1 W)
Y(1)	Low wattage type (0.5 W)
R(2)	External pilot

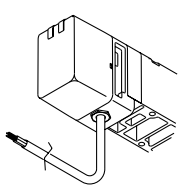
Note 1) Applicable to DC specification.
Note 2) Refer to page 2-6-39 for details on external pilot specifications.
Note 3) When two or more symbols are specified, indicate them alphabetically.

Coil voltage

1	100 VAC (50/60 Hz)	4	220 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)	5	24 VDC
3	110 VAC (50/60 Hz)	6	12 VDC

Electrical entry

Grommet	G	Lead wire length 0.6 m
	H	Lead wire length 1.5 m

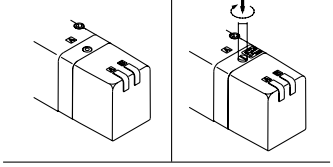


Light/Surge voltage suppressor

Nil	Yes
E	Without light, with surge voltage suppressor

Manual override

Nil:	B:
Non-locking push type (Tool required)	Locking type (Tool required)



Enclosure

Nil	Dusttight
W	Dusttight/Low jetproof type (IP65)

How to Order Manifold Assembly

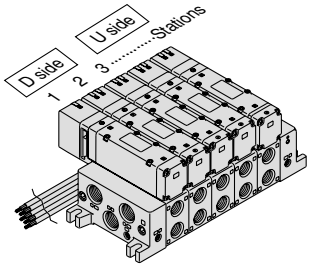
Specify the part numbers for valves and options together beneath the manifold base part number.

<Example>
Connector kit

W5Q55-05042C-z-1 set —Manifold base part no.
* VQ5150-5G ····· 2 sets—Valve part no. (Stations 1 and 2)
* VQ5250-5G ····· 2 sets— Valve part no. (Stations 3 and 4)
* VQ5350-5G ····· 1 set — Valve part no. (Station 5)

Prefix the asterisk to the part nos. of the solenoid valve, etc.

Enter in order starting from the first station on the D side.
When entry of part numbers becomes complicated, indicate in the manifold specification sheet.



SMC

Manifold Specifications

Series	Base model	Type of connection	Porting specifications			Maximum applicable stations	Applicable solenoid valve	5 station weight (kg)
			4(A), 2(B) port location	Port size Note)				
				1(P), 5(R1), 3(R2)	4(A), 2(B)			
VQ5000	**VV5Q55-□□□**	■ C kit–Grommet	Side	Rc 3/4 Option Direct exhaust with silencer box	Rc 3/8 Rc 1/2	2 to 12 stations	VQ5□50 VQ5□51	3.7 • Except solenoid valve weight
			Bottom		Rc 1/2			

Note) For details about international standard threads other than Rc threads, refer to "Option" on page 2-6-39.

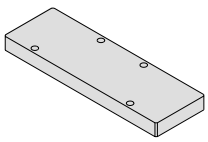
Flow Characteristics at the Number of Manifold Stations (Operated individually)

Model	Passage/Stations		Station 1	Station 5	Station 10
2 position metal seal **VQ5$^{1}_{2}$00**	1 → 4/2 (P → A/B)	C [dm³/(s·bar)]	11	11	11
		b	0.24	0.24	0.24
		Cv	2.7	2.7	2.7
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	12	12	12
		b	0.14	0.14	0.14
		Cv	2.9	2.9	2.9
2 position rubber seal **VQ5$^{1}_{2}$01**	1 → 4/2 (→ RA/B)	C [dm³/(s·bar)]	12	12	12
		b	0.33	0.33	0.33
		Cv	3.4	3.4	3.4
	4/2 → 5/3 (A/B → EA/EB)	C [dm³/(s·bar)]	16	16	16
		b	0.33	0.33	0.33
		Cv	4.4	4.4	4.4

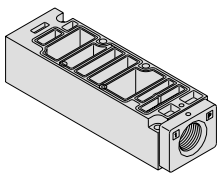
Note) For port size Rc 1/2

Manifold Option

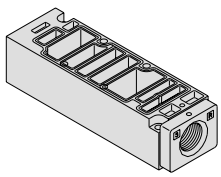
Blanking plate assembly
VVQ5000-10A-5



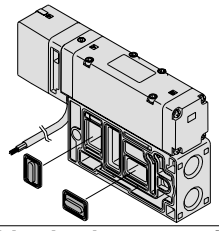
Individual SUP spacer
VVQ5000-P-5-$^{03}_{04}$



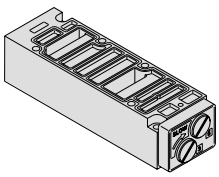
Individual EXH spacer
VVQ5000-R-5-$^{03}_{04}$



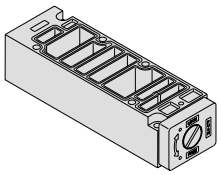
EXH block plate
VVQ5000-16A-2



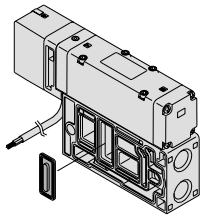
Throttle valve spacer
VVQ5000-20A-5



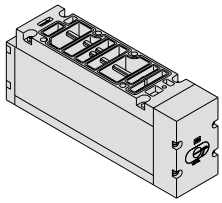
SUP stop valve spacer
VVQ5000-37A-5



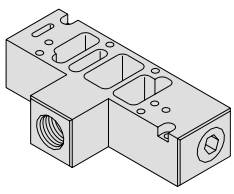
SUP block plate
VVQ5000-16A-1



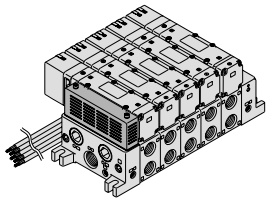
Double check spacer with residual pressure release valve
VVQ5000-25A-5



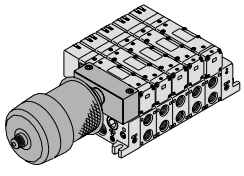
Release valve spacer
VVQ5000-24A-5D



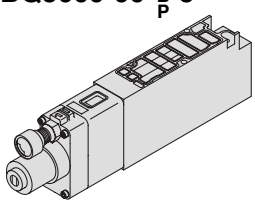
Direct exhaust with silencerbox
[-S$^{D}_{U}$]



For exhaust cleaner mounting
[-C$^{D}_{U}$□]

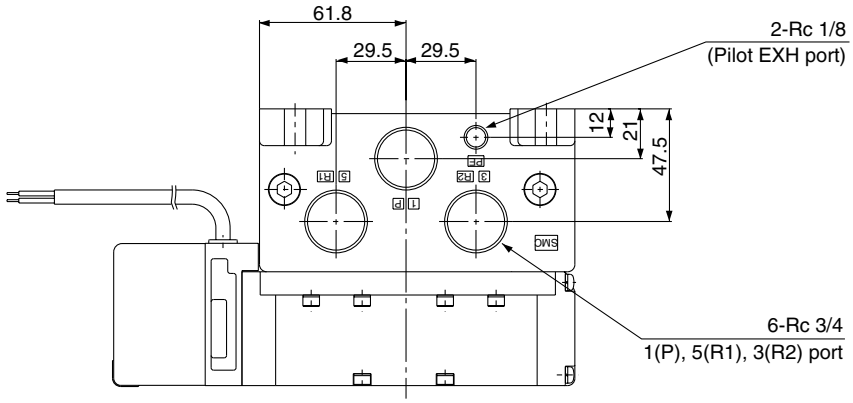


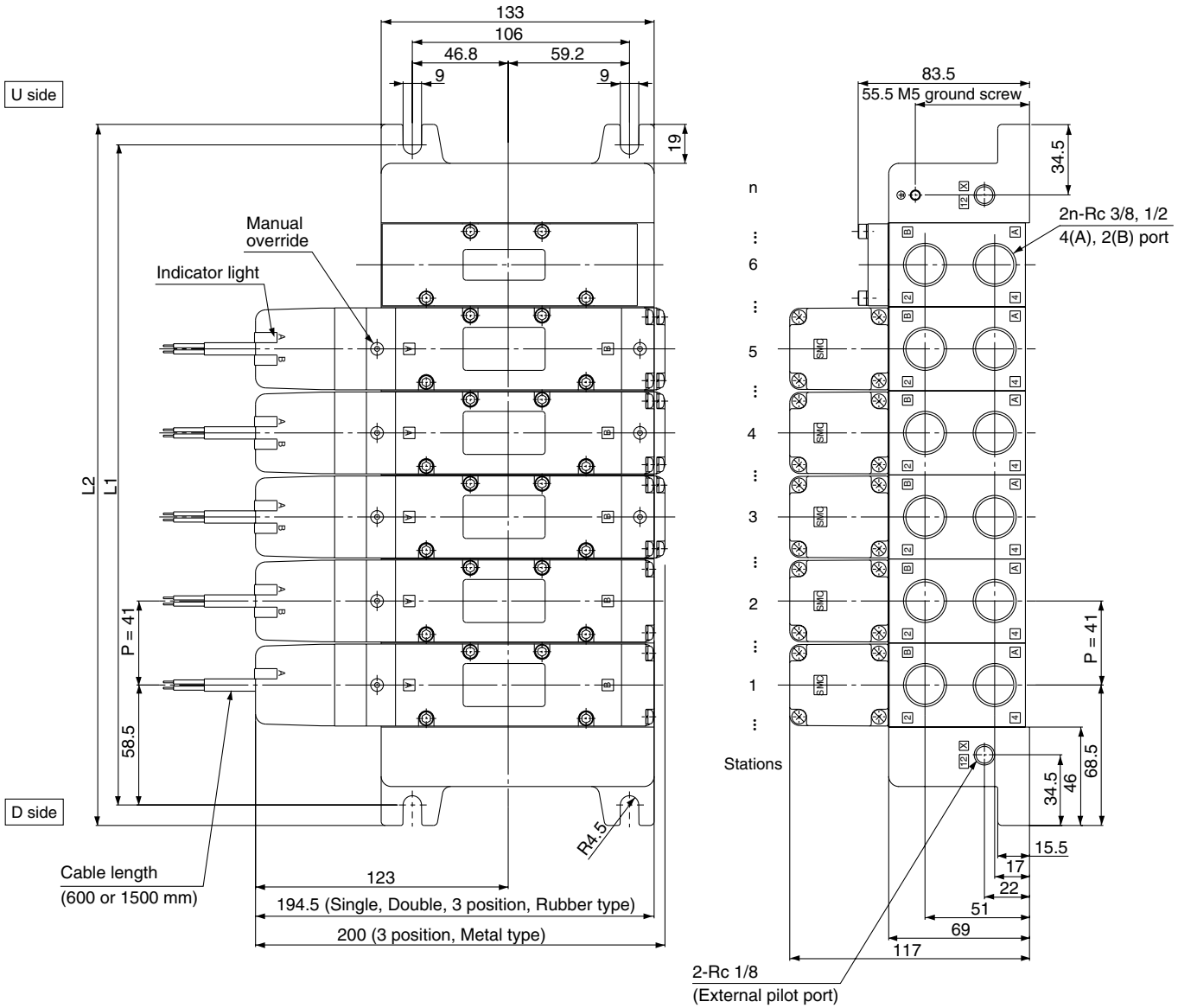
Interface regulator
ARBQ5000-00-$^{A}_{B}$$^{}_{P}$-5



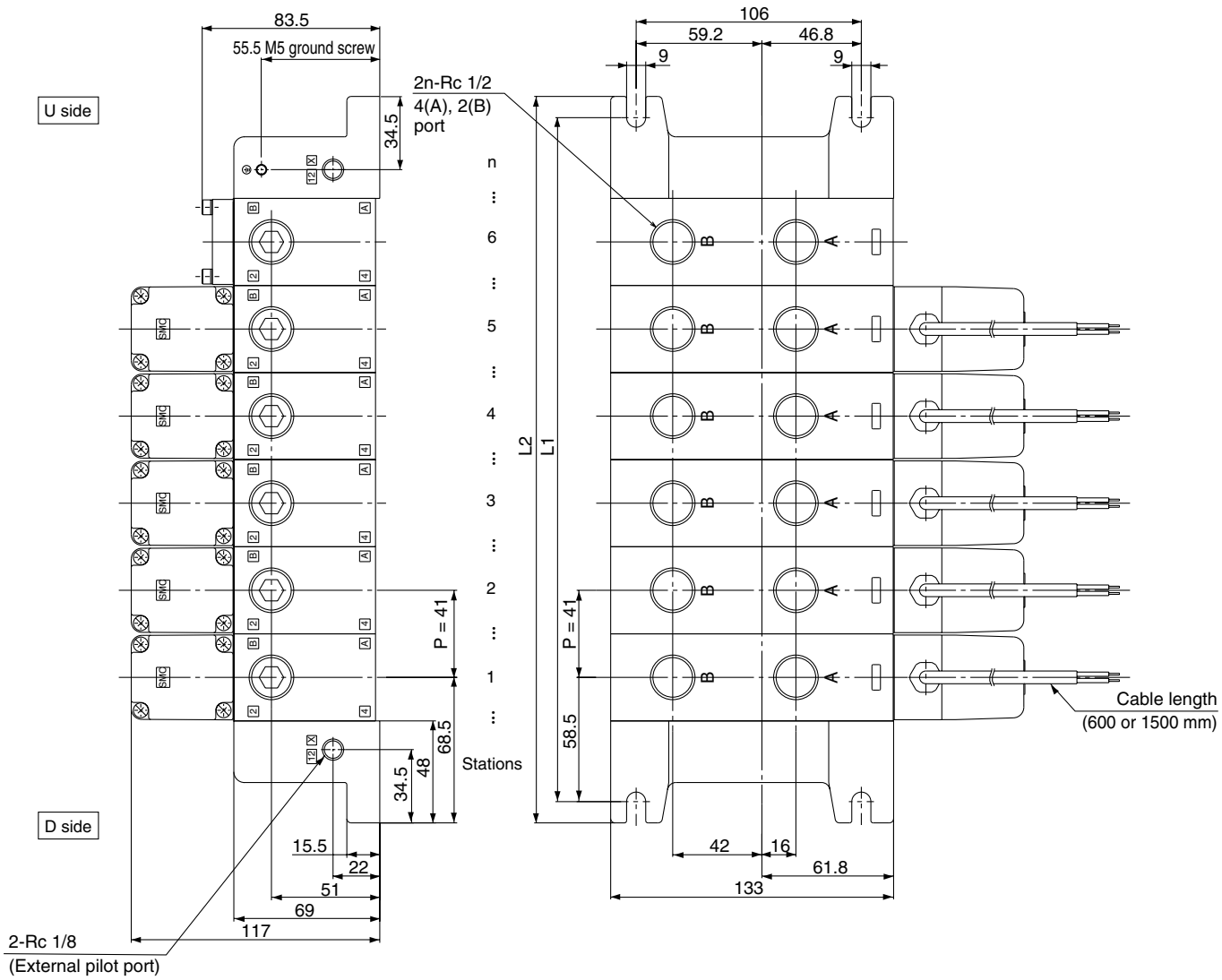
• Refer to pages 2-6-34 to 2-6-39 for detailed dimensions of each option.
For replacement parts, refer to page 2-6-43.

C Kit (Connector)





Bottom ported drawing



Dimensions

Formula: $L_1 = 41n + 76$, $L_2 = 41n + 96$
n: Stations (Maximum 12 stations)

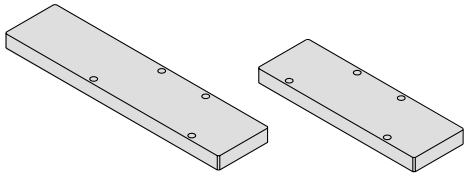
L \ n	1	2	3	4	5	6	7	8	9	10	11	12
L_1	117	158	199	240	281	322	363	404	445	486	527	568
L_2	137	178	219	260	301	342	383	424	465	506	547	588

Manifold Option Parts

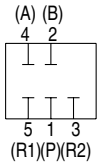
Blanking plate assembly

VVQ5000-10A-1 (Plug-in type)
VVQ5000-10A-5 (Plug lead type)

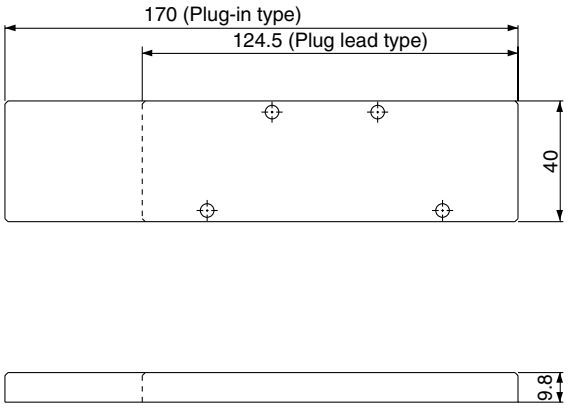
It is used by attaching on the manifold block for being prepared for removing a valve for maintenance reasons or planning to mount a spare valve, etc.



Plug-in type　　Plug lead type



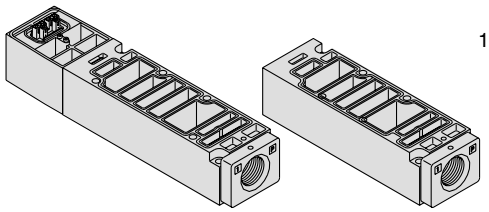
Circuit diagram



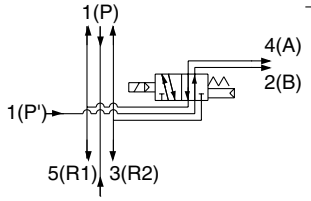
Individual SUP spacer

VVQ5000-P-1-$^{03}_{04}$ (Plug-in type)
VVQ5000-P-5-$^{03}_{04}$ (Plug lead type)

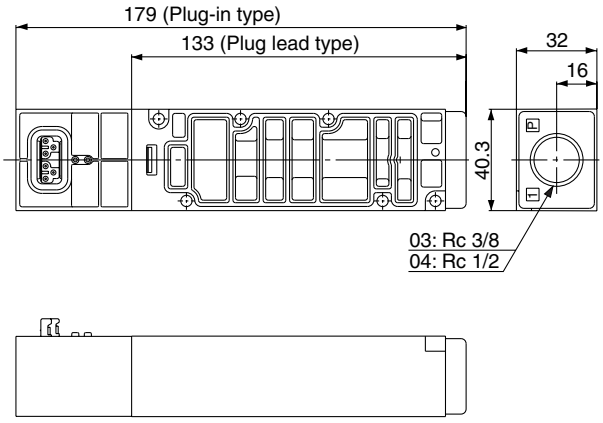
By mounting individual SUP spacers on a manifold block, it is possible to provide individual supply ports for each valve.



Plug-in type　　Plug llead type



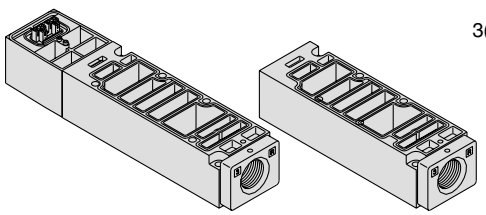
Circuit diagram



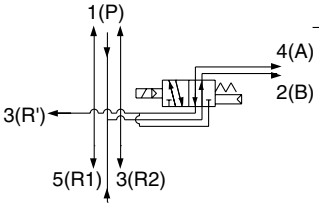
Individual EXH spacer

VVQ5000-R-1-$^{03}_{04}$ (Plug-in type)
VVQ5000-R-5-$^{03}_{04}$ (Plug lead type)

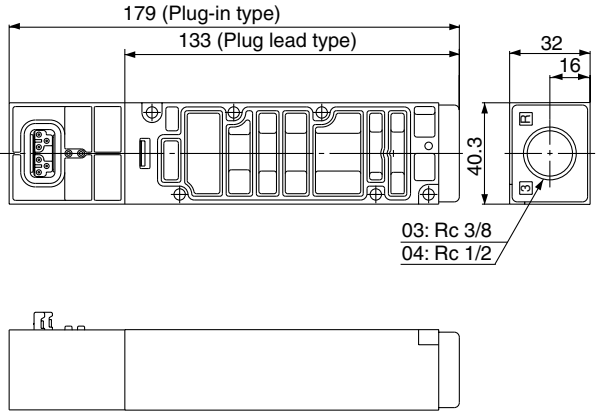
By mounting individual EXH spacers on a manifold block, exhaust ports can be provided individually for each valve. (Common EXH type)



Plug-in type　　Plug lead type



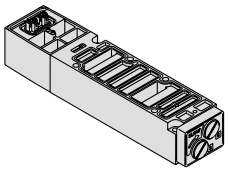
Circuit diagram



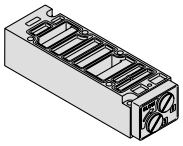
Throttle valve spacer

VVQ5000-20A-1 (Plug-in type)
VVQ5000-20A-5 (Plug lead type)

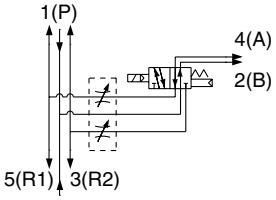
A throttle valve spacer is mounted on a manifold block to control cylinder speed by throttling exhaust air flow.



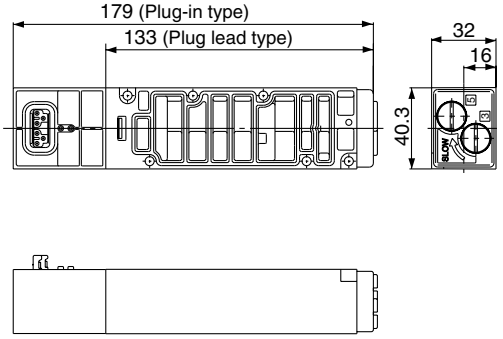
Plug-in type



Plug lead type



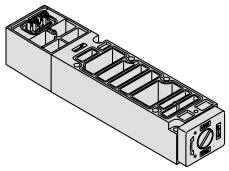
Circuit diagram



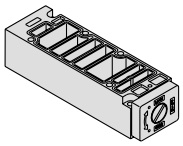
SUP stop valve spacer

VVQ5000-37A-1 (Plug-in type)
VVQ5000-37A-5 (Plug lead type)

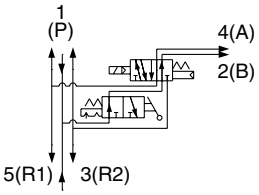
A SUP stop valve spacer is mounted on a manifold block, making it possible to individually shut off supply air to each valve.



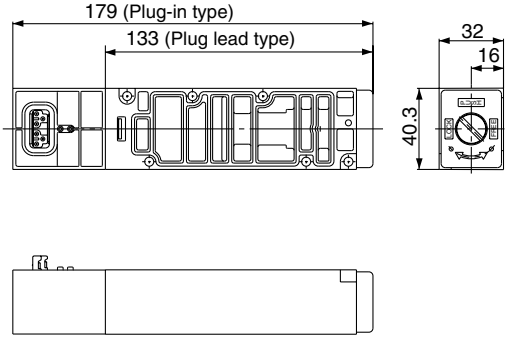
Plug-in type



Plug lead type



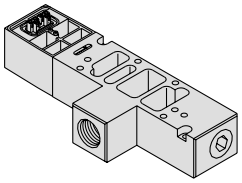
Circuit diagram



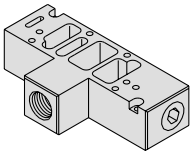
Release valve spacer: For D side mounting

VVQ5000-24A-1D (Plug-in type)
VVQ5000-24A-5D (Plug lead type)

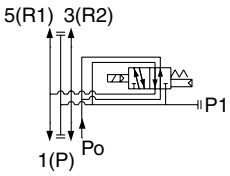
A VQ51□□ (single) valve can be used as an air release valve by combining it with a release valve spacer.
Note) 2 position double and 3 position cannot be mounted.



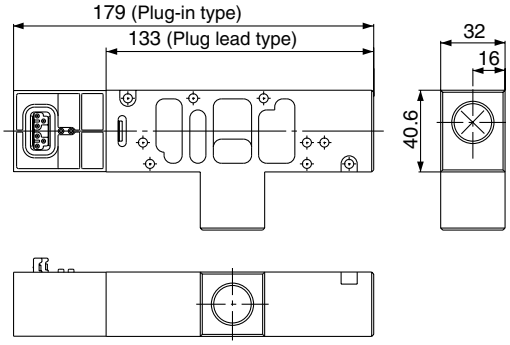
Plug-in type



Plug lead type



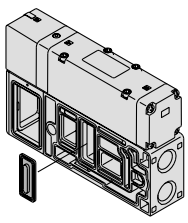
Circuit diagram



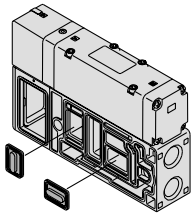
SUP block plate EXH block plate

VVQ5000-16A-1 VVQ5000-16A-2

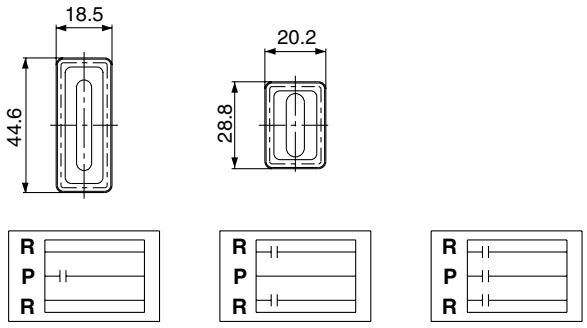
When different pressures, high and low, are supplied to manifold, a SUP block plate is inserted between the stations under different pressures.



< SUP blocking plate >



< EXH blocking plate >



SUP passage blocked EXH passage blocked SUP/EXH passage blocked

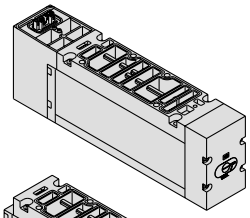
Manifold Option Parts

Double check spacer with residual pressure release valve

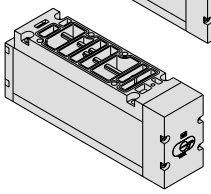
VVQ5000-25A-1 (Plug-in type)
VVQ5000-25A-5 (Plug lead type)

Can hold an intermediate cylinder position for an extended time.
When combined with a double check spacer with built-in double check valve, it is unaffected by air leakage between the spool valves, making it possible to hold a cylinder at an intermediate stopping position for an extended time.
Further, a combination of a 2 position type (VQ5$^{1}_{2}$□□) and a double check spacer can be used for drop prevention.

Plug-in type



Plug lead type



Specifications

Double check spacer part no.	VVQ5000-25A-$^{1}_{5}$	
	Intermediate stop	Drop prevention
Applicable solenoid valve	VQ54□□	VQ5$^{1}_{2}$□□

Leakage N cm^3/min	One solenoid energized	1(P)	5 (R1)	320 or less
			3 (R2)	
	Both solenoids unenergized	1(P)	5 (R1)	320 or less
			3 (R2)	
		4(A)	5 (R1)	0
		2(B)	3 (R2)	

∗ Supply pressure: 0.5 MPa

⚠ Caution

Handling Precautions

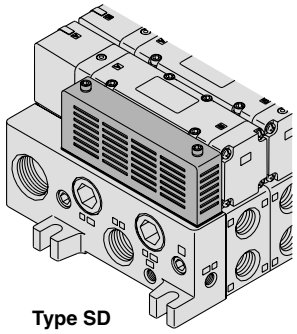
- In the case of 3 position double check (VZS65$^{00}_{51}$0), check the leakage from piping and fittings in between valve and cylinder by means of synthetic detergent solutions, and ensure that there is no such leakage found there. Also check the leakage from cylinder seal and piston seal. If there is any leakage, sometimes the cylinder, when valve is de-energized, can move without stopping at intermediate position.
- Use caution, as excessive throttling of the double check spacer exhaust can cause a loss of intermediate stopping accuracy and malfunction.
- Combination with a 3 position VQ5$^{3}_{5}$□□ is not possible.
- Set the cylinder load so that the cylinder pressure will be within two times that of the supply pressure.

Direct exhaust with silencer box

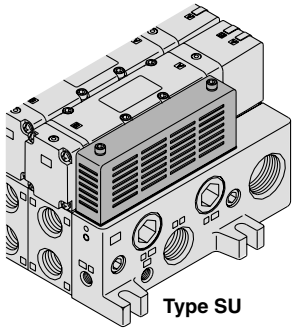
VV5Q5$^{1}_{5}$-□□□-SD (D side exhaust)
VV5Q5$^{1}_{5}$-□□□-SU (U side exhaust)
VV5Q5$^{1}_{5}$-□□□-SB (Double side exhaust)

The EXH outlet is placed on the top side of the manifold end plate. The built-in silencer provides highly effective noise reduction. (Noise reduction of 35 dB or more)

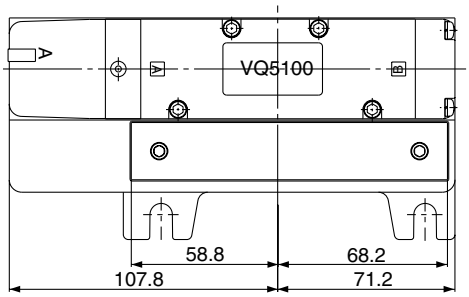
Note) Note that when excessive drainage occurs in the air supply, the drainage will be released along with the exhaust.

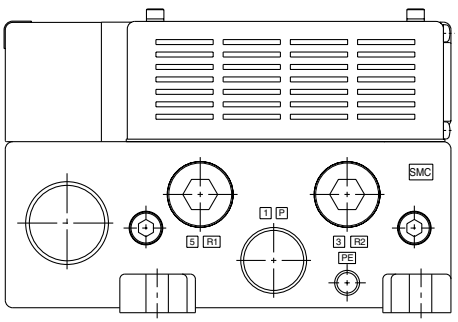


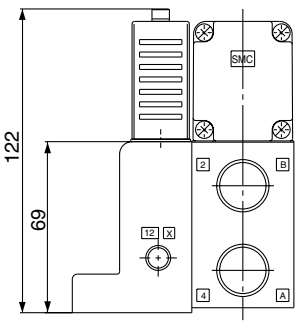
Type SD



Type SU





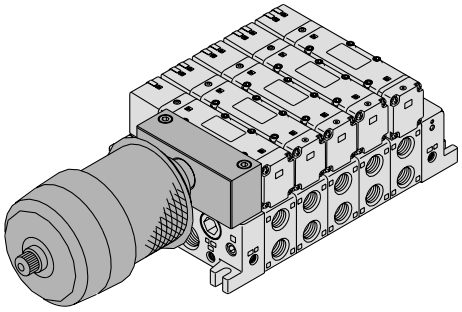


Note) The drawing shows a VV5Q51-□□□-SD.

Manifold mounted exhaust cleaner

VV5Q5$^{1}_{5}$-□□□-CD (D side mounting)
VV5Q5$^{1}_{5}$-□□□-CU (U side mounting)

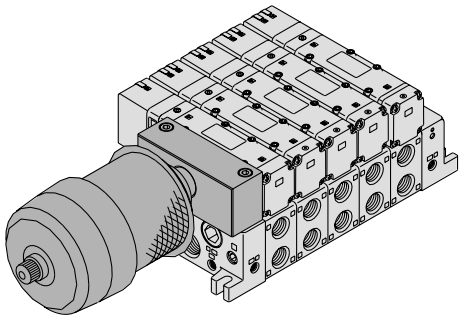
An adapter plate for exhaust cleaner mounting is provided on the top of the manifold end plate. The exhaust cleaner collects drainage and oil mist (99.9% or more) and is highly effective for noise reduction.
(Noise reduction of 35 dB or more)



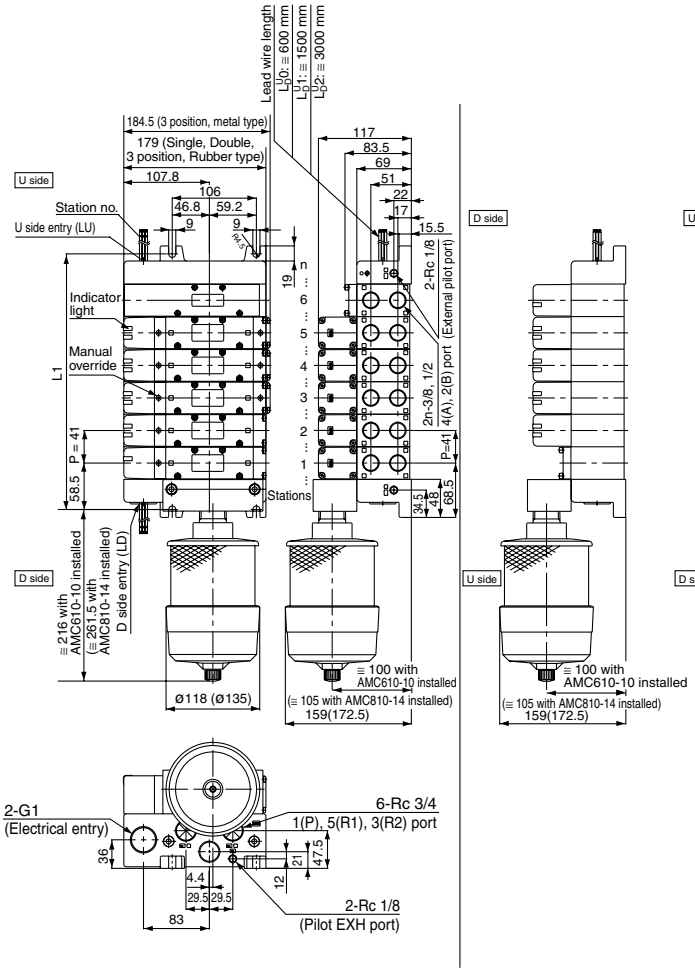
Applicable exhaust cleaners

AMC610-10 (Port size Rc 1), AMC810-14 (Port size Rc 1 1/2)

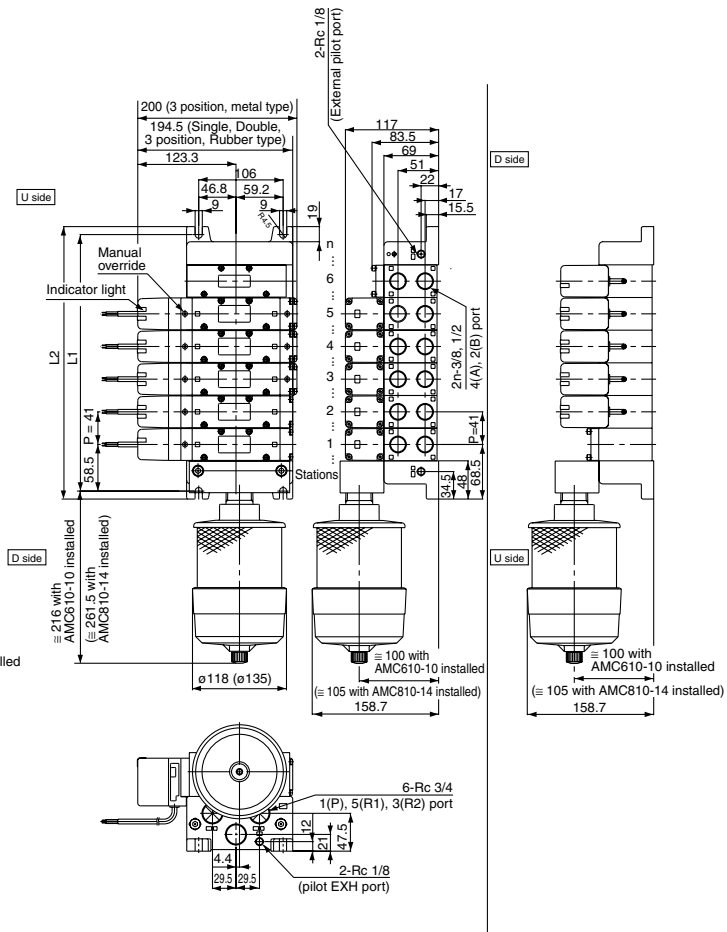
Note 1) Exhaust cleaner: AMC610-10 and MC810-14 are not included. (Order separately)
Note 2) Mount so that the exhaust cleaner is at the lower side.
Note 3) For details about the exhaust cleaner, refer to Best Pneumatics vol.5.



Plug-in type



Plug lead type



Dimensions

Formula: L1 = 41n + 76, L2 = 41n + 96
n: Stations (Maximum 12 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12
L1	158	199	240	281	322	363	404	445	486	527	568
L2	178	219	260	301	342	383	424	465	506	547	588

Dimensions

Formula: L1 = 41n + 76, L2 = 41n + 96
n: Stations (Maximum 12 stations)

L \ n	2	3	4	5	6	7	8	9	10	11	12
L1	158	199	240	281	322	363	404	445	486	527	568
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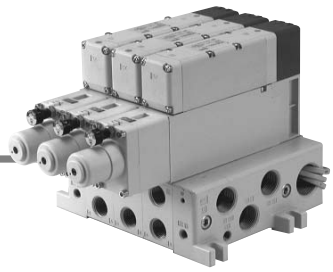


Manifold Option Parts

Interface regulator (P, A, B port regulation)

ARBQ5000-00-□-1 (Plug-in type)
ARBQ5000-00-□-5 (Plug lead type)

By mounting a spacer regulator on the manifold block, it enables to regulate pressure per every valve.

Specifications

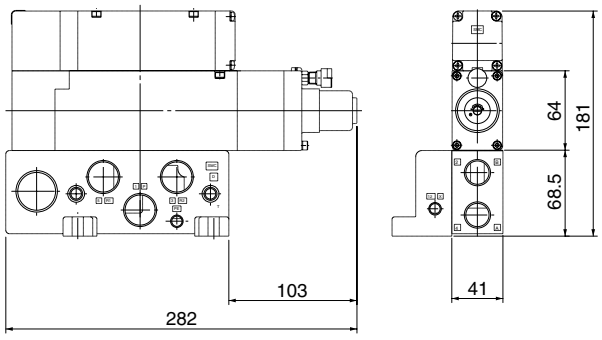
Interface regulator		ARBQ5000					
Regulating port		A		B		P	
Applicable solenoid valve		Plug-in	Plug lead	Plug-in	Plug lead	Plug-in	Plug lead
Maximum operating pressure		1.0 MPa					
Set pressure range		0.05 to 0.85 MPa					
Fluid		Air					
Ambient and fluid temperature		–5 to 60°C (No freezing)					
Port size for connection of pressure gauge		M5 x 0.8					
Weight (kg)		0.79	0.74	0.78	0.73	0.79	0.74
Effective area at supply side (mm^2) S at P1 = 0.7 MPa/P2 = 0.5 MPa	P → A	33		75		29	
	P → B	64		33		28	
Effective area at exhaust side (mm^2) S at P2 = 0.5 MPa	A → EA	36		75		78	
	B → EB	68		38		69	

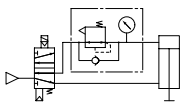
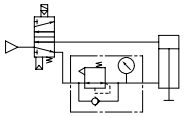
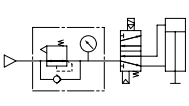
Note 1) Set the pressure within the operating pressure range of the solenoid valve.
Note 2) Use a spacer regulator by pressurizing from the P port on the base except the case of being used as a dual pressure valve. Besides, P port regulation is not allowed to use.
Note 3) When using a perfect spacer, assemble a valve, a spacer regulator and a perfect spacer in this order to use it.
Note 4) When using in A port regulation, B port regulation by closed center, since there is a problem in its operation, please contact SMC.
Note 5) Dusttight/splash proof enclosure (IP65) is not available with interface regulator.

How to Order

Solenoid valve	Interface regulator	Regulating port
VQ5□0□ (Plug-in type)	ARBQ5000-00-A-1	A
	ARBQ5000-00-B-1	B
	ARBQ5000-00-P-1	P
VQ5□5□ (Plug lead type)	ARBQ5000-00-A-5	A
	ARBQ5000-00-B-5	B
	ARBQ5000-00-P-5	P

Dimensions

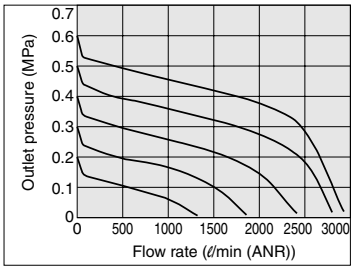


Regulating port: A	Regulating port: B	Regulating port: P
		

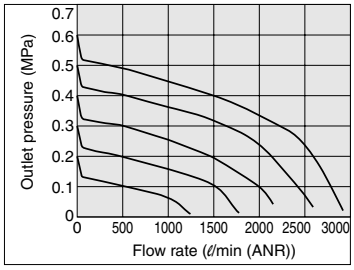
Flow Characteristics

Conditions Inlet pressure: 0.7 MPa

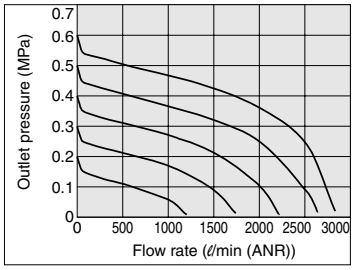
ARBQ5000-00-A (P → A)



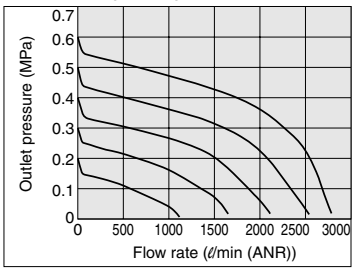
ARBQ5000-00-B (P → B)



ARBQ5000-00-P (P → A)

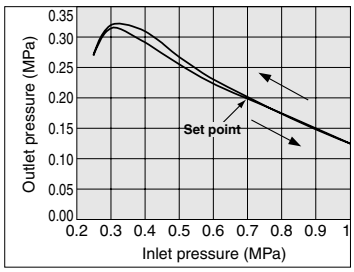


ARBQ5000-00-P (P → B)



Pressure Characteristics

Conditions
Inlet pressure: 0.7 MPa
Outlet pressure: 0.2 MPa
Flow rate: 20 ℓ/min(ANR)



Option

External Pilot Specifications

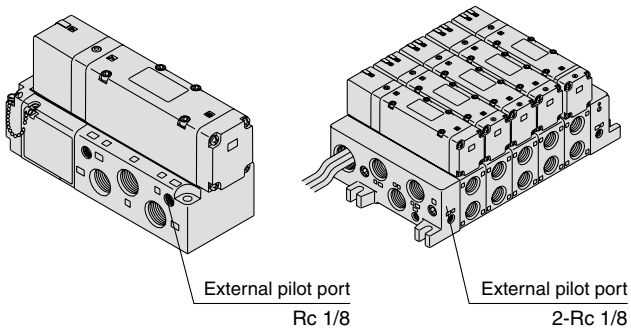
When the supply pressure is
- lower than the minimum solenoid valve operating pressure of 0.1 to 0.2 MPa, or when it drops below this level,
- used for reverse pressure (R port pressure) or cylinder pressure (A, B port pressure),
- used for vacuum specifications (please contact SMC), it can be used for external pilot specifications.

Order a valve by adding the external pilot specification [R] to the part number.
External pilot is available as standard for manifolds and options.

How to Order Manifold

VQ5100 R — 5 — 04

External pilot specifications



<Sub-plate> **<Manifold>**

Note) Mixed mounting of internal and external pilots is possible

Pressure Specifications

Valve construction		Metal seal	Rubber seal
Operating pressure range		Vacuum to 1.0 MPa	
External pilot [Note] pressure range	Single	0.1 to 1.0 MPa (0.1 to 0.7 MPa)	0.2 to 1.0 MPa (0.2 to 0.7 MPa)
	Double		0.15 to 1.0 MPa (0.15 to 0.7 MPa)
	3 position	0.15 to 1.0 MPa (0.15 to 0.7 MPa)	0.2 to 1.0 MPa (0.2 to 0.7 MPa)

Note) Values inside ( ) denote the low wattage (0.5 W) specifications.

International Thread Standards Other than Rc

Rc specifications are standard for all ports, however, NPT, NPTF and G are available for international markets.
Add the appropriate symbol following the port size in the standard part number.

How to Order Single Valves (Example)

VQ5100 — 5 — 04 □

Cylinder port Port size

Thread type 1(P), 5(R1), 3(R2) and 4(A), 2(B) port

Nil	Rc
N	NPT
T	NPTF
F	G

How to Order Manifold

VV5Q51 — 08 03 □ FU1

Cylinder port Port size

Thread type 1(P), 5(R1), 3(R2) and 4(A), 2(B) port

Nil	Rc
N	NPT
T	NPTF
F	G

How to Order Sub-plates and Options (Example)

VQ5000 — P — B 04 □ (Sub-plate)

VVQ5000 — P — 1 — 04 □ (Option)

Port size

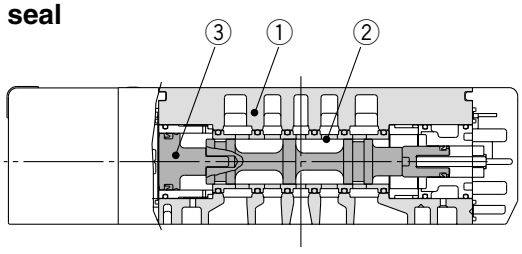
Thread type

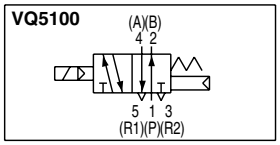
Nil	Rc
N	NPT
T	NPTF
F	G

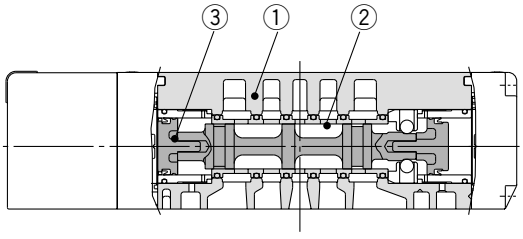
Construction

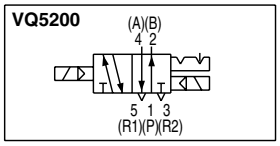
Plug-in Unit

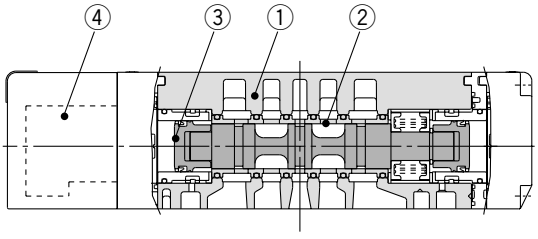
Metal seal

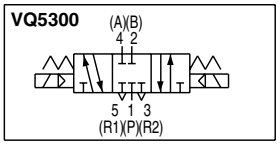


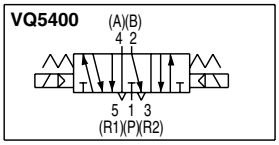


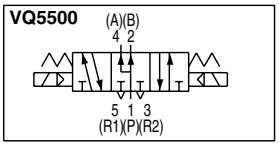




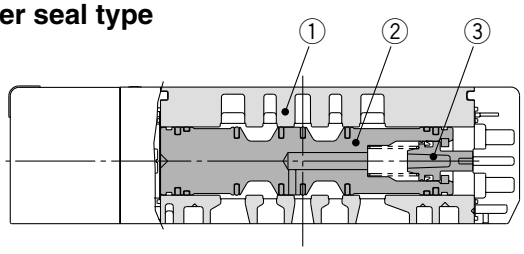


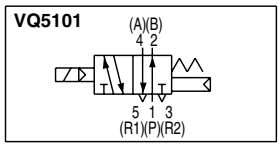


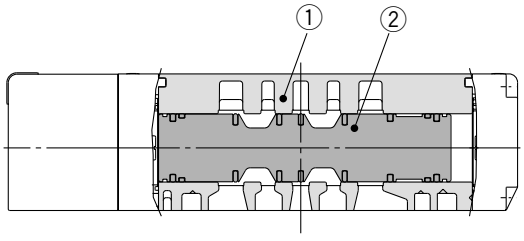


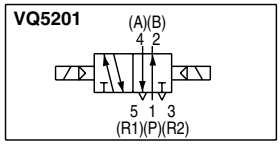


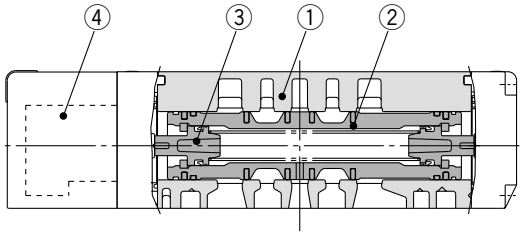
Rubber seal type

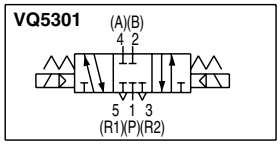


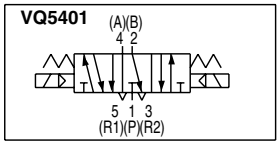


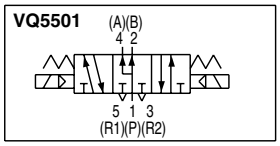












Component Parts

Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQZ111P-□	* Coil rated voltage Example) 24 VDC: 5

Component Parts

Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum, NBR	
③	Piston	Resin	

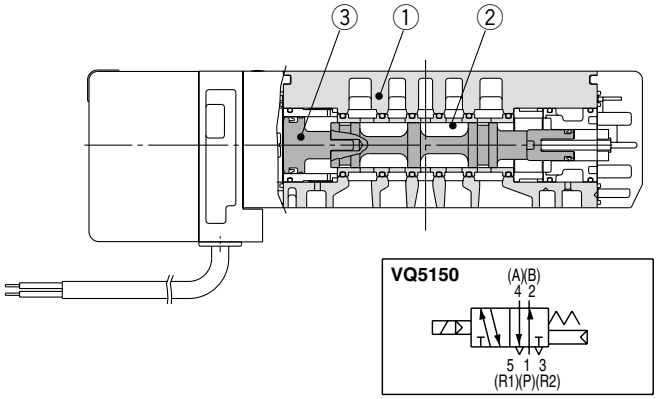
Replacement Parts

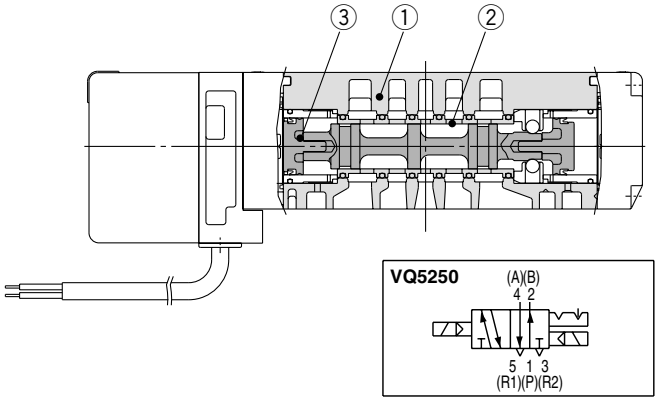
④	Pilot valve assembly	VQZ111P-□	* Coil rated voltage Example) 24 VDC: 5

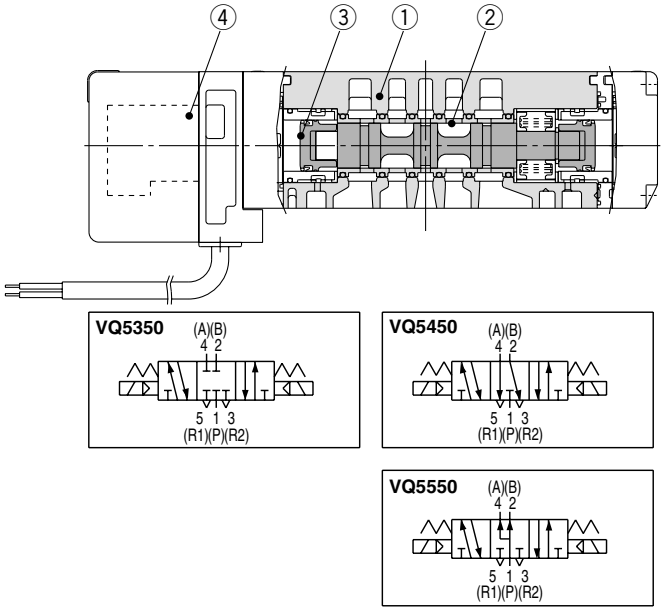
Construction

Plug Lead Unit

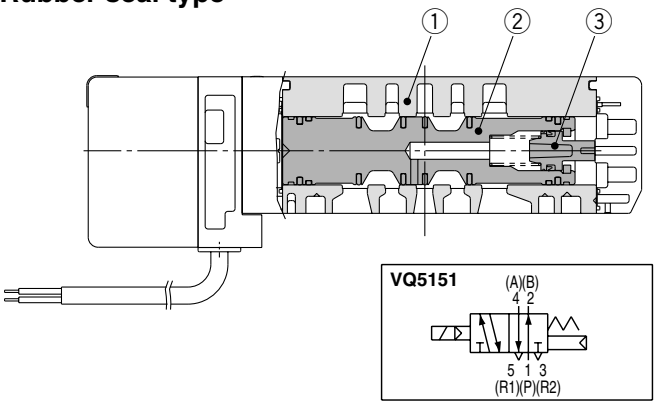
Metal seal

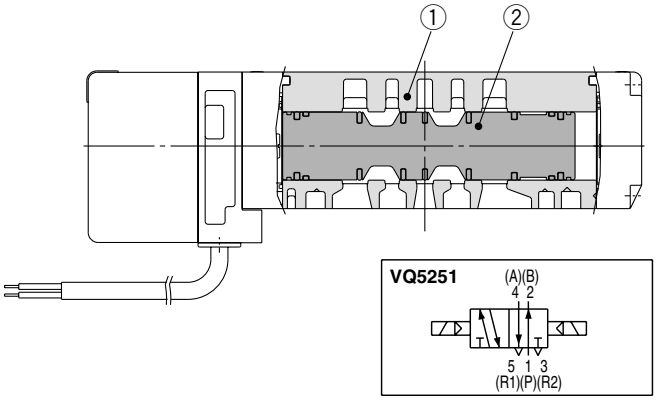


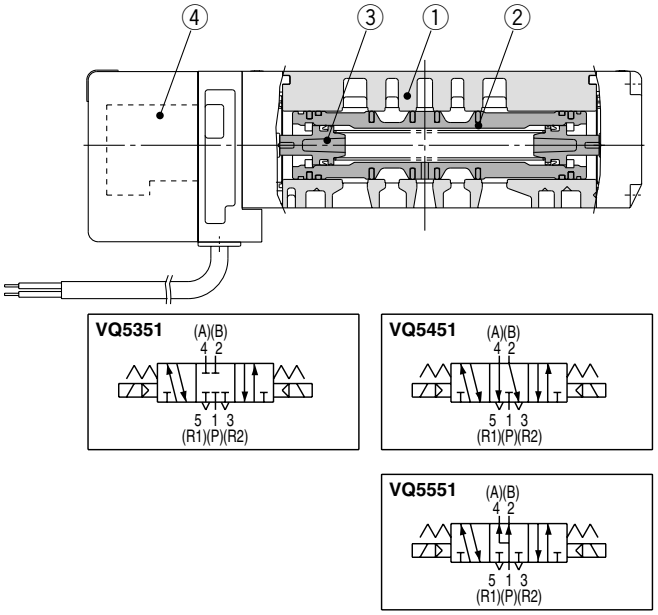




Rubber seal type







Component Parts

Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool/Sleeve	Stainless steel	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQZ111P-□	∗ Coil rated voltage Example) 24 VDC: 5

Component Parts

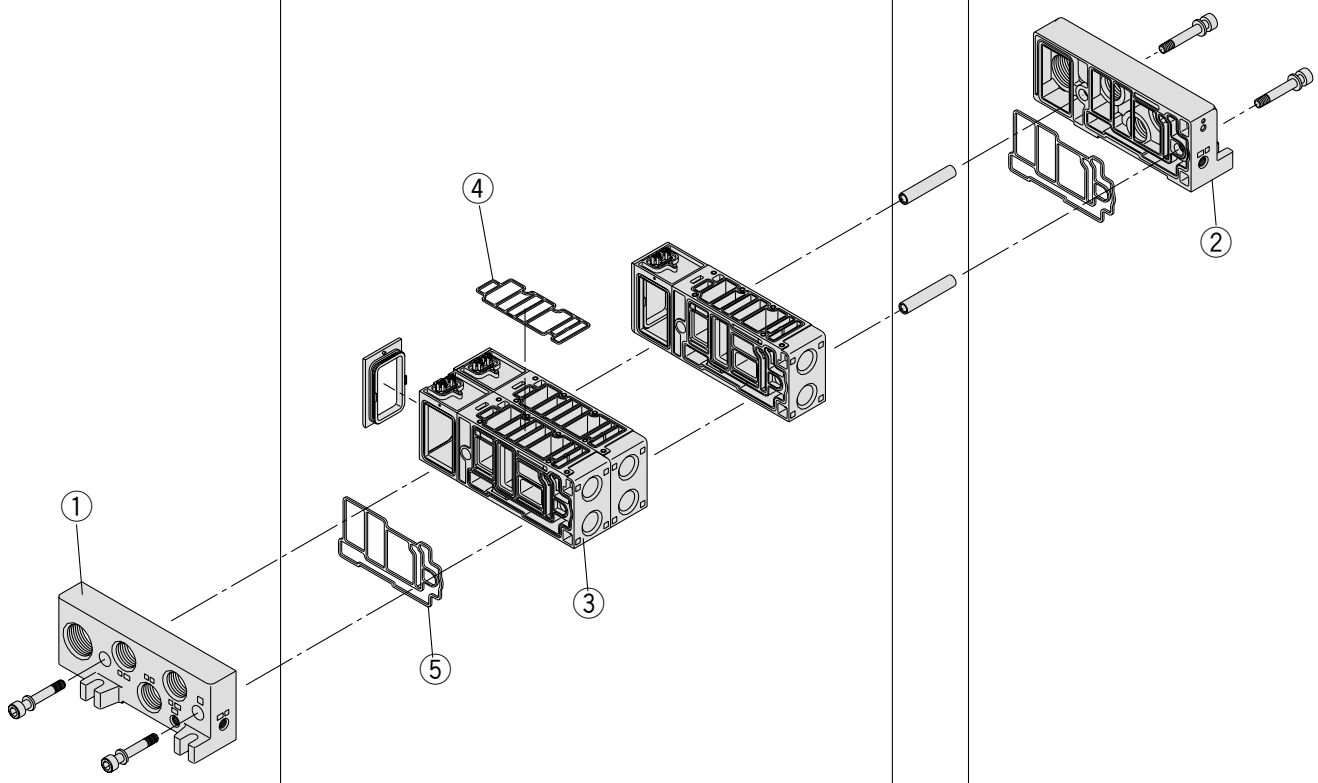
Number	Description	Material	Note
①	Body	Aluminum die-casted	
②	Spool valve	Aluminum, NBR	
③	Piston	Resin	

Replacement Parts

④	Pilot valve assembly	VQZ111P-□	∗ Coil rated voltage Example) 24 VDC: 5

Exploded View of Manifold

D side end plate assembly	Manifold block assembly	Tie-rod	U side end plate assembly



Note) The electrical entry cannot be changed.

The drawing shows a plug-in type.

<D Side End Plate Assembly>
1. D side end plate assembly part no. (for F, L, S, T & T1 kits)

VVQ5000 — 3A — 1 — □ — □

Electrical entry

L	T1, F, L, T, S kits
F(1)	F kit (Connector side)
C	C kit (plug lead type)

Option

Nil	Standard
W(2)	IP65 enclosure is dust
CD1	Exhaust cleaner mounting Rc 1
CD2	Exhaust cleaner mounting Rc 1 1/2
SD	Direct exhaust with silencer box

Note 1) D-sub connector is not included.
Note 2) Splashproof specifications is not available for F and T1.

<U Side End Plate Assembly Part No.>
2. U side end plate assembly part no. (for F, L, S, T & T1 kits)

VVQ5000 — 2A — 1 — □ — □

Electrical entry

L	T1, F, L, T, S kits
F(1)	F kit (Connector side)
C	C kit (plug lead type)

Option

Nil	Standard
W(2)	IP65 enclosure is dust
CU1	Exhaust cleaner mounting Rc 1
CU2	Exhaust cleaner mounting Rc 1 1/2
SU	Direct exhaust with silencer box

Note 1) D-sub connector is not included.
Note 2) Splashproof specifications is not available for F and T1.

<Manifold Block Assembly>
3. Manifold block assembly part no.

VVQ5000 — 1 — □ — □ — □

Type

A	For 1 station

Option

Nil	Standard
W(2)	Enclosure IP65 compliant

Electrical entry

F1	F kit Double wiring
F2	F kit Single wiring
T0	T1 kit (Individual terminal block) Double wiring
T1	T kit (Terminal box) Double wiring
T2	T kit (Terminal box) Single wiring
S1	S kit Double wiring
S2	S kit Single wiring
L0□	L0 kit □: Stations (1 to 12)
L1□	L1 kit □: Stations (1 to 12)
L2□	L2 kit □: Stations (1 to 12)
C	C kit (Plug lead type)

Port size

03	Rc 3/8
04	Rc 1/2
B	Bottom ported Rc 1/2

Note 1) Tie-rods (2 pcs.) and lead wire assembly for station addition included.
Note 2) Splashproof specifications is not available for F and T1.

<Manifold Block Replacement Parts>

Replacement Parts

No.	Part no.	Description	Material	Number
④	VVQ5000-80A-1	Gasket	NBR	10
⑤	VVQ5000-80A-2	Gasket	NBR	10

Note) Spare parts consist of sets containing 10 pcs. each.

<SI Unit>
SI Unit Part No.

Type	Model symbol	SI unit part no.		Description
		For U side mounting	For D side mounting	
Dedicated output model	A	EX323U-S001	EX323D-S001	General type SI unit (Series EX300)
	B	EX123U-SMB1	EX123D-SMB1	Mitsubishi Electric Corporation: MELSECNET/MINI-S3 Data Link System
	BB	EX124U-SMB1	EX124D-SMB1	Mitsubishi Electric Corporation: MELSECNET/MINI-S3 Data Link System (2 power supply systems)
	C	EX123U-STA1	EX123D-STA1	OMRON: SYSBUS Wire System
	D	EX123U-SSH1	EX123D-SSH1	SHARP: Satellite I/O Link System
	F1	EX123U-SUW1	EX123D-SUW1	NKE: Uni-wire System (16 output points)
	H	EX123U-SUH1	EX123D-SUH1	NKE: Uni-wire H System
	J1	EX123U-SSL1	EX123D-SSL1	SUNX: S-LINK System (16 point outputs)
	J2	EX123U-SSL2	EX123D-SSL2	SUNX Corporation: S-LINK System (8 output points)
	K	EX123U-SFU1	EX123D-SFU1	Fuji Electric Co.: T-LINK Mini System
	Q	EX124U-SDN1	EX124D-SDN1	OMRON Corp.: DeviceNet, CompoBus/D (2 power supply systems)
	R1	EX124U-SCS1	EX124D-SCS1	OMRON Corp.: CompoBus/S (16 output points, 2 power supply systems)
	R2	EX124U-SCS2	EX124D-SCS2	OMRON Corp.: CompoBus/S (8 output points, 2 power supply systems)
	U	EX124U-SJN1	EX124D-SJN1	JEMANET (2 power supply systems)
	V	EX124U-SMJ1	EX124D-SMJ1	Mitsubishi Electric Corporation: CC-Link System (2 power supply systems)
	G	EX124U-SAB1	EX124D-SAB1	Allen-Bradley Remote I/O (RIO) System (2 power supply systems) (Rockwell Automation, Inc.)

Air Filter
AF10 to 60

How to Order

AF 30 – F 03 BD – 2R

- AF: Air filter
- 30: Body size
- F: Thread type
- 03: Port size
- BD: Accessories
- 2R: Optional specifications

Body size

10	20	30	40	50	60

Thread type

Nil	Metric thread (M5)
	Rc
N Note 1)	NPT
F Note 2)	G

Port size

Symbol	Port size	Body size 10	20	30	40	50	60
M5	M5	●	—	—	—	—	—
01	1/8	—	●	—	—	—	—
02	1/4	—	●	●	●	—	—
03	3/8	—	—	●	●	—	—
04	1/2	—	—	—	●	—	—
06	3/4	—	—	—	●	●	—
10	1	—	—	—	—	●	●

Accessories

Symbol	Description	Applicable model
Nil	—	—
B Note 3)	With bracket	AF20 to 60
C	Float type Note 4) auto drain (N.C.)	AF10 to 60
D	Float type Note 4) auto drain (N.O.)	AF30 to 60

Optional specifications

Symbol	Description	Applicable model
2	Metal bowl	AF10 to 60
6	Nylon bowl	AF10 to 60
8	Metal bowl with level gauge	AF30 to 60
C	With bowl guard	AF20
J Note 5)	Drain guide 1/4	AF30 to 60
R	Flow direction: Right to left	AF10 to 60
W	Drain cock with barb fitting: ø6 x ø4 nylon tubing	AF30 to 60
Z Note 6)	Name plate and caution plate for bowl in imperial units (PSI, °F)	AF10 to 60

Note 1) Drain guide is NPT1/4 (applicable to AF30 to 60), and the exhaust port for auto drain comes with ø3/8" One-touch fitting (applicable to AF30 to 60).

Note 2) Drain guide is G1/4 (applicable to AF30 to 60).

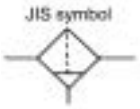
Note 3) Bracket is not assembled and is supplied loose at the time of shipment.

Note 4) Applicable tube O.D for auto drain connection should be ø3/8" in case NPT thread port is chosen.

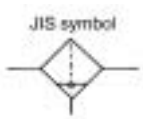
* When more than one specification is required, indicate in ascending alphanumeric order.

Note 5) Without a valve function.

Note 6) This product is for overseas use only according to the new Measurement Law. (The SI unit type is provided for use in Japan.)



With auto drain



Made to Order Page 28

Accessory/Optional specification combinations

◎: Combination available ○: Varies depending on the model △: Available only with NPT thread ▭: Combination not available

Accessory/Optional specifications \ Combination		Symbol	Accessory B	C	D	Optional specification 2	6	8	C	J	R	W	Z	Applicable filter AF10	AF20	AF30 to 60
Accessories	With bracket	B		◎	○	◎	◎	○	○	○	◎	○	△		◎	◎
	Float type auto drain (N.C.)	C	○			◎	◎	○	○		◎		△	◎	◎	◎
	Float type auto drain (N.O.)	D	◎			◎	◎	◎			◎		△			◎
Optional specifications	Metal bowl	–2	○	◎	○					○	◎		△	◎	◎	◎
	Nylon bowl	–6	○	◎	○				○	○	◎	○	△	◎	◎	◎
	Metal bowl with level gauge	–8	◎	◎	◎					◎	◎		△			◎
	With bowl guard	–C	◎	◎			◎				◎		△		◎	
	Drain guide 1/4	–J	◎			◎	◎	◎			◎		△			◎
	Flow direction: Right to left	–R	○	◎	○	◎	◎	○	○	○		○	△	◎	◎	◎
	Drain cock with barb fitting: ø6 x ø4 nylon tubing	–W	◎				◎				◎		△			◎
	Name plate and caution plate for bowl in imperial units (PSI, °F)	–Z	△	△	△	△	△	△	△	△	△	△		△	△	△

Standard specifications

Model	AF10	AF20	AF30	AF40	AF40-06	AF50	AF60
Port sizes	M5 x 0.8	1/8, 1/4	1/4, 3/8	1/4, 3/8, 1/2	3/4	3/4, 1	1
Fluid	Air						
Proof pressure	1.5MPa						
Maximum operating pressure	1.0MPa						
Ambient and fluid temperature	–5 to 60°C (with no freezing)						
Nominal filtration rating	5μm						
Bowl material	Polycarbonate						
Bowl guard	—	Option	Standard				
Drain capacity (cm³)	2.5	8	25	45	45	45	45
Weight (kg)	0.06	0.18	0.22	0.45	0.49	0.99	1.05

Accessory part no.

Accessory \ Applicable model		AF10	AF20	AF30	AF40	AF40-06	AF50	AF60
Bracket assembly Note 1)		—	AF20P-050AS	AF30P-050AS	AF40P-050AS	AF40P-070AS	AF50P-050AS	AF50P-050AS
Float type Note 2) auto drain	N.O.	—	—	AD38 / AD38N Note 3)	AD48 / AD48N Note 3)	AD48 / AD48N Note 3)	AD48 / AD48N Note 3)	AD48 / AD48N Note 3)
	N.C.	AD17	AD27	AD37 / AD37N Note 3)	AD47 / AD47N Note 3)	AD47 / AD47N Note 3)	AD47 / AD47N Note 3)	AD47 / AD47N Note 3)

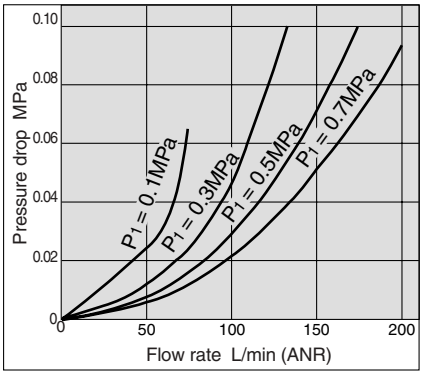
Note 1) Assembly includes a bracket and 2 mounting screws.

Note 2) Minimum operating pressure: N.O. type–0.1MPa; N.C. type–0.1MPa (AD17/27) and 0.15MPa (AD37/47).

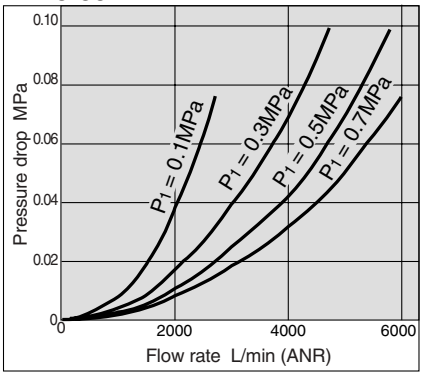
Note 3) When "N" is specified in the end of part number of auto drain, applicable tube O.D should be ø3/8".

Flow Characteristics (Representative values)

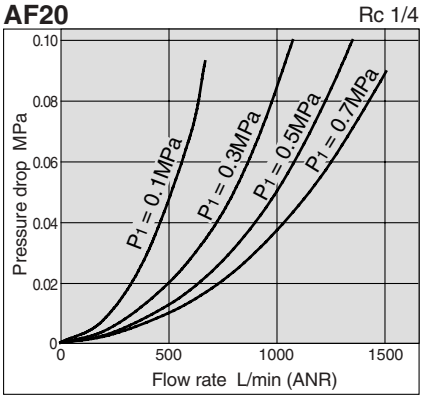
AF10 M5



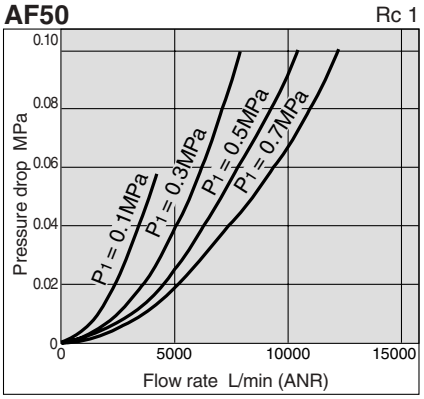
AF40-06 Rc 3/4



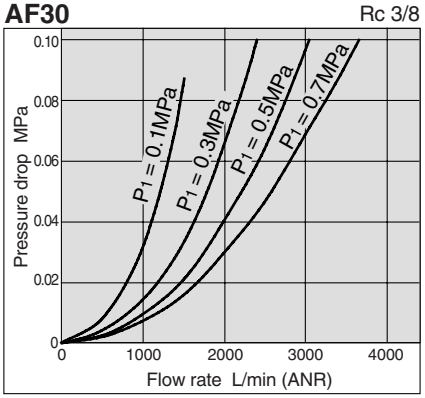
AF20 Rc 1/4



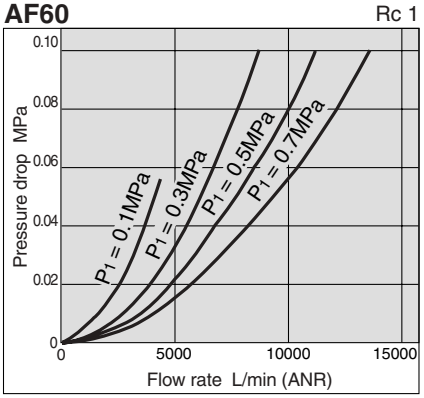
AF50 Rc 1



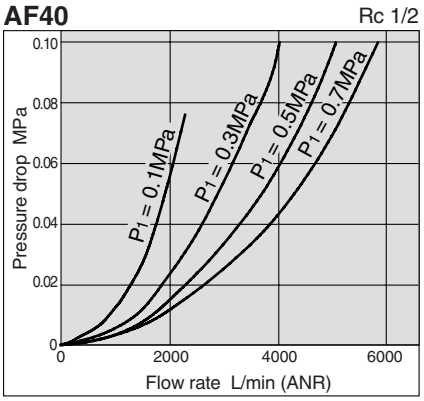
AF30 Rc 3/8



AF60 Rc 1



AF40 Rc 1/2



⚠ Specific Product Precautions

Be sure to read before handling.
Refer to pages 75 through 78 for safety instructions and F.R.L. unit precautions.

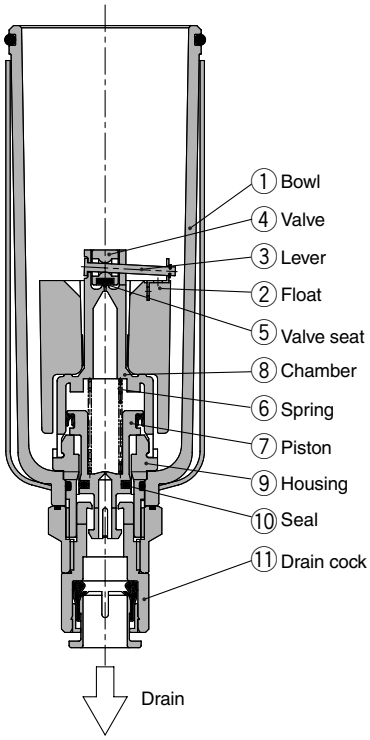
Maintenance

⚠Warning

1. Replace the element every 2 years or when the pressure drop becomes 0.1MPa, whichever comes first, to prevent damage to the element.

Operation Principle: Float Type Auto Drain

N.O. type: AD38, 48



- **When the pressure inside the bowl is released:**

  When pressure is released from the bowl ①, piston ⑦ is lowered by spring ⑥.

  The sealing action of seal ⑩ is interrupted, and the outside air flows inside the bowl ①, through housing hole ⑨ and drain cock ⑪.

  Therefore, if there is an accumulation of condensate in the bowl ①, it will drain out through the drain cock.

- **When pressure is applied inside the bowl:**

  When the pressure exceeds 0.1MPa, the force of piston ⑦ surpasses the force of spring ⑥, and the piston goes up.

  This pushes seal ⑩ up so that the it creates a seal and the inside of the bowl ①, is shut off from the outside air.

  If there is no accumulation of condensate in the bowl ①, at this time float ② will be pulled down by its own weight, causing valve ④, which is connected to lever ③, to seal valve seat ⑤.

- **When there is an accumulation of condensate in the bowl:**

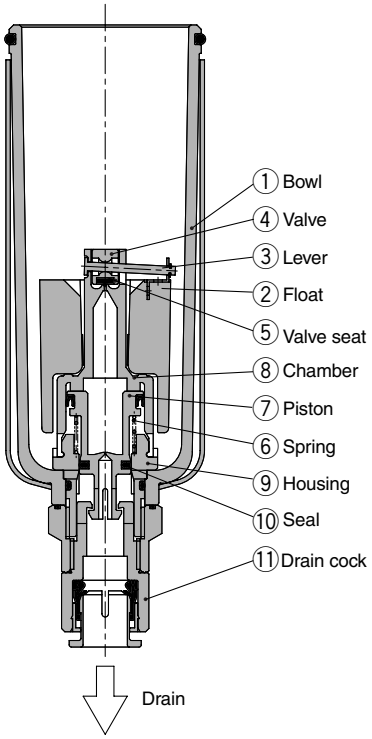
  Float ② rises due to its own buoyancy and pushes open the seal created by the valve seat, ⑤.

  This allows the pressure inside the bowl ①, to enter the chamber ⑧. The result is that the combined pressure inside chamber ⑧ and the force of the spring ⑥, lower the piston ⑦.

  This causes the sealing action of seal ⑩ to be interrupted, and the accumulated condensate in the bowl ①, drains out through the drain cock ⑪.

  Turning drain cock ⑪ manually counterclockwise lowers piston ⑦, which pushes open the seal created by seal ⑩, thus allowing the condensate to drain out.

N.C. type: AD37, 47



- **When the pressure inside the bowl is released:**

  Even when pressure inside the bowl ①, is released, spring ⑥ keeps piston ⑦ in its upward position.

  This keeps the seal created by the seal ⑩, in place, thus shutting the outside air from inside the bowl ①.

  Therefore, even if there should be some condensate accumulation inside the bowl ①, it will not drain out.

- **When pressure is applied inside the bowl:**

  Even when pressure is applied inside the bowl ①, the combined force of spring ⑥ and the pressure inside the bowl ①, keeps piston ⑦ in its upward position.

  This maintains the seal created by the seal ⑩, in place, thus shutting the outside air from inside the bowl ①.

  If there is no accumulation of condensate in the bowl ①, at this time float ② will be pulled down by its own weight, causing valve ④, which is connected to lever ③, to seal valve seat ⑤.

- **When there is an accumulation of condensate in the bowl:**

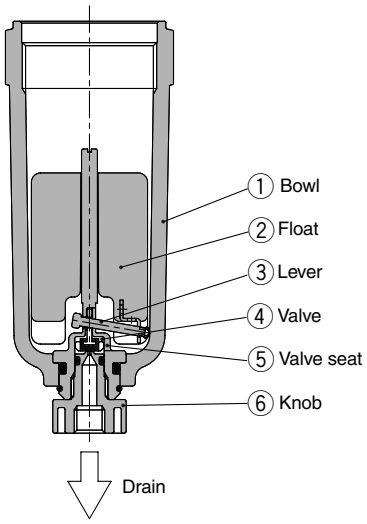
  Float ② rises due to its own buoyancy and pushes open the seal created by the valve seat ⑤. Pressure passes from the bowl to chamber ⑧.

  The result is that the pressure inside chamber ⑧ surpasses the force of the spring ⑥, and pushes piston ⑦ downwards.

  This causes the sealing action of seal ⑩ to be interrupted and the accumulated condensate in the bowl ①, drains out through the drain cock ⑪.

  Turning drain cock ⑪ manually counterclockwise lowers piston ⑦, which pushes open the seal created by seal ⑩, thus allowing the condensate to drain out.

Compact auto drain N.C. type: AD17, 27



- **When the pressure inside the bowl is released:**

  Even when pressure inside the bowl ①, is released, the weight of the float ② causes valve ④, which is connected to lever ③, to seal valve seat ⑤. As a result, the inside of the bowl ①, is shut off from the outside air.

  Therefore, even if there is an accumulation of condensate in the bowl ①, it will not drain out.

- **When pressure is applied inside the bowl:**

  Even when pressure is applied inside the bowl ①, the weight of the float ②, and the differential pressure that is applied to valve ④ cause valve ④ to seal valve seat ⑤, and the outside air is shut off from the inside of the bowl ①.

- **When the drain is accumulated in the bowl:**

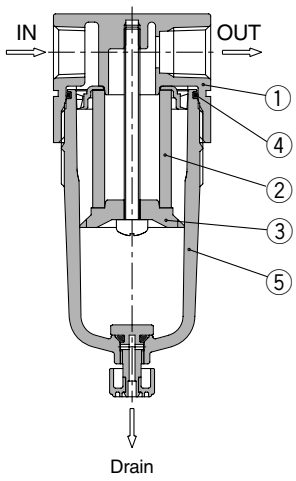
  Float ② rises due to its own buoyancy and the seal at valve seat ⑤ is interrupted.

  The condensate inside the bowl ① drains out through the knob, ⑥.

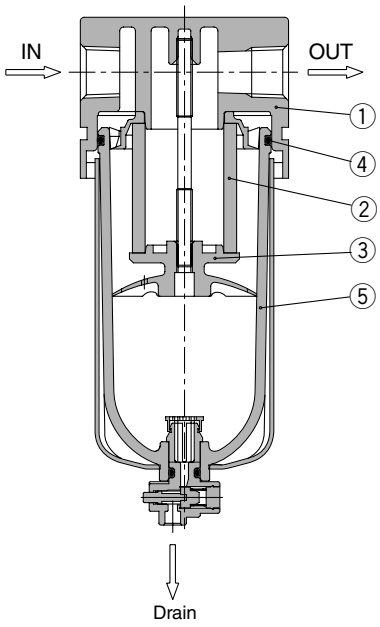
  Turning knob ⑥ manually counterclockwise lowers it and causes the sealing action of valve seat ⑤ to be interrupted, thus allowing the condensate to drain out.

Construction

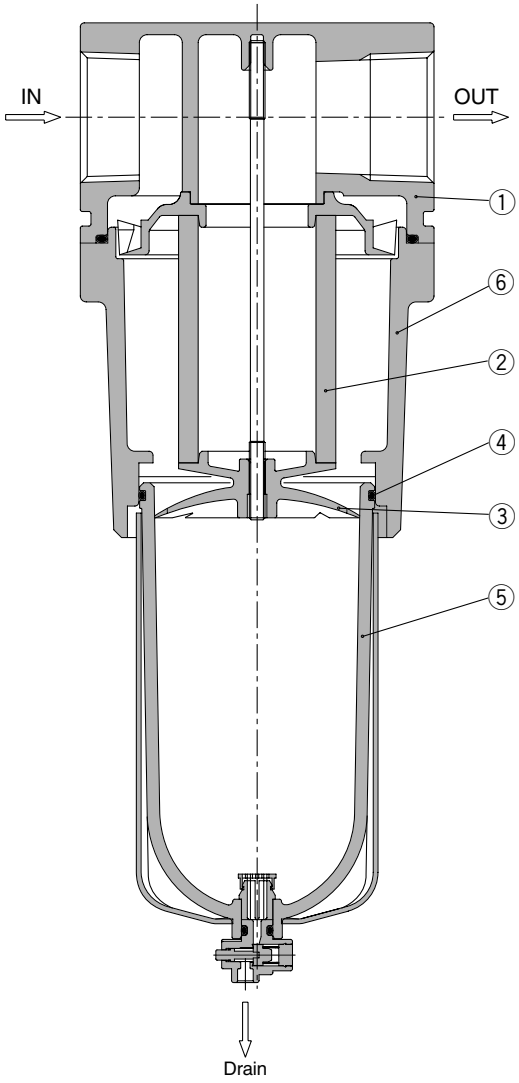
AF10, 20



AF30, 40



AF50, 60



Parts list

No.	Description	Material			Color
		AF10, 20	**AF30, 40, 40-06**	**AF50, 60**	
1	**Body**	Zinc die-cast	Aluminum die-cast		Platinum silver
6	**Housing**	—		Aluminum die-cast	Platinum silver

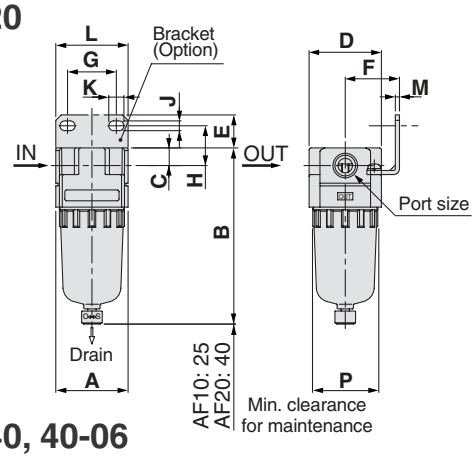
Air filter replacement parts

No.	Description	Material	Part no.						
			AF10	**AF20**	**AF30**	**AF40**	**AF40-06**	**AF50**	**AF60**
2	**Filter element**	Non-woven fabric	AF10P-060S	AF20P-060S	AF30P-060S	AF40P-060S	AF40P-060S	AF50P-060S	AF60P-060S
3	**Baffle**	PBT	AF10P-040S Note 1)	AF20P-040S	AF30P-040S	AF40P-040S	AF40P-040S	AF50P-040S	AF60P-040S
4	**Bowl O-ring**	NBR	C1SFP-260S	C2SFP-260S	C3SFP-260S	C4SFP-260S	C4SFP-260S	C4SFP-260S	C4SFP-260S
5	**Bowl assembly** Note 2)	PC	C1SF	C2SF	C3SF Note 3)	C4SF Note 3)	C4SF Note 3)	C4SF Note 3)	C4SF Note 3)

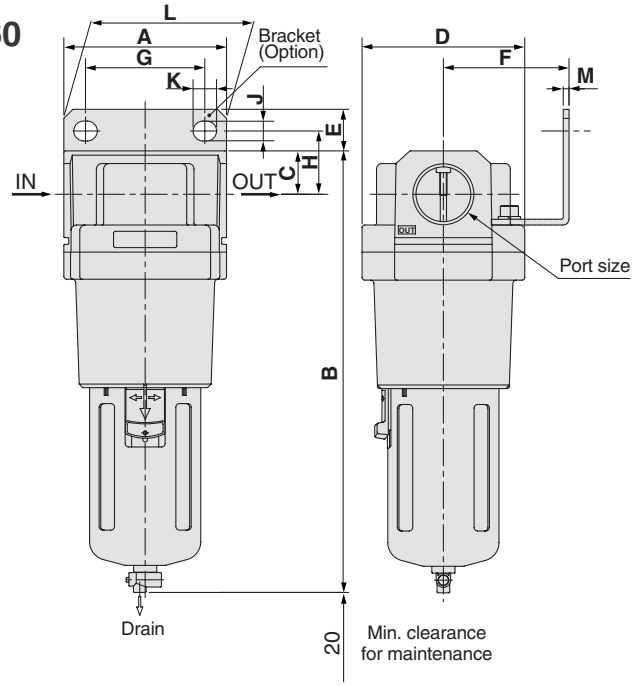
Note 1) The material of the baffle for AF10 (AF10P-040S) only is POM.
Note 2) Contact SMC regarding the bowl assembly supply for PSI and °F unit specifications.
Note 3) Bowl assembly for AF30 to 60 models comes with a bowl guard (steel band material).

Dimensions

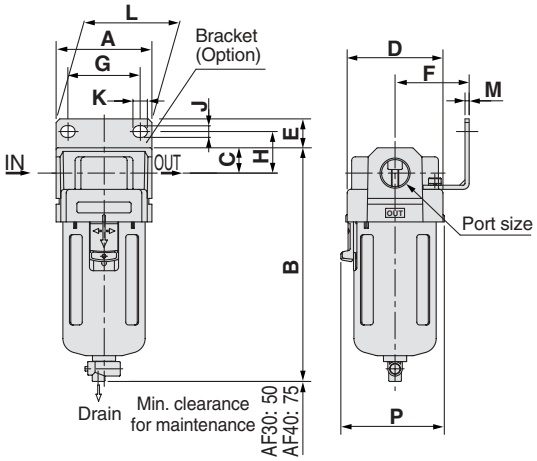
AF10, 20

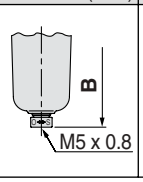
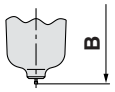
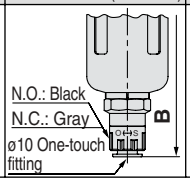
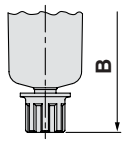
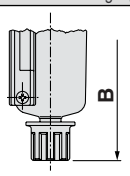
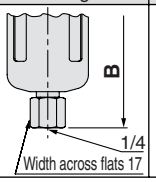
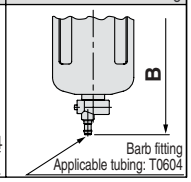


AF50, 60



AF30, 40, 40-06



Applicable model	AF10, AF20		AF30, AF40, AF40-06, AF50, AF60				
	With auto drain (N.C.)	Metal bowl	With auto drain (N.O./N.C.)	Metal bowl	Metal bowl with level gauge	With drain guide	Drain cock with barb fitting
Optional specifications							

Model	Port size	Standard specification					Accessory specification								
							Bracket mounting size								With auto drain
		A	B	C	D	P	E	F	G	H	J	K	L	M	B
AF10	M5 x 0.8	25	67	7	25	28	—	—	—	—	—	—	—	—	85
AF20	1/8, 1/4	40	97	10	40	—	18	30	27	22	5.4	8.4	40	2.3	115
AF30	1/4, 3/8	53	129	14	53	57	16	41	40	23	6.5	8	53	2.3	170
AF40	1/4, 3/8, 1/2	70	165	18	70	73	17	50	54	26	8.5	10.5	70	2.3	204
AF40-06	3/4	75	169	20	70	73	14	50	54	25	8.5	10.5	70	2.3	208
AF50	3/4, 1	90	245	24	90	—	23	70	66	35	11	13	90	3.2	284
AF60	1	95	258	24	95	—	23	70	66	35	11	13	90	3.2	297

Model	Optional specification			
	With drain guide	With barb fitting	Metal bowl	Metal bowl with level gauge
	B	B	B	B
AF10	—	—	66	—
AF20	—	—	97	—
AF30	136	137	142	162
AF40	172	173	178	198
AF40-06	176	177	182	202
AF50	252	253	258	278
AF60	265	266	271	291

Air Filter *AF20 to 60*
Made to Order Specifications

Made to Order

Contact SMC for detailed dimensions, specifications, and lead times.

① Special Temperature Environment

Special materials are used in the manufacturing of seals and resin parts to allow them to withstand various temperature conditions in cold or tropical (hot) climates.

Specifications

Part no.		–X430	–X440
Environment		Low temperature	High temperature
Ambient temperature		–30 to 60°C	–5 to 80°C
Fluid temperature		–5 to 60°C (with no freezing)	
Material	**Rubber parts**	Special NBR	FPM
	Main parts	Metal (Aluminum die-cast)	

Applicable models

Model	AF30	AF40	AF40-06	AF50	AF60
Port sizes	1/4 3/8	1/4 3/8 1/2	3/4	3/4 1	1

How to Order

AF 30 – F 03 B – 2 R – X430

Air filter

Body size

30	40	50	60

Thread type

Nil	Rc
N Note 2)	NPT
F Note 3)	G

Note 1) Drain guide is NPT1/4 (applicable to AC30 to 60)

Note 2) Drain guide is G1/4 (applicable to AF30 to 60).

Port size

Symbol	Port size	Body size 30	40	50	60
02	1/4	●	●	—	—
03	3/8	●	●	—	—
04	1/2	●	●	—	—
06	3/4	—	●	●	—
10	1	—	—	●	●

For high/low temperature

X430	Low temperature
X440	High temperature

Optional specifications

Symbol	Description	Applicable model
J Note 5)	Drain guide 1/4	AF30 to 60
R	Flow direction: Right to left	AF30 to 60
Z Note 6)	Name plate and caution plate for bowl in imperial units (PSI, °F)	AF30 to 60

∗ When more than one specification is required, indicate in ascending alphanumeric order.

Note 5) Without a valve function.

Note 6) For thread type NPT. This product is for overseas use only according to the new Measurement Law. (The SI unit type is provided for use in Japan.)

Bowl

Symbol	Description	Applicable model
2 Note 4)	Metal bowl	AF30 to 60

Note 4) Only Metal Bowl available.

Option

Symbol	Description	Applicable model
Nil	—	—
B Note 3)	With bracket	AF30 to 60

Note 3) Bracket is not assembled and is supplied loose at the time of shipment.

② High Pressure

Strong materials are used in the manufacturing of air filters intended for high pressure operation.

Specifications

Part no.	–X425
Proof pressure	3.0MPa
Maximum operating pressure	2.0MPa
Ambient and fluid temperature	–5 to 60°C (with no freezing)

Applicable models

Model	AF20	AF30	AF40	AF40-06	AF50	AF60
Port sizes	1/8 1/4	1/4 3/8	1/4 3/8 1/2	3/4	3/4 1	1

How to Order

AF 30 – F 03 B – 2 R – X425

Air filter

Body size

20	30	40	50	60

Thread type

Nil	Rc
N Note 1)	NPT
F Note 2)	G

Note 1) Drain guide is NPT1/4 (applicable to AF30 to 60)

Note 2) Drain guide is G1/4 (applicable to AF30 to 60).

Port size

Symbol	Port size	Body size 20	30	40	50	60
01	1/8	●	—	—	—	—
02	1/4	●	●	●	—	—
03	3/8	—	●	●	—	—
04	1/2	—	—	●	—	—
06	3/4	—	—	●	●	—
10	1	—	—	—	●	●

For high pressure

Optional specifications

Symbol	Description	Applicable model
J Note 5)	Drain guide 1/4	AF30 to 60
R	Flow direction: Right to left	AF20 to 60
Z Note 6)	Name plate and caution plate for bowl in imperial units (PSI, °F)	AF20 to 60

∗ When more than one specification is required, indicate in ascending alphanumeric order.

Note 5) Without a valve function.

Note 6) For thread type NPT. This product is for overseas use only according to the new Measurement Law. (The SI unit type is provided for use in Japan.)

Bowl

Symbol	Description	Applicable model
2 Note 4)	Metal bowl	AF20 to 60
8 Note 3)	Metal bowl with level gauge	AF30 to 60

Note 4) Only metal bowl or metal bowl with level gauge available.

Option

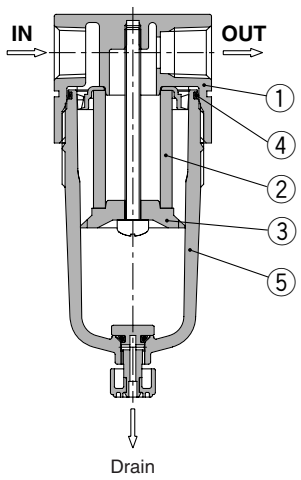
Symbol	Description	Applicable model
Nil	—	—
B Note 3)	With bracket	AF20 to 60

Note 3) Bracket is not assembled and is supplied loose at the time of shipment.

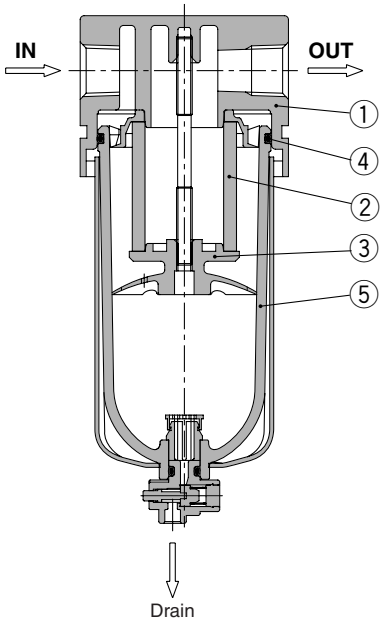
Note) Contact SMC regarding the detailed dimensions and optional availability.

Construction

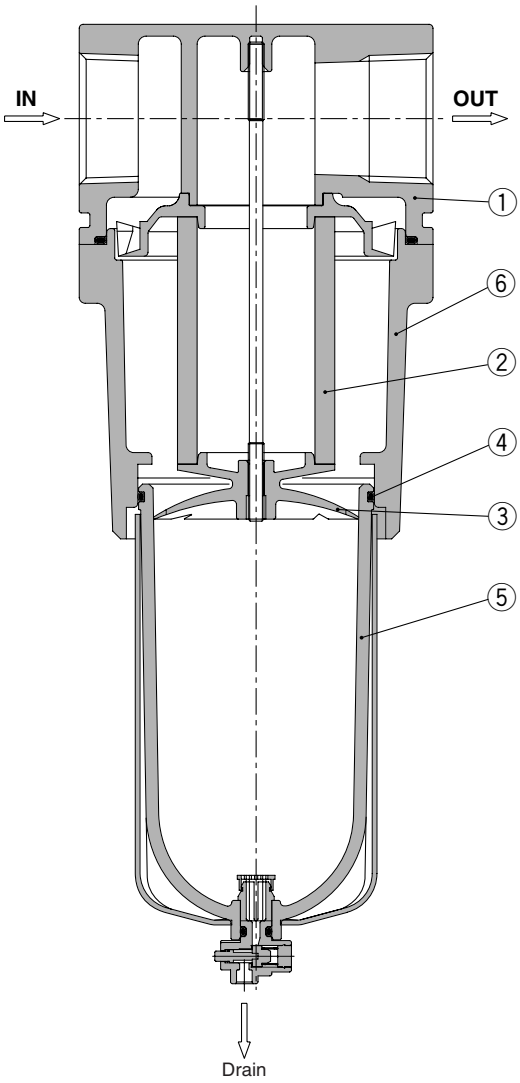
AF10, AF20



AF30 to AF40-06



AF50, AF60



Component Parts

No.	Description	Material	Model	Color
1	**Body**	Zinc die-cast	AF10, AF20	Platinum silver
		Aluminum die-cast	AF30 to AF60	
6	**Housing**	Aluminum die-cast	AF50, AF60	Platinum silver

Replacement Parts

No.	Description	Material	Part no.						
			AF10	**AF20**	**AF30**	**AF40**	**AF40-06**	**AF50**	**AF60**
2	**Filter element**	Non-woven fabric	AF10P-060S	AF20P-060S	AF30P-060S	AF40P-060S		AF50P-060S	AF60P-060S
3	**Baffle**	PBT	AF10P-040S Note 1)	AF20P-040S	AF30P-040S	AF40P-040S		AF50P-040S	AF60P-040S
4	**Bowl O-ring**	NBR	C1SFP-260S	C2SFP-260S	C3SFP-260S	C4SFP-260S			
5	**Bowl assembly** Note 2)	Polycarbonate	C1SF	C2SF	C3SF Note 3)	C4SF Note 3)			

Note 1) The material of the baffle for the AF10 (AF10P-040S) only is polyacetal.
Note 2) Bowl O-ring is included. Please contact SMC regarding the bowl assembly supply for psi and °F unit specifications.
Note 3) Bowl assembly for the AF30 to AF60 models comes with a bowl guard (steel band material).

Mist Separator
AFM20/30/40

How to Order

AFM **30** – **F** **03** **BD** – **2R**

Mist separator

Body size

20	30	40

Thread type

Nil	Rc
N Note 1)	NPT
F Note 2)	G

Note 1) Drain guide is NPT1/4 (applicable to AFM30 and 40), and the exhaust port for auto drain comes with ø3/8" One-touch fitting (applicable to AFM30 and 40).
Note 2) Drain guide is G1/4 (applicable to AFM30 and 40).

Port size

Symbol	Port size	Body size 20	30	40
01	1/8	●	—	—
02	1/4	●	●	●
03	3/8	—	●	●
04	1/2	—	—	●
06	3/4	—	—	●

Note 3) Bracket is not assembled and is supplied loose at the time of shipment.

Accessories

Symbol	Description	Applicable model
Nil	—	—
B Note 3)	With bracket	AFM20 to 40
C	Float type auto drain (N.C.) Note 4)	AFM20 to 40
D	Float type auto drain (N.O.) Note 4)	AFM30, 40

Note 4) Applicable tube O.D for auto drain connection should be ø3/8" in case NPT thread port is chosen.

Optional specifications

Symbol	Description	Applicable model
2	Metal bowl	AFM20 to 40
6	Nylon bowl	AFM20 to 40
8	Metal bowl with level gauge	AFM30, 40
C	With bowl guard	AFM20
J Note 5)	Drain guide 1/4	AFM30, 40
R	Flow direction: Right to left	AFM20 to 40
W	Drain cock with barb fitting: ø6 x ø4 nylon tube	AFM30, 40
Z Note 6)	Name plate and caution plate for bowl in imperial units (PSI, °F)	AFM20 to 40

∗ When more than one specification is required, indicate in ascending alphanumeric order.
Note 5) Without a valve function.
Note 6) For NPT thread type.
This product is for overseas use only according to the new Measurement Law. (The SI unit type is provided for use in Japan.)

◎: Combination available
○: Varies depending on the model
▭: Combination not available
△: Available only with NPT thread

Accessory/Optional specification combinations

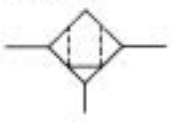
Accessory/Optional specifications \ Combination		Symbol	Accessory			Optional specification								Applicable mist separator	
			B	C	D	2	6	8	C	J	R	W	Z	AFM20	AFM30 to 40
Accessories	With bracket	B		◎	○	◎	◎	○	○	○	◎	○	△	◎	◎
	Float type auto drain (N.C.)	C	◎			◎	◎	○	○		◎		△	◎	◎
	Float type auto drain (N.O.)	D	◎			◎	◎	◎			◎		△		◎
Optional specifications	Metal bowl	–2	◎	◎	○					○	◎		△	◎	◎
	Nylon bowl	–6	◎	◎	○				○	○	◎	○	△	◎	◎
	Metal bowl with level gauge	–8	◎	◎	◎					◎	◎		△		◎
	With bowl guard	–C	◎	◎			◎				◎		△	◎	
	Drain guide 1/4	–J	◎			◎	◎	◎			◎		△		◎
	Flow direction: Right to left	–R	◎	◎	○	◎	◎	○	○	○		○	△	◎	◎
	Drain cock with barb fitting: ø6 x ø4 nylon tubing	–W	◎				◎				◎		△		◎
	Name plate and caution plate for bowl in imperial units (PSI, °F)	–Z	△	△	△	△	△	△	△	△	△	△		△	△


AFM20


AFM30


AFM40

JIS symbol



Standard specifications

Model	AFM20	AFM30	AFM40	AFM40-06
Port sizes	1/8 1/4	1/4 3/8	1/4 3/8 1/2	3/4
Fluid	Air			
Proof pressure	1.5MPa			
Maximum operating pressure	1.0MPa			
Minimum operating pressure	0.05MPa			
Ambient and fluid temperature	–5 to 60°C (with no freezing)			
Rated flow L/min (ANR) Note 1)	200	450	1100	1100
Nominal filtration rating	0.3µm (95% filtered particle size)			
Outlet side oil mist concentration	Maximum 1.0mg/m³ (ANR) (approx. 0.8ppm) Note 2)			
Bowl material	Polycarbonate			
Bowl guard	option	Standard		
Drain capacity (cm³)	8	25	45	45
Weight (kg)	0.18	0.22	0.44	0.49

Note 1) When the inlet pressure is 0.7MPa. Flow rate varies depending on the inlet pressure.
Note 2) When the compressor oil mist discharge concentration is 30mgf/m³ (ANR).

Accessory part no.

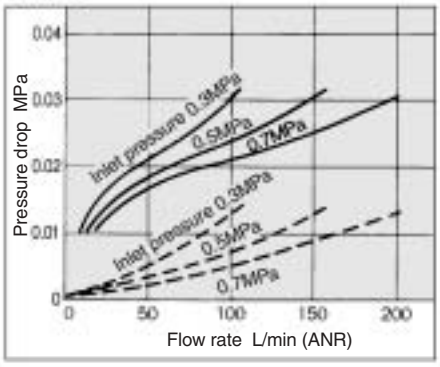
Accessory \ Applicable model		AFM20	AFM30		AFM40		AFM40-06	
Bracket assembly Note 1)		AF20P-050AS	AF30P-050AS		AF40P-050AS		AF40P-070AS	
Float type auto drain Note 2)	N.O.	—	AD38	AD38N Note 3)	AD48	AD48N Note 3)	AD48	AD48N Note 3)
	N.C.	AD27	AD37	AD37N Note 3)	AD47	AD47N Note 3)	AD47	AD47N Note 3)

Note 1) Assembly includes a bracket and 2 mounting screws.
Note 2) Minimum operating pressure: N.O. type–0.1MPa; N.C. type–0.1MPa (AD17/27) and 0.15MPa (AD37/47).
Note 3) When "N" is specified in the end of part number of auto drain, applicable tube O.D should be ø3/8".

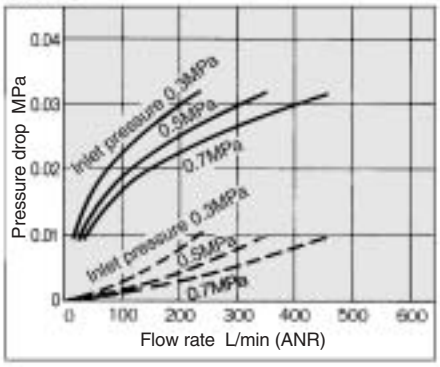
Flow Characteristics (Representative values)

——— : When saturated with oil
- - - - : Initial state

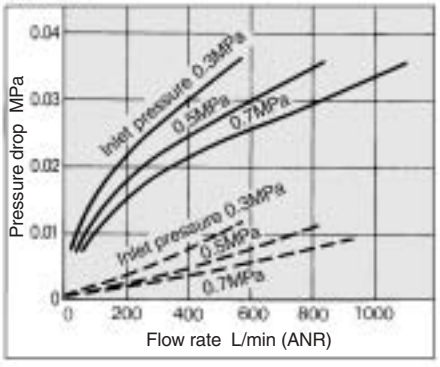
AFM20



AFM30

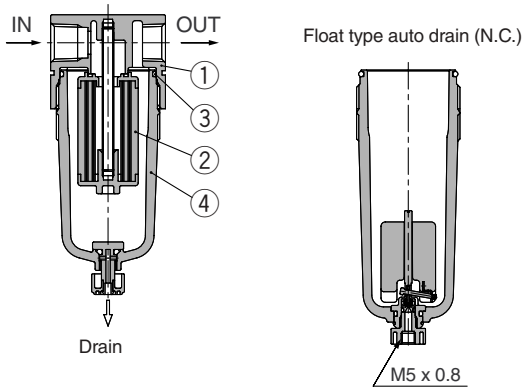


AFM40

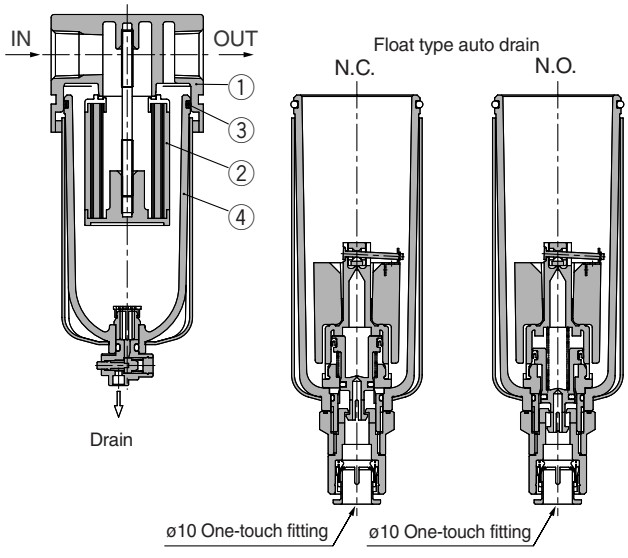


Construction

AFM20



AFM30, 40



Parts list

No.	Description	Material		Note
		AFM20	**AFM30, AFM40, AFM40-06**	
1	**Body**	Zinc die-cast	Aluminum die-cast	Platinum silver

Replacement parts

No.	Description	Material	Part no.			
			AFM20	**AFM30**	**AFM40**	**AFM40-06**
2	**Element assembly**	—	AFM20P-060AS	AFM30P-060AS	AFM40P-060AS	AFM40P-060AS
3	**Bowl O-ring**	NBR	C2SFP-260S	C3SFP-260S	C4SFP-260S	C4SFP-260S
4	**Bowl assembly** Note 1)	PC	C2SF	C3SF Note 2)	C4SF Note 2)	C4SF Note 2)

Note 1) Including O-Ring. Contact SMC regarding the bowl assembly supply for PSI and °F unit specifications.
Note 2) Bowl assembly for AFM30 to AFM40-06 includes a bowl guard (steel band material).

⚠ Specific Product Precautions

Be sure to read before handling. Refer to pages 75 through 78 for safety instructions and F.R.L. unit precautions.

Air Supply

⚠ Caution

1. Install an air filter (Series AF) as a preliminary filter on the inlet side of the mist separator to prevent premature clogging.
2. Do not install on the inlet side of the dryer as this can cause premature clogging of the element.

Maintenance

⚠ Warning

1. Replace the element every 2 years or when the pressure drop becomes 0.1MPa, whichever comes first, to prevent damage to the element.

Design

⚠ Caution

1. Design the system so that the mist separator is installed in a pulsation-free location. The difference between internal and external pressure inside the element should be kept within 0.1MPa, as exceeding this value could cause damage.

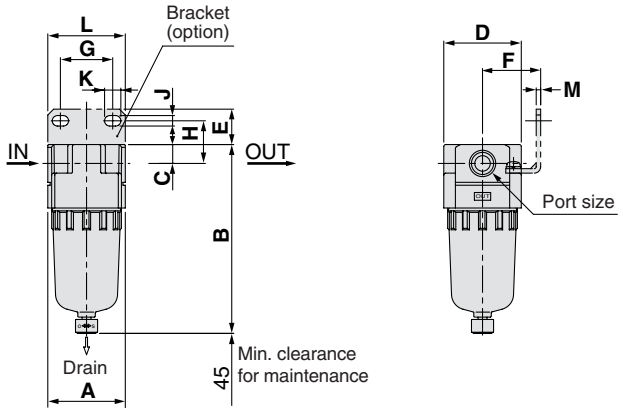
Selection

⚠ Caution

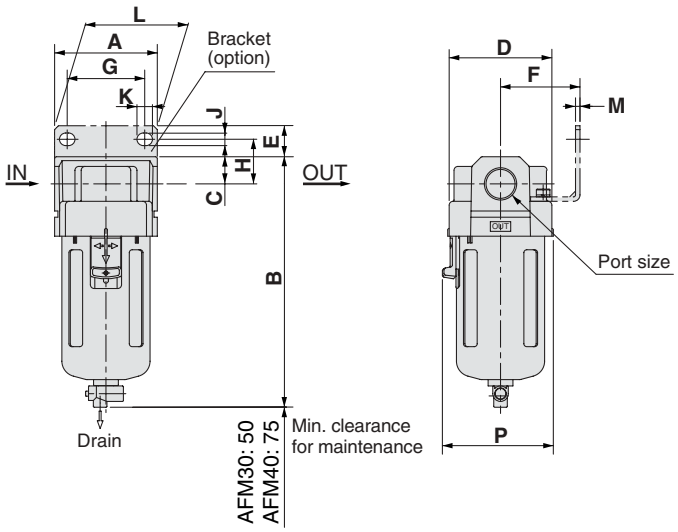
1. Do not allow air flow that exceeds the rated flow. If the air flow is allowed outside the range of the rated flow even momentarily, drainage and lubricant may splash at the outlet side or cause damage to the component.
2. Do not use in a low pressure application (such as a blower). F.R.L. unit has its own minimum operating pressure depending on the equipment and is designed specifically to function with compressed air. If used below the minimum operating pressure, a loss of performance and malfunction can occur. Contact SMC if an application under such conditions cannot be avoided.

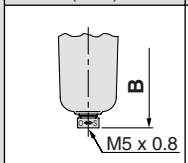
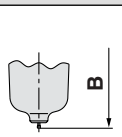
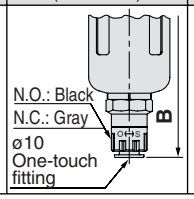
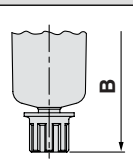
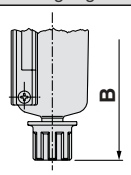
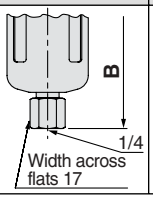
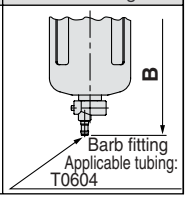
Dimensions

AFM20



AFM30, 40, 40-06



Applicable model	AFM20		AFM30, AFM40, AFM40-06				
	With auto drain (N.C.)	Metal bowl	With auto drain (N.O./N.C.)	Metal bowl	Metal bowl with level gauge	With drain guide	Drain cock with barb fitting
Optional specifications							

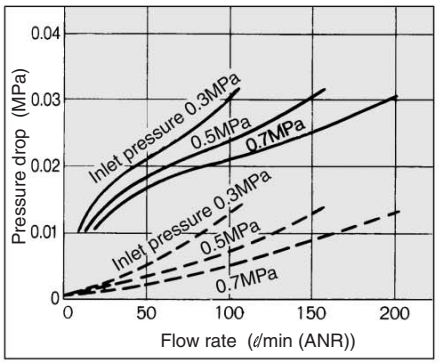
Model	Port size	Standard specification					Accessory specification								
							With bracket								With auto drain
		A	B	C	D	P	E	F	G	H	J	K	L	M	B
AFM20	1/8, 1/4	40	97	10	40	—	18	30	27	22	5.4	8.4	40	2.3	115
AFM30	1/4, 3/8	53	129	14	53	57	16	41	40	23	6.5	8	53	2.3	170
AFM40	1/4, 3/8, 1/2	70	165	18	70	73	17	50	54	26	8.5	10.5	70	2.3	204
AFM40-06	3/4	75	169	20	70	73	14	50	54	25	8.5	10.5	70	2.3	208

Model	Optional specification			
	With drain guide	With barb fitting	Metal bowl	Metal bowl with level gauge
	B	B	B	B
AFM20	—	—	97	—
AFM30	136	137	142	162
AFM40	172	173	178	198
AFM40-06	176	177	182	202

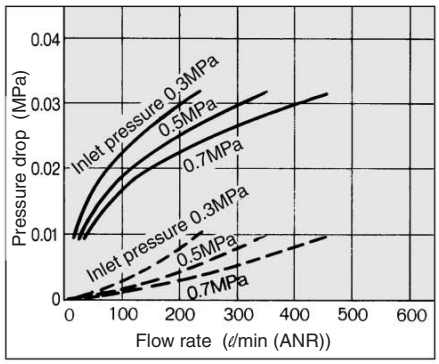
Flow Characteristics (Representative values)

——— : When saturated with oil
– – – – : Initial state

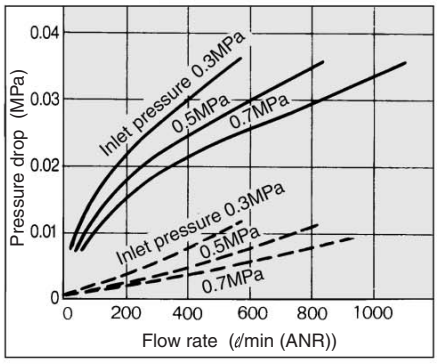
AFM20



AFM30

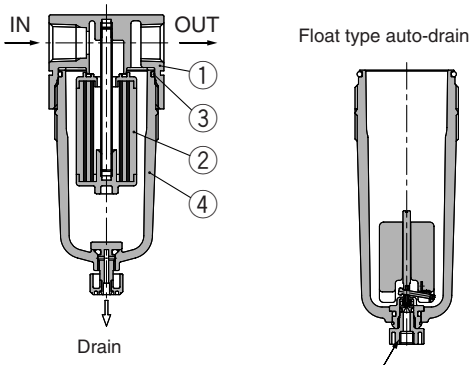


AFM40

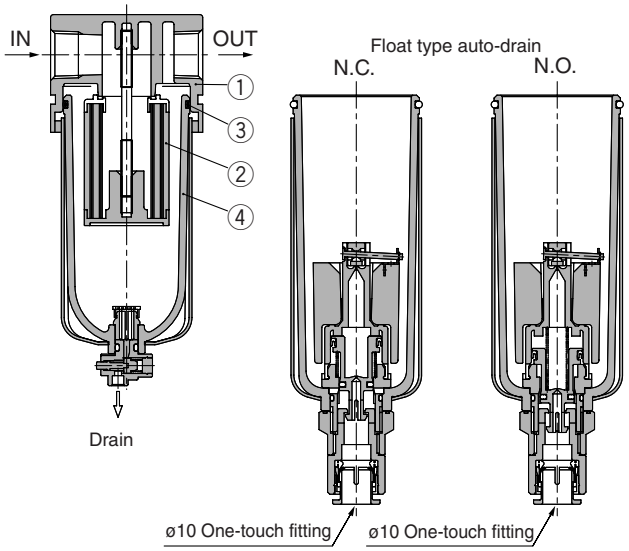


Construction

AFM20



AFM30/40



Component Parts

No.	Description	Material		Note
		AFM20	**AFM30, AFM40, AFM40-06**	
①	Body	Zinc die-casted	Aluminum die-casted	Platinum silver

Replacement Parts

No.	Description	Material	Part no.			
			AFM20	**AFM30**	**AFM40**	**AFM40-06**
②	Element assembly	—	AFM20P-060AS	AFM30P-060AS	AFM40P-060AS	AFM40P-060AS
③	Bowl O-ring	NBR	C2SFP-260S	C3SFP-260S	C4SFP-260S	C4SFP-260S
④	Bowl assembly (1)	PC	C2SF	C3SF (2)	C4SF (2)	C4SF (2)

Note 1) Including O-Ring. Please contact SMC regarding the bowl assembly supply for PSI and °F unit specifications.
Note 2) Bowl assembly for AFM30 to AFM40-06 includes a bowl guard (steel band material).

⚠ Precautions

Be sure to read before handling. Refer to pages 14-21-3 to 14-21-4 for Safety Instructions and Common Precautions.

Air Supply

⚠ Caution

1. Install an air filter (Series AF) as a preliminary filter on the inlet side of the mist separator to prevent premature clogging.
2. Do not install on the inlet side of the dryer as this can cause premature clogging of the element.

Maintenance

⚠ Warning

1. Replace the element every 2 years or when the pressure drop becomes 0.1 MPa, whichever comes first, to prevent damage to the element.

Design

⚠ Caution

1. Design the system so that the mist separator is installed in a pulsation-free location. The difference between internal and external pressure inside the element should be kept within 0.1 MPa, as exceeding this value could cause damage.

Selection

⚠ Caution

1. Do not allow air flow that exceeds the rated flow. If the air flow is allowed outside the range of the rated flow even momentarily, drainage and lubricant may splash at the outlet side or cause damage to the component.
2. Do not use in a low pressure application (such as a blower). F.R.L. unit has its own minimum operating pressure depending on the equipment and is designed specifically to function with compressed air. If used below the minimum operating pressure, a loss of performance and malfunction can occur. Please contact SMC if an application under such conditions cannot be avoided.

printed September 28, 2012

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FOR THE ONES WHO GET IT DONE

Unit Heater, 3.0/2.2 Kw, 240/208 V

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Additional Info

Electric Unit Heaters

Advanced pull-through airflow design for even air distribution and cooler element operation. Automatic reset thermal protection disconnects heater if normal operating temps. are exceeded. Heavy-duty, totally enclosed 60 Hz motors. Aluminum-finned, copper-clad steel sheath heating element. Neutral gray housing with threaded reinforced mounting holes (4 top and 4 back)—20-ga. steel for 3 to 20kW units, 18-ga. steel for 25 to 100kW units. Ceiling mounting requires 5/16-18 threaded rods, except 30" H units require 3/8-16 rods (see page 3061). Provide auxiliary, supplemental, or primary heat source in large exposed areas. 3-phase, 30 to 50kW units are wired for 1- or 2-stage control and contain 2-speed motor for High/Low fan selection. 60kW units are wired for 3-stage. 80 to 100kW are wired for 4-stage for greater flexibility in stage heating.

3 to 50kW units are UL and C-UL Listed. 60 to 100kW units are ETL Listed.

- Adjustable outlet louvers
- Fan-forced
- Ceiling
- or wall-mount, vertically or horizontally
- 24V low-voltage control circuit, except single-phase 3kW and 5kW units are wired for direct line voltage control

Tech Specs

Item: Electric Unit Heater
Type: Fan Forced
kW: 3.0/2.2
BtuH: 10,200/7500
Voltage: 240/208
Hz: 60
Phase: 1
Amps AC: 12.5/11.0
Temp. Rise (F): 27
CFM: 350
Height (In.): 16
Width (In.): 14
Depth (In.): 8-1/2
Max. Mounting Height (Ft.): 8
Horizontal Air Throw (Ft.): 12
Vertical Floor Coverage (Ft.): 18
Vertical Mounting H (Ft.): 9
Housing Material: 20 Gauge Steel
Housing Finish: Neutral Gray Powder Coated

Optional Accessories

Radial Diffuser, For 7.5/10/15 kW Heaters

Item #: 2YU34
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $166.75

Disconnect Switch, 120-600 V, 25 Amps

Item #: 2YU93
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $208.75

Unit Mounted Tstat, 24-277 V, SPST, 25 Amp

Item #: 2YU33
Brand: DAYTON
Usually Ships: Ready to Ship

Mounting Position: Vertical or Horizontal
Built-In Features: Totally Enclosed Fan Motor, 4 Top and 4 Back Threaded Reinforced Holes for Field Mounting with 5/16" Threaded Rod (Not Included), Automatic Reset Linear Thermal Protector
Requires: 5/16"-18 Threaded Rod for Ceiling Installation
Agency Compliance: UL/CUL
Includes: Adjustable Air Outlet Louvers
Warranty (Years): 1

Notes & Restrictions

Note: Wall-mounted or unit-mounted thermostat required; sold separately, this page.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Price (ea): $111.15

Unit Mounted Summer Fan Switch, 240-480 V

Item #: 2YU82
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $113.55

Ceiling Mount Bracket, Vert Throw, 3-5 kW

Item #: 2YU83
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $169.75

Disconnect Switch, 120-600 V, 63 Amps

Item #: 2YU94
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $326.25

Wall or Ceiling Mount Bracket

Item #: 2YV16
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $98.35

Line Voltage Control

Item #: 4E636
Brand: PECO
Usually Ships: Ready to Ship
Price (ea): $60.40

Alternate Products

UNIT HEATER, 3 kW, 208 V

Item #: 2YU61
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $418.80

Repair Parts

Repair Parts Information is available for this item.

printed September 27, 2012

GRAINGER
FOR THE ONES WHO GET IT DONE

Exhaust Fan, 12 In, 115 V, 820 CFM

Exhaust Fan, Guard Mounted, Propeller Dia. (In.) 12, CFM @ 0.000-In. SP 820, CFM @ 0.125-In. SP 535, Voltage 115, 60 Hz, 1 Phase, Operating Amps 1.5, Motor HP 1/25, Max. Ambient Temp. (F) 104, Motor RPM 1550, Motor Type Shaded Pole, Motor Enclosure Totally Enclosed Air-Over, Max. Depth (In.) 5-15/16, Mounting Position Horizontal or Vertical, Mounting Holes O.C. (In.) 10-3/16, Guard Material Steel, Wire Guard Finish Gray Polyester, Outside Dia. (In.) 13-1/2, Propeller Material Stamped Aluminum

Grainger Item #	1HKL4
Price (ea.)	**$125.60**
Brand	DAYTON
Mfr. Model #	1HKL4
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	8.72
Availability	Ready to Ship
Catalog Page No.	4257

Price shown may not reflect your price. Log in or register.

Additional Info

Guard- and Ring-Mount Exhaust Fans

Designed for low-pressure exhausting and cooling applications. Automatic shutter is recommended; see Index under "Shutters, Fan".

Guard-mount fans are UL and C-UL Listed.

- Mount: vertical or horizontal
- Motors: totally enclosed, 115V, 60 Hz
- Max. inlet/ambient temp.: 104°F

Tech Specs

Item: Exhaust Fan
Type: Guard Mounted
Propeller Dia. (In.): 12
CFM @ 0.000-In. SP: 820
CFM @ 0.125-In. SP: 535
Sones @ 0.000-In. SP @ 5 Ft.: 6.2
Voltage: 115
Hz: 60
Phase: 1
Operating Amps: 1.5
Motor HP: 1/25
Max. Ambient Temp. (F): 104
Bearing Type: Sleeve
Motor RPM: 1550
Motor Type: Shaded Pole
Motor Enclosure: Totally Enclosed Air-Over
Motor Insulation: Class A
Max. Depth (In.): 5-15/16
Mounting Position: Horizontal or Vertical
Mounting Holes O.C. (In.): 10-3/16
Guard Material: Steel
Wire Guard Finish: Gray Polyester
Outside Dia. (In.): 13-1/2
Propeller Material: Stamped Aluminum
Number of Blades: 3
Thermal Protection: Auto
Includes: Wiring, Junction Box, and 8" Leads
Agency Compliance: UL-CUL E53236

Notes & Restrictions

Optional Accessories

Thermostat, Linevoltage

Item #: 2E734
Brand: WHITE-RODGERS
Usually Ships: Ready to Ship
Price (ea): $66.08

Ventilation Control

Item #: 2E869
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $52.45

Alternate Products

Exhaust Fan, 10 In, 115 V, 595 CFM

Item #: 1HKL3
Brand: DAYTON
Usually Ships: Ready to Ship
Price (ea): $119.85

Repair Parts

Repair Parts Information is available for this item.

There are currently no notes or restrictions for this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Honeywell

T4031A,B,P; T6031A,B
Refrigeration Temperature Controllers

PRODUCT DATA

GENERAL

The T4031A,B,P and T6031A,B are temperature controllers used in a variety of cooling applications where remote mounting of the sensing element in the controlled medium is required.

FEATURES

- **Wide control temperature range is suitable for controlling ducts, tanks, freezers, coolers, display cases. and defrost termination.**
- **Universal mounting bracket is available for easy replacement of other controllers.**
- **Models are available with various control ranges.**
- **Control setpoint is dial-knob adjustable.**
- **Models are available with fixed or adjustable temperature differentials.**
- **Capillary lengths are 5, 8, or 20 ft (1.5, 2.4, 6.1m) depending on model.**
- **Reliable snap-acting spst or spdt switch.**
- **Ambient temperature compensated.**
- **Insert supplied with TRADELINE® models replaces setpoint knob to discourage tampering.**

Contents

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SPECIFICATIONS

IMPORTANT

The specifications given in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the specifications listed. Also, this product is tested and calibrated under closely controlled conditions, and some minor differences in performance can be expected if those conditions are changed.

TRADELINE® Models

TRADELINE® models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. TRADELINE® model specifications are the same as those of standard models except as noted below.

TRADELINE® Model Available:

T6031A Refrigeration Temperature Controller-spdt switch, adjustable temperature differential, tamper-resistant insert.

Capillary Length:

8 ft (2.4m)

Additional Features:

TRADELINE® pack with cross reference label and special instructions

Standard Models

T4031A Refrigeration Temperature Controller-spst switch makes on temperature rise; fixed differential

T4031B Refrigeration Temperature Controller—same as T4031A but less case

T4031P Refrigeration Temperature Controller—same as T4031A but uses screw, not knob, to adjust setpoint

T6031A Refrigeration Temperature Controller-spdt switch, fixed or adjustable temperature differential

T6031B Refrigeration Temperature Controller—same as T6031A but less case

Switch Action:

T4031A,B,P spst switch makes R to W on temperature rise

T6031A,B spdt switch makes R to W on temperature rise, R to B on temperature fall

Capillary Lengths and Temperature Ranges:

Model	Copper Capillary Tube Length		Setting Range[a]		Differential	
	ft	m	°F	°C	°F	°C
T4031A,B	5	1.5	-30 to 50	-34 to 10	Fixed at 3.5	Fixed at 1.6
	20	6.1				
T4031P	8	2.4	-30 to +90	-34 to +32	3.5 to 16	1.6 to 9
T6031A,B	5	1.5	-15 to +90	-9 to +32	Fixed at 3.5 or Adjust. from 3.5 to 12	Fixed at 1.6 or Adjust. from 1.6 to 7
	20	6.1				
	5	1.5	-30 to +50	-34 to +10		
	20	6.1				
	8	2.4	-30 to +90	-34 to +32		

[a] Dial scale markings in degrees Fahrenheit

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or your distributor, refer to the TRADELINE® catalog or price sheets for complete ordering number, or specify:

1. Order number.
2. Setting range.
3. Fixed or adjustable differential (T6031).
4. Length of copper capillary tube.
5. Accessories, if desired.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Home and Building Control Sales office (check white pages of your phone directory).
2. Home and Building Control Customer Relations
   Honeywell, 1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9. International Sales and Service Offices in all principal cities of the world.

Electrical Ratings:

	120 Vac		240 Vac	
	Normally Closed	Normally Open[a]	Normally Closed	Normally Open[a]
Full Load Amp	8	16	5.1	8
Locked Rotor Amp	48	80	30.6	40

[a] Makes on temperature rise.

Pilot Duty:
125 VA

Dimensions:
See Fig. 1

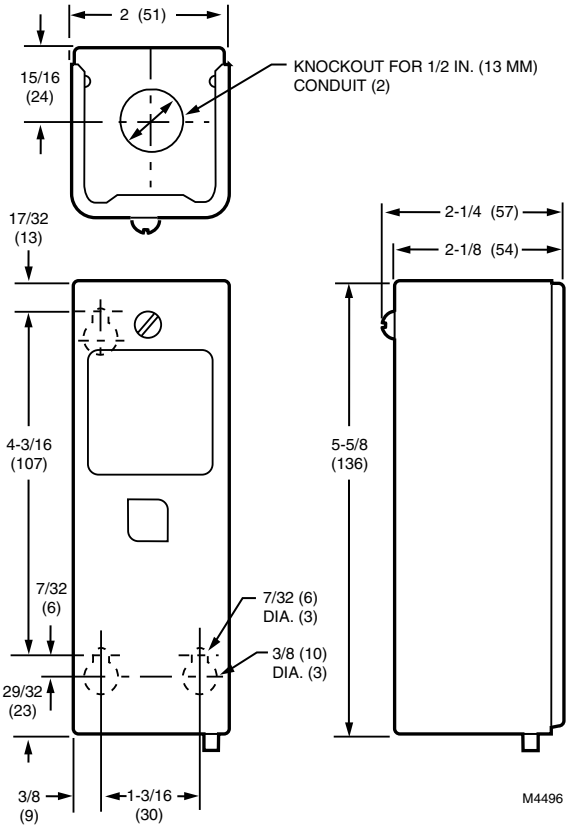

Fig. 1. Dimensions of T4031, T6031 in. (mm).

Underwriters Laboratories Inc.:
Listed

Maximum Ambient Operating Temperature:
125°F (52°C)

Accessories:
112622AA Immersion Well—short-necked, 1/2 in. NPT, copper
7617ABY Compression Fitting—50 psi water, 15 psi air
107324A Bulb Holder—for duct installation
105900 T-strap—for strapping bulb to pipe
7617ABZ Bag Assembly—for mounting controller to fan coil units
801534 Calibration Wrench
7640HY Standoff Bracket Bag Assembly—to mount controller to an insulated duct
130883 Universal Mounting Bracket
194899 Tamper-resisting Insert Button
Celsius Scaleplates:
194486 D: -15°C to +35°C replaces (0°F to 100°F) scaleplate
194486H: 15°C to 75°C replaces (55°F to 175°F)
194486F: 75°C to 125°C replaces (160°F to 260°F)

INSTALLATION

When Installing this Product…

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ CAUTION

- Disconnect power supply before installation to prevent electrical shock and equipment damage.
- Do not damage or change shape of capsule. Deformed capsule will cause calibration offset.

Mounting

Install controller in any convenient location. Make sure that the sensing bulb reaches the system to be controlled. The ambient temperature must not exceed 125°F (52°C) in the area where the controller is installed.

Install the sensing element where it can sense the average temperature. Avoid sharp bends or kinks in the capillary tubing that can affect the accuracy of the controller. Carefully coil the excess capillary tubing and leave it directly beneath the controller.

The 130883 Mounting Plate furnished with TRADELINE® models allows the control to be mounted in existing mounting holes.

Duct Installation

Position the sensing bulb in the duct to sense the average air temperature. Avoid mounting the bulb close to hot pipes, cooling coils, etc.

The 107324A Bulb Holder is available for suspending the bulb in a duct. See Fig. 2.

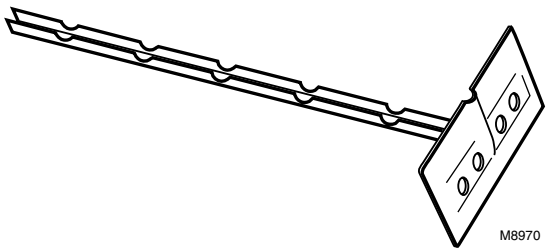

Fig. 2. 107324A bulb holder.

To install duct:

1. Make a hole in duct wall to admit sensing bulb into holder.
2. Using holder as template, mark and drill mounting holes.
3. Break off bulb holder to required length. (Be sure holder is long enough to hold sensing bulb away from duct wall and in freely circulating air.)
4. Place capillary tubing in bulb holder channel, with bulb at inner end of holder. Pinch together top edges of channel segments.
5. Insert assembled bulb and holder into duct, and fasten to duct wall with screws supplied.

Tank Installation

The sensing bulb can be inserted directly into a tank using a compression fitting; or the bulb can be inserted into an immersion well (order separately), which is screwed into a tank or boiler.

Select a location where liquid of average temperature can circulate freely around the sensing bulb.

Using Compression Fitting (Fig. 3)

1. Drain system. Screw boiler plug into properly sized and threaded boiler or pipe tapping.
2. Place packing nut on capillary tubing.
3. Slide sensing bulb completely through boiler plug.
4. Place composition disc and the four slotted brass washers on capillary tubing.
5. Slide assembly into boiler plug and tighten packing nut.
6. Refill system and check for leaks. Neatly coil excess capillary tubing.

Using Immersion Well (Fig. 4)

1. Drain system. Screw the well into threaded fitting.
2. Refill system and check for leaks.
3. Insert sensing bulb into well until it bottoms.
4. Fit bulb retaining clamp over immersion well flange and capillary tubing, and tighten screw.

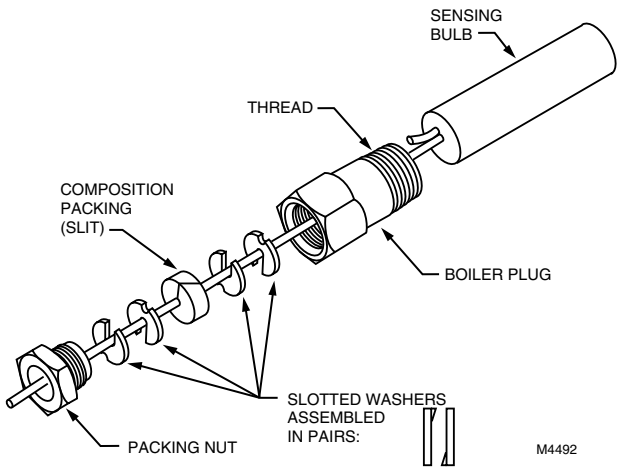

Fig. 3. Compression fitting installation.

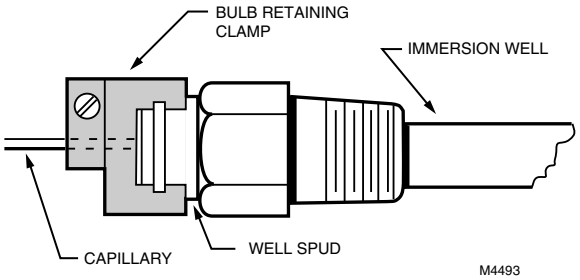

Fig. 4. Immersion well installation.

Cold Room Installation

Locate the bulb in freely circulating air in the controlled area or on the suction side of a refrigerant line, and secure the bulb in position.

Wiring (Fig. 5)

All wiring must comply with local electrical codes and ordinances.

Two knockouts are provided, one at the top and one at the bottom of the case for 1/2 in. conduit. Follow the wiring instructions furnished with the heating or cooling system. For replacement, make sure the new control is wired into the system to operate the same as the old control.

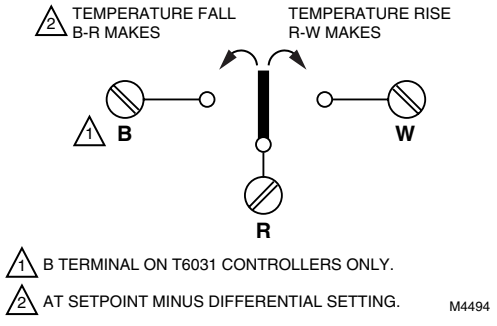

Fig. 5. Wiring terminals on T4031 and T6031 temperature controllers.

OPERATION AND CHECKOUT

When the temperature at the sensing bulb rises above the controller setpoint, a circuit is made between the R-W terminals. During a temperature fall, the R-W circuit breaks at the setpoint temperature *minus* the switch differential. Controllers with a B terminal break the B-R terminal circuit on a temperature rise to the setpoint. B-R makes again when R-W breaks on a temperature drop. See Fig. 6.

For example, if a controller with a 3°F (1.7°C) differential is set at 39°F (3.9°C), R-W makes when the bulb temperature rises to 39°F. Then during a temperature fall, R-W breaks when the temperature drops to 35°F (1.7°C) (39°F minus the 3°F differential [3.9°C minus the 1.7°C differential]).

On models with a B terminal, B-R makes when R-W breaks. Then the temperature has to climb past the control differential to the set point of 39°F (3.9°C) before the B-R circuit breaks and the R-W circuit makes.

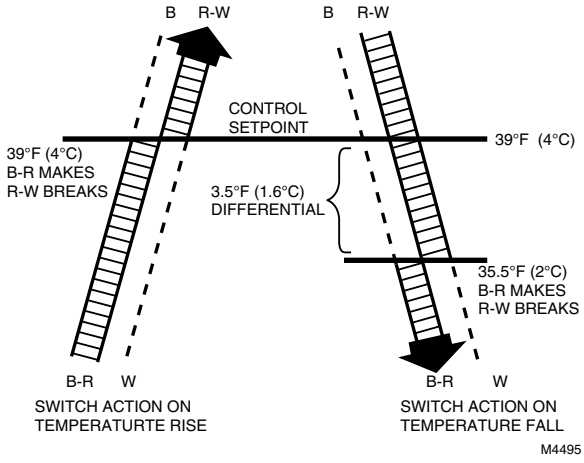

Fig. 6. Operation of switch on temperature rise and fall.

SETTING

Set the controller to the system manufacturer's recommended settings, if available.

Temperature Setpoint Knob—Turn the knob on the front of the case until the pointer indicates the temperature to be maintained in the controlled medium.

Screw—Insert a flatheaded screwdriver into the slot on the shaft, which is located in the center of the scaleplate. Turn the screwdriver clockwise ↷ to increase the temperature control point. Turn the screwdriver counterclockwise ↶ to decrease the temperature control point.

Adjustable Differential—With the cover off, turn the differential adjustment wheel (marked 3-6-9-12°F) until the desired differential is aligned with the notch in the frame. See Fig. 7.

Fixed differential models are 3.5°F at midscale.

Calibration

All controllers are carefully tested and calibrated at the factory under controlled conditions. If the controller is not operating at a temperature corresponding to the scale and differential setting, verify that the bulb senses the average temperature of the medium. If the temperature of the controlled medium is changing rapidly, the differential will appear wider than its setting.

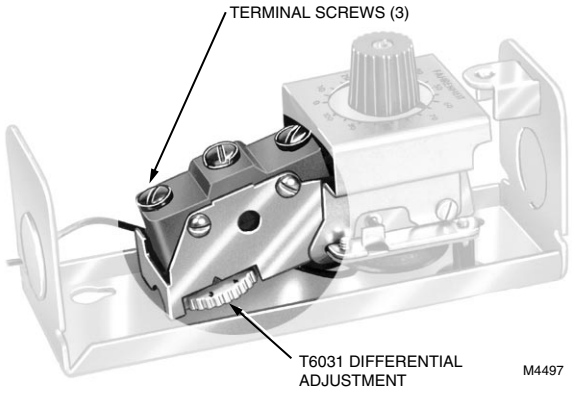

Fig. 7. Internal view showing differential adjustment wheel (applicable models).

For calibration, take an accurate temperature reading of the controlled medium. Place an accurate thermometer near the bulb of the controller, or refer to a thermometer installed as part of the system. If the bulb of the controller is installed in an inaccessible area, or if the controlled medium is unstable, remove the bulb and place in a controlled bath for accurate calibration.

These controllers are calibrated so the dial setting is the point at which the R-W switch contacts make (B-R contacts break) on a temperature rise. Measure the temperature at the bulb. Rotate the dial counterclockwise ↶ from the top of the scale, simulating a temperature rise, until the R-W switch contacts make. Note the dial reading. If it differs from the setpoint, calibrate the dial as follows:

1. Determine the number of degrees difference between the set point and the point at which the contacts make.
2. Remove the dial knob and slip the fingers of the calibration wrench into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note the dial indication at this point. Turn the dial and the calibration nut up or down scale the number of degrees that the set point differs from the point at which the contacts make (determined in step 1). For example, move the dial from 45 to 65 degrees for a 20 degree change in calibration.
3. Check the calibration adjustment by moving the dial up and down the scale while watching the contacts make and break. If dial is still out of calibration, repeat calibration procedure.
4. To install tamper-resisting insert on TRADELINE® model, remove screw from adjustment knob, remove knob, and install insert.

Honeywell

Home and Building Control
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1985 Douglas Drive North
Golden Valley, MN 55422

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www.honeywell.com/building/components

Shutter, Wall, 12 In

Exhaust Shutter, Gravity Operated, Single Panel, Fits Fan Dia 12 In, Overall Square 15 In, Opening Required 12 1/2 x 12 1/2 In, Frame Depth 2 1/2 In, Open Depth 5 3/4 In, Flange Width 1 1/2 In, Free Area 0.786 Square-Ft, Max Velocity 2500 FPM, Vertical Mounting Position, Blade Material White Painted Aluminum, Extruded Aluminum Frame and G-90 Glavanized Tie Rod, For Use With Vertical Mounted Exhaust Fans

Grainger Item #	4C556
Price (ea.)	**$37.50**
Brand	DAYTON
Mfr. Model #	4C556
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	4.0
Usually Ships	Today
Catalog Page No.	3915

Price shown may not reflect your price. Log in or register.

Additional Info

Single- and Double-Panel Exhaust Shutters

Efficient shutters for direct- or belt-driven exhaust fans are designed to prevent air backflow when the fan is off.

Counterbalanced louvers with felted edges (except fiberglass models) open easily and seal quietly. Units with 54" and 60" galvanized and aluminum shutters have 4 additional tie rods on the discharge side for smooth, quiet operation.

- Exhaust only
- Mount: vertical
- Max. velocity: 2500 FPM
- 1 1/2" flange

Aluminum Frame

For areas where corrosion may be a problem.

Aluminum louvers have white enamel finish, galvanized steel reinforcement strip, and stainless steel rivets. 16-ga. extruded aluminum frame. Frame depth: 2 1/2" for 10 to 24" models, 3" for models 30" and up.

Tech Specs

Item: Exhaust Shutter
Type: Gravity Operated, Single Panel
Fits Fan Dia. (In.): 12
Overall Square (In.): 15
Opening Required (In.): 12 1/2 x 12 1/2
Frame Depth (In.): 2 1/2
Open Depth (In.): 5 3/4
Flange Width (In.): 1 1/2
Mounting Hole Size (In.): 9/32 x 1/2
Free Area (Square-Ft.): 0.786
Max. Velocity (FPM): 2500
Mounting Position: Vertical
Blade Material: White Painted Aluminum
Construction Material: Extruded Aluminum Frame and G-90 Galvanized Tie Rod
For Use With: Vertical Mounted Exhaust Fans

Notes & Restrictions

There are currently no notes or restrictions for this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Optional Accessories

Shutter Motor

Item #: 2C831
Brand: DAYTON
Usually Ships: Today
Price (ea): $89.80

Pull Chain Kit, Single Pannel Shutters

Item #: 2FTW3
Brand: DAYTON
Usually Ships: Today
Price (ea): $25.30

Alternate Products

Fan Shutter, 12 1/2 In

Item #: 1C742
Brand: DAYTON
Usually Ships: Today
Price (ea): $34.05

Fan Shutter, 12 In, Beige Fiberglass

Item #: 5C211
Brand: DAYTON
Usually Ships: Today
Price (ea): $62.65

Repair Parts

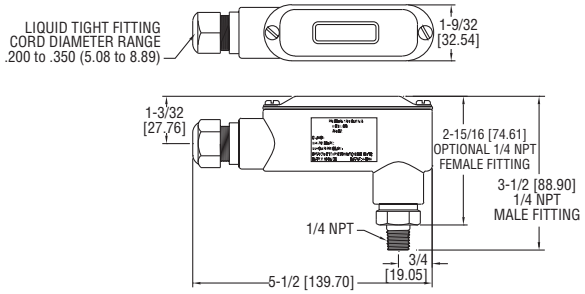
A Repair Part may be available for this item. Visit our Repair Parts Center or contact your local branch for more information.

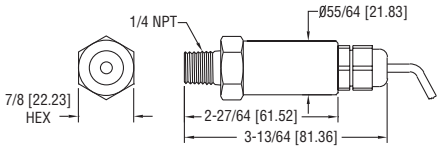
Series 626 & 628 Pressure Transmitters

Specifications - Installation and Operating Instructions

-CH Conduit Housing

-GH General Purpose Housing





The Series 626 and 628 Pressure Transmitters converts a single positive pressure into a standard 4-20 mA output signal. The Series 626 and 628 can be used to accurately measure compatible gases and liquids; Series 626 full scale accuracy is 0.25%; Series 628 full scale accuracy is 1.0% (see specifications). Designed for industrial environments with a NEMA 4X (IP66) housing, this transmitter resists most effects of shock and vibration.

CAUTION: Do not exceed specified supply voltage ratings. Permanent damage not covered by warranty will result. This device is not designed for 120 or 240 volt AC operation. Use only on 13 to 30 VDC.

Pressure Ranges		
Pressure Range	**Maximum Pressure**	**Over Pressure**
0-15 psia	30 psia	45 psia
15-0 psia	30 psia	45 psia
0-30 psia	60 psia	90 psia
0-50 psia	100 psia	150 psia
0-100 psia	200 psia	300 psia
0-200 psia	400 psia	600 psia
0-300 psia	600 psia	900 psia
0-5 psig	10 psig	50 psig
0-15 psig	30 psig	150 psig
0-30 psig	60 psig	300 psig
0-50 psig	100 psig	300 psig
0-100 psig	200 psig	500 psig
0-150 psig	300 psig	750 psig
0-200 psig	400 psig	1000 psig
0-300 psig	600 psig	1500 psig
0-500 psig	1000 psig	2500 psig
0-1000 psig	2000 psig	5000 psig
0-1500 psig	3000 psig	5000 psig
0-2000 psig	4000 psig	5000 psig
0-3000 psig	6000 psig	7500 psig
0-5000 psig	7500 psig	10000 psig
0-8000 psig	10000 psig	12000 psig

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Type 316 SS.
Accuracy:
626: 0.25% FS;
: 0.20% RSS;
628: 1.0% FS;
: 0.5% RSS;
626 absolute ranges: 0.5% FS;
: 0.35% RSS.
(Includes linearity, hysteresis, and repeatability).
Temperature Limit: 0 to 200°F (-18 to 93°C).
Compensation Temperature Range: 0 to 175° (-18 to 79°C).
Thermal Effect: 626: ±0.02% FS/°F. 628: ±0.04% FS/°F (includes zero and span).
Pressure Limits: See table.
Power Requirements: 10-30 VDC (for 4-20 mA, 0-5, 1-5, 1-6 VDC outpus); 13-30 VDC (for 0-10, 2-10 VDC outputs); 5 VDC ±0.5 VDC (for 0.5-4.5 VDC ratio-metric output).
Output Signal: 4-20 mA, 0-5 VDC,1-5 VDC, 0-10 VDC, or 0.5-4.5 VDC.
Response Time: 50 msec.
Loop Resistance: 0-1000 Ohms max. R max = 50 (Vps-10) Ohms (4-20 mA output), 5K Ohms (0-5, 1-5, 1-6, 0-10, 2-10, 0.5-4.5 VDC output).
Current Consumption: 38 mA maximum (for 4-20 mA output); 10 mA maximum (for 0-5, 1-5, 1-6, 0-10, 2-10, 0.5-4.5 VDC output); 140 mA maxumum (for all 626/628/629-CH with optional LED).
Electrical Connections: Conduit Housing (-CH): terminal block, 1/2″ female NPT conduit; General Purpose Housing (-GH): cable DIN EN 175801-803-C.
Process Connection: 1/4″ male or female NPT and BSPT.
Enclosure Rating: NEMA 4X (IP66).
Mounting Orientation: Mount in any position.
Weight: 10 oz (283 g).
Agency Approvals: CE.

INSTALLATION

1. Location: Select a location where the temperature of the transmitter will be between 0 and 175°F (-18 to 79°C). Distance from the receiver is limited only by total loop resistance. The tubing or piping supplying pressure to the unit can be practically any length required but long lengths will increase response time slightly.

2. Position: The transmitter is not position sensitive. However all standard models are originally calibrated with the unit in a position with the pressure connection downward. Although they can be used at other angles, for best accuracy it is recommended that units be installed in the position calibrated at the factory.

3. Pressure Connection: Use a small amount of plumber's tape or other suitable sealants to prevent leaks. Be sure the pressure passage inside the port is not blocked.

4. Electrical Connections

Wire Length -The maximum length of wire connecting the transmitter and receiver is a function of wire size and receiver resistance. Wiring should not contribute more than 10% of the receiver resistance to total loop resistance. For extremely long runs (over 1000 feet), choose receivers with higher resistance to minimize the size and cost of connecting leads. Where wiring length is under 100 feet, wire as small as 22 AWG can be used.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Phone: 219/879-8000 **www.dwyer-inst.com**
Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**

CURRENT (4-20 mA) OUTPUT OPERATION

An external power supply delivering 10-30 VDC with minimum current capability of 40 mA DC (per transmitter) is required to power the control loop. See Fig. A for connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistance (R_L) for the DC power supply voltage available is expressed by the formula:

$$R_L \text{ Max} = \frac{Vps - 10}{20 \text{ mA DC}}$$

Shielded cable is recommended for control loop wiring.

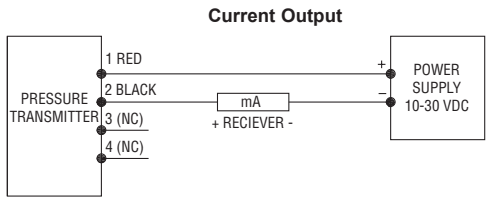


Fig. A: Current output connection

Conduit Housing with 4-20 mA Output (-CH) Electrical connections to the pressure transmitters are made to the terminal block located inside the housing. Remove the screws and lift off the cover. Wire as shown in Fig. A, B or C. Use Fig. A for current output connection. Use Fig. B for current output with optional LED display. Use Fig. C for current output with optional LED display using two power supplies.

If ordering optional pre-wired cable, black wire is negative (-) and red wire is positive (+).

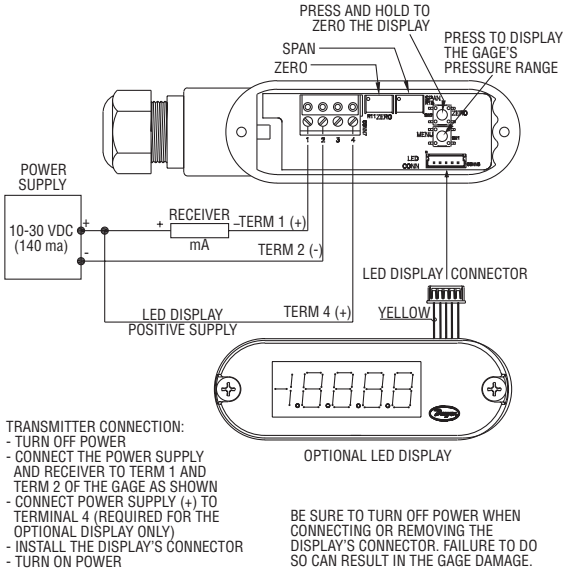


Fig. B: Current output with optional LED display connection

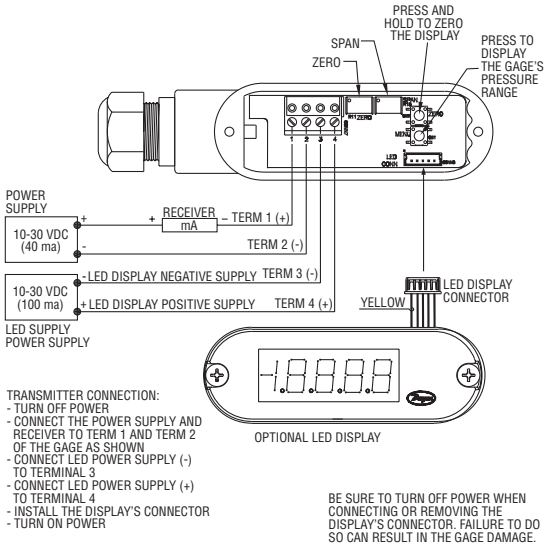


Fig. C: Current output with optional LED display using two power supplies

Heirschman DIN Connector with 4-20 mA When using cable version of -GH General Purpose Housing, black wire is negative (-) and red wire is positive (+). When using optional Heirschman DIN Plug, remove top-center screw and lift off the terminal block assembly. Wire to terminals shown below in Fig. D. For optional 4-pin M-12 connector, wire to pins as shown in Fig. E.

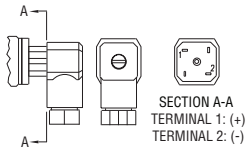


Fig. D

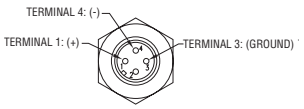


Fig. E

VOLTAGE (0-5, 1-5, 0-10, 1-6 or 2-10 VDC) OUTPUT OPERATION
(Other outputs contact the factory) See Fig. F for connection of the power supply, transmitter and receiver.

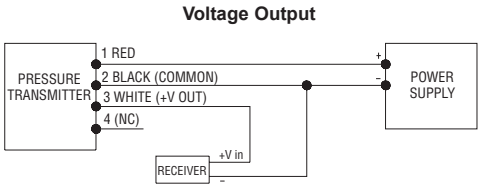


Fig. F: Voltage output connection

Conduit Housing (-CH) Electrical connections to the pressure transmitters are made to the terminal block located inside the housing. Remove the screws and lift off the cover. Wire as shown in Fig. F or Fig. G. Use Fig. F for voltage output connection. Use Fig. G for voltage output with optional LED display connection. If ordering optional pre-wired cable, black wire is negative (-), red wire is positive (+) and white wire is +Vout.

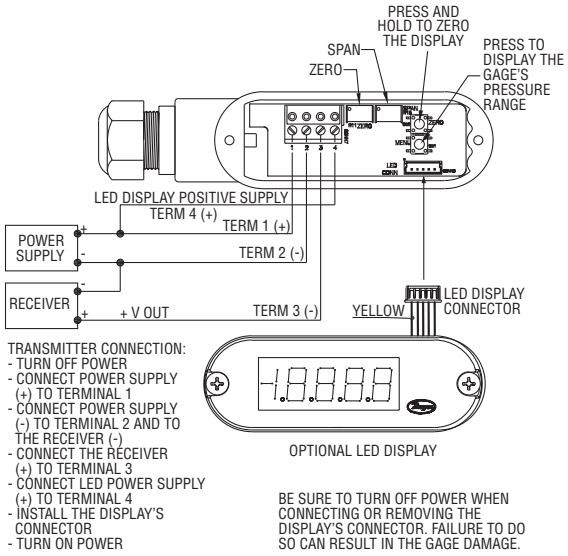


Fig. G: Voltage output with optional LED display connection

Heirschman DIN Connector with Voltage Output When using cable version of -GH General Purpose Housing, black wire is negative (-), red wire is positive (+) and white wire is output. When using optional Heirschman DIN Plug, remove top-center screw and lift off the terminal block assembly. Wire to terminals shown below in Fig. H. For optional 4-pin M-12 connector, wire to pins as shown in Fig. I. If utilizing optional A-164 cable for M-12 connection, brown wire corresponds to pin #1, white #2, blue #3, and black #4.

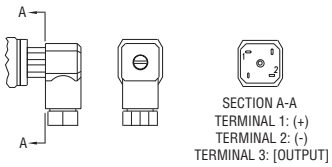


Fig. H

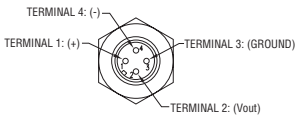


Fig. I

RATIOMETRIC (0.5-4.5 VDC) OUTPUT OPERATION
(Other outputs contact the factory) See Fig. J for connection of the power supply, transmitter and receiver.

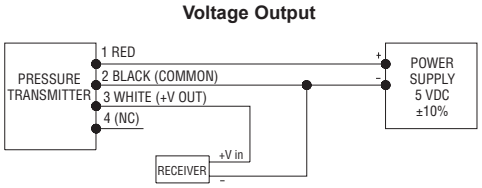


Fig. J: Voltage output connection

General Purpose Housing with Ratiometric Output When using cable version of -GH General Purpose Housing, black wire is negative (-), red wire is positive (+) and white wire is output. When using optional Heirschman DIN Plug, remove top-center screw and lift off the terminal block assembly. Wire to terminals shown below in Fig. K. For optional 4-pin M-12 connector, wire to pins as shown in Fig. L. If utilizing optional A-164 cable for M-12 connection, brown wire corresponds to pin #1, white #2, blue #3, and black #4.

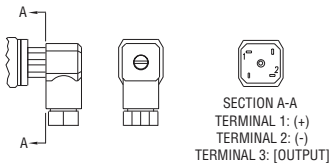


Fig. K

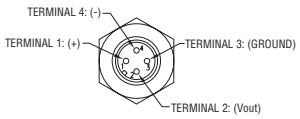


Fig. L

MAINTENANCE
After final installation of the pressure transmitter and its companion receiver, no routine maintenance is required. A periodic check of system calibration is suggested. The Series 626 and 628 transmitters are not field repairable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.

Phone: 219/879-8000
Fax: 219/872-9057

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Series 626 & 628

Industrial Pressure Transmitter

Complete Offering of Ranges, Connections and Outputs

General Purpose Housing (-GH)

General Purpose Housing (-GH) with DIN C

626 with LED Display (CH housing only)

Conduit Housing (-CH)

***Please see our website for dimensional drawings.**

The Series 626 Pressure Transmitters possess a highly precise 0.25% piezo-resistive sensor contained in a compact, rugged, NEMA 4X (IP66) stainless steel general purpose housing or cast aluminum conduit housing.

The Series 628 Pressure Transmitters are ideal for OEMs with 1% full scale accuracy sensors. The transmitter is also available in the general purpose stainless steel housing and the cast aluminum conduit housing.

The corrosion resistant 316L stainless steel wetted parts allow the Series 626 and 628 transmitters to measure the pressure in a multitude of processes from hydraulic oils to chemicals. The Series 626 and 628 are available in ranges of vacuum, compound to 5000 psi with a variety of optional outputs, process connections and electrical terminations to allow you to select the right transmitter for your application.

APPLICATIONS

- Compressors
- Pumping systems
- Irrigation equipment
- Hydraulic
- Industrial process monitoring

FEATURES

- Metal conduit housing option
- Robust 316 SS oil filled sensor
- Compact design

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Type 316L SS.
Accuracy:
626: 0.25% FS;
: 0.20% RSS;
628: 1.0% FS;
: 0.5% RSS;
626 Absolute Ranges: 0.5% FS;
: 0.35% RSS.
(Includes linearity, hysteresis, and repeatability.)
Temperature Limit: 0 to 200°F (-18 to 93°C).
Compensated Temperature Range: 0 to 175°F (-18 to 79°C).
Thermal Effect: ±0.02% FS/°F (includes zero and span).
Pressure Limits: See table.
Power Requirements: 13-30 VDC (for 4-20 mA, 0-5 VDC, 1-5 VDC, 0-10 VDC);
5 VDC ±10% (for 0.5-4.5 VDC).
Output Signal: 4-20 mA, 0-5 VDC,1-5 VDC, 0-10 VDC, or 0.5-4.5 VDC.
Response Time: 50 ms.
Loop Resistance: 0 - 1300 Ω max for current. For voltage outputs, min load resistance: 2000 Ω.
Stability: 1.0% FS/year (Typ.).
Current Consumption: 38 mA (max).
Electrical Connections: Conduit Housing (-CH): terminal block, 1/2″ female NPT conduit; General Purpose Housing (-GH): cable DIN EN 175801-803-C.
Process Connection: 1/4″ male or female NPT and BSPT.
Enclosure Rating: NEMA 4X (IP66).
Mounting Orientation: Mount in any position.
Weight: 10 oz (283 g).
Agency Approvals: CE.

Pressure Limits

Range Number	Pressure Range	Maximum Pressure (psig)	Over Pressure (psig)	Range Number	Pressure Range (psig)	Maximum Pressure (psig)	Over Pressure (psig)
00	0-15 psia	30	45	11	0-150	300	750
30	15-0 psia	30	45	12	0-200	400	1000
06	0-5 psig	10	50	13	0-300	600	1500
07	0-15 psig	30	150	14	0-500	1000	2500
08	0-30 psig	60	300	15	0-1000	2000	5000
09	0-50 psig	100	300	16	0-1500	3000	5000
10	0-100 psig	200	500	18	0-3000	6000	7500
				19	0-5000	7500	10000
				26	0-8000	10000	12000

Ordering Chart

Accuracy	626							0.25% Full-Scale Accuracy
	628							1.0% Full-Scale Accuracy
Range		-00						0-15 psia
		-01						0-30 psia
		-02						0-50 psia
		-03						0-100 psia
		-04						0-200 psia
		-05						0-300 psia
		-06						0-5 psi
		-07						0-15 psi
		-08						0-30 psi
		-09						0-50 psi
		-10						0-100 psi
		-11						0-150 psi
		-12						0-200 psi
		-13						0-300 psi
		-14						0-500 psi
		-22						0-600 psi
		-15						0-1000 psi
		-16						0-1500 psi
		-18						0-3000 psi
		-19						0-5000 psi
		-26						0-8000 psi
		-67						0-0.5 bar
		-71						0-2.5 bar
		-75						0-10 bar
		-81						0-40 bar
Housing			-CH					Conduit Housing
			-GH					General Purpose Housing
Process Connection				-P1				1/4″ male NPT
				-P2				1/4″ female NPT
				-P3				1/4″ male BSPT
				-P5				1/4″ female SAE with Refrigerant Valve Depressor ①
				-P9				1/2″ male NPT ①
Electrical Connection					-E1			Cable Gland with 3' of Prewired Cable
					-E3			Cable Gland with 9' of Prewired Cable
					-E4			DIN EN 175801-803-L ①
					-E5			1/2″ female NPT Conduit ②
					-E6			M-12 4 Pin Connector
Signal Output						-S1		4-20 mA
						-S2		1-5 VDC
						-S4		0-5 VDC
						-S5		0-10 VDC
						-S7		0.5-4.5 VDC ①
Options							-AT	Aluminum Tag
							-NIST	NIST Traceable Certificate
							-LED	Bright Red LED display ②③

① Available with -GH Housing only
② Available with -CH Housing only
③ LED option is not NEMA 4X (IP66)
④ Power Requirement: 5 VDC ±10%

201L LIQUID FILLED

Our '200' series gauge line is a high quality line of liquid filled gauges. The glycerine filling helps dampen the effects of pulsation and vibration, while also perpetually lubricating the movement (and keeping contaminates such as dirt away from all moving parts) which will extend the life of the gauge.

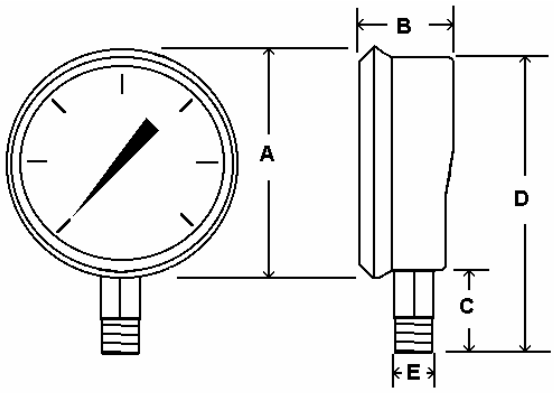
This gauge has been specifically designed with original equipment manufacturers in mind and are typically used on hydraulic & pneumatic systems as well as any commercial or industrial application not corrosive to brass and bronze wetted parts where glycerine filling is suitable for use.

SPECIFICATIONS:

- **Available Dial Sizes:** 1 ½", 2", 2 ½", 4", 6"
- **Available Connection Sizes:**
  1/8"MNPT on 1 ½" and 2"
  1/4"MNPT on 2", 2 ½" and 4"
  1/2"MNPT on 4" and 6"
- **Stainless Steel Case And Bezel**
- **Brass Internals & Connection**
- **Phosphour Bronze Bourdon Tube**
- **Liquid Filled (Dry Available)**
- **Accuracy :** 1 ½" or 2"Dial Size = 3-2-3 %
  2 ½"Dial Size = 1.5 %
  4" or 6"Dial Size = 1 %
- **Dual Scale: PSI & Bar (x100=kPa)**
  Single Scale available from stock
- **Ambient temperature:** FILLED: 30'F to 160'F
  DRY: -30'F to 180'F

RANGE	CODE	Major In	Minor In
30/0"VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	4
0/300	H	50	5
0/400	I	50	5
0/500	J	100	10
0/600	K	100	10
0/800	L	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/4000	Q	500	50
0/5000	R	1000	100
0/6000	S	2000	200
0/10,000	U	2000	200
0/15,000	V	2000	200

Some ranges not available in all dial sizes, please call with your particular application



		A	B	C	D	E
1 ½" Dial	In	1.88	1.06	.89	2.77	1/8" NPT
	MM	48	27	23	58	
2" Dial	In	2.24	1.27	.71	2.80	1/8" or ¼" NPT
	MM	57	32	23	71	
2 ½" Dial	In	2.80	1.28	1.07	3.55	1/4" NPT
	MM	71	33	27	90	
4" Dial	In	4.32	1.63	1.25	5.57	1/4" or ½" NPT
	MM	110	42	32	141	
6" Dial	In	6.54	1.70	1.68	8.22	1/4" or ½" NPT
	MM	166	43	43	210	

202L LIQUID FILLED

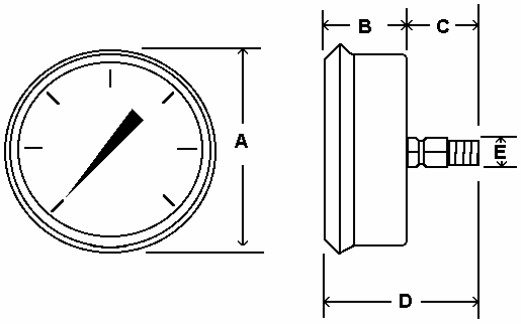
Our '200' series gauge line is a high quality line of liquid filled gauges. The glycerine filling and built in snubber helps dampen the effects of pulsation and vibration, while also perpetually lubricating the movement (and keeping contaminates such as dirt away from all moving parts) which will extend the life of the gauge.

This gauge has been specifically designed with the original equipment manufacturers in mind and are typically used on hydraulic & pneumatic systems as well as any commercial or industrial application not corrosive to brass and bronze wetted parts where glycerine filling is suitable for use.

SPECIFICATIONS:

- **Available Dial Sizes:** 1 ½", 2", 2 ½", 3 ½", 4"
- **Available Connection Sizes:** (includes built-in snubber)
  1/8"MNPT on 1 ½" and 2"
  1/4"MNPT on 2", 2 ½", 3 ½" and 4"
- **Stainless Steel Case And Bezel**
- **Brass Internals & Connection**
- **Phosphor Bronze Bourdon Tube**
- **Plastic Lens Standard (Glass Available)**
- **Liquid Filled (Dry Available)**
- **Accuracy :** 1 ½" and 2" Dial = 3-2-3 %
  2 ½" Dial Size = 1.5 %
  3 ½" and 4" Dial Size = 1 %
- **Dual Scale: PSI & Bar (x100=kPa)**
  Single Scale available from stock
- **Ambient temperature:** FILLED: 30'F to 160'F
  DRY: -30'F to 180'F

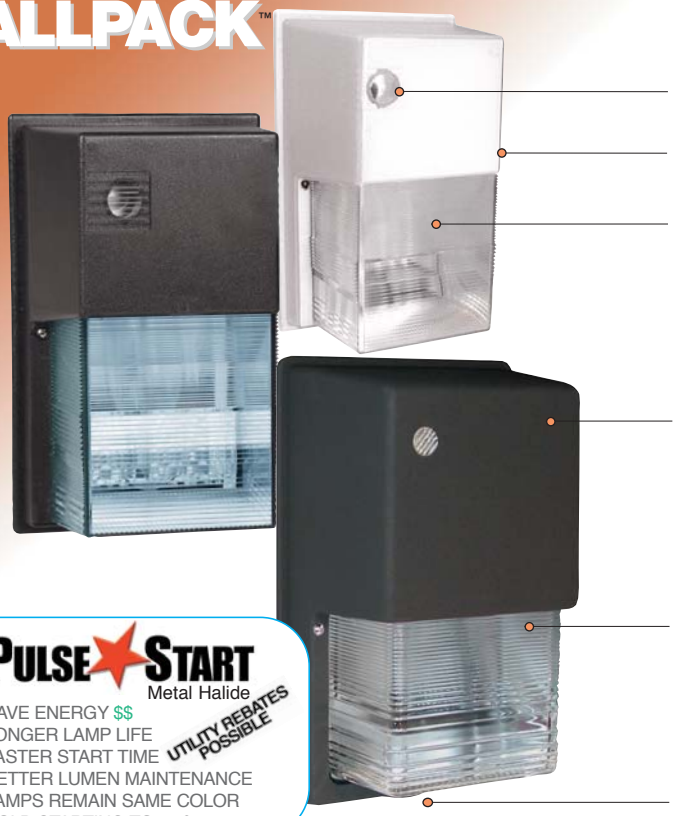
RANGE	CODE	Major In	Minor In
30/0"VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	5
0/300	H	50	5
0/400	I	50	5
0/600	K	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/5000	R	1000	100
0/10,000	U	1000	100
0/15,000	V	2000	200



		A	B	C	D	E
1 ½" Dial	In	1.88	1.06	.89	1.95	1/8" Npt
	MM	48	27	23	50	
2" Dial	In	2.23	1.09	.71	1.99	1/8" or ¼"npt
	MM	57	28	23	51	
2 ½" Dial	In	2.80	1.28	1.18	2.46	1/4" NPT
	MM	71	33	30	63	
3 ½" Dial	In	3.83	1.14	1.08	2.20	1/4" NPT
	MM	97	29	27	56	
4" Dial	In	4.32	1.63	1.14	2.77	1/4" NPT
	MM	110	42	29	71	

WALLPACKS
TALLPACK™

Compact, low-cost Wallpack with uniform light output for outdoor security lighting. HPS, Metal Halide or CFL with photocell or sensor.



Photocell for automatic dusk to dawn operation

Vandal resistant polycarbonate housing on WPT Series

Die formed aluminum reflector and prismatic polycarbonate refractor for wide light distribution

Heavy, die cast aluminum back plate with box mounting template

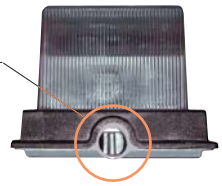
Heavy duty cast aluminum housing on WPTG Series

Shades work great with Tallpacks! (see pg. 54)

Heavy prismatic glass refractor

Packaging has product features, ballast and lamp specifications plus lighting layout photometrics and installation instructions

1/2" bottom conduit knockout



PULSE START Metal Halide
- SAVE ENERGY $$
- LONGER LAMP LIFE
- FASTER START TIME
- BETTER LUMEN MAINTENANCE
- LAMPS REMAIN SAME COLOR
- COLD STARTING TO -40°

UTILITY REBATES POSSIBLE

Product Information

	Watts	Lamp Type	Lamp Base	Ballast	Starting Amps / Operating Amps 120V	208V	240V	277V	Input Watts	Lamp ANSI	Initial Lumens	Lamp Hours
High Pressure Sodium Lamp supplied with fixture	35	ED17	Med	R-NPF 120V	1.4 / 0.9				46	S76	2,250	24,000
	50	ED17	Med	R-NPF 120V	1.8 / 1.2				62	S68	4,000	24,000
	70	ED17	Med	R-NPF 120V	2.1 / 1.6				86	S62	6,300	24,000
	70	ED17	Med	HX-HPF QT	.8 / .9	.5 / .5	.4 / .4	.4 / .4	91	S62	6,300	24,000
	100	ED17	Med	R-NPF 120V	3.1 / 2.1				115	S54	9,500	24,000
	100	ED17	Med	HX-HPF QT	1.3 / 1.2	.8 / .7	.7 / .6	.6 / .5	130	S54	9,500	24,000
Compact Fluorescent CFL Lamp supplied with fixture	28	Quad	GX32d-3	NPF 120V	.6 / .2				26		1,200	10,000
	42	Triple	GX24q-4	Electronic QT	.38	.25	.20	.17	47		3,200	12,000
Metal Halide Lamp supplied with fixture PS = Pulse Start	PS 50	ED17	Med	HX-NPF 120V	2.0 / 1.6				69	M110	3,400	10,000
	PS 50	ED17	Med	HX-HPF 120V	.8 / .7				69	M110	3,400	10,000
	PS 50	ED17	Med	HX-HPF DT	.6 / .7			.3 / .3	72	M110	3,400	10,000
	PS 70	ED17	Med	HX-NPF 120V	2.5 / 2.1				94	M98	5,600	15,000
	PS 70	ED17	Med	HX-HPF QT	.6 / .9	.3 / .5	.3 / .5	.3 / .4	90	M98	5,600	15,000
	PS 100	ED17	Med	HX-HPF QT	1.2 / 1.2	.8 / .7	.7 / .6	.6 / .5	129	M90	9,000	15,000

Accessories

Wire Guard
Shade - curved
Shade - rectangular

Specifications

UL Listing:
Suitable for wet locations

Housing & Refractor:
WPTS
Vandal resistant polycarbonate molded refractor. Die cast Aluminum back plate.
WPTG
Heavy die cast aluminum housing with prismatic glass refractor.

Reflector:
Die formed aluminum for wide light distribution.

Ballast Housing:
Stamped steel painted white

Back Plate:
Heavy die cast aluminum. 1/2" bottom conduit knockout. Knockouts for mounting to 3" or 4" junction boxes.

Socket:
HPS: Porcelain 4kv Pulse Rated
CFL: 28w = GX32d-3, 42w = GX24q-4

Sensor Switching Capacity:
250 watts fluorescent on WPTFMS model only. 120 volt only.

Sensor Time Adjustment:
5 seconds to 15 minutes

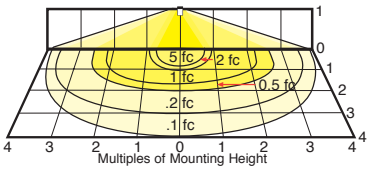
Sensor Detection Zone:
Full 180° by 30'

Info Online 24/7

Installation Manuals, Wiring Diagrams and Photometrics
www.rabweb.com > click "PRODUCTS"

Photometrics

70w HPS @ 10' Mounting Height



Mounting Height	Multiplier
8'	1.6
10'	1.0
12'	.7
16'	.4
20'	.25

HPS Watts	Multiplier	CFL Watts	Multiplier
100	1.5	22	.2
70	1.0	42	.5
50	.6		
35	.4		

MH Watts	Multiplier
100	1.4

Tallpack Die Cast w/ Glass

Heavy duty die cast aluminum housing with prismatic glass refractor. HPS and Metal Halide models available. with 1/2" bottom and back conduit knockout. Factory installed photocell optional. Lamp included.

Finish: ● Architectural Bronze
○ White

HPS Tallpack

HPS "Tall" Wallpack. Vandal resistant polycarbonate housing. Heavy die-cast aluminum back plate with 1/2" bottom and back conduit knockout. Factory installed photocell optional. Lamp included.

Finish: ● Architectural Bronze
○ White

Fluorescent Tallpack

28 & 42 watt compact fluorescent Tallpack. Vandal resistant polycarbonate housing. Heavy die-cast aluminum back plate with 1/2" bottom and back conduit knockout. Factory installed photocell optional. Operating temperature 28w (-20ºF), 42w (0ºF). Lamp included.

Finish: ● Architectural Bronze
○ White

Fluorescent Smart Tallpack

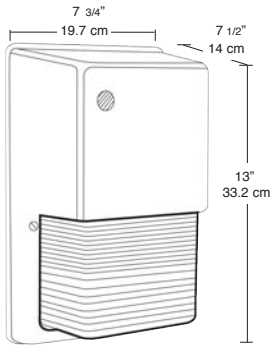
28 & 42 watt compact fluorescent Tallpack with built-in mini sensor for motion activated operation. Vandal resistant polycarbonate housing. Sensor has 180º detection and controls up to 250 watts. 120 volt only. Lamp included.

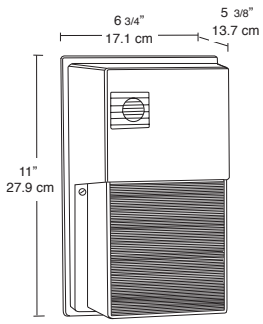
Finish: ● Architectural Bronze
○ White

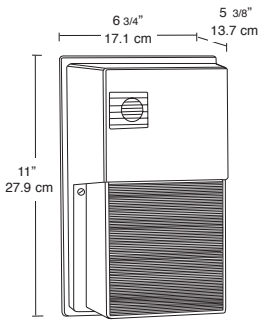
Catalog Numbers

For white fixture finish add suffix "W"		For white fixture finish add suffix "W"		For white fixture finish add suffix "W"		For white fixture finish add suffix "W"
Photocell	**No Photocell**	**Photocell**	**No Photocell**	**Photocell**	**No Photocell**	**With Sensor**
		WPTS35	WPTS35NPC			
		WPTS50	WPTS50NPC			
		WPTS70	WPTS70NPC			
WPTGSN70/PC	WPTGSN70					
WPTGSH70QT/PC▲	WPTGSH70QT					
WPTGSN100/PC	WPTGSN100					
WPTGSN100QT/PC▲	WPTGSH100QT					
▲Specify Photocell voltage				WPTF28	WPTF28NPC	WPTF28MS (120 volt only)
				WPTF42▲	WPTF42NPC	WPTF42MS (120 volt only)
WPTGHN50/PC	WPTGHN50					
WPTGHH50/PC	WPTGHH50					
WPTGHH50QT/PC▲	WPTGHH50QT					
WPTGHN70/PC	WPTGHN70					
WPTGHH70QT/PC▲	WPTGHH70QT					
WPTGHH100QT/PC▲	WPTGHH100QT					
GDWPTG	GDWPTG					
SHC1	SHC1	SHC1	SHC1	SHC1	SHC1	SHC1
SHR1	SHR1	SHR1	SHR1	SHR1	SHR1	SHR1

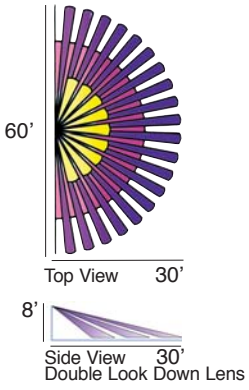
Dimensions







Detection Pattern



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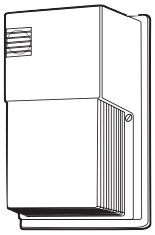
RAB LIGHTING

TALLPACK

Installation Instructions

c UL us LISTED
SUITABLE FOR WET LOCATIONS



Thank you for buying RAB lighting fixtures. Our aim is to design the best quality products so you can get the job done right. We'd like to hear your comments. Call us at 888-RAB-1000, attention Marketing Department.

IMPORTANT

READ CAREFULLY BEFORE INSTALLING FIXTURE. RETAIN INSTRUCTIONS FOR FUTURE REFERENCE.

RAB Tallpack fixtures must be wired in accordance with the National Electrical Code and applicable local codes. Proper grounding is required for safety.

Tallpack fixtures are for outdoor use and should not be used in areas with limited ventilation or high ambient temperatures. Installation should be done by a qualified electrician.

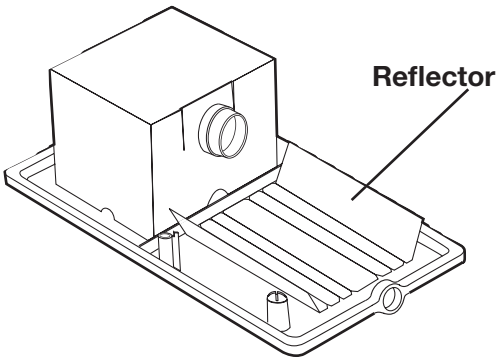
USE SUPPLY WIRE RATED FOR 90°. WARNING: RISK OF FIRE. MOST DWELLINGS BUILT BEFORE 1985 HAVE SUPPLY WIRE RATED FOR 60°. CONSULT AN ELECTRICIAN BEFORE INSTALLING.
Warning: Make certain power is OFF before installing or maintaining fixture.

LOCATION

Fixtures should not be recessed and is for wall mount only. Fixture must be positioned with lamp in vertical position with lampholder base up.

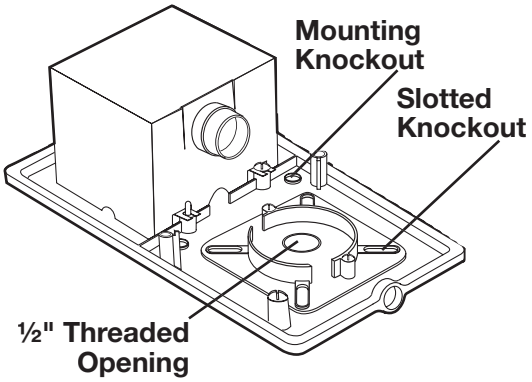
MOUNTING

1. Loosen 2 screws from both sides of the front refractor.
2. Remove front refractor.
3. Remove refractor by loosening screws just enough to allow reflector to slide upward until keyhole in reflector releases screws.



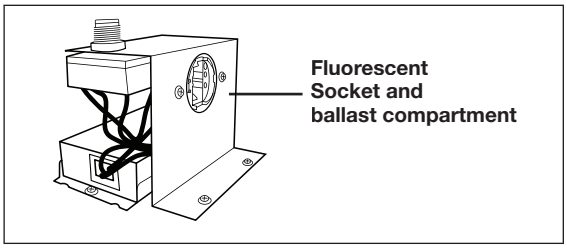
Standard Box Mounting:

1. Remove center ½" Plug to route wires.
2. For 3½" or 4" round box or 4" square box, knockout 2 or 4 slotted openings in rear housing for screw attachment to box (screws not provided).
3. Use gasket supplied. It is also advised to use weatherproof silicone sealant to prevent entry of moisture into fixture.



Odd-sized Box Mounting:

1. Remove center ½" Plug to route wires.
2. Knockout 2 mounting holes in housing.
3. Mount with 2 lag screws (not provided) which will penetrate at least ¾" of wood or similar solid surface.
4. Use weatherproof silicone sealant when mounting fixture to outlet box and mounting surface to prevent entry of moisture into fixture.



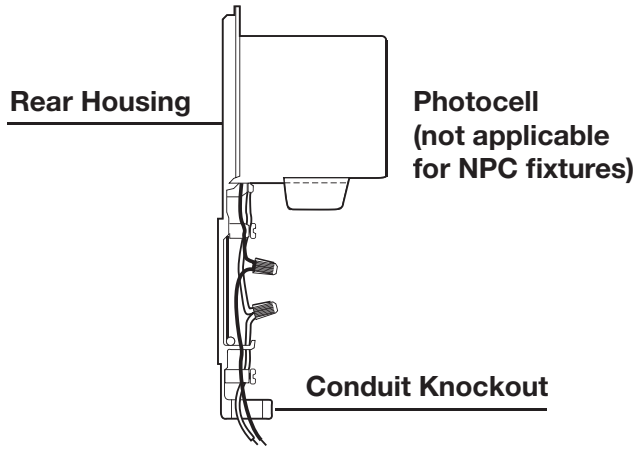
Bottom Conduit Mounting: See Back

TALLPACK INSTALLATION INSTRUCTIONS

MOUNTING (continued)

Bottom Conduit Mounting:

1. With front housing and reflector off, knockout the bottom conduit hole in the rear housing.
2. Pull service wires through the conduit opening and make connection as indicated under Wiring section.
3. Replace the reflector and refractor cover.
4. Attach to wall box per “Odd-sized Box Mounting”, instructions #2 & 3 on previous page.

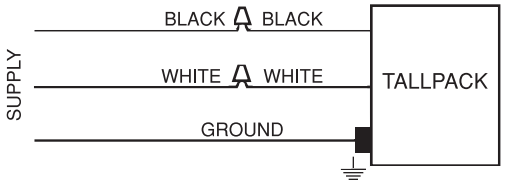


WIRING

Use supply wire rated for 90°C.

Caution: Check that voltage is compatible with fixture ballast.

1. Connect the black fixture lead to the black supply lead.
2. Connect the white fixture lead to the white supply lead.
3. Connect supply ground wire to fixture ground screw.



RE-LAMPING

Caution: Prior to installing, check that the lamp is of the proper type and wattage. Observe lamp manufacturers recommendations on lamp operation, ballast type and burning positions. Disconnect power. Make sure fixture and lamp are cool enough to touch.

1. Remove front refractor following instructions under Mounting section.
2. Remove old lamp.
3. Place lamp into lamp socket securely until it is firmly seated.
4. Replace front refractor.

REPLACEMENT LAMPS

High Pressure Sodium

Wattage	Catalog #	ANSI Code
35	LHPS35	S76
50	LHPS50	S68
70	LHPS70	S62

Fluorescent

Wattage	Catalog #
28	LCFL28
42	LCFL42

CLEANING

Caution: *Be sure fixture is cool enough to touch. Be sure power is off.*

Clean reflector and refractor with a cloth moistened with non abrasive, non flammable glass cleaning solution.

TROUBLE SHOOTING CHECKLIST

Check that:

1. Proper lamp is installed. Lamp is not faulty.
2. Line voltage at the fixture is proper.
3. Fixture is wired properly.
4. Fixture is grounded properly.

EASY INSTALLATION & PRODUCT HELP

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Tech Help Line
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888-RAB-1000

Website
www.rabweb.com

e-mail
sales@rabweb.com

THESE INSTRUCTIONS DO NOT COVER ALL DETAILS OR VARIATIONS IN EQUIPMENT, NOR DO THEY PROVIDE FOR EVERY POSSIBLE CONTINGENCY TO BE MET IN CONNECTION WITH INSTALLATION, OPERATION OR MAINTENANCE.

Over 28 warehouses nationwide!

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WPTS70

JOB NAME: _____

DATE: _____

TYPE: _____

DESCRIPTION

HPS "Tall" Wallpack. Vandal resistant polycarbonate housing. Heavy die-cast aluminum back plate with 1/2" bottom and back conduit knockout. Factory installed photocontrol optional. Lamp supplied.

SPECIFICATIONS

Back Plate:
Heavy die cast aluminum. 1/2" bottom conduit knockout. Knockouts for mounting to 3" or 4" junction boxes

Ballast Housing:
Stamped steel painted white

Reflector:
Die formed aluminum for wide light distribution

UL Listing:
Suitable for wet locations

Housing:
Vandal resistant polycarbonate housing

Patents:
RAB sensor and fixture designs are protected under U.S. and International Intellectual Property laws.

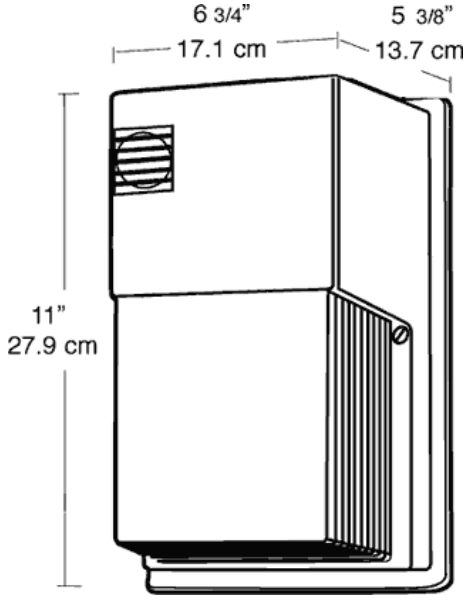
Refractor:
Prismatic polycarbonate refractor for wide light distribution

Socket:
Porcelain 4kv Pulse Rated

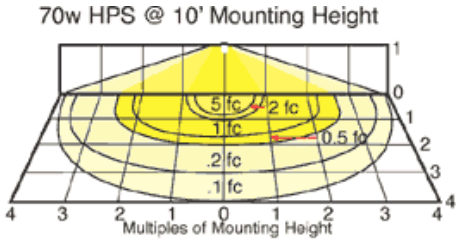
Color:
Bronze

Weight:
6.17

DIMENSIONS



PHOTOMETRIC



Mounting Height	Multiplier
8'	1.6
10'	1.0
12'	.7
16'	.4
20'	.25

HPS Watts	Multiplier	CFL Watts	Multiplier
100	1.5	22	.2
70	1.0	42	.5
50	.6		
35	.4		

MH Watts	Multiplier
100	1.4

ORDERING INFORMATION

High Pressure Sodium
Lamp supplied with fixture

Total Watts	Lamp Type	Lamp Base	Ballast	Starting Amps/ Operating Amps 120V	208V	240V	277V	Input Watts	LAMP ANSI	Initial Lumens	Lamp Hours
70	ED17	Medium	R-NPF 120V	2.1/1.6				86	S62	6300	24000

Factory Installed Options
Add suffix to Catalog Number

- Tamperproof screws (/TP)
- Swivel Photocontrol (/PCS)
- Single fusing for 120 and 277 volt (/F)
- Double fusing for 208 and 240 volt (/FF)
- Button Photocontrol (/PC)

Note: Specifications may change without notice

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Appendix C

PROCESS ROOM COMPONENTS

Component	PID	Description	Manufacturer	Part Number
Liquid Ring Pump 101	LRP-101	Liquid Ring Pump 101 40 HP, 600 ACFM @ 28.6" HG, 1750RPM 230/460 VAC, 3 Phase, 60 HZ	Travaini DynaSeal	TRO600V-1A-XP
Liquid Ring Pump 102	LRP-102	Liquid Ring Pump 102 40 HP, 600 ACFM @ 28.6" HG, 1750RPM 230/460 VAC, 3 Phase, 60 HZ	Travaini DynaSeal	TRO600V-1A-XP
Transfer Pump 200	TP-200	Transfer Pump 200 Progressive Cavity 1-1/2" Suction, 1-1/4" Discharge	Moyno	35601
Transfer Pump 200 Motor	TP-200	Transfer Pump 200 Motor 1//.75 HP, 1750//1450 RPM, 3 Phase, 143T Frame, 60//50 HZ, 230/460//190/380 VAC	Baldor	M7014T
Transfer Pump 202	TP-202	Transfer Pump 202 Progressive Cavity 1-1/2" Suction, 1-1/4" Discharge	Moyno	35601
Transfer Pump 202 Motor	TP-202	Transfer Pump 202 Motor 1//.75 HP, 1750//1450 RPM, 3 Phase, 143T Frame, 60//50 HZ, 230/460//190/380 VAC	Baldor	M7014T
Transfer Pump 300	TP-300	Air Operated Diaphragm Pump Max 49 GPM, Max 100 PSI, Max 30 CFM	Dayton	6PY44
Transfer Pump 301	TP-301	Transfer Pump 301 - Centrifugal 3 HP, 3500 RPM, 3 Phase, 60 HZ, 208-230/460 VAC, 8.3-7.6/3.8 A, 1-1/2" Suction, 1-1/4" Discharge, 56C Frame	Goulds	2ST1H7B
Lovejoy Coupler Body 1		Lovejoy Shaft Coupler Body for Transfer Pump 200, 202 & Motors	Lovejoy	68514436059 (Grainger 1L801)
Lovejoy Coupler Body 2		Lovejoy Shaft Coupler Body for Transfer Pump 200, 202 & Motors	Lovejoy	68514436060 (Grainger 1L802)

Component	PID	Description	Manufacturer	Part Number
Lovejoy Shaft Coupler Insert		Lovejoy Shaft Coupler Insert for Transfer Pump 200, 202 & Motors	Lovejoy	5JE (Grainger 1L797)
Oil Water Separator	OWS	200 GPM Oil Water Separator 80 Ft^3 Coalescing Media	Hydro Quip	AG-4CS-IP-1H
Knock Out Tank		220 Gallon Knock Out Tank Vapor Liquid Separator	ProAct	
Knock Out Tank Filter		6" L-Style Vacuum Filter	Solberg	CSL-375P-600F
Air Silencer		Dilution Air Silencer – Manifold Header	Solberg	FS-231P-200
Vacuum Relief Valve		Knock Out Tank Vacuum Breaker Set at 29”HG	Kunkle	215V
Bag Filter		Particulate Filters P12 bag size, 2" female NPT, 150PSI	RoseDale	NLCO8
Liquid Carbon Vessel		1000 LB Stainless Steel Liquid Carbon Vessel	ProAct	
Liquid Carbon Media		Granular Activated Liquid Carbon (Regen)	Envirotrol	EI-30R
Liquid Clay Vessel		1000 LB Stainless Steel Liquid Clay Vessel	ProAct	
Clay Media		Organoclay media – 8x30 Mesh	Hydrosil	HS-200
Vapor Carbon Vessel		1000 LB Stainless Steel Vapor Carbon Vessel	ProAct	

Component	PID	Description	Manufacturer	Part Number
Vapor Carbon Media		Granular Activated Vapor Carbon (Virgin)	Envirotrol	EI-410
Clean Water Tank		750 Gallon Clean Water Holding Tank	Norwesco	40606
Forced Air Heater		7.5kW Rear Process Room Heater	Indeeco	233-FA-0086U-T
Forced Air Heater		7.5kW Front Process Room Heater	Indeeco	233-FA-0086U-T
P-Fan		Process Room Fan - 16" Diameter 1/4HP, 1PH, 120V, XP, 1725RPM	Cook	16A17D
Shutter		12”x 12” Shutter for Process Room Man Doors	Dayton	4C556
Shutter		16” x 16” Shutter for Process Room Vent Fan	Dayton	4C557
Shutter		18” x 18” Shutter for Process Room Rear Doors	Dayton	4C558
Vapor Flow Meter	FM1 – FM2	Pitot Tube In-Line Flow Sensor for LRP-101, LRP-102	Dwyer	DS-300
Vapor Flow Transducer		Flow Transmitter and Display for FM1, FM2	Dwyer	ISDP
Liquid Flow Meter	FM3	Liquid Flow Meter - 1" B111 Meter Product Flow Totalizer	Blancett	B111-110
Liquid Flow Meter	FM4	Liquid Flow Meter – 1-1/2" B111 Meter Water Flow Totalizer	Blancett	B111-121

Component	PID	Description	Manufacturer	Part Number
Liquid Flow Monitor		Liquid Flow Monitor for FM3, FM4 B2800 Simplified	Blancett	B2800
Vacuum Transducer	VT1 – VT14	Vacuum Transducer - DPE Manifold (-14.7 – 30 PSI)	American Sensor Technologies, Inc.	AST4400
Vacuum Transducer	VT15	Vacuum Transducer - Knock Out Tank (-14.7 – 30 PSI)	American Sensor Technologies, Inc.	AST4400
Vacuum Transducer	VT16 – VT17	Vacuum Transducer - LRP-101, LRP-102 (-14.7 – 30 PSI)	American Sensor Technologies, Inc.	AST4400
Pressure Transducer	PT1 – PT3	Pressure Transducer - Vapor Pressure (0 – 5 PSI)	American Sensor Technologies, Inc.	AST44LP
Pressure Transducer	PT4 – PT11	Pressure Transducer - Liquid Pressure (0 – 50 PSI)	American Sensor Technologies, Inc.	AST4400
Differential Pressure Transducer	DPT1	Differential Pressure Transducer – Knock Out Tank (0 – 50 IWC)	Dwyer	ISDP
Differential Pressure Transducer	DPT2	Differential Pressure Transducer – Bag Filters (0 – 50 PSID)	InterTechnology GP:50	315Z
Vacuum Gauge	VI1 – VI15	Vacuum Gauge (-30 – 0 HG)	Precision Instrument Co	201L 202L
Pressure Gauge	PI1 – PI7	Pressure Gauge (0 - 160 IWC)	Precision Instrument Co	LP1
Pressure Gauge	PI8 – PI9, PI11 – PI20	Pressure Gauge (0 - 60 PSI)	Precision Instrument Co	201L 202L
Pressure Gauge	PI10	Pressure Gauge (0 - 100 PSI)	Precision Instrument Co	201L 202L

Component	PID	Description	Manufacturer	Part Number
Pneumatic Actuator		Pneumatic Actuator for AV1-AV14	Valworx	5301
Butterfly Valve	AV1 – AV14	4” Automated Butterfly Valve – DPE Manifold	Valworx	5647
Gate Valve	PV1 – PV14	4" Gate Valve	Nibco	TI-8
Butterfly Valve	PV29 – PV32	2" Butterfly Valve - Bag Filter Influent / Effluent Isolation Valves	Delval	DN50
Butterfly Valve	PV16 – PV17	4" Butterfly Valve – LRP-101, LRP-102 Isolation Valves	Delval	DN100
Ball Valve	PV19 – PV20	1" Ball Valve – TP-200, TP-202 Effluent Valves	Apollo	94A-105
Ball Valve	PV22 – PV24	1" Ball Valve – Miscellaneous Product Valves	Apollo	94A-105
Ball Valve	PV28	1-1/4" Ball Valve – TP-301 Discharge Valve	Apollo	94A-106
Ball Valve	PV15	2" Ball Valve – Air Dilution DPE Manifold	Apollo	94A-108
Ball Valve	PV18	2" Ball Valve – Knock Out Tank Water Effluent	Apollo	94A-108
Ball Valve	PV21	2" Ball Valve – TP-200 and TP-202 Combined Discharge Valve	Apollo	94A-108
Ball Valve	PV27	2" Ball Valve – Oil Water Separator Site Discharge Valve	Apollo	94A-108

Component	PID	Description	Manufacturer	Part Number
Ball Valve	PV33 – PV41	2" Ball Valve – Carbon Vessel, Clay Vessel Inlet and Outlet Valves	Apollo	94A-108
Ball Valve	PV25 – PV26	2" Ball Valve – Oil Water Separator Site Tube Isolation Valve	Asahi	1605020
Ball Valve (Sample Ports)	SP1 - SP26	1/4" Ball Valve - Sample Port Valves	Apollo	94A-101
Ball Valve (Air Bleed)	ABV1 - ABV2	1/4" Ball Valve - Bag Filter Ambient Breather Valves	Apollo	94A-101
Ball Valve (Bypass Loop)	BLV	1" Ball Valve - Transfer Pump Bypass Loop Valves	Apollo	94A-105
Ball Valve (Drain)	D	1" Ball Valve - Drain Valves	Apollo	94A-105
Check Valve		1/2" Check Valve - Anti-Siphon	Nibco	T-413
Check Valve		1" Check Valve – Transfer Pump Discharge Valves	Nibco	T-413
Vacuum Relief Valve		1/2” Anti-Siphon Valve	Watts	N36-M1
Floor Sump Float Switch	LSH17 – LSH18	Float Switch NC, Open on Rise	Madison	M5000
Y-Strainer		2” Y-Sediment Strainer Under Knock Out Tank	Asahi	1257-020
Hose		Petroleum Hose used in system	Goodyear	Flexwing

Component	PID	Description	Manufacturer	Part Number
Hose		Petroleum Hose used in system	Gates	Longhorn
Hose		Thermoplastic Rubber Hose used in system	West Michigan Rubber & Supply	RFH

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Operating & Maintenance Manual *for* Liquid Ring Vacuum Pumps, Compressors & Systems

TRH-TRS-TRM-TRV-SA

Water Sealed & Oil Sealed (DynaSeal™) Systems

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OPERATING MANUAL FOR INSTALLATION, START-UP AND MAINTENANCE FOR LIQUID RING VACUUM PUMPS, COMPRESSORS AND SYSTEMS

This manual applies to TRAVAINI PUMPS USA liquid ring pumps single stage series TRM, TRS, TRV, double stage series TRH, compressors series SA and systems series water sealed and oil sealed (DynaSeal™) Systems, which utilize above pump series. (Please see section 18 or 19 for details pertaining to systems).

NOTE: Unless otherwise specified, the term pump used throughout this manual means also pump/motor assembly or system type water sealed or oil sealed (DynaSeal™).

MANUFACTURER:

TRAVAINI PUMPS USA
200 Newsome Drive
Yorktown, VA 23692
Telephone: (757) 988-3930
Fax: (757) 988-3975
Website: www.travaini.com

WARRANTY:

All products manufactured by TRAVAINI PUMPS USA are guaranteed to meet the conditions listed on the general terms & conditions of sales and/or conditions listed on the order confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual, will void the manufacturer's warranty. Detailed warranty policy can be found in Section 21.

PROPRIETY DOCUMENT:

This document and the information enclosed herein are proprietary to Travaini Pumps USA and must, along with any copies, be returned upon demand. Reproduction or use of any information disclosed herein, or the manufacture of any assembly or part depicted herein is permissible only to the extent expressly authorized in writing by Travaini Pumps USA on and for which this document is provided.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump and/or system. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OUR PRODUCTS

LIQUID RING VACUUM PUMPS

LIQUID RING COMPRESSORS

ROTARY VANE VACUUM PUMPS

ROTARY VANE VACUUM SYSTEMS

MEDICAL SYSTEMS (NFPA99)

PACKAGE VACUUM SYSTEMS WITH PARTIAL OR TOTAL SERVICE RECIRCULATION

CUSTOM ENGINEERED VACUUM SOLUTIONS

"Proven Designs"

1 – GENERAL INSTRUCTIONS

This manual is intended to provide reference to:

- application and operating safety
- installation and maintenance for pump or system
- starting, operating and stopping procedures for pump or system

NOTE: All references made to pumps are also applicable to systems that employ these pumps, unless otherwise specified.

Upon receipt of this manual, the operator should complete the Product Data sheet with the requested data. The manual should then be read **CAREFULLY** and kept in a safe file for future reference. It should always be available to the qualified operating and maintenance personnel responsible for the safe operation of the pump or system. (Qualified personnel should be experienced and knowledgeable of Safety Standards, should be recognized by the safety department manager as being capable to effectively act on safety issues, should the need arise and knowledge of first aid should also be required).

The pump is to be used only for the applications specified on the confirming order for which TRAVAINI PUMPS USA has selected the design, materials of construction and tested the pump to meet the order specifications. Therefore, the pump or system **CANNOT** be used for applications other than those specified on the order confirmation.

In the event the pump is to be used for different applications, please consult TRAVAINI PUMPS USA or a representative of the manufacturer. TRAVAINI PUMPS USA declines to assume any responsibility if the pump is used for different applications without prior written consent. The user is responsible for the verification of the ambient conditions where the pump will be stored or installed. Extreme low or high temperatures may severely damage the pump or system unless proper precautions are taken. TRAVAINI PUMPS USA does not guarantee repairs or alterations done by user or other unauthorized personnel. Special designs and constructions may vary from the information given in this manual. Please contact TRAVAINI PUMPS USA should you have any difficulty or doubt.

NOTE: Drawings appearing in this manual are only schematics. These drawings are not for construction.

2 - SAFETY INSTRUCTIONS

CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS. STRICTLY ADHERE TO THE INSTRUCTIONS LISTED BELOW TO PREVENT PERSONAL INJURIES AND/OR EQUIPMENT DAMAGE.

- **ALWAYS** apply the pump for the conditions outlined on the confirming order.
- Electrical connections on the motor or accessories must **ALWAYS** be carried out by authorized personnel and in accordance to the local codes.
- Any work on the pump should be carried out by at least 2 people.

When approaching the pump **ALWAYS** be properly dressed (avoid use of clothing with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done.

- **ALWAYS** stop the pump prior to touching it, regardless of the reason.
- **ALWAYS** disconnect the power to the motor prior to working or removing the pump from the installation.
- **NEVER** work on the pump when it is hot.
- After completion of the work **ALWAYS** re-install the safety guards previously removed.
- **ALWAYS** be careful when handling pumps that convey acids or hazardous fluids.
- **ALWAYS** has a fire extinguisher in the vicinity of the pump installation.
- **DO NOT** operate the pump in the wrong direction of rotation.
- **NEVER** put hands or fingers in the pump or system openings or cavities.
- **NEVER** step on pump and/or piping connected to the pump.
- Pump or piping (connected to the pump) must **NEVER** be under pressure or vacuum when maintenance or repair is carried out.

NOTE: There are materials in the pump that may be hazardous to people suffering from allergies. Maintenance and operating personnel should consult Table 1 for such materials.

TABLE 1

MATERIAL	USE	POSSIBLE DANGER
Oil and Grease	General lubrication, ball or roller bearings	Skin and eye irritation
Plastic and elastomer components	O-Ring, V-Ring, Splash ring, Oil seals	Release of fumes and vapours when overheated
Teflon & Kevlar fibers	Packing rings	Release of dangerous powders, release of fumes when overheated
Varnishes	Exterior pump surface	Release of powder and fumes in case of rework, flammable
Protective liquid	Pump inside surface	Skin and eye rash
Liquid compound	Gasket between flat surfaces	Skin, eye and breathing organs irritation

3 - IN CASE OF EMERGENCY

Should the pump break down leak gas and/or service liquid, immediately disconnect the electrical power following the instructions given in section 11. Alert the maintenance personnel, at least two people should intervene using precautions, as it is required for the specific installation: pump may be handling dangerous and/or hazardous fluids.

After correction of all the problems that created the emergency situation, it is necessary to carry out all the recommended starting procedures (see section 10).

3.1 - BASIC FIRST AID

In the event dangerous substances have been inhaled and/or have come in contact with the human body, immediately contact the medical staff and follow the instructions given by the company's internal medical safety procedures.

4 - PUMP OUTLINES

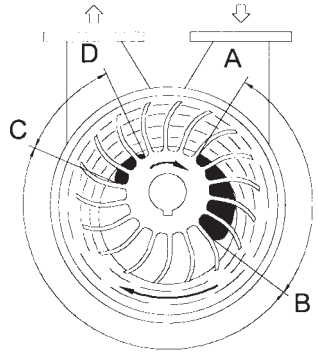
The instructions given in this manual are for liquid ring vacuum pumps and compressors and for systems type WATER SEALED or OIL SEALED (DynaSeal™) which utilize said pumps.

NOTE: Capacities, vacuum and pressures are nominal and are the maximum attainable values under standard operating conditions. Please contact TRAVAINI PUMPS USA for data on liquid ring compressors series TR...

TRM	Single stage liquid ring vacuum pumps Capacity to 210 ACFM, max vacuum 33 mbar (25 Torr)
TRS	Single stage liquid ring vacuum pumps Capacity to 2100 ACFM, max vacuum 150 mbar (100 Torr)
TRV	Single stage vacuum pumps Capacity to 300 ACFM, max vacuum 33 mbar (25 Torr)
TRH	Two stage liquid ring vacuum pumps Capacity to 2100 ACFM, max vacuum 33 mbar (25 Torr)
SA	Double acting liquid ring compressors Capacity to 110 ACFM, pressures to 10 bar–(145 psig)

4.1 - PRINCIPLE OF OPERATION

(See figure at side)
The aspirated gas enters the pump chamber A-B via the pump suction flange. The gas is trapped between two (2) impeller vanes. The impeller rotates eccentrically in relation to the centerline of the liquid ring that, by centrifugal force, assumes the shape of the impeller casing. The progressive change of volume between the two (2) vanes, the impeller hub and the liquid ring first creates a vacuum and then a compression of the gas in the B-C area till the gas is discharged, together with a portion of the liquid, through the discharge port C-D. The lost liquid must then be replenished.



4.2 - SERVICE LIQUID PROPERTIES

For good operation, the liquid ring pumps must be supplied with a service liquid, which is clean, non-abrasive and free of any solids. The service liquid temperature should not exceed 80 °C and the gas handled should be maximum 100 °C; the liquid density should be between 0.8 and 1.2 g/cm3 and the viscosity should be less than 40 °C (the pump performance will change if the service liquid has properties different than those of water at 15°C (60°F). All engineering data is based on the use of 15°C (60°F) as service liquid, see section 17 for additional information. Contact TRAVAINI PUMPS USA before using liquids with properties outside the ranges listed above.

4.3 - PUMP MODELS AND TABLES FOR MATERIAL OF CONSTRUCTION

On the pump nameplate are printed the pump serial number, the year of manufacture and the pump model. Refer to the following example for understanding the coding of the pump model. Every letter or number in the pump model designation has a specific meaning relating to the pump design.

Example of pump model number:

T R H C 80 - 750 / C - M / GH

T	– Manufacturer POMPETRAVAINI	**750**	– Nominal capacity in m^3/h
R	– Liquid ring pump	**C**	– C = Shaft sealing by mechanical seal B = Shaft sealing by stuffing box
H	– M and V = Single stage pump with high vacuum S = Single stage pump with medium vacuum H = Two stage pump with high vacuum	**M**	– Monoblock design with motor flange (upon request)
		GH	– Material of construction GH - F - RZ - RA - A3 (see following table)
C	– Revision of hydraulic design		
80	– Ø Flange size (mm)		

STANDARD materials of construction

VDMA	Description	GH	F	RZ	RA	A3
106	Suction casing	Cast iron 1561				
107	Discharge casing					
137	Intermediate plate					
110	Center body	Carbon Steel				
210	Shaft	Stainless steel AISI 420			Stainless steel AISI 316	
147	Manifold	Carbon steel				
357	Bearings & M.S. Hous.	Cast iron 1561				
230	Impeller	Bronze	Ductile iron	Stainless steel AISI 316		

For additional details regarding standard or special materials contact TRAVAINI PUMPS USA.

5 - UNCRATING, LIFTING AND MOVING INSTRUCTIONS

Upon receipt, verify that the material received is in exact compliance with that listed on the packing slip.

When uncrating, follow the instructions listed below:

- check for visible damages on the crate that could have occurred during transport
- carefully remove the packaging material
- check the pump/or accessories such as tanks, piping, valves, etc. to ensure that it is free of visible markings such as dents and damage which may have occurred during transportation
- in the event of damage, report this immediately to the transport company and to TRAVAINI PUMPS USA Customer Service department.

Discard through controlled disposals all packaging materials that may constitute personal injury (sharp objects, nails, etc.).

The pump or assembly must **ALWAYS** be moved and transported in the horizontal position. Prior to moving the unit find the following:

- total weight
- center of gravity
- maximum outside dimensions
- lifting points location.

	For safe lifting to prevent material damages and/or personal injuries is recommended to use ropes, or belts properly positioned on the pump and/or lifting eyebolts and make correct movements. NOTE: Lifting eyebolts fitted on single components of the assembly (pump or motor) should not be used to lift the total assembly.

Avoid lifts whereby the ropes or straps, form a triangle with the top angle over 90° (see fig. 3). The fig. 4 shows several additional examples of lifting to be avoided. Prior to moving the unit from an installation, always drain any pumped fluid from the pump, piping and accessories, rinse and plug all openings to prevent spillage. For instructions to remove the unit from installation see section 15.

Fig. 1

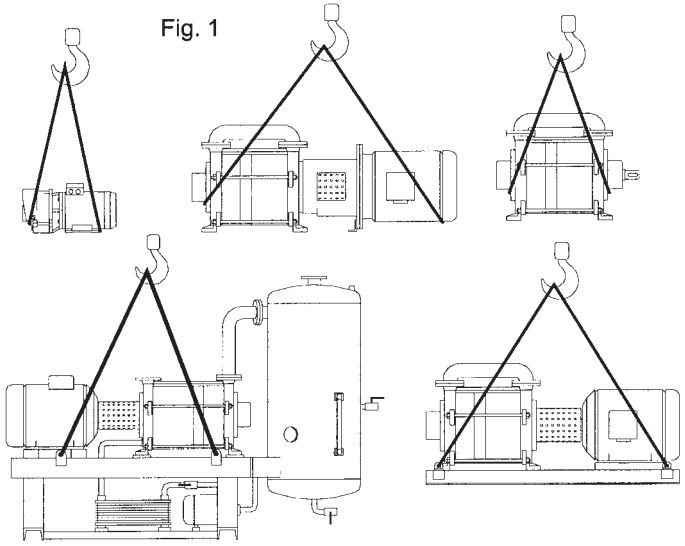


Fig. 2

OK

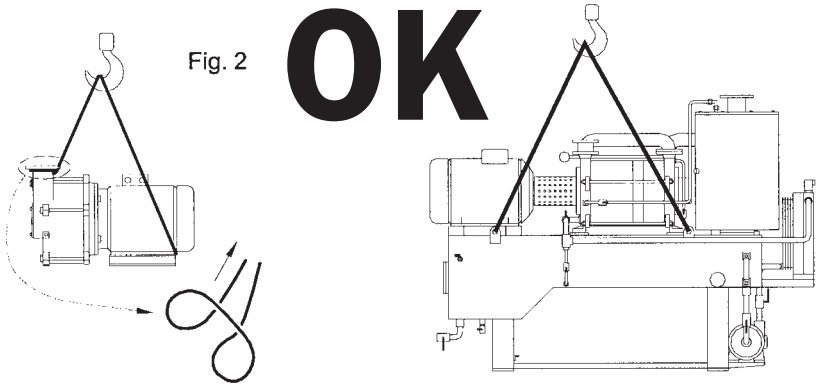
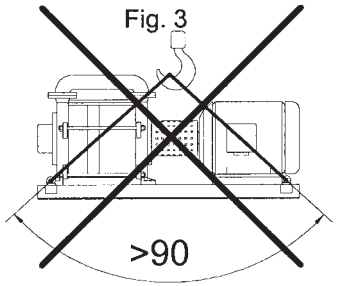


Fig. 3



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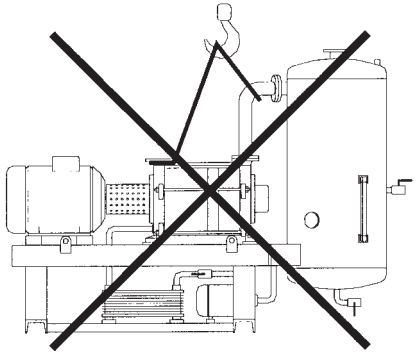


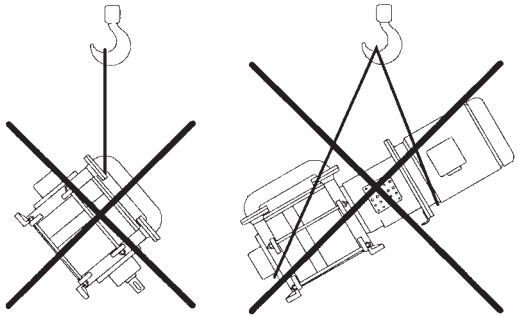
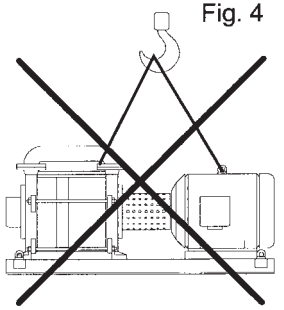
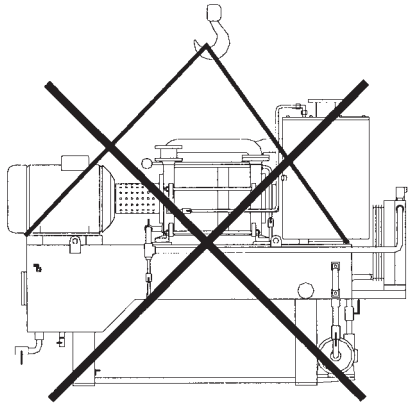


Fig. 4





6 - STORAGE INSTRUCTIONS

After receipt and inspection, if not immediately installed, the unit must be repackaged and stored. For a proper storage proceed as follows:

- store the pump in a location that is closed, clean, dry and free of vibrations
- do not store in areas with less than 5 °C (41 °F) temperature (for lower temperature it is necessary to completely drain the pump of any liquids that are subject to freezing)

FREEZING DANGER!
Where the ambient temperature is less than 5 °C (41°F) it is recommended to drain the pump, piping, separator, heat exchanger, etc. or add an anti-freeze solution to prevent damage to the equipment.

- fill the pump halfway with an anti-rust liquid but compatible with gaskets and elastomers materials, rotate the pump shaft by hand so that all internal parts get wet and then drain the pump of the excessive anti-rust liquid
- plug all openings that connect the pump internals to the atmosphere
- protect all machined surfaces with an anti-rust material (grease, oils, etc.)
- cover the unit with plastic sheet or similar protective material
- rotate pump shaft at least every three months to avoid possible rust build-up which may result in seizing of the pump.
- pump accessories should be subjected to similar procedure.

7 - MOUNTING AND ALIGNMENT INSTRUCTIONS

7.1 - ASSEMBLY OF BASE MOUNTED PUMP UNIT

In some cases such as bare pump orders, pumps are shipped with anti-rust and anti-freeze agents. Ensure pump is thoroughly flushed and these agents are removed prior to installation.

If the pump has been purchased with a free shaft end, a proper baseplate is required to mount the pump/motor assembly. The baseplate must be properly designed for maximum rigidity to prevent vibrations and distortions. It is recommended the use of a fabricated baseplate manufactured with rigid “U” shaped channel (fig. 16 illustrates an example).

When the pump has been purchased without the electric motor, it is then required to select the proper motor before proceeding to the installation of the unit. When selecting a motor the following must be considered:

- maximum power absorbed by the pump over the total operating range
- pump operating speed (RPM)
- available power (Hertz, voltage, etc.)
- motor enclosure type (ODP, TEFC, EX.PR., etc.)
- motor mount (B3, B5, horizontal, vertical, C-flange, D-flange, etc.).

When selecting Flexible couplings the following must be considered:

- nominal motor horsepower
- motor operating speed
- coupling guard must meet safety standards as dictated by OSHA, etc.

Flexible couplings must be properly aligned. Bad alignments will result in coupling failures and damage to pump and motor bearings.

Assembly instructions for MONOBLOCK design are listed on paragraph 7.3 steps 1, 2, 4, 5, 6.
Assembly instructions for PUMP-MOTOR ON BASEPLATE are listed on paragraph 7.3 steps 7, 1, 8, 5, 9, 10, 11.
For pump driven with V-Belt, please consult TRAVAINI PUMPS USA for further information.

7.2 - ALIGNMENT PROCEDURES FOR MONOBLOCK AND FOR PUMP/MOTOR ASSEMBLY ON BASEPLATE.

TRAVAINI PUMPS USA prior to shipment properly aligns the pump/motor assembly. It is however required to verify the alignment prior to the start-up. Misalignment can occur during handling, transportation, grouting of assembly, etc.

For alignment procedures of MONOBLOCK design see paragraph 7.3 steps 3, 4, 5, 6.
For alignment procedure of BASEPLATE design see paragraph 7.3 steps 7, 5, 9, 10, 11.

NOTE: Coupling sizes and permissible coupling tolerances listed in this manual are applicable to the particular coupling brand installed by TRAVAINI PUMPS USA as a standard. For sizes and tolerances of other type of couplings, follow the instructions given by their respective manufacturer.

7.3 - ALIGNMENT INSTRUCTIONS

NOTE: Alignment should be done at ambient temperature, with power to the motor disconnected and following the safety procedures to avoid accidental starting (see section 2).

Should the pump operate at high temperatures that could upset the coupling alignment, it is necessary to check the alignment to secure proper working operation at such operating temperatures. It is recommended the use of proper hand protections such as gloves, when carrying out the operations listed below (schematics for various assemblies are shown).

NOTE: The following points must be followed with the sequence stated above and depending upon the type of operation: alignment assembly or alignment verification.

1 - Thoroughly clean motor/pump shaft ends and shaft keys, place the shaft keys in the proper key way slots and fit the coupling halves in line with the shaft ends. The use of rubber hammers and even pre-heating of the metal half couplings may be required (see fig. 5). Lightly tighten the set screws. Verify that both pump and motor shafts rotate freely.

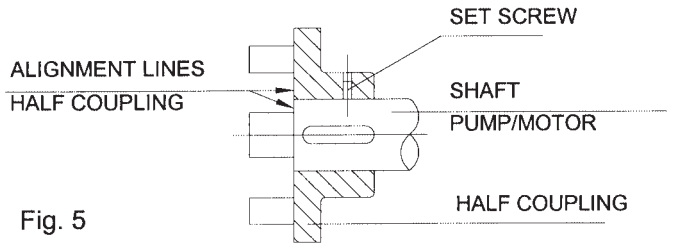


Fig. 5

2 - Insert the perforated metal sheet coupling guard inside the lantern so that the coupling is accessible from one of the lateral openings. Couple the electric motor to the pump lantern engaging the two coupling halves, hands may reach the coupling halves through the lateral opening (see fig. 7) tighten the assembly with bolts supplied with the unit and install the supporting foot, when applicable (see fig. 6).

3 - Applying slight hand pressure to the coupling guard, rotate it so that one opening of the lantern is accessible (see fig. 8).

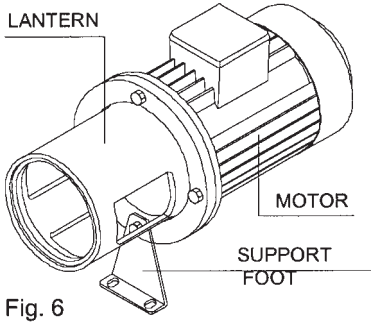


Fig. 6

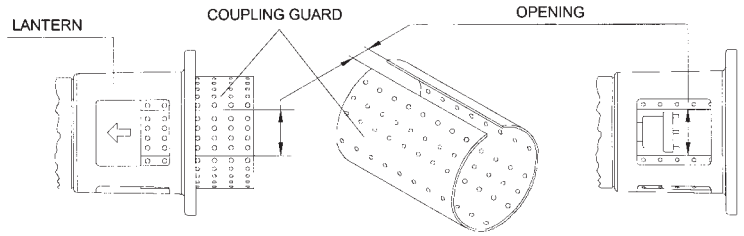


Fig. 7 - PREPARING TO ASSEMBLE THE MONOBLOCK DESIGN

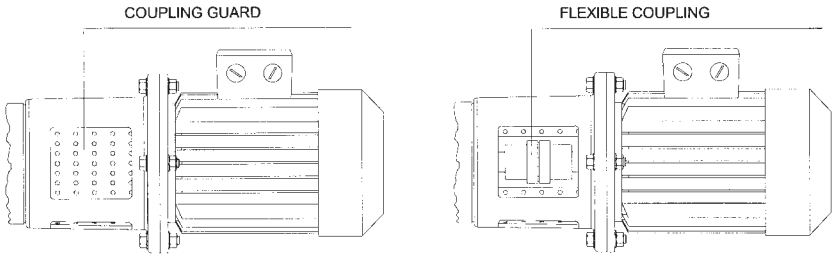


Fig. 8 - CHECKING THE ALIGNMENT 0N MONOBLOCK DESIGN

4 - Rotate by hand the coupling through the lateral opening of the lantern to make sure the pump is free.

5 - With a feeler gauge, check the distance between the two coupling halves. The gap value "S" should be as listed on table 2 or as given by the coupling manufacturer. In the event, an adjustment is necessary, loosen the set screws on the coupling half and with a screw driver move the coupling half to attain the gap "S" (see fig. 12). Then tighten the set screw and rotate the rotor by hand to make sure, once more, that there is no obstruction.

6 - Rotate back the coupling guard by hand through the two openings of the lantern so that both openings are completely covered. This will complete the alignment verification of the MONOBLOCK design.

7 - Remove the coupling guard and its extension (if there is one) attached to the pump, by removing the two locking screws (see fig. 9 and 10).

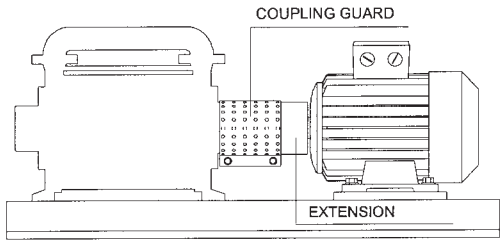


Fig 9 - CHECKING ALIGNMENT ON BASE MOUNTED PUMP DESIGN

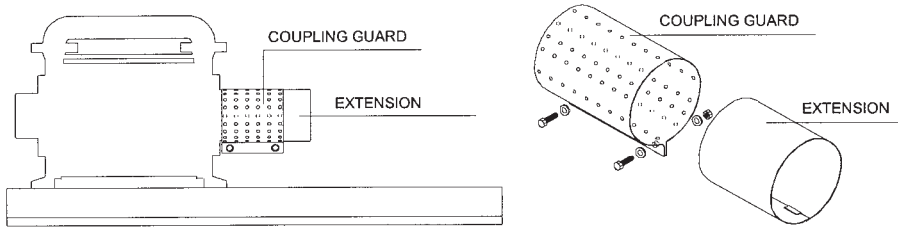


Fig. 10 - ASSEMBLING THE UNIT ON THE BASEPLATE

8 - Place the electric motor on the baseplate and bring the two coupling halves together with approx. 2mm gap between them keeping the motor axially aligned with the pump shaft. In the event the two shaft heights do not align, proper shimming under the pump or motor feet will be required. Mark the motor and/or pump anchoring bolt holes. Remove motor and/or pump, drill and tap the holes, clean and mount pump and/or motor in place and lightly tighten the bolts (see fig. 11).

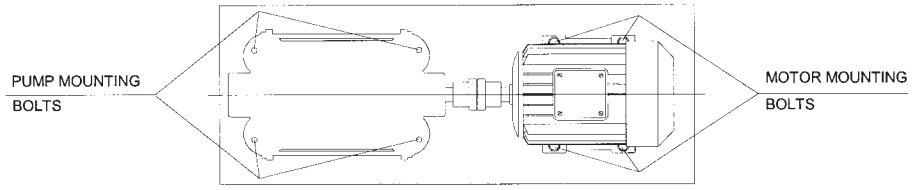


Fig. 11

9 - With a straight edge ruler check the parallelism of the two coupling halves at several points, 90° from each other (see fig. 13).

NOTE: Easier and more accurate readings can be attained with instruments such as Dial Indicators (if readily available).

If the maximum value of "X" is higher than that listed in the table 2 (for the given coupling size) it will be required to correct the alignment by using shims under the pump or motor feet. When the measured values fall within the tolerances (tolerances only given for "S"), the pump and motor mounting bolts can be tightened.

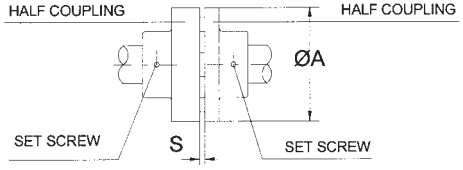


Fig. 12 (Center - Under view)

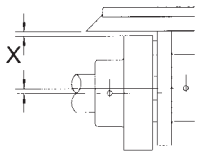


Fig. 13

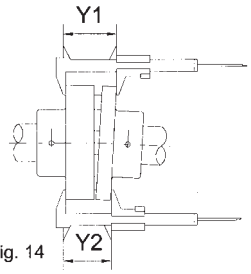


Fig. 14

10 - Angular misalignment can be measured with a Caliper. Measure the outside coupling dimension at several points (see fig. 14). Find the minimum and maximum width of the coupling, the difference between these two readings "Y" (Y1-Y2) should not exceed the value listed in table 2 for the given coupling size. Should this value be greater it will be necessary to correct the alignment by shimming the pump and/or motor. Following this operation it is recommended to check once more the value "X" to make sure that both values are within the allowed tolerance (see point 9). Make sure that both set screws on the coupling halves are properly secured.

Table 2

COUPLING "Ø A" mm	GAP "S" mm	PARALLEL "X" mm	ANGULAR "Y" mm
60	2 to 2.50	0.10	0.20
80	2 to 2.50	0.10	0.20
100	2 to 2.50	0.15	0.25
130	2 to 2.50	0.15	0.25
150	3 to 3.75	0.15	0.30
180	3 to 3.75	0.15	0.30
200	3 to 3.75	0.15	0.30

11 - Install the coupling guard and its extension (if applicable) on the pump, secure the two locking bolts. The gap between motor frame and the guard should not be greater than 2 to 3mm (see fig. 15).

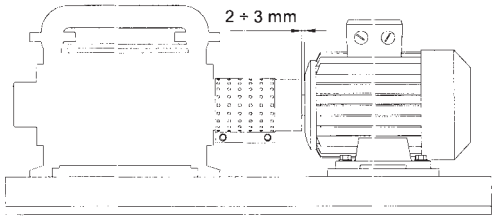


Fig. 15

8 - ELECTRICAL CONNECTIONS

Electrical connections must be made exclusively by qualified personnel in accordance with the instructions from the manufacturer of the motor or other electrical components and must adhere to the local National Electrical Code.

FOLLOW ALL SAFETY PRECAUTIONS AS LISTED IN SECTION 2. BEFORE DOING ANY WORK TO THE INSTALLATION, DISCONNECT ALL POWER SUPPLIES.

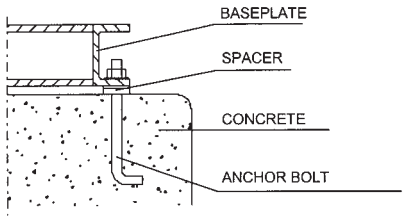
It is recommended that electric motors be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be sized in accordance with the full load amperage appearing on the motor nameplate. It is advisable to have an electrical switch near the pump for emergency situations. Prior to connecting the electrical wiring, turn the pump shaft by hand to make sure that it rotates freely. Connect the electrical wiring in accordance with local electrical codes and be sure to ground the motor. Motor connection should be as indicated on the motor tag (frequency and voltage) and as discussed in the motor instruction manual. It is recommended that motors over 75Hp be wired for soft start, to avoid electrical overloads to the motor and mechanical overloads to the pump. Be sure to replace all safety guards before switching on the electrical power. If possible check the direction of rotation before the motor is coupled to the pump but protect the motor shaft to prevent any accidents. When this is not possible briefly jog the pump to check its direction of rotation (see arrow on pump for correct rotation). If the direction must be changed two of the three electrical wire leads must be alternated with each other (at the terminal box or at the motor starter). Be aware that rotation in the wrong direction and/or pump running dry may cause severe pump damage. Electrical instrumentation such as solenoid valves, level switches, temperature switches, etc. which are supplied with the pump or systems must be connected and handled in accordance with the instructions supplied by their respective manufacturers. Contact TRAVAINI PUMPS USA for specific details.

9 - INSTALLATION INSTRUCTIONS

Information to determine the piping sizes and floor space requirements can be obtained from dimensional drawings and other engineering data. The information required is:

- size and location of suction and discharge flanges
- size and location of service liquid connection and connections for cooling, heating, flushing, draining, etc.
- location and size for mounting bolts for monoblock pump and/or baseplate and/or frame.

In the event additional accessories are required to complete the installation such as separators, piping, valves, etc. refer to sections 9.2 to 9.8. Proper lifting devices should be available for installation and repair operations. Pump assembly should be installed in an accessible location with adequate clear and clean space all around for maintenance, so that an efficient and proper installation can be made. It is important to have proper room around the unit for ventilation of motor and air-cooled radiator, if applicable. Avoid installing the unit in hidden locations, dusty and lacking of ventilation. Select a mounting pad that will minimize vibrations or torsion of the pump baseplate or frame. It is generally preferred to have a concrete base or sturdy steel beams. It is important to provide adequate anchor bolting for the pump frame or baseplate to be firmly attached to the foundations (see fig. 16).



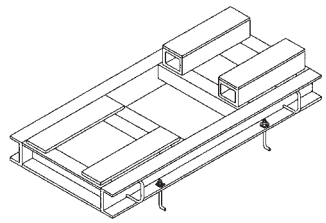


Fig. 16

Concrete pads and other concrete works must be aged, dry and clean before the pump assembly can be positioned in place. Complete all the work relating to the foundations and grouting of the pump assembly, before proceeding with the mechanical and electrical portion of the installation.

9.1 - PIPING CONNECTIONS

Identify first locations and dimensions of all connections required to interconnect the pump with the installation, then proceed with the actual piping: connect the pump suction and discharge flanges, the service liquid line and all other service connections (see fig. 17 to 26).

BE SURE TO PIPE THE CORRECT CONNECTION FROM THE INSTALLATION TO THE RESPECTIVE PUMP CONNECTION!

To prevent foreign matters from entering the pump during installation, do not remove protection cap from flanges or cover from openings until the piping is ready for hook-up. Verify that all foreign objects such as welding bits, bolts, nuts, rags and dirt are removed from piping, separators, etc. before these are connected to the pump. Flanges should be connected parallel with each other, without stress and with bolt holes lined up. The flange gaskets should not interfere with the inside diameter of piping and/or flange. All piping must be independently supported, easily located and must not transmit forces or torque to the pump due to the weight or to thermal expansions. Piping size must never be less than the respective connection on the pump. Suction and discharge flanges are vertical and identified with arrows. To minimize friction losses and back-pressures, the discharge piping should be one size larger than the pump connection size. To avoid back-pressure and possibility of flooding the pump when it stops, it is recommended to limit the rise of the discharge piping to approximately 2 feet above the pump discharge flange. Upon completion, piping and connections should be tested for leakage under vacuum.

9.2 - ACCESSORIES

Listed below are common accessories that may be supplied with the pump or added at a later date. See fig. 17 to 26 for locations and connection sizes on the pumps.

Non return valve, (check valve)

Prevent back-flow of gas and liquid in the suction piping and/or discharge piping when the pump stops. Is installed on the pump suction flange in the case of vacuum service or on the pump discharge flange in the case of compressor service.

Vacuum relief valve

It is used to protect the pump from cavitation or to regulate the suction minimum pressure (or max vacuum).

When the pump capacity exceeds the system load at a given vacuum, the relief valve opens letting in atmospheric air or gas (if connected to the discharge separator) keeping constant the pre-set vacuum.

Automatic draining valve

It is used to drain the pump to the shaft centerline when the pump stops so to prevent that the pump has excessive liquid for the next start-up. Starting the pump full or with too much liquid could severely damage the pump and may cause excessive Amp draw from the motor.

Vacuum gauge

It usually installed under the pump suction flange and will provide an indication of the pump operating vacuum (pressure).

Discharge reservoir separator

It separates the service liquid from the gases at the pump discharge. It can be mounted on the pump discharge flange or on the pump baseplate. It is required when the system is with partial or total recovery of the service liquid.

Heat exchanger

It cools the service liquid for those systems with total liquid recovery: it can be plate and frame, shell and tube or radiator type, depending upon the application.

Filter

Required to stop solids from entering the pump suction. Sizing of the filter is very important as it could create excessive pressure drops, which would affect the pump performance.

9.3 - INSTALLATION SCHEMATICS FOR LIQUID RING VACUUM PUMPS

The working principle of the vacuum pump requires a continuous flow of fresh and clean liquid that enters the pump at the service liquid connection identified by the letter **Z** (see section 9.11). The liquid is discharged together with the handled gas through the pump discharge flange. The quantity of said liquid will vary with pump size and degree of working vacuum (see performance curves and/or table 3). The service liquid absorbs the compression heat generated by the pump compression, which results in a temperature rise of the service liquid (for additional information, see chapter 17). There are three basic installation schematics listed below that may be considered, depending upon the quantity of service liquid that is desired and possible to be recycled.

9.3.1 - Service liquid: Once-through system (no recovery)

All the service liquid is supplied from an external source. The liquid is separated from the incoming gas in the discharge separator and is completely drained. This is a popular installation and is used where there is an abundant supply of fresh liquid and/or there is no contamination of the same. The service liquid should be supplied at the pump connection with a pressure of 5.8psig maximum to avoid flooding the pump with too much liquid. If this is not possible it is recommended to install a reservoir fitted with a float valve, this tank is supplied with the liquid that is then pulled by the pump as required by the operating conditions. The liquid level in the reservoir should be approximately at the pump shaft centerline. Schematic fig. 17 illustrates the once-through system.

9.3.2 - Service liquid: Partial recovery system

This type of installation is used where it is desired to minimize the use of fresh service liquid (for calculations see section 17). The service liquid enters and leaves the pump same as the once through system, however part of the liquid is recycled from the discharge separator and the balance is continuously supplied from an external source. The excessive liquid is drained through the separator overflow connection. The temperature of the mixed liquid supplied to the pump will be higher than the temperature of the make-up liquid. Its final temperature will depend upon the amount of the recycled liquid. It is important to remember that with higher service liquid temperature the pump performance will decrease (see section 17) with the possibility of operating the pump in the cavitation area. When the separator/reservoir is installed along side of the pump, its liquid level should not be above the pump shaft centerline. When flanged separators are mounted on the pump discharge flange, the liquid level is automatically maintained by the location of the connections. Schematic fig. 18 illustrates the system with partial recovery of the service liquid.

9.3.3 - Service liquid: Total recovery system

This system has total recycle of the service liquid without fresh liquid make-up from an outside source. A heat exchanger is required to lower and control the temperature of the recycled service liquid: for sizing and calculations of heat loads

see section 17. A circulating pump will be required for those applications where the vacuum pump operates for extended periods of times in the pressure ranges above 20"Hg vacuum or when there are high pressure drops in the closed loop including the heat exchanger (over approximately 30psi.). The liquid level in the separator/reservoir should not be above the pump shaft centerline. Losses of liquid from the closed loop must be compensated with an equal amount from an outside source. Schematic fig. 19 illustrates the system with total recovery of the service liquid.

9.4 - INSTALLATION SCHEMATICS FOR LIQUID RING COMPRESSORS

The liquid ring vacuum pump can also operate as a compressor up to a maximum differential pressure, depending upon the models, of about 30 psig. The compressor series SA are specifically engineered to perform with differential pressures of up to 150 psig, depending on models. The principle of operation is same as given in previous paragraph (9.3 for vacuum pumps) and there are three possible types of installation: once-through service liquid, partial recovery service liquid and total recovery service liquid. The service liquid entering the compressor connection should have a pressure of minimum 5psig. above the compressor operating inlet pressure. A booster pump will be required if the service liquid is available at lower pressures. Separator/reservoir is considered a pressure vessel and as such it must be engineered and built to the applicable codes (ASME, etc.). Accessories such as a pressure relief valve, check valve (non-return valve), automatic float type drain valve (water trap), etc. are required in a compressor system. Fig. 20, 21 and 22 illustrate the three possible types of installations.

9.5 - INSTALLATION OF "WATER SEALED" SYSTEMS

WATER SEALED systems are factory assembled and piped including discharge separator/reservoir, heat exchanger (air/liquid or air/air), circulating pump, and all required accessories mounted on a common compact baseplate/frame. See section 18 for additional details. Installation of WATER SEALED system is similar to that of a vacuum pump or a compressor with partial recovery or total recovery of service liquid depending upon the application (see section 9.3 or 9.4). It is important to properly engineer the connecting piping to the system suction and discharge, cooling lines, flushing lines, and draining lines. The used heat exchanger is designed with service liquid being cooled approximately 4 to 6°C (39 to 43 °F) over the available cooling media temperature. The cooling liquid flow is approximately the same as the service liquid flow needed by the pump at the operating conditions (see section 9.7 or 9.8). Schematics for once-through, partial and total service liquid recovery are shown in fig. 18 - 19 - 21 - 22.

9.6 - INSTALLATION OF "OIL SEALED (DynaSeal™)" SYSTEMS

OIL SEALED (DynaSeal™) are factory packaged systems including liquid ring vacuum pump using oil for service liquid. For additional details see section 19. Installation is simple and does not require additional details other than those already discussed in the previous chapter. Suction and discharge piping should be connected to the respective pump flanges. When locating the discharge piping it should be noted that although the system is fitted with oil demister, there may still be traces of oil fumes carried by the vented gas. Make sure therefore, that the selected area for vacuum pump discharge is suitable for such purpose. All other connections, (heat exchanger, draining, etc.) must be properly done. See fig. 37 for location of connections.

ATTENTION:
HOT SURFACES, DO NOT TOUCH TO AVOID POSSIBLE BURNS!

During operation, the temperature of pump, frame, separator and piping can reach values over 60 °C. Therefore, take all precautions necessary to comply with the safety regulations.

9.7 - SERVICE LIQUID (H_2O at 60 °F) FLOW (in GPM) FOR VACUUM PUMPS

The listed values are referred to the system with "Once-through" service liquid, handling dry air at 20 °C (68 °F) (for more specific data see the pumps performance curve). To reduce the amount of service liquid flow read the information given in section 17. If the pump is handling saturated or condensable gases at relatively high temperatures, there will be condensation inside the pump. In those cases the service liquid flow listed below can be increased up to 25% to reduce the discharge temperature and minimize the danger of pump cavitation at high vacuum.

Table 3

PUMP MODEL	SUCTION PRESSURE (in Torr)		
	25-150	>150-450	>450
TRH 32-4	0.9	0.9	0.7
TRH 32-20	1.5	1.3	1.2
TRH 32-45			
TRH 32-60	4.0	3.0	2.6
TRH 40-110			
TRH 40-140			
TRH 40-190	4.4	3.7	3.0
TRH 50-280	10.5	7.5	4.0
TRH 50-340	13.0	9.8	5.3
TRH 50-420	15.8	12.0	7.0
TRH 80-600	11.0	8.7	5.7
TRH 80-750	13.0	10.6	7.0
TRH 100-870	32.5	25.0	16.7
TRH 100-1260			
TRH 100-1600			
TRH 150-2000	53	42	26
TRH 150-2600	58	49	29
TRH 150-3100	16.20	14.10	8.70

PUMP MODEL	SUCTION PRESSURE (in Torr)		
	25-150	>150-450	>450
TRM 32-25	1.8	0.9	0.6
TRM 32-50	2.0	1.0	0.7
TRM 32-75	3.0	1.8	1.5
TRM/V 40-110	5.3	3.5	2.2
TRM/V 40-150			2.4
TRM/V 40-200	5.7	4.0	2.6
TRM/V 50-300	7.0	5.3	3.5
TRV 65-300			
TRV 65-450	10.5	7.4	4.0

PUMP MODEL	SUCTION PRESSURE (in mbar)	
	150 - 450	> 450
TRS 32-20	1.5	1.0
TRS 32-50		
TRS 40-55	3.4	1.9
TRS 40-80		
TRS 40-100	4.2	2.5
TRS 40-150	5.1	3.2
TRS 50-220	10.6	5.7
TRS 100-550	12.8	7.7
TRS 100-700	14.5	9.2
TRS 100-980	40	24
TRS 125-1250	38	18
TRS 125-1550	44	20
TRS 200-1950	80	50
TRS 200-2500	88	51
TRS 200-3100	114	77

For the above pumps running as compressors without the specific performance curves, please contact TRAVAINI PUMPS USA.

9.8 - SERVICE LIQUID FLOW (H_2O at 60°F) AND PRESSURE FOR COMPRESSORS SERIES "SA"

Values are applicable when the compressor suction is barometric pressure (1013 mbar) and the gas is air at 20°C (68 °F). The indicated flow and pressure requirements are valid for the compressor total performance curve.

SA0E3U = 4 GPM at minimum pressure of 20 to 40psi.
SA0G2D = 4 GPM at minimum pressure of 20 to 40psi.
SA0G2G = 6 GPM at minimum pressure of 20 to 40psi.

9.9 - TYPICAL INSTALLATION SCHEMATICS FOR VACUUM PUMPS

Fig. 17

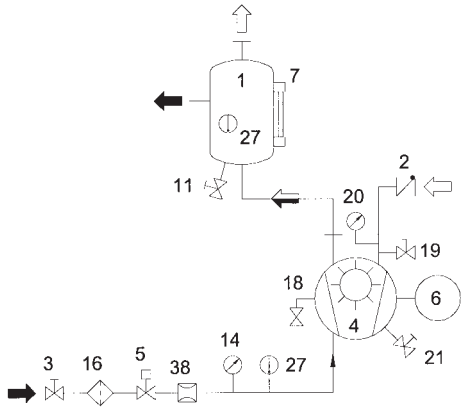


Fig. 18

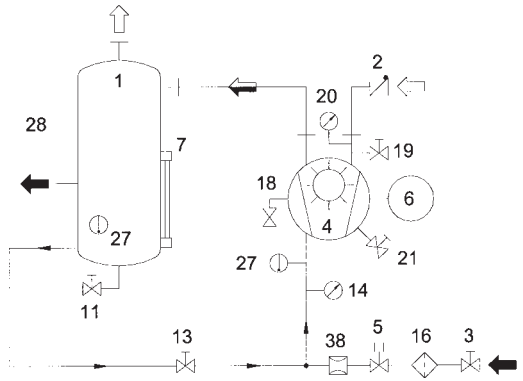
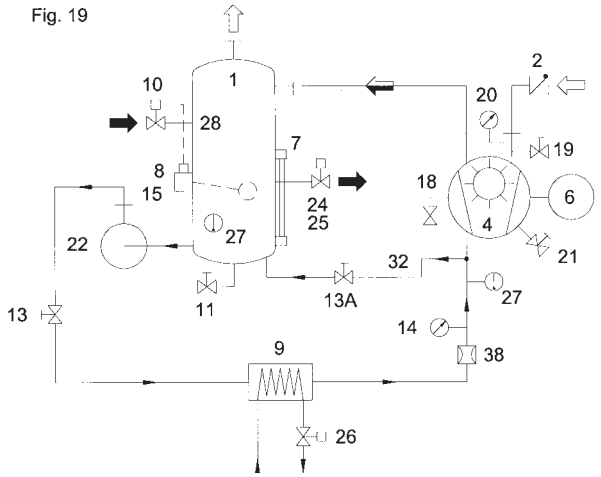


Fig. 19



1 Separator/ reservoir
2 Non-return valve
3 Shut-off valve (check valve)
4 Liquid ring vacuum pump
5 Solenoid valve
6 Electric motor
7 Level gauge glass
8 Float valve
9 Heat exchanger
10 Make-up solenoid valve
11 Drain valve
13 Flow control valve
13A By-pass valve
14 Pressure gauge
15 Level switch
16 Filter (y-strainer)
18 Automatic drain valve (check valve)

9.10 - TYPICAL INSTALLATION SCHEMATICS FOR COMPRESSORS

Fig. 20

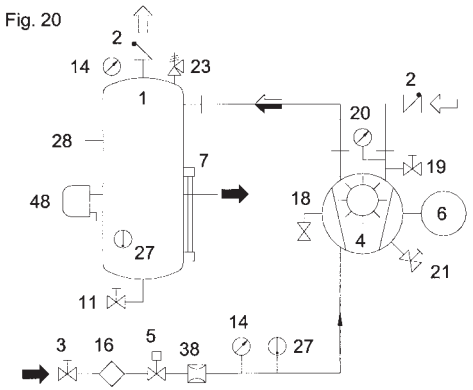


Fig. 21

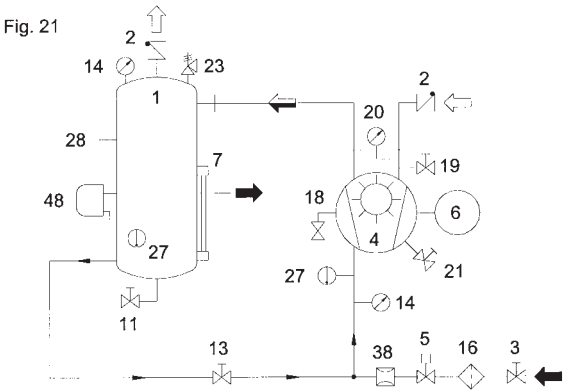
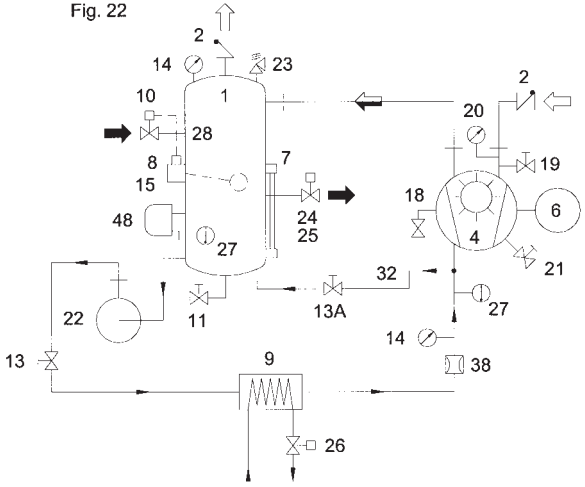


Fig. 22



19 Valve for spare vacuum connection

20 Vacuum gauge

21 Anti-cavitation valve

22 Circulating pump

23 Pressure relief valve

24 Overflow valve

25 Draining solenoid valve

26 Solenoid valve for heat exchanger cooling liquid

27 Temperature gauge

28 Fill connection

32 By-pass piping

38 Orifice flow

48 Automatic drain valve or water trap

⇧ Air or Gas

⇧ Liquid-Gas mixture

⬆ Liquid

9.11 - CONNECTIONS LOCATION

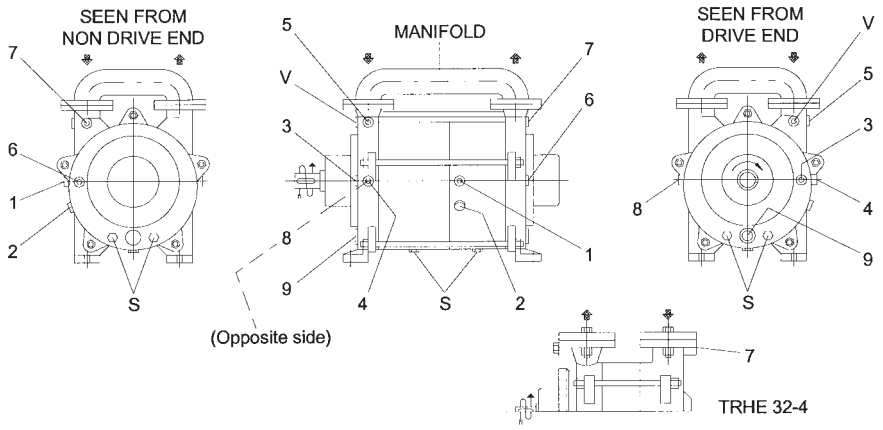


Fig. 23 - Pump series TRH (for details, see table 4)

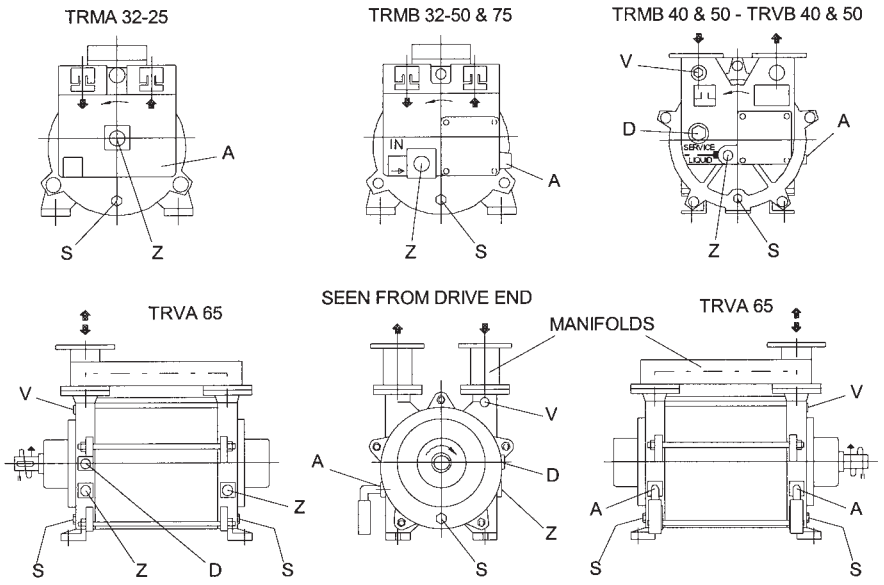


Fig. 24 - Pump series TRM - TRV (for details see table 5)

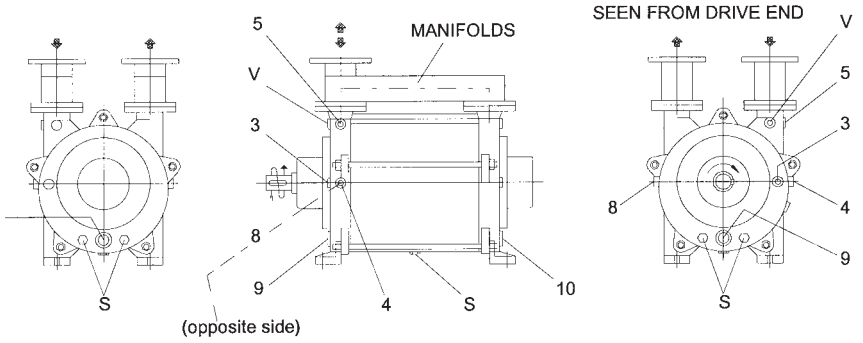


Fig. 25 - Pump series TRS (for details, see table 6)

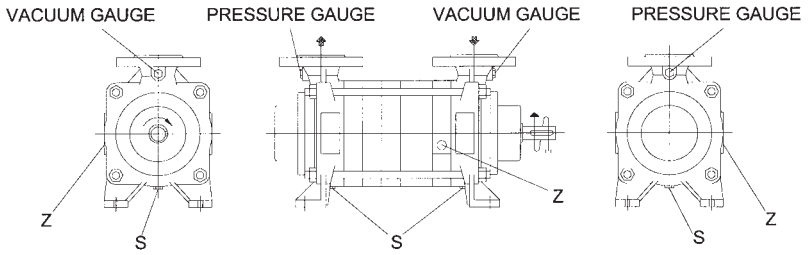


Fig. 26 - Pump series SA (for details, see table 7)

Table 4 – Pump series TRH

PUMP MODEL	A		D		Z		Qty. Manifolds
	Location	Connection Size	Location	Connection Size	Location	Connection Size	
TRHE 32-4	-	-	-	-	7	1/4" GAS	-
TRHE 32-20 & 45	1	1/4" GAS			8	3/8" GAS	
TRHC 32-20 & 45					4		
TRHE & TRHC 32-60						1/2" GAS	1
TRHE 40-110	2				9	3/4" GAS	-
TRHC 40-110			4	1/2" GAS		1/2" GAS	
TRHE 40-140 & 190			3			3/4" GAS	1
TRHC 40-140 & 190			4			1/2" GAS	
TRHB 50	7		3			1" GAS	
TRHC 80	6	3/8" GAS	4	1" GAS		1 1/4" GAS	
TRHE 100		1/2" GAS				1 1/2" GAS	
TRHA 150	7	3/4" GAS	4 - 5			2 1/2" GAS	

Table 5 - Pump series TRM – TRV

PUMP MODEL	Connection Size				Qty. Manifolds
	A	D	S	Z	
TRMA 32-25 & TRMB 32-50	1/8" GAS	-	1/8" GAS	1/4" GAS	-
TRMB 32-75				3/8" GAS	
TRMB & TRVB 40		1/2" GAS	1/4" GAS	1/2" GAS	
TRMB & TRVB 50		3/4" GAS		3/4" GAS	
TRVA 65		1/2" GAS		1/2" GAS	2

Table 6 - Pump series TRS

PUMP MODEL	D		Z		Qty. Manifolds
	Location	Connection Size	Location	Connection Size	
TRSE 32	-	-	8	3/8" GAS	-
TRSC 32			4		
TRSE 40-55 to 150			9	3/4" GAS	
TRSC 40-55 to 100	4	1/2" GAS		1/2" GAS	
TRSC 40-150					1
TRSE 50-220	3		9 - 10	3/4" GAS	2
TRSC 50-220	4			1/2" GAS	
TRSB & TRSC 100		1" GAS		1 1/4" GAS	
TRSE 125				1 1/2" GAS	
TRSA 200	4 - 5			2 1/2" GAS	

Table 7 - Pump series SA

COMPRESSOR MODEL	Connection Size	
	S	Z
SA0E3U	1/4" GAS	3/8" GAS
SA0G2D		1/2" GAS
SA0G2G		

GAS = Straight pipe thread
A = Connection anti-cavitation
D = Auxiliary connection for automatic draining valve, connection valve for spare vacuum pick-up, vacuum relief valve
S = Connection for drain plugs or valves
V = Connection for vacuum gauge 1/4" GAS (series 32 excluded)
Z = Connection for service liquid

All drawings are general and schematics (for additional details see the specific pump catalogue).

9.12 - PUMP ENGINEERING DATA

Table 8

PUMP MODEL	Noise Level	Weight Bare Pump	Weight assembly Monoblock (B5 design)	Weight assembly with baseplate	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
TRHE 32-4	67	30	42	70	1450	1750	0.55	0.75
TRHC 32-20	66	55	68	90	2900	3500	1.1	1.5
TRHE 32-20	66	40	50	75	2900	3500	1.1	1.5
TRHC 32-45	66	62	75	97	2900	3500	1.5	2.0
TRHE 32-45	66	46	56	81	2900	3500	1.5	2.0
TRHC 32-60	66	66	79	103	2900	3500	2.2	3
TRHE 32-60	66	57	68	95	2900	3500	2.2	3
TRHC 40-110	65	147	174	202	1450	1750	4	5
TRHE 40-110	65	108	134	160	1450	1750	4	5
TRHC 40-140	65	174	194	262	1450	1750	4	5
TRHE 40-140	65	147	167	220	1450	1750	4	5
TRHC 40-190	65	191	231	301	1450	1750	5.5	7.5
TRHE 40-190	65	165	205	260	1450	1750	5.5	7.5
TRHB 50-280	70	286	321	429	1450	1750	9	15
TRHB 50-340	70	308	374	466	1450	1750	11	15
TRHB 50-420	71	319	392	484	1450	1750	15	20
TRHC 80-600	76	484	539	792	1450	1750	22	30
TRHC 80-750	76	528	616	829	1450	1750	30	40
TRHE 100-870	79	906	—	1263	960	1150	30	40
TRHE 100-1260	79	1067	—	1434	960	1150	37	50
TRHE 100-1600	79	1140	—	1518	960	1150	45	60
TRHA 150-2000	83	2926	—	3971	730	880	75	100
TRHA 150-2600	84	3256	—	4609	730	880	90	125
TRHA 150-3100	84	3586	—	4939	730	880	110	150
TRSC 32-20	69	42	55	85	2900	3500	1.1	1.5
TRSE 32-20	69	32	45	68	2900	3500	1.1	1.5
TRSC 32-50	69	44	58	89	2900	3500	1.5	2.0
TRSE 32-50	69	38	47	73	2900	3500	1.5	2.0
TRSC 40-55	66	119	147	73	1450	1750	2.2	3
TRSE 40-55	66	75	103	130	1450	1750	2.2	3
TRSC 40-80	66	125	154	180	1450	1750	3	5.0
TRSE 40-80	66	81	110	136	1450	1750	3	5.0
TRSC 40-100	67	132	158	187	1450	1750	3	5.0
TRSE 40-100	67	86	114	141	1450	1750	3	5.0
TRSC 40-150	67	156	194	211	1450	1750	4	5.0
TRSE 40-150	67	97	125	152	1450	1750	4	5.0
TRSC 50-220	67	191	229	268	1450	1750	5.5	7.5
TRSE 50-220	67	162	202	240	1450	1750	5.5	7.5
TRSC 100-550	76	440	495	719	1450	1750	15	20
TRSC 100-700	76	506	561	836	1450	1750	18.5	30
TRSB 100-980	78	550	638	847	1450	1750	30	40
TRSE 125-1250	174	959	—	596	960	1150	37	50
TRSE 125-1550	174	1016	—	634	960	1150	45	60
TRSA 200-1950	183	2475	—	1600	730	880	75	100
TRSA 200-2500	184	2695	—	1700	730	880	75	100
TRSA 200-3100	184	2915	—	1800	730	880	110	160

Table 8 (continued)

PUMP MODEL	Noise Level	Weight assembly Monoblock 50 Hz motor	Weight assembly Monoblock 60 Hz motor	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
TRMA 32-25	69	37	40	2900	3500	0.75	1.1
TRMB 32-50	69	53	57	2900	3500	1.5	2.2
TRMB 32-75	70	81	91	2900	3500	3	4
TRMB 40-110	68	145	156	1450	1750	3	4
TRMB 40-150	69	167	233	1450	1750	4	5.5
TRMB 40-200	72	227	244	1450	1750	5.5	7.5
TRMB 50-300	72	277	—	1450	—	7.5	—

PUMP MODEL	Noise Level	Weight Bare Pump	Weight assembly Monoblock (B5 design)	Weight assembly with baseplate	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
TRVB 40-110	68	—	136	—	1450	1750	3	4
TRVB 40-150	69	—	141	—	1450	1750	4	5.5
TRVB 40-200	72	—	172	—	1450	1750	5.5	7.5
TRVB 50-300	72	—	194	—	1450	1750	7.5	10
TRVA 65-300	70	293	341	354	1450	1750	7.5	10
TRVA 65-450	70	321	387	442	1450	1750	11	15

PUMP MODEL	Noise Level	Weight assembly Monoblock 50 Hz motor	Weight assembly Monoblock 60 Hz motor	Operating Speed RPM		Installed Motor Size kW	
	dB(A)	lbs.	lbs.	50 Hz	60 Hz	50 Hz	60 Hz
SA0E3U	67	123	242	2900	3500	11 15	15 20
SA0G2D	69	183	297	2900	3500	11 15	18,5 25
SA0G2G	69	191	139 157	2900	3500	15 22	20 30

NOTES:

- Noise level (measured at 3 feet distance, without motor, with pump installed in the system) for pump series TRH, TRM, TRV when operating at 60 Torr and pump series TRS when operating at 175 Torr. Noise level test to ISO 3746 standards and with pumps at 50 Hz operating speeds.
- Weights are for pumps fitted with Mechanical Seals and in Cast Iron materials (tolerance ± 10%).
- The assemblies, Monoblock and with Baseplate, are suitable for 50 Hz motors, except where otherwise noted. Indicated total weights for the assemblies are without motors.
- The installed motor size will cover the whole performance curve when operating as vacuum pump.

10 - CHECK LIST PRIOR TO START-UP

All questions listed below must have **POSITIVE** answers prior to proceeding to the pump start-up. Please note that the following is a partial list. Special installations may require further precautions therefore; additional safety steps must be taken as the case dictates.

- **This manual has been completely read, including the following chapters, and is understood in its entirety?**
- **The piping system has been flushed of any foreign particles, welding impurities, etc.?**
- **Have all piping and pump obstruction been removed?**
- **All connections and piping are leak proof and there are no external forces or moments applied to the piping or pump flanges?**
- **Pump and motor are properly lubricated, per instructions?**
- **Pump/motor alignment has been checked?**
- **Mechanical seal flushing line has been connected, where required?**
- **All valves in the installation are in the correct position?**
- **All safety guards are in place?**
- **Pump direction of rotation has been checked by jogging the motor?**
- **The pump Stop switch is clear and visible?**
- **Pump as well as installation are ready for start-up?**

11 - STARTING, OPERATING AND STOPPING PROCEDURES

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free the rotor by applying a torque to the pump coupling with a pipe wrench. To free the rotor of a monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end that has a threaded connection and apply the torque by hand. In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.

NOTE: The selected solvent or lubricating fluid must be compatible with the pump, seals and gasketing materials.

CHECK PUMP-MOTOR COUPLING ALIGNMENT!
This must be done prior to the first start-up and before every start-up if pump or motor has been removed from the installation for maintenance or other reasons. See section 7.2.

Prior to starting the pump verify that all auxiliary components are available, ready for use and, where required, they are in the open position (i.e.: double mechanical seals are pressurized with buffer liquid, cooling liquid to heat exchanger is open, etc.) and the pump bearings are lubricated. If the gas and/or service liquid temperatures are in the dangerous levels, it is recommended to insulate the pump, piping and separator to avoid direct contact with their surface, avoid freezing, thermal shock or loosing heat energy.

NOTE: See section 11.4 to 11.6 for OIL SEALED (DynaSeal™) systems start-up, operation and shut-down.

11.1 - START-UP of WATER SEALED Systems

(In the following, reference is made to certain ITEM numbers, which appear on fig. 17 to 22 of section 9 and 18).

Open valve at gas discharge if installed and partially open the valve at the suction side. When operating the pump as a compressor, there must be a check valve ITEM 2, fitted at the discharge side. When pump ITEM 4, is fitted in a partial recovery or total recovery or WATER SEALED systems, as built by TRAVAINI PUMPS USA, it is required to have drain valve ITEM 11, at separator ITEM 1, in the closed position, flow regulating valve ITEM 13, in the open positions. Before start-up fill the pump to the shaft centerline, separator and piping of system with service liquid through pump inlet flange or fill connection ITEM 28. Check all components for leakage. Start all accessories (temperature switches, level switches, pressure switches, etc.) open cooling and flushing lines. Start the pump and open the service liquid valve, ITEM 3 if applicable, soon after, start the circulating pump, ITEM 22 (if applicable) and adjust the service liquid flow (see table 3). Gradually open the valve at gas suction side till the required vacuum level is reached. Check the system for abnormal conditions (see section 12 and 14). If the system is fitted with a circulating pump and/or the service liquid has an excessive pressure the by-pass valve ITEM 13A, (if available) or valve, ITEM 13 can be adjusted to reduce the service liquid flow to the vacuum pump and/or optimize the thermodynamic efficiency of the heat exchanger ITEM 9.

NOTE: WATER SEALED systems engineered with multiple pumps are fitted with isolating valves at suction, discharge, and service liquid lines of each pump. When one or more pumps are not operating it is required to isolate the idle pump(s) by closing these valves. When the pumps are put back into service the said valves (at suction and discharge) must be opened.

11.2 - OPERATION

After starting the vacuum pump check the following:

- the vacuum level is as desired or adjust the flow-regulating valve to the required vacuum
- flow and temperature of service liquid and/or cooling liquid are as expected (within 25% tolerance)
- motor does not draw more amperage than shown on its nameplate
- the pump-motor assembly does not have abnormal vibrations and noises such as cavitation
- the operating temperature at full load does not exceed approximately 85°C
- there are no leaks from mechanical seals, joints and flushing or cooling liquid lines
- liquid level in separator is between the minimum and the maximum.

NEVER OPERATE THE PUMP DRY!

If the gas discharge is not open to the immediate atmosphere but it is piped to other locations, the pump discharge should be checked for back-pressures that could cause higher power consumption and loss of pump capacity.

11.3 - SHUT DOWN of "WATER SEALED" SYSTEMS
First close the service liquid flow and cooling liquid flow (if applicable) then shut down the circulating pump, ITEM 22, (if applicable). Where possible, gradually decrease the vacuum level to 300-675 Torr in about 10 seconds max or, if compressor, decrease the discharge pressure. The discharged service liquid from pump, ITEM 4, helps produce a slow deceleration rather than sudden stop. Turn off the power to motor ITEM 6 and close any accessories and flushing lines. Make sure the non-return valves, ITEM 2 or similar, at suction and discharge lines are leak tight. Should the system be idle for an extended period of time it is recommended to disconnect the electricity to the motor or control panel and drain all liquids from pump, separator and piping. Refer to chapter 6 for storage procedures.

11.4 – START-UP OF "OIL SEALED (DynaSeal™)" SYSTEMS
(In the following, reference is made to certain ITEM numbers which are listed in the figures and legend of section 12.1 and 19). Open the valve at the gas discharge, if applicable, and partially close the valve at the suction side. Close draining valve ITEM 11, and valves for condensate recovery ITEMS 13F and 13L, which are on the frame separator, ITEM 1B; open the valve ITEM 13D which is between the circulating pump, ITEM 22, and the frame separator, ITEM 1B, then partially open flow regulating valve, ITEM 13 between the discharge of circulating pump, ITEM 22 and the heat exchanger, ITEM 9, and the by-pass valve, ITEM 13A. If the system is fitted with a separator cyclone, ITEM 1D, and the adjacent collecting tank, ITEM 1E, it is required to close valves, ITEM 11A and 12 and open valve ITEM 13E. Fill frame separator with service oil through the filling plugs ITEM 28. Proper oil level can be seen on sight glass ITEM 7. Refer to table 12 and 13 for the required oil quantity. Start and/or open applicable accessories (temperature switches, level switches, etc.) and circuitry for cooling and flushing. Start vacuum pump, ITEM 4, and soon after, start the circulating pump, ITEM 22. Adjust the circulating pump capacity with valve ITEM 13. Gradually open the system suction valve till the desired vacuum is achieved. Check the systems for abnormal noises or vibrations (see section 12 and 14). Adjust by-pass valve ITEM 13A, to regulate the oil flow to the vacuum pump or to improve the thermodynamic efficiency of the heat exchanger.

NOTE: OIL SEALED (DynaSeal™) systems engineered with multiple pumps are fitted with isolating valves at suction, discharge, and service liquid lines of each pump. When one or more pumps are not operating, it is required to isolate the idle pump(s) by closing these valves. When the pumps are put back into service the said valves (at suction and discharge) must be opened.

11.5 - OPERATION OF "OIL SEALED (DynaSeal™)" SYSTEMS
After starting the vacuum pump check the following:
- the vacuum level is as desired or adjust the flow-regulating valve to the required vacuum
- the oil temperature is between 140 and 175°F. If required, adjust the thermostat on the radiator or in case of water/oil heat exchanger adjust the cooling water flow
- motor does not draw more amperage than shown on its nameplate
- the pump-motor assembly does not have abnormal vibrations or noises such as cavitation
- the surface temperature at full load, does not exceed approximately 85°F
- that there are no leaks from mechanical seals, joints, flushing or cooling liquid lines
- liquid level in separator and pump is between the minimum and the maximum

- the pressure gauge of the oil demister separator does not read more than 4 psi. When this value is exceeded, it will be required to change the filter element.

If the gas discharge is not open to the immediate atmosphere but it is piped to other locations, the pump discharge should be checked for back-pressures that could cause higher power consumption and loss of pump capacity.

11.6 - SHUT DOWN OF "OIL SEALED (DynaSeal™)" SYSTEMS
Close, if applicable, the cooling water to the water/oil heat exchanger ITEM 9, then turn off the power to the circulating pump ITEM 22. Where possible, gradually decrease the vacuum level to 300-625 Torr in about 10 seconds max. The discharged service liquid from pump ITEM 4 helps producing a slow deceleration rather than sudden stop.
Turn off motor ITEM 6, radiator ITEM 9 and any accessories and flushing circuitry. Make sure the non-return valves ITEM 2, or similar, at suction and discharge lines are leak tight. Should the system be idle for an extended period of time it is recommended to disconnect the electricity to the motor panel, drain all liquids from pump, separator and piping. Refer to chapter 6 for storage procedures.

12 - OPERATING MAINTENANCE

Periodically check the working conditions of the system by means of the instrumentation on the installation (pressure gauges, vacuum gauges, temperature gauges, ampmeters, etc.) and that the pump is consistently handling the application for which it was selected. The operation of the pump should be without abnormal vibrations or noises, if any of these problems is noticed, the pump should be stopped immediately, search for the cause and make the necessary corrections. It is good practice to check the pump/motor alignment, the running conditions of the bearings and of the mechanical seals (see section 13) at least once a year, even if no abnormalities have been noticed. If there is a deterioration of the pump performance, which is not attributable to changes in system demands, the pump must be stopped and proceed with necessary repairs or replacement. If the mechanical seals are fitted with external flushing and/or quenching lines their pressures, temperatures and flows must be checked constantly.

NEVER ALLOW THE PUMP TO OPERATE IN THE CAVITATION AREA!

Cavitation has the characteristic metallic sound, like if gravel was rotating inside the pump, and it causes also high pump vibrations. This happens when the pump is running at absolute pressures close to the vapor pressure of the service liquid at the running conditions. This is a damaging condition for the impellers, port plates and casings. The cavitation causes erosion taking away metal particles and attacking the surface of the pump components. This is particularly damaging if the pump is handling corrosive gases, see chapter 14 for suggestions to correct the problem.

Pump series TRH, TRM and TRV are fitted with an anti-cavitation valve that should be left open (if required) see fig. 23 and 24 for the location. This valve should be connected toward the upper part of the discharge separator so that, depending upon the operating vacuum, the pump can either take air or discharge excessive liquid. For OIL SEALED (DynaSeal™) systems the anti-cavitation valve ITEM 13H is piped from pump ITEM 4 to the frame separator ITEM 1B.

During operation it must be avoided to have sudden and frequent variations from high to low vacuum. (e.g. suddenly opening the suction valve when the pump is operating at pressures lower than 150 Torr). This would flood the pump creating high power absorption that would put heavy stress on the motor and coupling.

Particular attention should be put on the quantity of the service liquid flow. The flow will depend upon the type of installation (see section 9), the pump size, and/or the desired temperature rise. The flow of service water at 15 °C, for standard pumps and normal operating conditions at various vacuum levels, is listed on the specific pump curves and/or on table 3 of section 9.7. Usually the temperature rise of service water, when handling dry air at 68 °F, is approximately 10 °F. When condensable (e.g.: vapours) are present in the gas stream the heat load to be removed by the service water will be higher, therefore the service water temperature rise will be higher. The service liquid flow and its temperature will affect the pump performance. Generally the low service liquid flow will decrease the pump capacity, while a high service liquid flow will increase the absorbed power by flooding the pump (see section 17 for information and calculations). Hard service water will generate lime build-up inside the pump. The severity of the deposit will vary with the water temperature. Lime or mineral deposits on the surface of the internal pump components will cause an increase of absorbed power, wear of the components and eventually will seize the pump. It is recommended to monitor the water hardness and, if too high, treat the water. If there are no alternatives, there should be periodical flushing of the pump with a solution that will remove the specific deposits, or the pump must be periodically disassembled, cleaned of all incrustations and re-assembled. Systems with total service liquid recovery require periodical change of the service liquid contained in the closed loop. The heat exchanger must be kept well cleaned of all mineral deposits for an effective thermodynamic heat exchange. During operation, a closed loop system will lose some of the service liquid, due to evaporation and/or saturation of the discharged gases. It will be required to periodically make-up fresh liquid into the system. This operation is not required for those systems that are fitted with a float type automatic make-up valve ITEM 8. This valve requires water at a pressure of approximately 2 bar. Systems that handle condensable will experience a rise in the level of the service liquid in the separator. The excessive liquid will be overflowed through the overflow valve or connection. If the specific gravity of the condensable is higher than that of the service liquid, the condensable must be discharged through the separator drain valve ITEM 11, preferably with system not running.

12.1 - "OIL SEALED (DynaSeal™)" SYSTEMS

(For ITEM numbers refer to fig. 27 and it's legend).

It is very important to keep the service oil temperature under control when the oil temperature exceeds 90 °C there is the danger of seizing the pump and the gasketing may start leaking.

Every 100 - 200 working hours it is suggested to check the oil level in the oil reservoir, make-up oil if necessary and change the oil every 10,000 working hours (depending upon the use and the application).
Those installations where the handled gases are contaminated with dust or suspended solids that can alter the oil characteristics will require more frequent oil check and changes.

Condensable vapors, if present during evacuation, can be flushed right through the discharge of the separator (if they have low boiling point) or, when the system is idle, can be drained by opening valves, ITEM 16. During operation, the oil demister filter will be impregnated with oil particles; the pressure gauge, ITEM 2,

installed at the housing, ITEM 2, will provide an indication of the filter being plugged; pressure reading over 4 psi. maybe an indication that the filter needs replacement. At higher discharge pressures the discharged air quality will decrease and the vacuum pump absorbed power will increase.

To replace the oil demister filter, simply disconnect the oil scavenger line, remove the cover, ITEM 25, remove the used filter element, apply a gasketing material over the gasket faces of the new filter and place the latter in the housing, put in place the cover and the scavenger line.

TYPICAL BILL OF MATERIALS

ITEM	DESCRIPTION
1	VACUUM GAUGE (STD)
2	PRESSURE GAUGE (STD)
3	TEMPERATURE GAUGE (STD)
4	COMPOUND GAUGE (STD)
5	LEVEL GAUGE (STD)
6	BULLSEYE GAUGE (STD)
7	BACK PRESSURE SWITCH (OPT)
8	LEVEL SWITCH, HIGH AND LOW (OPT)
9	TEMPERATURE SWITCH (STD)
10	HEAT EXCHANGER AIR OR WATER COOLED (STD)
11	FILTER SILENCER (STD)
12	INLET FILTER (OPT)
13	SPIN-ON OIL FILTER (OPT)
14	Y-STRAINER (STD)
15	SEPARATOR ELEMENT (STD)
16	BALL VALVE (STD)
17	BALL VALVE STRAINER ISOLATOR (STD)
18	MANUAL UNLOADING VALVE (STD)
19	AUTOMATIC UNLOADING VALVE (OPT)
20	GLOBE VALVE (STD)
21	CHECK VALVE (STD)
22	VACUUM RELIEF VALVE (OPT)
23	SOLENOID VALVE (NOT USED WITH ITEM 22)(OPT)
24	TEMPERATURE CONTROL VALVE (OPT)
25	SEPARATOR TANK (STD)
26	CIRCULATION PUMP (OPT)
27	TRAVAINI LIQUID RING VACUUM PUMP (STD)
28	CONTROL PANEL NEMA 12 (STD)

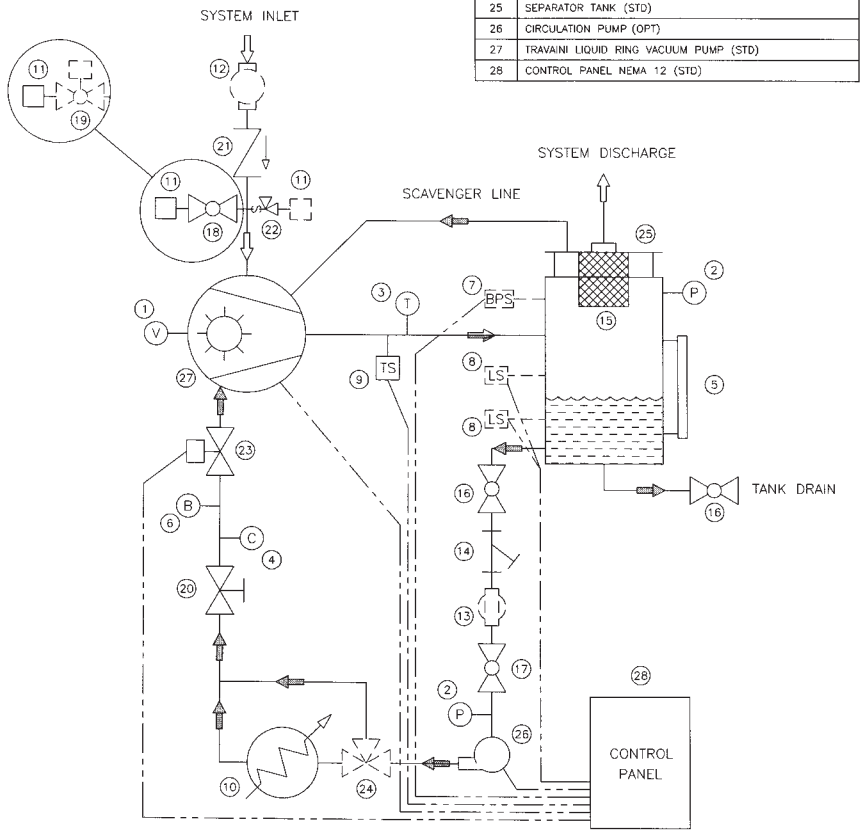


Fig 27 (General Schematic Drawing)

13 - BEARINGS AND MECHANICAL SEALS MAINTENANCE

WARNING: The maintenance must be carried out with the pump turned off and the electrical power, or other driving mechanism, must be disconnected. The power should only be turned back on by the same person doing the maintenance. It is, however, recommended to have at least a team of two workers doing the maintenance and the supervisors should be fully aware of the work in progress.

CAREFULLY FOLLOW THE SAFETY PROCEDURES LISTED IN CHAPTER 2.

13.1 - BEARINGS

At assembly time the pump bearings are lubricated with quality grease (sealed bearings are greased for life). Some of the recommended greases are:

BP - ENERGREASE LS - EP 2 MOBIL - MOBILUX EP 2
EXXON - BEACON EP 2 SHELL - SHELL ALVANIA EP GREASER

Bearings for pumps working in standard conditions should be lubricated every 2000/2500 working hours with a quality grease (see “Disassembly & Assembly” for the replacement of bearings). Bearing temperature should not exceed the 85 °C during normal working conditions and normal environments. Bearings can overheat for reasons such as too much grease, misalignment of flexible coupling, wrong bearings, excessive vibrations, bearing wear. See tab. 9 for bearing numbers and type used for each pump.

13.2 - MECHANICAL SEALS

Mechanical seals can be with many types of materials, design and installations (see fig. 28). TRAVAINI PUMPS USA has evaluated their selection at the time of pump design; it is a function of the fluid and working conditions. The seals are supplied with the proper flow of liquid for their lubrication, through internal pump passages. Upon request, the pump can be provided with seal lubrication coming from an outside source; the set-up must be such that the seals are guaranteed the liquid quantity and pressure as recommended by TRAVAINI PUMPS USA or by the seal manufacturer. For mechanical seal shaft size see table 9.

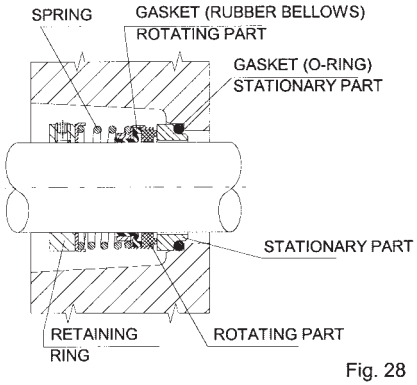


Fig. 28

Mechanical seals normally fitted in the vacuum pumps are to DIN 24960 standards. See “Disassembly & Assembly Instructions” for major seal dimensions. Normally mechanical seals do not require maintenance until there is a visible liquid loss (leakage). See “Disassembly & Assembly Instructions” for seal replacement.

Mechanical seals **MUST NOT** run dry! When seals are operated with out lubricant and/or flushing liquid their faces and the elastomers may suffer damages beyond repair. It is suggested to check the conditions of the seal faces every approximately 4000 working hours.

Table 9

PUMP MODEL	BEARING			MECHANICAL SEAL	
	Quantity	Type	Grease Quantity each bearing - gr.	Quantity	Diameter mm
TRHE 32-4	1	6302.2RSR		1	16
TRHC and TRSC 32 TRHE 32-20/45/60–TRSE 32	2	6304.2RSR		2	22
TRHE 40-110 – TRSE 40		6305.2RSR			
TRMA 32-25	1 1	6304.2RSR 6204.2RSR			28
TRMB 32-50	1 1	6305.2RSR 6205.2RSR			24
TRMB 32-75	1 1	6306.2RSR 6206.2RSR		1	28
TRMB 40-110	1 1	3208.2RSR 6206.2RSR	—		35
TRMB 40-150	1 1	3208.2RSR 6306.2RSR			
TRVB 40-110/150	2	6208.2RSR			
TRMB 40-200 and 50-300	1 1	3210.2RSR 6308.2RSR			45
TRVB 40-200 and 50-300	1 1	6210.2RSR 6208.2RSR			
TRHC and TRSC 40 TRHE 40-140/190 TRSC and TRSE 50	2	6306.2RSR			35
TRHB 50 - TRVA 50 and 65		6308	20	2	43
TRHB/C 80 - TRSB/C 100		6310	35		55
TRHE 100 - TRSE 125	1 1	6314 NU 314	50		75
TRHA 150 - TRSA 200	2 1	7320B.MB.UA 22320ES.TVPB.C3	180		110

NOTE: The supplied data are for pumps in STANDARD construction. For special construction please contact TRAVAINI PUMPS USA.

14 - TROUBLE SHOOTING: PROBLEMS, CAUSES AND SOLUTIONS

Consult the following table when problems are experienced, if solutions are not found in this chart or should there be any doubts; do not hesitate to contact TRAVAINI PUMPS USA or your local distributor.

Table 10 - LIST OF PROBLEMS

PROBLEM	LIST OF POSSIBLE CAUSES
Pump does not create or the vacuum is too low	1 - 2 - 3 - 4 - 9 - 11 - 18 - 19 – 22 - 23 - 24 - 25
Excessive noise	1 - 4 - 5 - 6 - 7 - 10 – 24
High power consumption	1 - 5 - 6 - 8 - 9 - 15 - 24 – 25
Vibration	5 - 6 - 7 - 8 - 10 - 12 - 13 – 24
Mechanical seal leaking	11 – 14
Pump looses liquid	11 – 19 - 23
Bearing failure	5 - 6 – 7
Pump does not start	1 - 6 – 20 - 21
Shaft partially or totally locked	6 - 10 - 15 - 16 - 21
Cavitation	3 - 4 – 8 - 9 - 17 - 24

	CAUSES	SOLUTIONS
1	Defective motor or wired wrong	Check the voltage, the frequency, motor type, power consumption, rotation, wiring connections, phase consistency
2	Leakage in suction piping	Repair piping; check valves for leakage
3	Service liquid high temperature	Lower the service liquid temperature; check the level of the service liquid; adjust the cooling liquid flow; adjust the radiator thermostat to lower temperature setting
4	Low service liquid flow	Increase the service liquid flow
5	Coupling misalignment	Re-align the coupling and the pump/motor assembly (see cap. 7)
6	Faulty bearing	Replace the bearing(see “Disassembly & Assembly Instructions”)
7	Cavitation	Open the anti-cavitation valve or set the relief valve to a lower vacuum (see table 4 to 6)
8	High service liquid flow	Reduce the service liquid flow; adjust the by-pass valve
9	High back pressure	Check the discharge line for obstructions or high friction losses; reduce the back-pressure to maximum 0.1 bar
10	Wrong pump/motor assembly	Verify that the base surface is level and that all pump feet are resting on the surface, add spacers if required (see section 11)
11	Mechanical seal failure	Change the mechanical seal (see “Disassembly & Assembly Instructions”)
12	Wrong pump mounting	Remount the pump (see section 7)
13	Piping weight resting on pump	Support the piping with hangers or other means (see section 11)

	CAUSES	SOLUTIONS
14	Inadequate seal lubrication	Check flushing liquid temperature, flow and pressure
15	Mineral deposits from hard water	Clean the pump
16	Foreign particles in pump	Disassemble the pump to remove the foreign objects (see “Disassembly & Assembly Instructions”)
17	Low suction pressure	Open the vacuum regulating valve and/or the anti-cavitation valve (vacuum relief valve)
18	Wrong pump rotation	Reverse the rotation (see section 8)
19	Bad gaskets	Replace the defective gaskets (see the “Disassembly & Assembly Instructions”)
20	Wrong motor connections	Check the electrical connections (connectors, fuses, breakers) and the power supply line (see section 8)
21	Pump seized	Disassemble and repair the pump (see “Disassembly & Assembly Instructions”)
22	Pump undersized	Select a pump with higher capacity
23	Pump worn-out	Disassemble and repair the pump (see “Disassembly & Assembly Instructions”)
24	Excessive liquid flow through suction line	Reduce the liquid flow through the pump suction; install a centrifugal separator (cyclone) before the pump
25	Instrumentation out of calibration	Check the working characteristics, replace if required

15 - REPAIRING AND REMOVING PUMP FROM THE INSTALLATION

Should there be the need for pump repair a knowledge of the specific “Disassembly and Assembly Instructions” is required.

FOLLOW THE SAFETY PRECAUTION MEASURES OUTLINED IN CHAPTER 2.

Before working on the pump it is important to:

- procure and wear the proper safety equipment (hard hat, safety glasses, gloves, safety shoes, etc.)
- disconnect the electrical power supply and, if required, disconnect the electrical cable from the motor
- close the isolating valves at pump inlet, outlet and service liquid
- let the pump cool down to ambient temperature if it has been handling hot fluids
- adopt safety measures if the pump has been handling hazardous liquids
- drain the pump internals of the pumped liquid through the draining connections, if necessary rinse with neutral liquid.

To remove the pump and the motor from the installation proceed as follows:

- remove bolts from pump suction and discharge flanges
- remove the coupling guard
- remove the spacer of the coupling, if there is one

- if required, remove the motor anchor bolts on the baseplate, for base mounted assembly, or the bolts on the adapter flange in the case of monoblock design
- remove the pump anchor bolts on the baseplate
- remove the pump from the installation. Avoid damaging other system components.

After pump repairs, re-install following the steps from “Assembly and Alignment” procedures and after (see the applicable chapters).

16 - SPARE PARTS

When ordering the pump it is good practice to also order the necessary spare parts, especially when there are no stand-by pumps in the installation. This will minimize unnecessary down times in the event of pump failure or routine maintenance.

It is therefore, recommended to stock the following spare parts for each pump size:

(1)	Impeller set
(1)	Complete shaft assembly
(1)	Bearing set
(1)	Mechanical seal set (or packing set)
(1)	Gasket sets
(1)	Radial seal ring set
(1)	Bearing spacer set
(1)	Coupling rubber insert set

For better parts management, the VDMA 24296 standards suggest to stock the number of parts as a function of the number of pumps being used in the plant. On the pump nameplate are printed pump model, year of manufacture and pump serial number. When ordering spare parts always provide this information. Pump type, parts item number (VDMA) and description as per the pump sectional drawing and parts list is useful information that helps to supply correct spare parts for your pump. We recommend the use of original spares: in case this is not respected, TRAVAINI PUMPS USA declines any responsibility for eventual damages and not correct running caused by not original spare parts.

17 - ENGINEERING DATA

17.1 - INFLUENCE OF SERVICE LIQUID TEMPERATURE, SPECIFIC GRAVITY AND VISCOSITY ON PUMP PERFORMANCE

The performance of liquid ring vacuum pumps is based on the use of water at 15 °C as service liquid. With water at different temperatures the pump capacity and the maximum attainable vacuum level will vary as a function of the type of pump, as illustrated by the curve sets of fig. 29 and 30.

EXAMPLE: Pressure = 45 Torr - Water temperature = 24°C - Pump series TRH - Capacity (15°C water) = 310 ACFM From curves of fig. 30 we find the correcting factor of 0.80, therefore the actual capacity for the pump at the given conditions will be: 310 x 0.80 = 248 ACFM. The maximum suction pressure before incurring cavitation will be approximately 35 Torr.

Regarding the performance variation due to changes of specific gravity and viscosity, it can be assumed a proportional variation in power consumption however; the changes in capacity at different pressures must be analyzed case by case. Please refer the conditions to TRAVAINI PUMPS USA when these corrections are needed.

Fig. 29
Single stage pump
(series TRM, TRS, TRV)

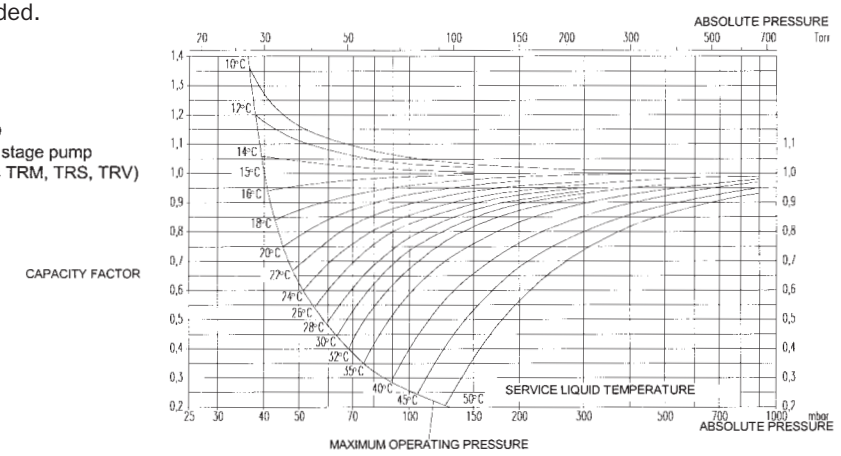
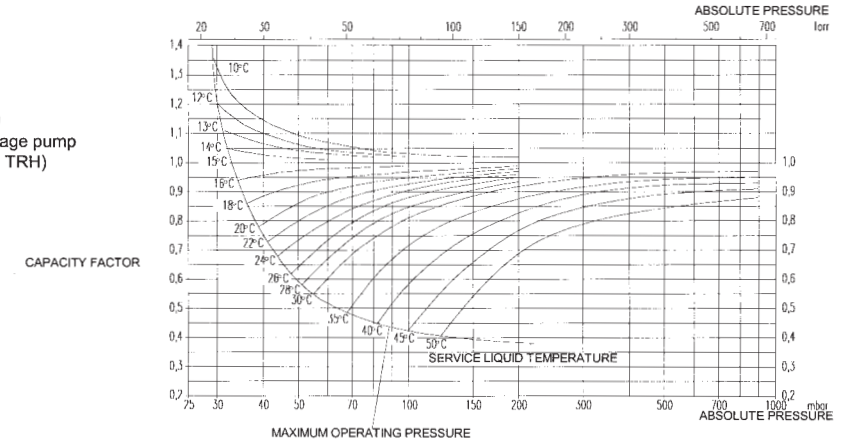


Fig. 30
Two stage pump
(series TRH)



17.2 - SERVICE LIQUID TEMPERATURE CHANGE ACROSS THE PUMP

The service liquid of a liquid ring pump absorbs total heat QT as follows:

$$Q_T\ (BTU) = Q_c + Q_K + Q_R$$

Where:

Q_c	=	0.9 x BHP x 2545	=	Isothermal compression heat
Q_K	=	m_V x r	=	Condensation heat
Q_R	=	m_g x c_p x ΔT_a	=	Cooling heat (Generally negligible, ignored in calculation of Q_T)

m_V	=	mass condensed incoming vapor in PPH
m_g	=	mass incoming gas in PPH
P	=	absorbed power at operating point in kW
c_p	=	gas specific heat in BTU/1B/°F
r	=	heat of vaporization in BTU's
ΔT_a	=	differential temperature in R, between incoming gas TG and service liquid discharge temperature ($T^2 + \Delta T$)
K	=	Kelvin temperature

Once the Q_T is known it is possible to calculate the differential temperature ΔT of the pump service liquid:

$$\Delta T = \frac{Q_T}{Q_A \cdot \rho \cdot c_P}$$

Where:

Q_T	=	total heat load before calculated in BTU/hour
Q_A	=	pump service liquid flow in GPM
ρ	=	service liquid density in kg/m³ (water = 1.0)
c_P	=	service liquid specific heat

NOTE: It can be assumed that the discharge gas and service liquid have same temperature.

17.3 - OPERATION WITH PARTIAL RECOVERY OF SERVICE LIQUID

Where the working conditions will allow it, the service liquid temperature can be increased utilizing a smaller quantity of fresh liquid from an outside source. A similar flow as the make-up is discharged to the drain while the balance of liquid required by the pump is recirculated. In these cases the service liquid working temperature rises and the pump capacity will require correction per curves of fig. 29 and 30. The system installation will be similar to the schematic of fig. 31.
Depending upon the affordable loss of capacity the service liquid temperature T2 may be set and the make-up flow of fresh liquid QF can then be calculated:

$$Q_F(m^3/h) = \frac{Q_A \cdot \Delta T}{T_2 - T_1 + \Delta T}$$

Where:

Q_F	=	Fresh make-up flow from outside source in m³/h
Q_A	=	Total service liquid flow required for the operating conditions in m³/h
ΔT	=	Service liquid temperature rise (see section 17.2)
T_2	=	Service liquid temperature to pump
T_1	=	Temperature of make-up liquid

The fig. 31 indicates a generic schematic of a liquid ring vacuum pump in a partial recovery system. By closing the recirculation line the system would become a "once through" installation where all the service liquid is drained, therefore:

$Q_A = Q_F$ and $T_2 = T_1$

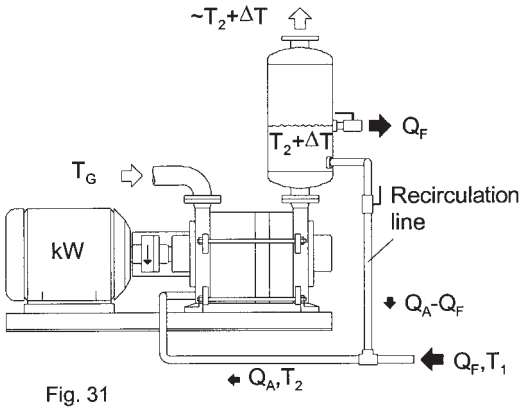
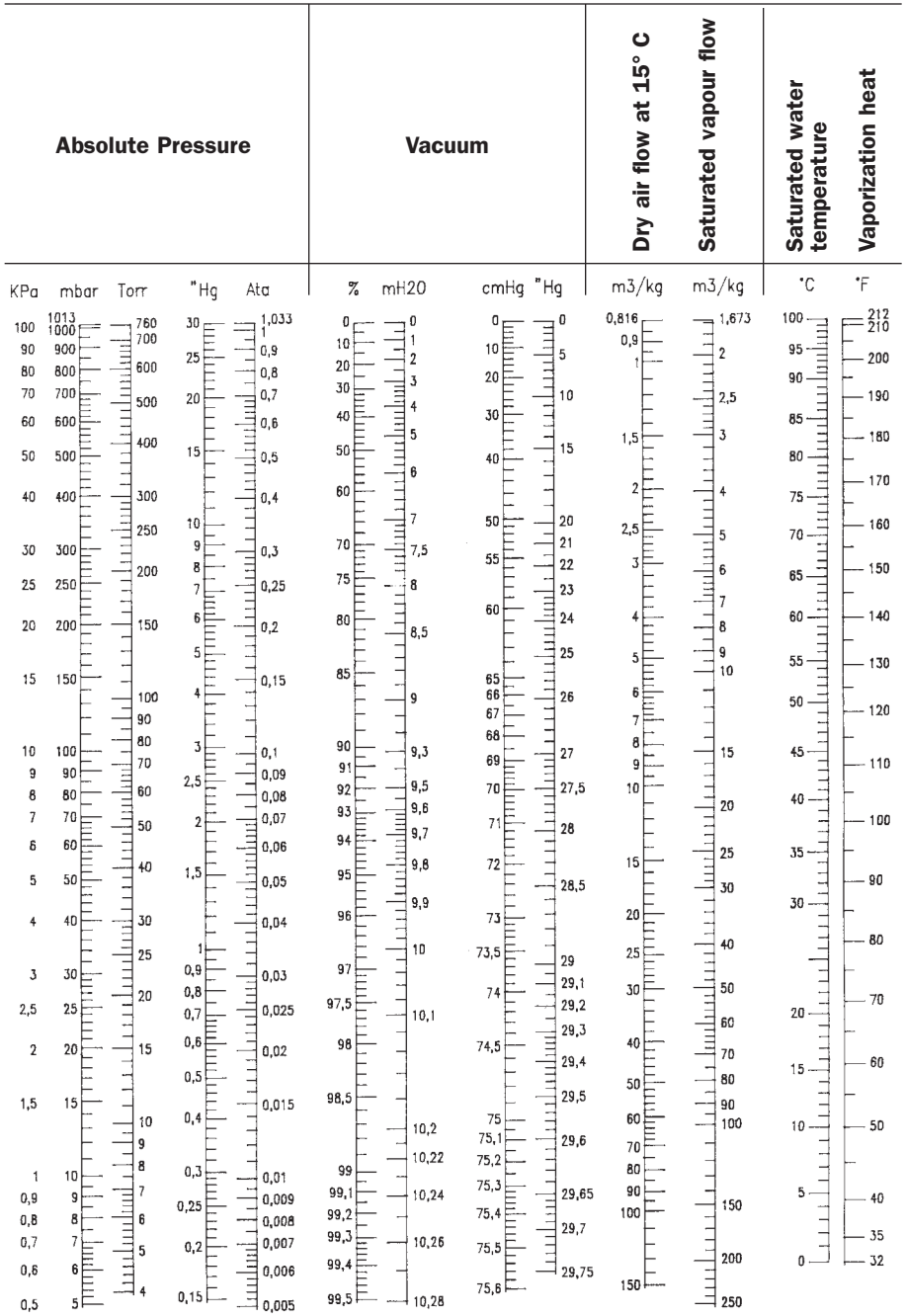


Fig. 31

17.4 - UNIT CONVERSION TABLE



18 - ENGINEERING DATA FOR "WATER SEALED" SYSTEMS

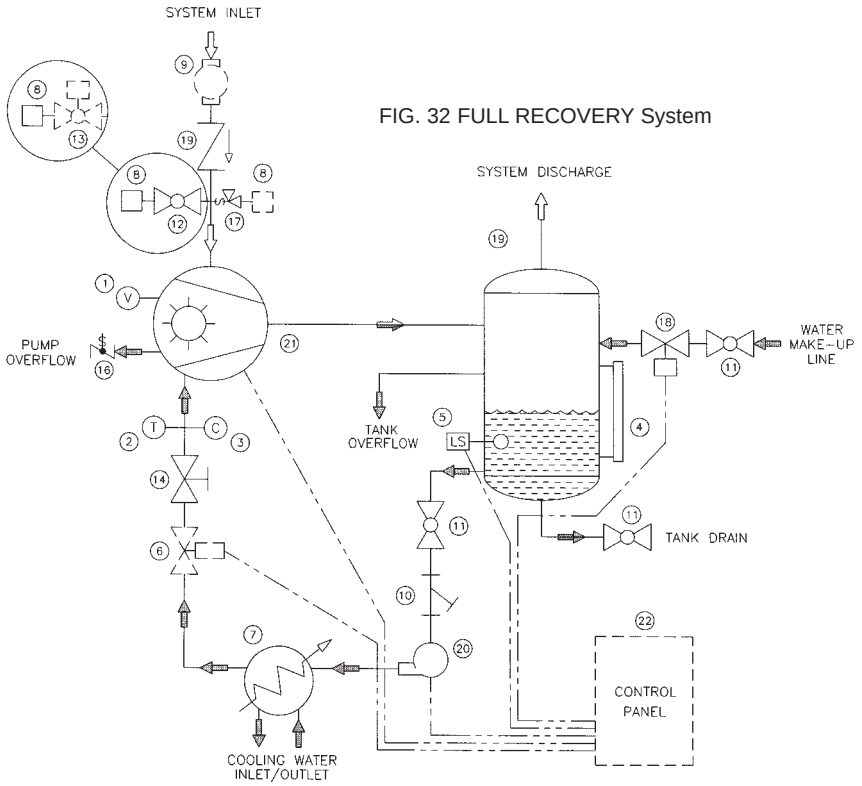


FIG. 32 FULL RECOVERY System

TYPICAL BILL OF MATERIALS	
ITEM	DESCRIPTION
1	VACUUM GAUGE (STD)
2	TEMPERATURE GAUGE (STD)
3	COMPOUND GAUGE (STD)
4	LEVEL GAUGE (STD)
5	LEVEL SWITCH (STD)
6	FLOW SWITCH (OPT)
7	HEAT EXCHANGER WATER COOLED (STD)
8	FILTER SILENCER (STD)
9	INLET FILTER (OPT)
10	Y-STRAINER (STD)
11	BALL VALVE (STD)
12	MANUAL UNLOADING VALVE (STD)
13	AUTOMATIC UNLOADING VALVE (OPT)
14	GLOBE VALVE (STD)
15	CHECK HINGE VALVE (STD)
16	CHECK SWING VALVE (STD)
17	VACUUM RELIEF VALVE (OPT)
18	SOLENOID VALVE (STD)
19	SEPARATOR TANK (STD)
20	CIRCULATION PUMP (STD 50HP AND UP)
21	TRAVAINI LIQUID RING VACUUM PUMP (STD)
22	CONTROL PANEL NEMA 12 (OPT)

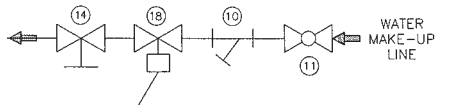


FIG. 32a PARTIAL RECOVERY System

WORKING PRINCIPLE

The WATER SEALED packages main components are: a liquid ring vacuum pump ITEM 21 from series **TRH, TRS, TRM, TRV**, an air/liquid separator reservoir ITEM 19, a heat exchanger ITEM 7, all mounted on a common base. When operating the vacuum pump discharges from the discharge port the gas handled with a portion of the liquid from the pump internal liquid ring. This liquid must be continuously returned to the pump.

The gas/liquid mixture is separated in a cylindrical tank (separator), the gas is vented through the top mounted discharge flange of the separator and the liquid is collected at the bottom of the separator ready to be returned to the vacuum pump.

During the suction and compression cycle of the vacuum pump, all the energy is transformed into heat energy and almost all of it is absorbed by the service liquid. Therefore the liquid must be cooled prior to be returned to the pump, either with a heat exchanger (total recovery system) or with the addition of cool make-up liquid (partial recovery system).

The **FULL RECOVERY** system (see fig. 32 and legend) does not require an appreciable flow of make-up from an external source but only the necessary amount to compensate for the liquid lost due to evaporation, with the discharged gases.

The heat exchanger sizing should be based on using a minimum amount of cooling liquid (usually water) to keep the service liquid at the ideal temperature for the best efficiency of the vacuum pump. Remember the higher the temperature of the service liquid the higher the losses in pump capacity and maximum vacuum see section 17.

This system is particular suitable where the service liquid and the condensed gases cannot be discharged to the environment, either for pollution reasons or because the fluids are too valuable.

The **PARTIAL RECOVERY** system (see fig. 32a and legend) requires a constant flow of cold make-up liquid from an external source. This liquid must be of the same nature as the service liquid being used by the pump. The mixture of the make-up and the service liquid being discharged by the pump, will have a constant temperature when enters the vacuum pump service liquid connection.

The same amount of service liquid taken from the outside source must be overflowed through the separator overflow connection situated at the pump shaft centerline. This system is utilized in many applications for conditions where there is intermittent use, or low vacuum levels, or there is no danger of pollution and the liquid can easily be drained.

Furthermore, this may prove to be the only alternative to the total recovery system for those installations where the cooling liquid is not available or it is too warm. Numerous accessories are available to meet the customers' requests and suitable for the installation, process and maintenance. For materials of construction and some engineering data see table 11 and 12.

Table 11 - STANDARD MATERIALS FOR "WATER SEALED" SYSTEMS

COMPONENT		MATERIAL DESIGN	
Vacuum pump		**GH - F - RA - RZ**	**A3**
Separator reservoir		Carbon steel	AISI 316 SS
Baseplate			
Heat Exchanger	Plates	Carbon Steel	
	Gaskets	Nitrile rubber / Viton	
Piping		Carbon steel	AISI 316 SS
Valves - Thermometer		Brass	
Level gauge		Polycarbonate	"Pirex" Glass

For vacuum pump materials (GH - F - RA - RZ - A3) see section 4.

Table 12 - GENERAL AND NOT BINDING ENGINEERING DETAILS FOR "WATER SEALED" and "OIL SEALED (DynaSeal™)" SYSTEMS

PACKAGE SERIES		Motor Size	Dry weight lbs.	
			WATER SEALED	OIL SEALED (DynaSeal™)
WATER SEALED OIL SEALED	2	5HP 2 poles / 60 Hz	300	450
WATER SEALED OIL SEALED	3	5HP 4 poles / 60 Hz	400	800
WATER SEALED OIL SEALED	4	10HP 4 poles / 60 Hz	1000	1000
WATER SEALED OIL SEALED	5	20HP 4 poles / 60 Hz	1200	1500
WATER SEALED OIL SEALED	6	40HP 4 poles / 60 Hz	1800	2000
WATER SEALED OIL SEALED	7	60HP 6 poles / 60 Hz	2500	3500

EXAMPLE OF "WATER SEALED" SYSTEM General Schematic and Accessories or Options

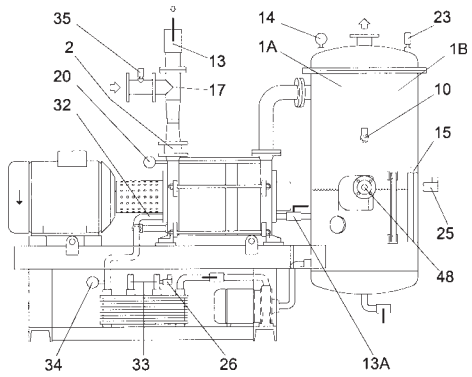


Fig. 34 - Typical accessories and options upon request

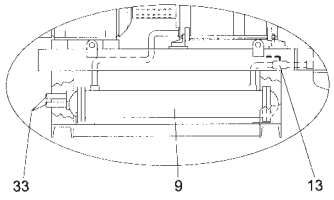


Fig. 35 - Option with Shell & Tube heat exchanger

LEGEND

1	Separator reservoir
1A	Separator reservoir with removable lid
1B	Oil demister
2	Check valve
4	Vacuum pump
6	Electric motor
7	Level gauge
8	Float valve
9	Heat exchanger
10	Solenoid valve liquid make-up
11	Drain valve
12	Isolating valve
13	Service liquid flow regulating valve
13A	By-pass valve
14	Pressure gauge
15	Level switch
17	Air ejector
20	Vacuum gauge
22	Circulating pump
23	Pressure relief valve
24	Overflow valve
25	Solenoid valve for overflow
26	Solenoid valve for cooling liquid
27	Thermometer
28	Fill connection
30	Frame
32	By-pass piping
33	Connection cooling lines
34	Temperature switch
35	Vacuum relief valve
48	Automatic drain valve (for systems used as Compressor only)

19 - ENGINEERING DATA FOR "OIL SEALED (DynaSeal™)" SYSTEMS

WORKING PRINCIPLE

OIL SEALED (DynaSeal™) packages main components are: a liquid ring vacuum pump, ITEM 4, from series **TRH, TRS, TRM, TRV,** an air/liquid separator reservoir, ITEM 1A, a heat exchanger ITEM 9 and an oil demister filter, ITEM 1B.

Turbine type mineral oil, or equal, is used for service liquid. The characteristics of the chosen oil are such that at pressures below 75 Torr, the pump capacity is greater than what would be when using water, and higher vacuum levels are attainable. When operating, the vacuum pump discharges the gas handled with a portion of the liquid in tank, ITEM 15, that acts as separator of gas from the oil and let settle any condensable or particles coming through the pump suction flange. The circulator pump, ITEM 26, pumps the oil back to the vacuum pump after it has been through the heat exchanger, ITEM 10, and cooled at about 140-180 ∞F. The gas is vented after being cleaned of all oil with the special oil demister element; a pressure gauge, ITEM 2, on the filter housing, ITEM 5, gives indication of the degree of dirt contained by the filter element. Contrary to rotary vane vacuum pumps, there are no moving parts that come in contact with each other, therefore there is no need for lubrication of the pump internals; these are very robust and reliable pump packages which offer extended operating life even when handling condensable gases. See table 14 for materials of construction and table 12 in chapter 18 for some engineering data.

Table 14 - STANDARD MATERIALS FOR "OIL SEALED (DynaSeal™)" SYSTEMS

COMPONENT		MATERIAL DESIGN
Vacuum pump		**GH - F - RA - RZ**
Baseplate		Carbon steel
Heat exchanger air-oil	Cooler core	Aluminium
	Shroud	Carbon steel
	Fan - Guard	Carbon steel-Plastic coated
Piping		Carbon steel -Carburite rubber
Valves - Thermometer		Brass
Level gauge		Polycarbonate

See section 4 for vacuum pump materials of construction (GH-F-RA-RZ).

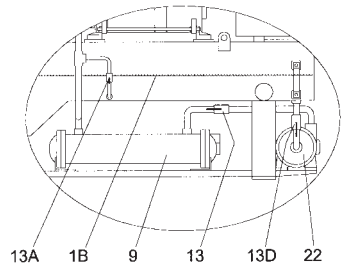


Fig. 38 – Option with Shell & Tube heat exchanger

LEGEND

13H - Anti-cavitation valve
13L - Condensate drain valve
13M - Flow regulating valve
14 - Pressure gauge
20 - Vacuum gauge
22 - Circulating pump
27 - Thermometer
28 - Fill connection
43 - Inspection openings

20 - PRODUCT DATA INFORMATION FORM

PUMP model	Serial Number	System Number	Year of mfg.
.....	.....	.....	.....

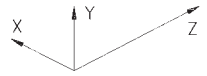
GAS handled	Capacity	Suction Pressure	Discharge Press.	Temp.
.....	.....cfm	.....Torr	.....psi	.....°C/°F

☐ Lethal ☐ Toxic ☐ Noxious ☐ Corrosive ☐ Malodorous ☐ .....

Service LIQUID	Capacity	Temperature
.....	.....GPM	.....°C

TOTAL WEIGHT
.....lbs

MAXIMUM DIMENSIONS



X =.....in
Y =.....in
Z =.....in

NOISE (measured at 1 m)
Pressure =.....dB(A)
Power =.....dB(A)

INSTALLATION
☐ Inside ☐ Outside
☐ Explosive area ☐ .....

SERVICE
☐ Continuous ☐ Intermittent
☐ .....

MOTOR type / Frame	No Poles	No Revolutions	Absorbed power	Installed power
.....	.....	.....RPM	.....Amp	.....kW / .....HP

Frequency	Supply	Enclosure	Insulation class	Absorbed power
.....Hz	.....Volt	IP.....	.....	.....kW / .....HP

COMMENTS _____

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OIL MATERIAL SAFETY DATA SHEET FOR DynaSeal™
OIL # 971-0022-A000

PRODUCT INFORMATION:
***CHEMICAL NAME*:** HYDROTREATED, PARAFFINIC MINERAL OIL
***CHEMICAL FAMILY*:** SEMI-SYNTHETIC HYDROCARBON
***FORMULA*:** PROPRIETARY
***CAS #*:** PROPRIETARY

COMPONENTS AND HAZARD STATEMENT:

***NOTE*:** This product is **NON-HAZARDOUS**. The product contains no known carcinogens. No special warning labels are required under OSHA 29 CFR 1910.1200.

SAFE HANDLING AND STORAGE:

***NOTE*:** Do not take internally. Avoid contact with skin, eyes, and clothing. Upon contact with skin, wash with soap and water. Flush eyes with water for 15 minutes and consult physician. Wash contaminated clothing before reuse.

***NOTE*:** Keep container tightly sealed when not in use.

PHYSICAL DATA:
***APPEARANCE*:** CLEAR LIQUID, LIGHT AMBER TINT
***BOILING POINT*:** >300°F
***VAPOR PRESSURE*:** <0.01mmHg @ 20°C
***SPECIFIC GRAVITY* (WATER = 1):** 0.87-0.89
VOLATILES, PERCENT BY VOLUME: 0%
ODOR: SLIGHT
SOLUBILITY IN WATER: INSOLUBLE
EVAPORATION RATE (BUTYL ACETATE = 1): NIL

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OIL MATERIAL SAFETY DATA SHEET FOR DynaSeal™
OIL # 971-0022-A000

FIRE AND EXPLOSION HAZARDS:

***FLASH POINT* (BY CLEVELAND OPEN CUP):** 375-500°F
***FLAMMABLE LIMITS*:** NOT ESTABLISHED
***AUTOIGNITION TEMPRATURE*:** NO DATA
***HMIS RATINGS*:**
HEALTH: 0
FLAMMABILITY: 1
REACTIVITY: 0
***NFPA RATINGS*:** NOT ESTABLISHED
***EXTINGUISHING MEDIA*:** DRY CHEMICAL; CO_2 FOAM; WATER SPRAY
***UNUSUAL FIRE AND EXPLOSION HAZARDS*:** NONE

NOTE: Burning fluid may evolve irritating/noxious fumes. Firefighters should use NIOSH/MNSA-approved self-contained breathing apparatus. Use water to cool fire exposed containers. Use water carefully near exposed liquid to avoid frothing and splashing of hot liquid.

REACTIVITY DATA:

***STABILITY*:** STABLE
***HAZARDOUS POLYMERIZATION*:** WILL NOT OCCUR
***INCOMPATABLE MATERIALS*:** STRONG OXIDIZERS
***CONDITIONS TO AVOID*:** EXCESSIVE HEAT
***HAZARDOUS DECOMPOSITION PRODUCTS*:** ANALOGOUS COMPOUNDS EVOLVE CARBON MONOXIDE, CARBON DIOXIDE, AND OTHER UNIDENTIFIED FRAGMENTS WHEN BURNED. SEE SECTION 5.

HEALTH HAZARDS DATA:

***THRESHOLD LIMIT VALUE*:** 5MG/M³ACGIH FOR OIL MISTS
***SITUATIONS TO AVOID*:** AVOID BREATHING OIL MISTS
***FIRST AID PROCEDURES*:**
INGESTION: CONSULT A PHYSICIAN AT ONCE. **DO NOT INDUCE VOMITING.** MAY CAUSE NAUSEA AND DIARRHEA.
INHALATION: PRODUCT IS NOT TOXIC BY INHALATION. IF OIL MIST IS INHALED, REMOVE TO FRESH AIR AND CONSULT PHYSICIAN.

NOTE: To the best of our knowledge the toxicity of this product had not been fully investigated. Analogous compounds are considered to be essentially non-toxic.

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

OIL MATERIAL SAFETY DATA SHEET FOR DynaSeal™
OIL # 971-0022-A000

PERSONAL PROTECTION INFORMATION:

***RESPIRATORY PROTECTION*:** USE IN WELL VENTILATED AREA
***VENTALATION*:** LOCAL EXHAUST
***PROTECTIVE GLOVES*:** NOT REQUIRED, BUT RECOMMENDED, ESPECIALLY FOR PROLONGED EXPOSURE.
***EYE/FACE PROTECTION*:** GOGGLES

SPILL OR LEAK PROCEDURES:

NOTE: In case of spill, wear suitable protective equipment, especially goggles. Stop source of spill. Dike spill area. Use absorbent materials to soak up fluid (i.e. sand, sawdust, and commercially available materials). Wash spill area with large amounts of water. Properly dispose of all materials.

WASTE DISPOSAL METHODS:

NOTE: Incinerate this product and all associated wastes in a licensed facility in accordance with Federal, state, and local regulations.

NOTE: The information in this material safety data sheet should be provided to all who use, handle, store, transport, or otherwise exposed to this product. TRAVAINI PUMPS believes the information in this document to be reliable and up to date of publication, but makes no guarantee that it is.

DOC: MATERIAL SAFETY DATA SHEET FOR TRAVAINI, P/N 971-0022-A000
FILE: 9710022.DOC
REV: 7/8/97

Transfer Pump 1 & Transfer Pump 1 Motor Shaft Coupler Body Lovejoy 68514436059 (Grainger 1L801)

S-Flex Shaft Coupling, Body Style 5J, Bore Dia 3/4 In, Rated Torque 240 In-Lb, Max RPM 7600, Keyway Length 3/16 In, Keyway Width 3/32 In

Item	S-Flex Shaft Coupling
Body Style	5J
Bore Dia. (In.)	3/4
Length through Bore (In.)	1.060
Rated Torque (In.-Lb.)	240
Max. RPM	7600
Keyway Length (In.)	3/16
Keyway Width (In.)	3/32
Outside Dia. (In.)	3 1/4
Length (In.)	2 7/8
Width (In.)	1.060
Height (In.)	3.250
Hub Dia. (In.)	1.880
Material of Construction	Cast-iron
Setscrew Location	One over the Key and One at 90 Degrees
Max. Angular Misalignment	1 Degree with EPDM Rubber Inserts and 1/4 Degree with H Inserts
Ideal For	Applications In Motors, Pumps, Compressors, Blowers, Mixers and Conveyors

Transfer Pump 1 & Transfer Pump 1 Motor Shaft Coupler Body Lovejoy 68514436060 (Grainger 1L802)

S-Flex Shaft Coupling, Body Style 5J, Bore Dia 7/8 In, Rated Torque 240 In-Lb, Max RPM 7600, Keyway Length 3/16 In, Keyway Width 3/32 In

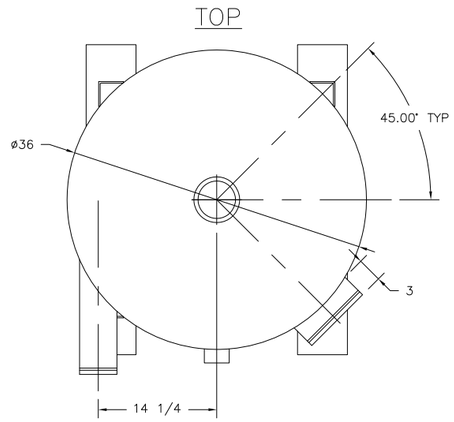
Item	S-Flex Shaft Coupling
Body Style	5J
Bore Dia. (In.)	7/8
Length through Bore (In.)	1.060
Rated Torque (In.-Lb.)	240
Max. RPM	7600
Keyway Length (In.)	3/16
Keyway Width (In.)	3/32
Outside Dia. (In.)	3 1/4
Length (In.)	2 7/8
Width (In.)	1.060
Height (In.)	3.250
Hub Dia. (In.)	1.880
Material of Construction	Cast-iron
Setscrew Location	One over the Key and One at 90 Degrees
Max. Angular Misalignment	1 Degree with EPDM Rubber Inserts and 1/4 Degree with H Inserts
Ideal For	Applications In Motors, Pumps, Compressors, Blowers, Mixers and Conveyors

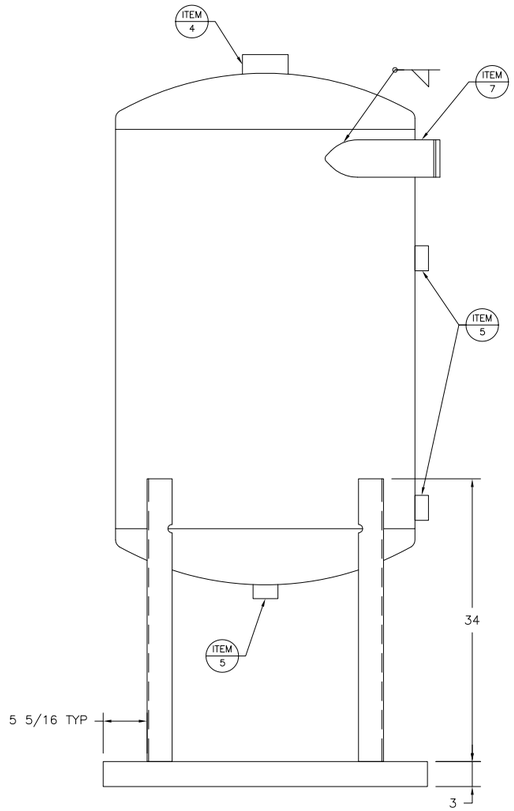
Transfer Pump 1 & Transfer Pump 1 Motor Shaft Coupler Insert Lovejoy 5JE (Grainger 1L797)

Shaft Coupling Insert, JE Insert Type, 5J Body Style, Rated Torque 240 In-Lb, Max RPM 7600, One-piece Solid EPDM Rubber Insert Material

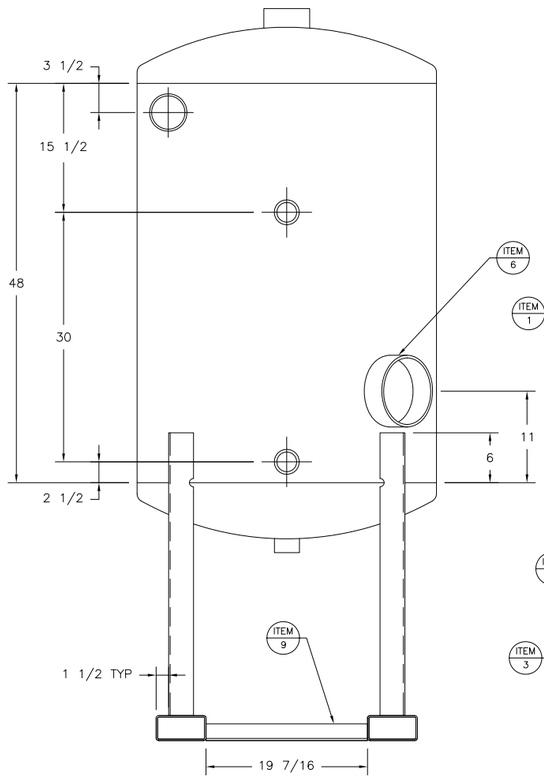
Item	Shaft Coupling Insert
Insert Type	JE
Body Style	5J
Rated Torque (In.-Lb.)	240
Max. RPM	7600
HP Rating @ 50 RPM	0.19
HP Rating @ 100 RPM	0.38
HP Rating @ 300 RPM	1.14
HP Rating @ 690 RPM	2.63
HP Rating @ 870 RPM	3.31
HP Rating @ 1150 RPM	4.38
HP Rating @ 1200 RPM	4.57
HP Rating @ 1750 RPM	6.66
HP Rating @ 1800 RPM	6.85
HP Rating @ 3450 RPM	13.33
HP Rating @ 3600 RPM	13.71
Operating Temp.	-30 - 275
Outside Dia. (In.)	2.94
Length (In.)	1.56
Width (In.)	2.94
Height (In.)	2.94
Insert Material	One-piece Solid EPDM Rubber
Application	General Industrial Purposes

ITEM	QTY	DESCRIPTION	MANUFACTURER	MANF NO
1	1	SHEET – 3/16 X 113-1/8" LONG X 48" HIGH, ROLLED AND TACKED AT 36" DIAMETER, CARBON STEEL HR A1011	CONSTRUCTIVE SHEET METAL	
2	2	TANK HEAD – 3/16" X 36" DIAMETER, FLANGED & DISHED ASTM A36 CARBON STEEL		
3	2	RECTANGULAR TUBING – 6" X 3" X 3/16 WALL, 39" LONG ASTM A500 CARBON STEEL GRADE B		
4	1	HALF COUPLER – 4" NPT, 3000 PSI CARBON STEEL		
5	3	HALF COUPLER – 2" NPT, 3000 PSI CARBON STEEL		
6	1	PIPE – 8" DIAMETER X 3" LONG WITH VICTAULIC GROOVE ASTM A500 CARBON STEEL GRADE B		
7	1	PIPE – 4" DIAMETER X APPROX 14" LONG WITH VICTAULIC GROOVE, ASTM A500 CARBON STEEL GRADE B		
8	4	ANGLE – 3" X 3" X 3/16" X 34" LONG ASTM A36 CARBON STEEL		
9	2	ANGLE – 2" X 2" X 1/4" X 19-7/16" LONG ASTM A36 CARBON STEEL		

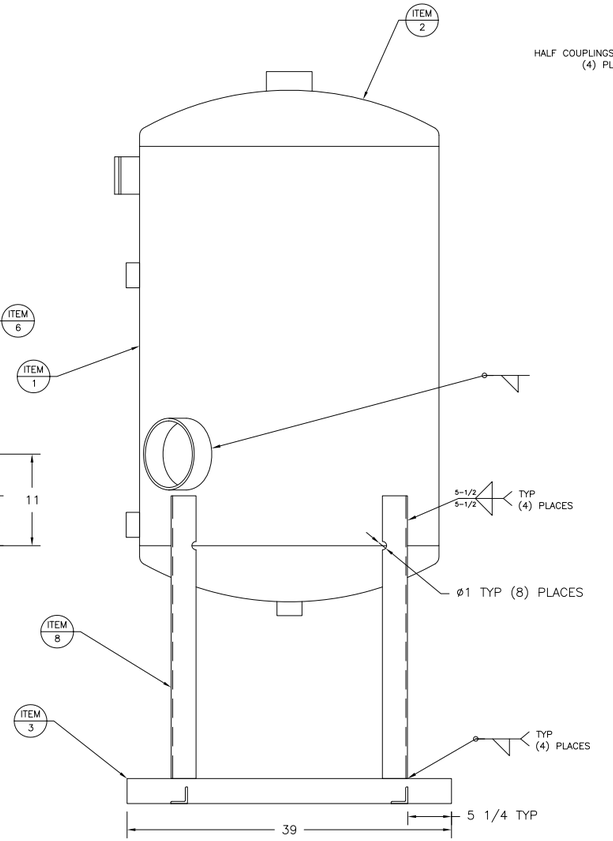




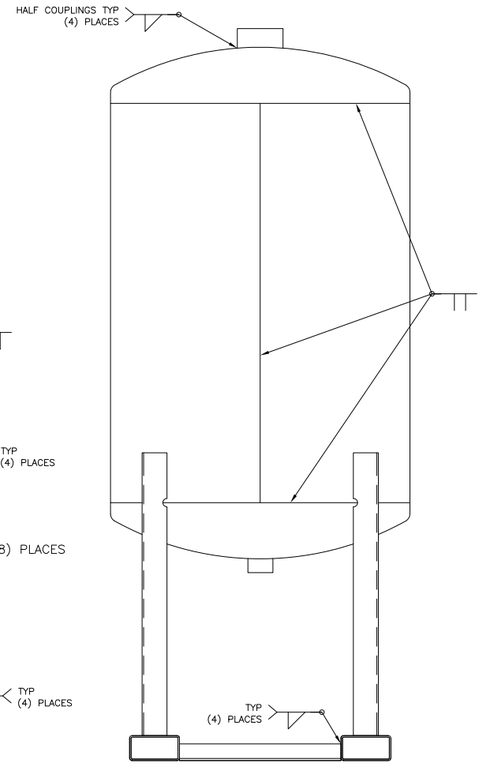
SIDE RH



FRONT



SIDE LH



BACK

ProAct Services Corporation

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PATENT PENDING

220 GALLON KNOCK OUT TANK FABRICATION, ASSEMBLY, AND WELDMENT

DRAWING NO.	SIZE	SCALE	JOB NO.	UNIT NO.	REV
	B	1/14			1

REV	DATE	DESCRIPTION	DRW	APPR	CUSTOMER	MATERIAL	DRAWN BY	DATE	SHEET
						CARBON STEEL	STEVE TURNER	12/1/12	1

Inlet Vacuum Filters

"CSL" Series 4" - 6" 125/150# Pattern Flange

APPLICATIONS & EQUIPMENT

- Vacuum Pumps & Systems – P.D., Side Channel, Rotary Vane, Screw, Piston
- Vacuum Packaging Equipment
- Vacuum Furnaces
- Blowers - Side Channel & P.D.
- Intake Suction Filters
- Pneumatic Conveying Systems
- Remote Install for Piston, Screw & Centrifugal Compressors
- Factory Automation Equip
- Ash Handling
- Food Industry
- Paper Processing
- Glass, Ceramic Processing
- Waste Water Treatment
- Woodworking
- Cement
- Bag House Systems
- Envelope Manufacturing
- Medical Industry
- Chemical Processing

FEATURES & SPECIFICATIONS

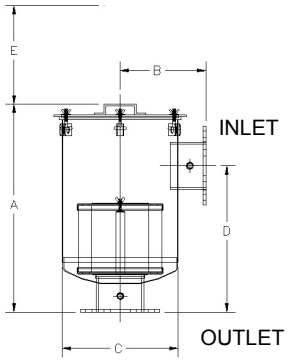
- **Vacuum level**: Typically $1x10^{-3}$ mmHg ($1.3x10^{-3}$ mbar)
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Heavy duty T bolts for easy maintenance
- Hydrostatically tested to 0.5 bar pressure for vacuum tightness
- Low pressure drop
- Positive engagement O-ring seal system
- **Large** dirt holding capacity and **Easy** field cleaning, especially when mounted horizontally or inverted
- Inlet/outlet 1/4" gauge taps standard
- Rugged all steel construction w/baked enamel finish
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10" - 15" H_2O over initial delta P
- Pressure drop graphs available upon request

OPTIONS (Inquiries Encouraged)

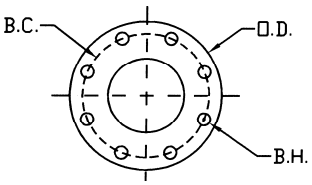
- Various media
- Larger sizes available
- Straight-Through Configurations
- Available in ***Stainless Steel***
- Epoxy coated housings
- Support brackets
- Special connections
- Activated carbon prefilters to reduce order

CONFIGURATION

DRAWING



Dimension tolerance ± 1/4"



Flange Orientation

Note: All side inlet to outlet flanges are orientated "split center".

I = Industrial Duty S = Severe Duty E = Extreme Duty

	with Polyester Element	with Paper Element	Flg Inlet & Outlet	DIMENSIONS - inches A	B	C	D	E	Rated Flow SCFM Nominal Rating	Element Rating	Approx. Wt. lbs
I	CSL-235P-400F	CSL-234P-400F	4"	27 1/8	9	14	18 1/2	15	520	570	62
S	CSL-335P-400F	CSL-334P-400F	4"	27 1/8	9	14	18 1/2	20	520	800	64
I	CSL-245P-500F	CSL-244P-500F	5"	28 1/8	11	18 1/2	19 1/2	15	800	880	88
S	CSL-345P-500F	CSL-344P-500F	5"	28 1/2	11	18 1/2	19 1/2	20	800	1100	90
I	CSL-275P-600F	CSL-274P-600F	6"	29 1/8	12	18 1/2	20 1/2	15	1100	1100	110
S	CSL-375P-600F	CSL-374P-600F	6"	29 1/8	12	18 1/2	20 1/2	20	1100	1500	113

125/150# Pattern Flg	DIMENSIONS - inches O.D.	B.C.	B.H.	No. of Holes	Flange Thickness
4"	9	7 1/2	0.75	8	0.38
5"	10	8 1/2	0.88	8	0.38
6"	11	9 1/2	0.88	8	0.38

Note: Model offerings and design parameters may change without notice.

1151 Ardmore Ave. • Itasca, IL 60143 USA
Sales/Service: 630.773.1363 • Fax: 630.773.0727
E-mail: sales@solbergmfg.com • Web Site: www.solbergmfg.com

SMALL COMPACT FILTER SILENCERS
w/ Standard Filter Design
"FS" Series 1/2" - 3" MPT

APPLICATIONS & EQUIPMENT

- Industrial & Severe Duty
- Piston Compressors
- Screw Compressors
- Blowers - Side Channel & P.D.
- Hydraulic Breathers – fine filtration
- Engines
- Construction\Contractor Industry
- Workshop
- Medical\Dental Industry
- Pneumatic Conveying
- Waste Water Aeration
- Nailers and Staplers
- Vacuum Vent Breathers

FEATURES & SPECIFICATIONS

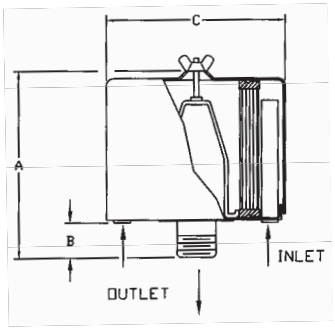
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tube is positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish and powder coated weatherhood
- Interchangeable media: Polyester, Paper, HEPA
- Several element sizes available per given connection (safety factor)
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10"-15" H_2O over initial delta P
- Pressure drop graphs available upon request

OPTIONS (Inquiries Encouraged)

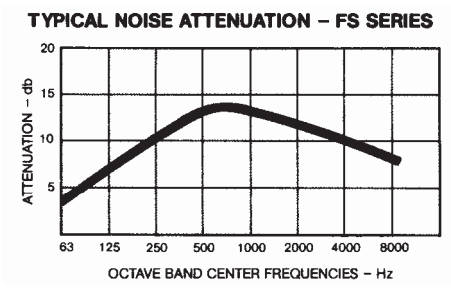
- 1/8" tap holes
- Pressure Drop Indicator
- Available in ***Stainless Steel***
- Epoxy coated housings
- Various media available
- Special connections, BSPT

CONFIGURATION

DRAWING



Dimension tolerance ± 1/4"



- Noise attenuation may vary due to the wide range of applications and machines

I = Industrial Duty S = Severe Duty

	with Polyester Element	with Paper Element	MPT Outlet	DIMENSIONS - inches A	B	C	Rated Flow SCFM Piston	Screw, Blower, Fan	Element Rating	No. of Silencing Tubes	Approx. Wt. lbs
I	FS-15-050	FS-14-050	1/2"	4	1 1/2	6	10	10	35	1	2
I	FS-15-075	FS-14-075	3/4"	4	1 1/2	6	20	25	35	2	2
I	FS-15-100	FS-14-100	1"	4	1 1/2	6	25	35	35	3	2
S	FS-19P-100	FS-18P-100	1"	6 5/8	1 5/8	6	35	55	100	3	3
I	FS-19P-125	FS-18P-125	1 1/4"	6 5/8	1 5/8	6	55	70	100	5	3
I	FS-19P-150	FS-18P-150	1 1/2"	6 5/8	1 5/8	6	70	85	100	5	4
I	FS-31P-200	FS-30P-200	2"	7 1/4	2 1/4	10	85	135	195	5	8
S	FS-231P-200	FS-230P-200	2"	12 1/4	2 1/4	10	135	135	300	5	14
I	FS-31P-250	FS-30P-250	2 1/2"	7 1/2	2 1/2	10	100	195	195	5	8
S	FS-231P-250	FS-230P-250	2 1/2"	12 1/2	2 1/2	10	195	195	300	9	15
I	FS-231P-300	FS-230P-300	3"	13	3	10	200	300	300	9	15

Note: Model offerings and design parameters may change without notice.

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Models 215V and 337

KUNKLE

Model 215V is Non-code Vacuum and Model 337 is ASME Section VIII, Air/Gas Vacuum, 'UV' National Board Certified, Safety Valves. PED Certified for Non-Hazardous Gas.

Features

- **Large nozzle design** provides high capacity.
- **Flat bronze valve seats are lapped** for optimum performance.
- **Warn ring offers easy adjustability** for precise opening with minimum pre-open or simmer and exact blowdown control.
- **Pivot between disc and spring** corrects misalignment and compensates for spring side thrust.

Model Descriptions

- **Model 337 has 'lift-pin' lift device** for easy manual testing.
- **Every valve is 100% tested/inspected** for pressure setting, blowdown and leakage.
- **All adjustments are factory sealed** to prevent tampering or disassembly.

Option

- SS trim. (nozzle and disc) (Variation 03)

Applications

- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

Vacuum Limits

Model 215V:
2-inch HG
to 29-inch HG
[67.7 to 982 mbarg]
-20° to 406°F [-29° to 208°C]

Pressure and Temperature Limits

Model 337:
1 to 60 psig [0.07 to 4.1 barg]
-20° to 406°F [-29° to 208°C]

tyco / Flow Control

Total Flow Control Solutions™

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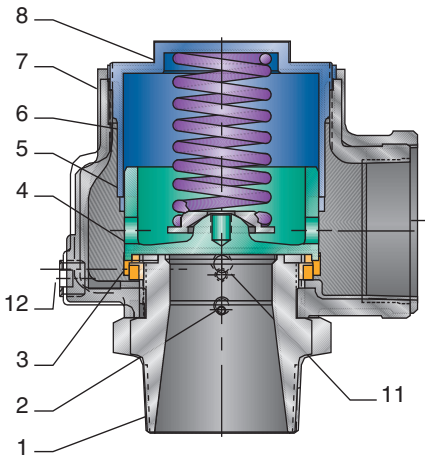
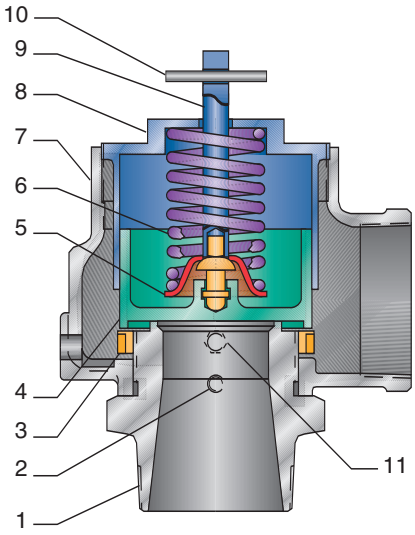
Models 215V and 337

Parts and Materials



Model 215V



Model 337

Models 215V and 337

No.	Part Name	215V	337
1	Nozzle[1]	Bronze, SB62	Bronze, SB62
2	Set Screw	Steel A108-1018 Brass Plated	Steel A108-1018 Brass Plated
3	Regulator Ring	Bronze B584 Alloy 84400	Bronze B584-C84400
4	Disc[1]	Bronze B584 Alloy 84400	Bronze B584-C84400
5	Spring Step	Steel A-109 Coated[3]	Steel A109 Coated[3]
6	Spring	SS, A313 TY 302	SS A313-302
7	Body	Cast Iron A-126, CL A or B	Iron A-126, CL A or B
8	Compression Screw	Bronze, B-584 Alloy 84400	Bronze, B584-C84400
9	Stem[2]	N/A	Brass B16
10	Lift Pin[2]	N/A	Steel, Zinc Plated
11	Regulator Ring Set Screw	N/A	Brass B16
12	NPT Drainplug	Steel A108-1018	N/A

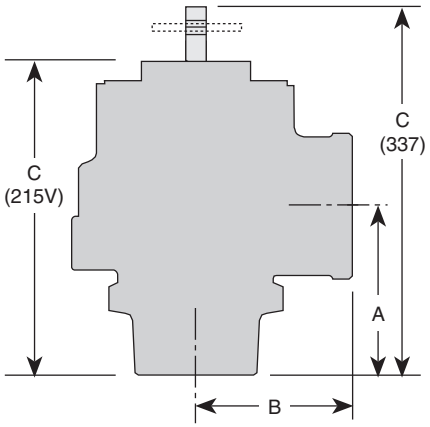
Notes

1. Disc and nozzle available in SSA-479 TY 316.
2. Stem and lift pin available on Model 337 only.
3. Corrosion preventative coating.

Specifications

Size Inlet and Outlet	Dimensions, in [mm] A	B	C 215V	C 337	Weight lb [kg]
2" [50.8 mm]	3 1/4 [82.5]	3 [76.2]	6 1/2 [165.1]	7 [177.8]	8 [3.6]
2 1/2" [63.5 mm]	3 3/4 [95.2]	3 1/2 [88.9]	7 5/8 [194.6]	8 [203.2]	12 [5.4]
3" [76.2 mm]	4 1/4 [107.9]	4 [101.6]	8 1/2 [215.9]	9 [228.6]	20 [9.07]

Dimensions are for reference only.



Model 337

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Models 215V and 337

Capacities

Model 337, Non-code[1] and ASME Section VIII Air (SCFM)

Set Pressure (psig)	Valve Inlet and Outlet Size 2" Orifice Area, in² 1.84	2½" 2.79	3" 4.04
1	240	364	527
5	531	805	1166
10	741	1124	1628
15	948	1436	2081
20	1092	1656	2399
25	1237	1875	2718
30	1382	2095	3036
35	1542	2337	3386
40	1701	2578	3736
45	1860	2820	4086
50	2020	3061	4436
55	2179	3303	4786
60	2338	3544	5136

Note

1. No code stamp or 'NB' on nameplate below 15 psig set.

Model 337, Non-code[1] and ASME Section VIII Air [Metric, Nm³/h]

Set Pressure [barg]	Valve Inlet and Outlet Size 50 mm	63 mm	80 mm
0.5	1049	1589	2303
1.0	1457	2208	3200
1.5	1888	2861	4147
2.0	2235	3387	4910
2.5	2613	3959	5739
3.0	2995	4538	6579
3.5	3377	5117	7418
4.0	3760	5696	8258

Note

1. No code stamp or 'NB' on nameplate below 1.1 barg set.

Model 215V, Non-code Vacuum Air (SCFM)

Relief Set (in, HG)	Valve Inlet and Outlet Size 2" Orifice Area, in² 1.84	2½" 2.79	3" 4.04
2	229	347	503
5	338	512	742
10	415	630	912
15	426	646	936
20	426	646	936
29	426	646	936

Note

1. Based on 10% accumulation.

Model 215V, Non-code Vacuum Air [Metric, Nm³/h]

Relief Set [mbarg]	Valve Inlet and Outlet Size 5.08 cm Orifice Area [11.86 cm²]	6.35 cm [17.97 cm²]	7.62 cm [26.05 cm²]
50	328	498	722
100	450	682	988
150	533	807	1170
200	593	899	1303
250	638	966	1400
300	669	1014	1470
350	690	1046	1516
400	701	1062	1540
450	704	1067	1546
500	704	1067	1546
550	704	1067	1546
600	704	1067	1546
650	704	1067	1546
700	704	1067	1546
750	704	1067	1546

Note

1. Based on 10% accumulation.

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Models 215V and 337

Model Number/Order Guide

Model Number Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	2	1	5	V	—	H	0	1	A	Q	E	0	0	5	0

Model
215V
0337

Inlet Size
H - 2-inch [50.8 mm]
J - 2½-inch [63.5 mm]
K - 3-inch [76.2 mm]

Variation (01 through 99)
01 - Bronze Disc and Nozzle
03 - SS Disc and Nozzle
60 - BSP Connections

Design Revision
Indicates non-interchangeable revision. Current Design is at Revision 'A'

Valve Service
K - Air ASME Section VIII (Model 337 only)
Q - Vacuum (Model 215V only)
N - Non-code Air/Gas (Model 337 only)

Spring Material
E - SST Type 302
(H-Orifice up to 8 psi; J-Orifice up to 20 psi; K-Orifice up to 25 psi)
M - SST Type 17-7
(H-Orifice above 8 psi; J-Orifice above 20 psi; K-Orifice above 25 psi)

Set Pressure
Model 337, 1 psig [0.7 barg] (0001) through 60 psig [4.1 barg] (0060)
Model 215V, 2-inch HG [68 mbarg] (0002) through 29-inch HG [982 mbarg] (0029) vacuum

Facility Phone: 828-669-3700
www.kunklevalve.com

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Liquid Storage Tanks

NORWESCO

2011 Edition

Norwesco is proud to be the world's largest manufacturer of molded poly tanks. For over 25 years, our customers have relied on Norwesco tanks for premium quality and reliability in performance.

Norwesco tanks are manufactured to strict quality guidelines to ensure years of high-performance use. Rugged, impact-resistant, one-piece seamless polyethylene construction make our tanks suitable for the storage and/or transport of most liquid chemicals. Norwesco tanks are manufactured using resins that meet FDA specifications to ensure safe storage of potable water. Norwesco tanks will be delivered to you with a fitting installed when applicable, but may also be ordered without a fitting.

Our goal is to make it easy and pleasant to do business with Norwesco. We consider our relationship with our customers to be our most valuable asset.

Vertical Storage Tanks

Vertical storage tanks are most frequently used for bulk storage and mobile nursing applications. Norwesco vertical tanks feature tie-down slots, built-in graduated gallon indicators, an offset fill-opening and a self-vented, slosh-proof lid.

Gallon Capacity	Diameter	Overall Height	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White	Heavy Weight Part No. Blue
25 ¤	18"	29"	5"	¾"	41867	—
50 ¤	18"	53"	5"	¾"	41865	—
65 ¤	23"	43"	8"	1¼"	45192	—
75 ¤	23"	49"	8"	1¼"	41863	—
100 ¤	28"	43"	8"	1¼"	41861	
105 ¤	23"	63"	8"	2"	40803	––
150	30"	56"	8"	1¼"	41859	—
165	31"	56"	16"	2"	40281	—
200	30"	72"	8"	2"	41856	—
210	32"	67"	16"	2"	47401	––
250	30"	89"	8"	2"	41854	—
300	36"	79"	16"	2"	40213	—
305	46"	50"	16"	2"	40302	—
500	48"	73"	16"	2"	40148	40150
550	67"	44"	16"	2"	40023	—
750	48"	103"	16"	2"	40606	—
850	48"	118"	16"	2"	42214	—
1000	64"	80"	16"	2"	40152	40154
1100	87"	53"	16"	2"	40070	40081
1100 G	87"	53"	16"	2"	42591	42593
1500	64"	116"	16"	2"	40144	40146
1550	87"	67"	16"	2"	40235	40236
1550 G	87"	67"	16"	2"	42595	42597
1700	87"	74"	16"	2"	40010	40012
2000	64"	152"	16"	2"	47109	47564
2100	87"	89"	16"	2"	40178	40241
2100	102"	69"	16"	2"	41399	—
2500	95"	91"	16"	2"	40051	40052
2500	102"	79"	22"	2"	42382	42384
3000	91"	119"	16"	2"	45081	—
3000	95"	109"	16"	2"	40754	40755
3000	102"	93"	16"	2"	45246	42380
3000	102"	93"	22"	2"	43136	43138
4000	102"	125"	16"	3"/2"	40312	—
4200	102"	131"	16"	3"/2"	41403	—
5000	102"	152"	16"	3"/2"	40164	40166
5500	138"	92"	16"	3"/2"	45086	—
6000	102"	182"	16"	3"/2"	40226	40233
6100	119"	140"	16"	3"/2"	40659	40661
6500	119"	150"	16"	3"/2"	40224	40232
6500	120"	147"	16"	3"/2"	42315	42317
7800	119"	176"	16"	3"/2"	40663	40665
8400	119"	188"	16"	3"/2"	42060	42062
9000	141"	146"	16"	3"/2"	40543	40231
10000	141"	160"	16"	3"/2"	40545	40353
10000	141"	160"	22"	3"/2"	43128	43130
12000	141"	193"	16"	3" *	40539	40541
15000	141"	244"	16"	3" *	41334	41336

¤ May ship UPS G=Gusset Top *316 Stainless Steel Bolted Fitting

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

325 Gallon Horizontal Leg Tank

1025 Gallon Horizontal Leg Tank

Horizontal Leg Tanks

With the broadest leg tank line available, Norwesco manufactures a size that will fit your needs. Used primarily for transport and nursing applications, Norwesco's leg tanks feature molded-in legs that act as "baffles" to reduce sloshing. Please refer to page 5 for support bands.

Gallon Capacity	Diameter	Overall Height	Length	Fill Opening	Outlet/Drain Specification	No. of Bands	Premium Weight Part No. White	Heavy Weight Part No. Blue
35 ¤	20"	23"	29"	5"	¾"	2 optional	45223	––
55 ¤	23"	26"	34"	5"	¾"	2 optional	41873	––
65 ¤	23"	26"	43"	5"	¾"	2 optional	45191	—
125	32"	35"	41"	8"	2"	2 optional	40298	—
225	38"	41"	49"	8"	2"	2 optional	40299	—
225 Stand	38" W	41"	45"	—	—	—	42854	—
325	38"	43"	68"	16"	2"	2 optional	40217	—
330	38"	40"	74"	5"	2"	2 optional	42923	—
425	49"	54"	60"	16"	2"	2 optional	42016	—
525	49"	54"	71"	16"	2"	2 optional	40181	40193
725 *	49"	54"	101"	16"	2"	3 required	40180	40194
925 *	62"	65"	80"	16"	2"	2 required	45209	—
925 * with sump	62"	69"	80"	16"	2"	2 required	45210	—
1025 *	49"	54"	139"	16"	2"	4 required	40089	40131
1325 *	66"	70"	99"	16"	2"	3 required	41875	41877
1625 *	63"	68"	139"	16"	2"	4 required	40026	40133
1800 * 2CPT	62"	68"	146"	16"	2"	4 required	42990	—
1800 * with sump, 2CPT	62"	72"	146"	16"	2"	4 required	42992	—
5025 *	92"	96"	190"	16" **	3"/2"	5 required	41879	41881

¤ May ship UPS *Require full length support and bands **16" hinged lid

2035 Gallon Elliptical Leg Tank

Elliptical Leg Tanks

This elliptical tank style is designed to provide the greatest capacity with the lowest center of gravity, making it the best design available for transporting larger volumes. Norwesco elliptical tanks feature molded-in legs that act as "baffles" to reduce sloshing and provide increased stability during transport. Norwesco elliptical leg tanks require full length bottom support as well as support bands. Please refer to page 5 for support bands. The 1600 flat bottom requires full length bottom support but does not require bands.

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White	Heavy Weight Part No. Blue
335	48"	33"	71"	16"	2"	42339	—
535	57"	39"	80"	16"	2"	42353	—
1035	79"	54"	89"	16"	2"	40191	—
1235	66"	53"	128"	16"	2"	40239	—
1335	66"	55"	126"	16"	2"	42927	42929
1600 flat bottom	80"	53"	126"	16"	2"	43143	43167
1635	71"	58"	142"	16"	2"	40387	40388
2035	84"	56"	142"	16"	2"	40618	40623
2635	90"	72"	140"	16"	3"/2"	40547	40283
3135	88"	80"	150"	16"	3"/2"	40686	40688
4035	92"	75"	192"	16" **	3"/2"	41267	41269

**16" hinged lid

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

Drainable Leg Tanks

When complete drainage is necessary, these are the tanks of choice. They are designed primarily for use on fertilizer and chemical nurse trailers. All Norwesco drainable tanks require full length bottom support as well as support bands. Please refer below for support bands.

1010 Gallon Drainable Leg Tank

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	No. of Bands	Premium Weight Part No. White	Heavy Weight Part No. Blue
710 (horizontal)	47"	57"	104"	16"	2"	3 required	40655	40657
1010 (horizontal)	47"	58"	140"	16"	2"	4 required	40393	40395
1310 (horizontal)	66"	75"	99"	16"	—	3 required	41871	41872
1315 (elliptical)	66"	60"	126"	16"	—	3 required	42925	42926
1610 (elliptical)	69"	63"	140"	16"	—	4 required	40806	40808
2610 (elliptical)	90"	79"	140"	16"*	—	4 required	41382	41383
3210 (elliptical)	92"	75"	178"	16"*	—	4 required	40822	40824

*16" hinged lid

Steel Supports and Accessories for Leg Tanks

Norwesco bands are custom fabricated to support the Norwesco tanks and are galvanized or powder coated for added corrosion protection. Whether using the tank in a stationary position or for transport, bands are necessary to ensure that the tank retains its shape and integrity.

Elliptical Leg Tank Bands

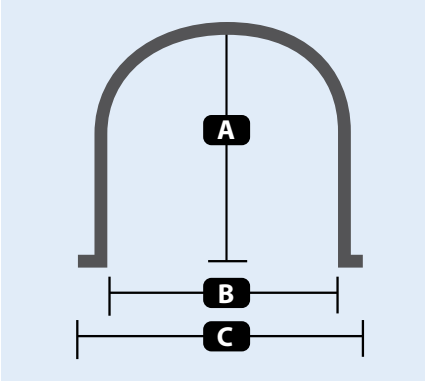
Tank Size (Gallon)	A	B	C	No. of Bands	Part No.
335	29"	46½"	52½"	2 required	63546
535	35"	55½"	61½"	2 required	63547
1035	47¼"	77"	83"	3 required	60325
1235	47¾"	64¾"	70¾"	4 required	60477
1335	53"	65"	71"	3 required	63642
1635	51"	68"	74"	4 required	60586
2035	51¼"	81½"	86¾"	4 required	62079
2635	65¼"	87½"	94"	4 required	60353
3135 *	75¼"	85½"	92"	4 required	62097
3135 **	74¼"	85½"	92"	4 required	63620
4035	70¼"	89½"	96"	4 required	62832

* For tanks manufactured in CA, MN, OK, TX, UT
** For tanks manufactured in GA, OH

Horizontal Leg Tank Bands

Tank Size (Gallon)	A	B	C	No. of Bands	Part No.
35 ¤	18½"	18½"	21⅜"	2 optional	60520
55 ¤	22"	22"	26½"	2 optional	61745
65 ¤	22"	22"	26½"	2 optional	61745
125 ¤	30¾"	30½"	35"	2 optional	61744
225 ¤	36½"	36"	42"	2 optional	60478
325 ¤	36½"	36"	42"	2 optional	60478
330 ¤	36½"	36"	42"	2 optional	60478
425	47¾"	46¼"	52¼"	2 optional	60057
525	47¾"	46¼"	52¼"	2 optional	60057
725	47¾"	46¼"	52¼"	3 required	60057
925	61"	60"	66"	2 required	62852
1025	47¾"	46¼"	52¼"	4 required	60057
1325	64"	64"	70"	3 required	63282
1625	61"	60¾"	67¼"	4 required	60079
1800 ∞	61"	60"	66"	4 required	62852
5025	89¾"	89½"	93⅞"	5 required	63284

¤ May ship UPS ∞ Tank requires one connecting bar, Part No. 63653



Drainable Leg Tank Bands

Tank Size (Gallon)	A	B	C	No. of Bands	Part No.
710 ¤	46¼"	45"	51"	3 required	60584 short
1010 ¤*	46¼"	45"	51"	2 required	60584 short
1010 ¤*	48"	45"	51"	2 required	60585 long
1310	64"	64"	70"	3 required	63282
1315	50"	64"	70"	3 required	63642
1610	49"	66"	72"	4 required	62434
2610 *	58"	87½"	91⅞"	2 required	63044 short
2610 *	62"	87½"	91⅞"	2 required	63045 long
3210 *	56"	89½"	92¾"	2 required	62347 short
3210 *	60"	89½"	92¾"	2 required	62348 long

¤ May ship UPS * 2 short and 2 long bands are required for 1 tank

Ladders (Galvanized)

Description	Tank Size (Gallon)	Part No.
Ladder (optional)	2635 & 3135	60354
Ladder (optional)	2610 & 3210	63047
Ladder (optional)	4035	63033
Adaptor kit for ladder †	3135	62301

† This kit is required when using the ladder on the 3135 gallon tank

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

Pickup Truck Tanks

Designed to fit full-size, American made pickups, the 325 and 425 sizes have low profiles for better rear vision. They feature fill openings offset to the side of the tank for safety and easy access. A tough circular design adds strength. The 210 gallon tank fits both "mini" pickups and full-size models. Depending on which way the tank is turned, the bottom width can be either 39" or 48".

Gallon Capacity	Top Width or Diameter	Bottom Width or Diameter	Overall Height	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
210	60"/51"	48"/39"	29"	8"	2"	40300
325	62"	49"	33"	8"	2"	40160
425	65"	49"	39"	8"	2"	40102

Flat Bottom Utility Tanks

Like the PCO tank, the Flat Bottom Utility tank can be used for many applications. It is the perfect choice when looking for a tank to put in the bed of a pickup truck. The tank may be used with or without bands.

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/ Drain Specification	Premium Weight Part No. White
50 ¤	19"	23"	38"	8"	1"	42341
100 ¤	27"	29"	43"	8"	1"	42343
110 low profile	35"	18"	48"	5"	1"	42349
150	36"	29"	48"	8"	1"	42345
200	36"	38"	48"	8"	1"	42347

¤ May ship UPS

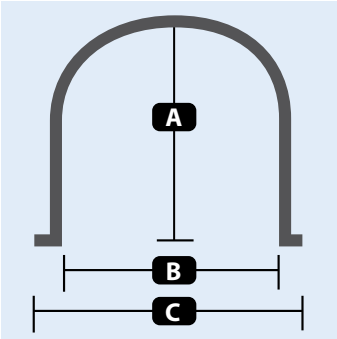
Smooth Wall PCO

PCO Tanks

A multi-purpose tank, the PCO is well suited for nursery, agricultural and lawn care applications. These tanks feature self-supporting legs and do not require any saddles or steel supports. Flat spots are molded into both ends to provide mounting areas for agitation equipment.

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Premium Weight Part No. White
SMOOTH WALL					
30 ¤	19"	23"	25"	5"	41254
50 ¤	19"	22"	38"	8"	40664
100 ¤	30"	28"	38"	8"	40668
150	36"	28"	48"	8"	40669
200	36"	37"	48"	8"	41413
300	36"	37"	69"	16"	41381
RIBBED					
50 ¤	19"	23"	38"	8"	42834
100	30"	30"	38"	8"	42835
150	37"	29"	48"	16"	42836
200	37"	37"	48"	16"	42837

¤ May ship UPS



Flat Bottom Utility Tank Bands

Tank Size (Gallon)	A	B	C	No. of Bands	Part No.
50 ¤	19"	18½"	23"	2 optional	63551
100 ¤	24"	25"	29½"	2 optional	63552
150 ¤	24"	34½"	39"	2 optional	63553
200 ¤	33"	34½"	39"	2 optional	63554

¤ May ship UPS

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

Mini Bulk Tanks

Norwesco mini bulk tanks are most frequently used for chemical dispensing. The tanks can be mounted on forklift accessible pads for ease of movement. A 2" polypropylene fitting is installed directly across from the fill-opening.

Gallon Capacity	Diameter	Overall Height	Fill Opening	Outlet/ Drain Specification	Premium Weight Part No. White
120	38"	31"	5"	2"	40318
220	42"	44"	5"	2"	40320

750 Gallon Elliptical Tank

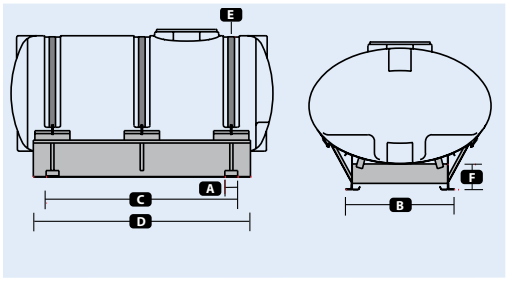
Elliptical Tanks

Designed for larger volume applicator needs, the Norwesco elliptical tanks feature a low profile design and a low center of gravity for excellent visibility in the field and increased stability when towed. A deep sump permits complete drainage and the tanks feature an 8"or 16" fill-opening. Please refer to information below for steel supports.

Gallon Capacity	Width	Overall Height Including Sump	Length	Sump Depth	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
200	40"	30"	66"	¾"	8"	1¼" & 1¼"	41252
300	48"	36"	70"	3"	16"	1¼" & 1¼"	40327
500	57"	44"	82"	5"	16"	1¼" & 1¼"	40328
750	69"	48"	88"	3"	16"	2"	40329
1000	78"	55"	90"	3"	16"	2"	40330
1600 *	78"	54"	138"	2½"	16"	2"	47111
2550 **	88"	82"	142"	9"	16"	3"	47677

Skid not included with tank. See below for skids.

* Includes 1 stainless steel baffle ** The 2550 requires support bands



Elliptical Tank Skids (See dimensional drawings at left.)

(Skids come with bands and bolts.)

Tank Size (Gallon)	Tank Part No.	A	B	C	D	E	F	Part No.
200	41252	4"	24"	52"	57"	2" x 68"	8"	63015
300	40327	4"	34"	46¼"	54¼"	2" x 76"	8"	63016
500	40328	4"	34"	60"	68"	2" x 96"	8"	63018
750	40329	4"	38"	69½"	78"	2" x 112"	8"	60371
1000	40330	4"	46"	60"	72"	2" x 130"	8"	60372
2550*	47677	—	—	—	—	—	—	67456

* Band only, no skid. The 2550 requires 4 support bands, part #67456.
200 and 300 are galvanized; 500 and larger are black painted steel.
Replacement bands and hardware are available. Please contact Norwesco Customer Service for details.

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

Applicator, Inductor, Total Drain and Spot Sprayer Tanks

Whether you're looking for a new or replacement tank, you'll find it in the Norwesco line. All Norwesco applicator tanks feature a lid which threads directly into the fill-opening of the tank to prevent the sloshing or leaking of tank contents during transport or application. The inductor tanks are suitable for mixing chemicals when filling a tank. The spot sprayers feature threaded inserts on the bottom of the tank for mounting purposes, on one side for wand/gun placement and on the top for a 12 volt pump. Please refer to page 9 for steel supports.

150 Gallon x 32" Applicator Tank

200 Gallon by 32" Applicator Tank

15 Gallon (24"D) Inductor Tank in Stand

(Stand not included with tank. See page 9 for stands.)

5 Gallon Total Drain Tank

14 and 25 Gallon Spot Sprayer Tank

Applicator Tanks

Gallon Capacity	Diameter	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
20 ¤	15"	18"	31"	5"	¾"	61737
30 ¤	23"	26"	21"	5"	¾"	41799
55 ¤	23"	27"	34"	5"	¾"	45193
85 ¤	23"	26"	52"	5"	¾"	45105
100 ¤	24"	28"	57"	8"	¾"	60204
110 ¤	30"	34"	41"	8"	1¼" & 1¼"	45053
150	30"	33"	58"	8"	1¼" & 1¼"	40648
150	32"	35"	46"	8"	1¼" & 1¼"	45117
200	32"	35"	62"	8"	1¼" & 1¼"	45059
200	38"	42"	47"	8"	1¼" & 1¼"	45061
300	38"	41"	68"	8"	1¼" & 1¼"	40135
400	42"	45"	74"	8"	1¼" & 1¼"	40137
500	48"	51"	75"	8"	1¼" & 1¼"	40274
150 Slim Line	28"	41"	50"	8"	1¼" & 1¼"	40777
200 Slim Line	24"	48"	61"	8"	1¼" & 1¼"	41305
200 Slim Line	31"	46"	48"	8"	1¼" & 1¼"	40780

¤ May ship UPS

Inductor Tanks

Gallon Capacity	Diameter	Overall Height	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
15 ¤	19"	23"	8"	2"	60214
15 ¤	24"	21"	16"	2"	42064
30 ¤	24"	28"	16"	2"	42065
35 ¤	23"	29"	8"	2"	45098
60 ¤	31"	32"	16"	2"	62205
60	24"	42"	16"	2"	42066
80	32"	37"	16"	2"	47190

¤ May ship UPS

Total Drain Tanks

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
5 square ¤	11"	18"	11"	8"	1¼"	42321
10 square ¤	13"	21"	13"	8"	1¼"	42351
12 ¤	14"	15"	18"	5"	¾"	60521

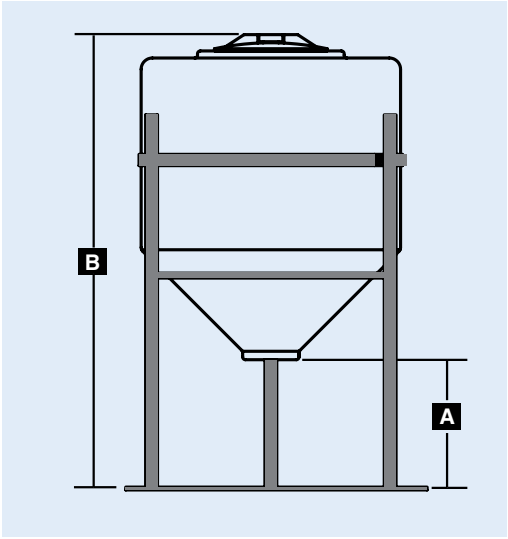
¤ May ship UPS

Spot Sprayer Tanks

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
14 ¤	14"	15"	31"	5"	—	45115
25 ¤	18"	18"	36"	5"	—	62080

¤ May ship UPS

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.



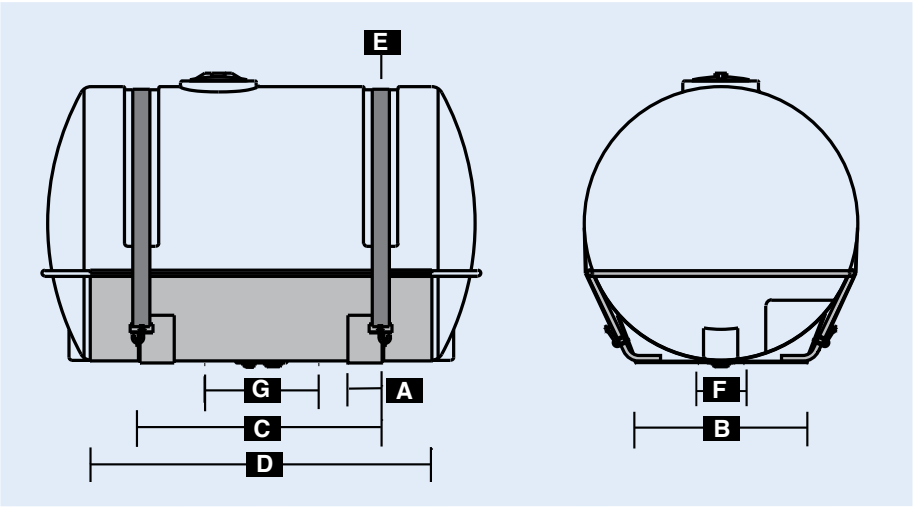
Inductor Stands and Applicator Saddle Assemblies

Designed to provide necessary support for the applicator/inductor tank during use. Norwesco saddles include polyester straps, buckles and bolts to secure tanks, and inductor stands are supplied with all necessary hardware.

Inductor Tank Stands (See dimensional drawing at left.)

Tank Size (Gallon)	Tank Part No.	A	B	Part No.
15 × 19"D ¤	60214	15½"	38"	60313
15 × 24"D ¤	42064	13½"	36"	63397
30 × 24"D ¤	42065	13½"	43"	63397
35 × 23"D ¤	45098	15"	44"	65517
60 × 31"D ¤	62205	14½"	47"	62204
60 × 24"D ¤	42066	13¼"	56"	63397

¤ May ship UPS



Replacement bands and hardware are available. Please contact Norwesco Customer Service for details.

Applicator Tank Saddle Assemblies (See dimensional drawings above.)

Tank Size (Gallon)	Tank Part No.	A	B	C	D	E	F	G	Part No.
30 ¤	41799	3"	19"	13½"	13½"	2" x 54"	8"	7¾"	60321
55 ¤	45193	6"	18⅛"	24"	24"	2" x 48"	—	12"	60303
85 ¤	45105	6"	18⅛"	24"	24"	2" x 48"	—	12"	60303
110 ¤	45053	12"	23¾"	28¾"	34¾"	2" x 72"	—	10¾"	60315
150-30" ¤	40648	12"	23¾"	28¾"	34¾"	2" x 72"	—	10¾"	60315
150-32" ¤	45117	12"	23¾"	28¾"	34¾"	2" x 72"	—	10¾"	60315
200-32"	45059	6"	24⅞"	36"	60"	2" x 96"	8"	13¼"	63019
200-38"	45061	6"	24¾"	34"	42"	2" x 96"	—	13¼"	63020
300-38"	40135	6"	24¾"	34"	60"	3" x 96"	8"	12"	63021
400-42"	40137	6"	30⅛"	42½"	60"	3" x 96"	8"	12"	63022
500-48"	40274	6"	30⅛"	42½"	60"	3" x 132"	8"	12"	63023

¤ May ship UPS

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

Black or Dark Green Water Tanks

Our water tanks are manufactured using resins that meet FDA specifications to ensure safe storage of potable water. The black or green color limits light penetration, which reduces the growth of waterborne algae. These tanks are rated at 8 pounds per gallon, which means that they are for WATER STORAGE ONLY! They should not be used for chemicals, fertilizers or any other product. Where applicable, the tanks will carry the NSF approval. Please contact your distributor for more specific information regarding NSF approval.

Gallon Capacity	Diameter	Overall Height	Fill Opening	Bottom Fitting	Top Fitting
305	46"	50"	16"	2"	1½"
500	48"	73	16"	2"	1½"
550	67"	44"	16"	2"	1½"
1000	64"	80"	16"	2"	1½"
1100	87"	53"	16"	2"	1½"
1350	71"	88"	16"	2"	1½"
1500	95"	58"	16"	2"	1½"
1550	87"	67"	16"	2"	1½"
2500	95"	91"	16"	2"	1½"
2500	102"	79"	16"	2"	1½"
2500	102"	79"	22"	2"	1½"
3000	95"	109"	16"	2"	1½"
3000	102"	93"	16"	2"	1½"
3000	102"	93"	22"	2"	1½"
5000	102"	152"	16"	2"	1½"
5000 Peanut Can	119"	112"	22"	2"	1½"
5000 Tuna Can	141"	86"	22"	2"	1½"
10,000 *	141"	160"	16"	2"	–
10,000 *	141"	160"	22"	2"	–

*Includes one bottom fitting only.

Please refer to **www.norwesco.com** for part numbers and tank availability locations.

Specialty Water Tanks

Horizontal Box Tank

Low Profile Tank

Horizontal Box Tank

The low profile design of this tank makes it ideal for use on trailers or in the back of a truck. The slosh reduction ribs provide excellent structural support. It can also be used as a stationary water storage tank.

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
2400	90"	53"	150"	16"	2"	40912

Low Profile Tank

The low profile tanks may be used for storage or transport. They are an excellent choice when height limitations are a factor and are the perfect height for putting under your cottage or cabin.

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No.
1250	81"	38"	130"	16"	2"	40756
1275	84"	36"	126"	16"	2"	43011
1500	81"	44"	130"	16"	2"	41392
1600	84"	42"	126"	16"	2"	43013

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

Free Standing Water Tank

These tanks have been specifically designed with residential and commercial applications in mind. The dimensions of the 250, 300 or 400 gallon allow it to fit through a conventional doorway. The design of the freestanding/self-supporting tanks eliminate the need for a steel support frame.

Free Standing Water Tank

Gallon Capacity	Width	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
250	29"	40"	62"	16"	1¼"	42337
300	29"	48"	62"	16"	1¼"	41869
400	30"	68"	63"	16"	1¼"	41247

300 and 400 Gallon Free Standing Tank

Containment Basins/Tanks

Be kind to the environment and limit your liability by using a Norwesco polyethylene containment tank. Federal, state and local agencies are enforcing stringent rules and regulations regarding spills, leaks and overflows from primary containment tanks. These spills can be hazardous and costly and with that in mind, we have designed our containment basins and tanks to meet your containment needs. Our containment basins and tanks are impact and corrosion resistant and are molded as a one-piece, seamless unit. The 140, 250, 360, 500, 600 and 1300 gallon sizes are "basin style"; the 1350 is an open top tank and the 2050 and 2800 "Tank In A Tank" is molded with a dome that can be cut off to enable it to be used as a containment tank. Required containment capacity may vary depending on application and location.

250 Gallon Containment Basin

1300 Gallon Containment Basin

Gallon Capacity	Width/Diameter	Overall Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No.	Color
125 w/stand*	48" Diameter	60"	—	8"	1" SS Fitting	43161	White Tank / Black Stand
140	45"	17"	45"	—	—	42771	Black
250	68"	11"	92"	—	—	42114	Black
360	69"	16"	93"	––	—	42940	Black
500	80"	19"	92"	––	—	42051	Black
600	84"	20"	98"	—	—	43069	Black
1300	97"	22"	175"	—	—	42195	Black
1350	87" Diameter	53"	—	—	—	42052	White
2050 **	102" Diameter	82"	—	16"	—	43072	White
2800 **	102" Diameter	104"	—	16"	—	42222	White

* Polyethylene stand
** Tank In A Tank

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

500 Gallon Cone Bottom Tank with Polyethylene Stand

1600 Gallon Cone Bottom Tank with Polyethylene Stand

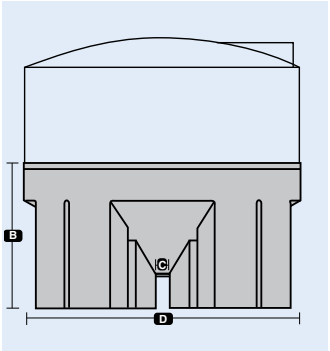
3000 Gallon Cone Bottom Tank with Heavy Duty Steel Stand

Cone Bottom Tanks

Norwesco offers a full range of cone bottom tanks designed for a variety of applications. The conical bottoms enable quick and complete drainage. As with all Norwesco tanks, the cone bottom tanks are molded of rugged, high density polyethylene and are both impact and chemical resistant. Please refer below for polyethylene or steel stands.

Gallon Capacity	Diameter	Overall Height	Slope	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White	Heavy Weight Part No. Blue
175 w/stand*	43"	49"/9"†	30˚	16"	2"	60113	—
300 w/stand*	49"	61"/9"†	30˚	16"	2"	62343	—
310 w/stand*	43"	72"/9"†	30˚	8"	2"	62441	—
500 w/stand*	49"	87"/9"†	30˚	16"	2"	40289	—
750	72"	56"	20˚	16"	2"	40811	—
750 w/stand*	73"	67"/11"†	20˚	16"	2"	40809	—
1050	72"	75"	20˚	16"	2"	40356	—
1050 w/stand*	73"	86"/11"†	20˚	16"	2"	40359	—
1600	88"	84"	30˚	16"	2"	40817	40819
1600 w/stand*	89"	96"/11"†	30˚	16"	2"	40813	40815
2500	95"	105"	30˚	16"	2"	40066	40129
2500 w/stand*	96"	116"/10"†	30˚	16"	2"	40672	40674
2500 15˚ slope**	91"	108"	15˚	16"	2"	43065	43067
3000	95"	123"	30˚	16"	2"	40170	40172
3000 w/stand*	96"	134"/10"†	30˚	16"	2"	40797	40799
3000 15˚ slope**	91"	120"	15˚	16"	3"/2"	45141	—
4500	102"	145"	10˚	16"	3"/2"	43058	43060
5500	119"	148"	30˚	16"	3"/2"	40549	40316
6000	102"	195"	15˚	16"	3"/2"	40931	40933
6000 10˚ slope	102"	189"	10˚	16"	3"/2"	43054	43056
7500	141"	149"	30˚	16"	3"/2"	40551	40409

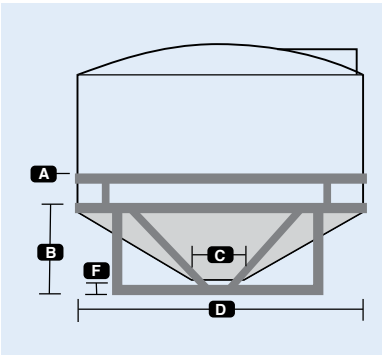
* Polyethylene stand ** Stand not available for this tank † Distance from bottom of cone to ground



Polyethylene Cone Bottom Stands

Maintenance free, light-weight Norwesco polyethylene stands offer unequaled corrosion resistance.

Tank Size (Gallon)	A	B	C	D
175	—	31½"	8"	43"
300	—	32"	8"	49"
310	—	31½"	8"	43"
500	—	32"	8"	49"
750	—	34"	10"	73"
1050	—	34"	10"	73"
1600	—	46"	10"	89"
2500/3000 (30˚)	—	47"	10"	96"



Heavy Duty Steel Cone Bottom Stands

Norwesco heavy duty cone bottom stands are manufactured from structural steel and offer a full dish for uniform support. An optional top band is available for the 2500/3000 steel stand when additional support is needed.

Tank Size (Gallon)	A	B	C	D	F	Part No.
2500/3000 (30˚)	—	36"	11"	96"	11"	60059
4500/6000 (10˚)	—	20⅞"	12"	102"	12"	63675
5500	—	45"	11"	119"	12½"	60358
6000	—	25"	13"	102"	12⅛"	62473
7500	—	49"	11"	140"	10¾"	61860
2500/3000 (30˚)	Optional Top Band Assembly	—	—	—	—	60359

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.

High Density Polyethylene Lids

Description	Item Code	Part No.
22" Lid and ring with air vent		63679
16" Lid and ring with blue snap-in vent	A	63485
16" Lid, ventless with ring		60367
16" Lid, ventless	B	60365
16" Ring only		60012
Ethafoam gasket for 16" non-hinged lid		62941
Blue snap-in vent for 16" lid (63485)		63539
8" Lid with blue snap-in vent	C	63480
Blue snap-in vent for 8" lid (63480)		63482
5" Lid with ball check air vent (for tanks manufactured after 2/1/00)	D	63484
5" Lid with 2" FPT (does not include vent cap)		63264
5" Lid, hinged for 110 Low Profile		63673
EPDM gasket for 5" lid, 63264 or 63484		60366
2" MPT vent cap with poly screen		63266
18" lanyard for 8" lid and 16" non-hinged lid (tethers lid to tank)		62531
Stainless steel screw for 8" and 16" rings		60081
Strainer basket for 16" fill-opening (7" depth)		67374

Hinged Lid

This lid is manufactured from a co-polymer material for strength, durability and excellent chemical resistance. Our unique locking tab allows you to easily slip a padlock through it and secure your lid from theft or spills. The lid is interchangeable with a standard 16" lid and ring assembly if you choose to replace your existing lid.

- Easy open/close – opens a full 180 degrees
- Comes complete with a baffle vent assembly, allowing for adequate venting when bottom filling your tank.
- Unique locking tab
- All parts of lid may be ordered as repair parts

Description	Part No.
Complete lid assembly	62532

Hinged Lid Repair Parts

Description	Part No.
16" hinged lid with vent assembly, without ring	62826
16" hinged ventless lid, with ring	63390
Vent assembly	62827
Ring assembly	62828
Hinge assembly	62829
EPDM O-ring for lid	62830
Neoprene O-ring for ring	62831

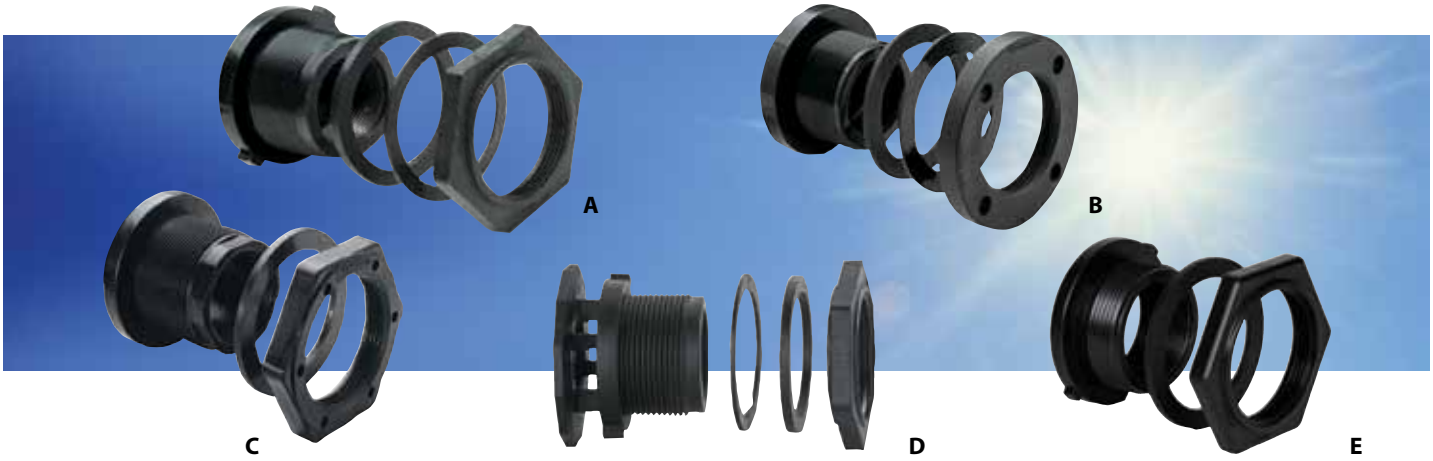
Polyethylene Tank Repair Kits

The tank repair kit (welding gun and rod) includes a specially formulated welding wire containing co-polymers and adhesives. Wire may be used to effectively repair linear polyethylene. Easy to use and requires only 110 volt power. The poly patch kit is ideal for repairing pinholes, hairline cracks and holes up to ½" in diameter. For best results, surface to be repaired should be above 32˚ F. The kit consists of epoxy, a small brush to apply the epoxy, a small piece of sandpaper to "roughen" the area to be patched, a piece of mastic to temporarily fill the hole/crack and a piece of fiberglass.

Description	Part No.
Poly welding gun & rod	60221
Poly welding rod 30'	61879
Poly patch kit	67412

Poly Welding Gun

PLEASE NOTE: Tank availability may vary according to manufacturing location. Please contact Norwesco Customer Service or your Norwesco distributor for specific details. Tank dimensions and capacities may vary slightly and are subject to change without notice.



Polypropylene Bulkhead Fittings / EPDM Or Viton Gaskets

Norwesco's polypropylene fittings come standard with an EPDM gasket. Viton gaskets are available as an option when EPDM may not be suitable for your application. The 2" stainless steel bulkhead fitting comes standard without a gasket.

Description	Hole Size Required in Tank for Installation	Part No.	Item Code
½" Heavy duty double threaded polypropylene fitting	1 7/16"	62834	A
¾" Double threaded polypropylene fitting	1 7/16"	60401	A
EPDM gasket for ½" and ¾" (62834 and 60401)		60402	
Type B Viton gasket for ½" and ¾" (62834 and 60401)		60360	
¾" Heavy duty double threaded polypropylene fitting	1⅝"	62798	A
EPDM gasket ¾" (62798)		62799	
Type B Viton gasket for ¾" (62798)		62800	
1" Double threaded polypropylene fitting	2¼"	60427	A
1¼" Double threaded polypropylene fitting	2¼"	60403	A
1¼" Anti-vortex polypropylene fitting	2¼"	63065	D
EPDM gasket for 1" and 1¼" (60427, 60403 and 63065)		60404	
Type B Viton gasket for 1" and 1¼" (60427, 60403 and 63065)		60361	
Anti-vortex adapter for 1¼" (60403)		62398	
1½" Double threaded polypropylene fitting	3"	60124	A
Siphon tube, 1½" x 12" long		63279	
2" Double threaded polypropylene fitting	3"	60405	A
2" Double threaded 316 stainless steel fitting, less gasket	3"	61767	
EPDM gasket for 1½" and 2" (60124, 60405, 63481 and 61767)		60406	
Type B Viton gasket for 1½" and 2" (60124, 60405, 63481 and 61767)		60523	
2" Standard duty double threaded polypropylene fitting (Maximum tank wall thickness = ⅜")	3"	63481	E
2" Heavy duty double threaded polypropylene fitting	3¼"	63683	B
EPDM gasket for 2" (63683)		60336	
Type B Viton gasket for 2" (63683)		60008	
Siphon tube, 2" short		60335	
Siphon tube, 2" x 12" long		63262	
2" MPT vent cap with poly screen		63266	
2" MPT vent cap, anti-vortex, without screen		63316	
Anti-vortex adapter for 2" bulkhead fitting		62399	
2" Polypropylene dust plug		60021	
2" Self-aligning double-threaded polypropylene fitting (Designed to install in dome of vertical tank above the liquid level)	4½"	63668	
EPDM gasket for 2" self-aligning (63668)		60331	
Type B Viton gasket for 2" self aligning (63668)		60351	
3" Double threaded polypropylene fitting	4½"	62299	C
EPDM gasket for 3" (62299)		60331	
Type B Viton gasket for 3" (62299)		60351	
2" Polypropylene reducer for 3"		60330	
Siphon tube, 3" short		60327	
Siphon tube, 3" x 12" long		63263	
4" Double threaded polypropylene fitting (hex nut as shown in photo C)	5¾"	62171	
EPDM gasket for 4" (62171)		62785	
Type B Viton gasket for 4" (62171)		62786	
Siphon tube for 4"		62714	

Bolted Fittings

Polypropylene Double Threaded Bolted Fittings / EPDM or Viton Gaskets (Require two gaskets.)

Bolted polypropylene fittings are equipped with 316 stainless steel bolts and come standard with EPDM gaskets. Viton gaskets are available as an option for the fittings.

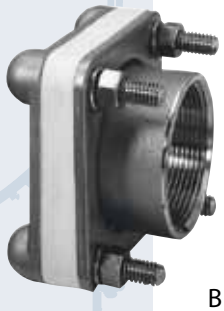
Description	Part No.	Item Code
¾" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60502	A
1" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60505	A
EPDM gasket for ¾" and 1"	60498	
Type B Viton gasket for ¾" and 1"	60355	
1½" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60513	A
2" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60516	A
EPDM gasket for 1½" and 2"	60497	
Type B Viton gasket for 1½" and 2"	60356	
3" Polypropylene bolted fitting with ss bolts and EPDM gaskets	62471	
EPDM gasket for 3"	62048	
Type B Viton gasket for 3"	60602	


A

Stainless Steel Double Threaded Bolted Fittings

Bolts are threaded into the back plate of the fitting so there are no welds or bolt holes that can be potential points of leakage. These fittings come standard without a gasket and require a single gasket that is installed on the inside of the tank. Available gaskets are cross-linked polyethylene, EPDM or Viton.

Description	Part No.	Item Code
½" 316 Stainless steel double threaded bolted fitting less gasket	63216	B
¾" 316 Stainless steel double threaded bolted fitting less gasket	63035	B
1" 316 Stainless steel double threaded bolted fitting less gasket	62948	B
EPDM gasket for ½", ¾" & 1" (1 required)	63205	
Type B Viton gasket for ½", ¾" & 1" (1 required)	63224	
Cross-linked polyethylene gasket for ½", ¾" & 1" (1 required)	62950	
1¼" 316 Stainless steel double threaded bolted fitting less gasket	63036	B
Cross-linked polyethylene gasket for 1¼" (1 required)	63041	
1½" 316 Stainless steel double threaded bolted fitting less gasket	63037	B
EPDM gasket for 1¼" and 1½" (1 required)	63426	
Cross-linked polyethylene gasket for 1½" (1 required)	63042	
2" 316 Stainless steel double threaded bolted fitting less gasket	63038	B
EPDM gasket for 2" (1 required)	63206	
Type B Viton gasket for 1¼", 1½" and 2" (1 required)	63225	
Cross-linked polyethylene gasket for 2" (1 required)	62848	
3" 316 Stainless steel double threaded bolted fitting less gasket	63039	C
EPDM gasket for 3" (1 required)	63223	
Type B Viton gasket for 3" (1 required)	63226	
Cross-linked polyethylene gasket for 3" (1 required)	63043	
4" 316 Stainless steel 8-bolt double threaded bolted fitting with gasket	63688	
EPDM gasket for 4" (1 required)	63690	
Viton gasket for 4" (1 required)	63691	
Cross-linked polyethylene gasket for 4" (1 required)	63689	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Stainless Steel Single Threaded Bolted Fittings

Description	Part No.
2" 316 Stainless steel single threaded bolted fitting less gasket	62847
EPDM gasket for 1¼", 1½" and 2" (1 required)	63206
Type B Viton gasket for 1¼", 1½" and 2" (1 required)	63225
Cross-linked polyethylene gasket for 2" (1 required)	62848
3" 316 Stainless steel single threaded bolted fitting, anti-vortex, less gasket	63233
EPDM gasket for 3" (1 required)	63223
Type B Viton gasket for 3" (1 required)	63226
Cross-linked polyethylene gasket for 3" (1 required)	63043


C

Manufacturing and Distribution

B. St. Bonifacius, Minnesota
C. Lancaster, Ohio
D. Griffin, Georgia
E. Shawnee, Oklahoma
F. Tooele, Utah
G. Owego, New York
H. Washougal, Washington
I. Sheldon, Iowa
J. Washington Court House, Ohio
L. Hanford, California
M. Edmonton, Alberta-Canada
O. Saskatoon, Saskatchewan-Canada
Q. Edmonton, Alberta-Canada
T. Fairfield, Texas
X. Albertville, Alabama

Tank dimensions and capacities may vary slightly and are subject to change without notice.

Warranty

Norwesco offers a three year warranty from date of manufacture on all premium weight tanks and a five year warranty on all heavy weight tanks. Should a defect appear within the warranty period Norwesco will supply a new, equivalent tank in replacement thereof. Norwesco's liability is limited to the value of the tank itself and specifically excludes the cost of installation and/or removal or consequential damages. Please contact your chemical supplier or Norwesco Customer Service for chemical resistance information.

NORWESCO
Norwesco, INC.

4365 Steiner Street
P.O. Box 439
St. Bonifacius, MN 55375-0439
Tel (800) 328-3420
Fax (800) 874-2371

www.norwesco.com

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ULTRA-SAFE™ EXP UNIT HEATER

INDEECO's ULTRA-SAFE™ EXP explosion-proof unit heater is designed with both safety and versatility in mind. Unique ULTRA-SAFE™ EXP features include:

- **Industry's Lowest Ignition Temperature Code Rating:** T3C, 320°F (160°C)
- **Dual Overtemperature Protection:** With both automatic and manual reset overtemperature cutouts for additional safety.
- **Nontoxic Propylene Glycol Heat Transfer Fluid**
- **Low 70 PSIG Relief Valve Setting:** This assures that in an emergency, the initial escaping vapor temperature remains below the 320°F (160°C) ignition temperature.
- **Corrosive Resistant Options:** INDEECO offers three constructions suitable for most applications. Standard construction for use in dry non-corrosive areas includes: welded steel heat exchanger; powder-coated cabinet; epoxy-coated motor. A 316 stainless steel construction suitable for Waste Water Treatment Plants includes: 316 stainless steel heat exchanger, headers and tubes with aluminum fins; stainless steel cabinet; corrosive resistance hardware; epoxy-coated motor. Third construction is suitable for use in Chemical Plants where chlorides are present and includes: Heresite® coated heat exchanger, cabinet, fan blade; corrosive resistance hardware; epoxy-coated motor.

Applications

- Aircraft Hangars/Service Areas
- Chemical Storage/Handling Areas
- Coal Preparation Plants
- Compressor Stations
- Grain Elevators
- Oil Refineries and Rigs
- Paint Storage Areas
- Petrochemical Plants
- Sewage Pump Stations/ Treatment Plants
- Spray Booths

Class I, Divisions 1 and 2, Groups C and D
Class II, Divisions 1 and 2, Groups E, F and G
Class I, Zones 1 and 2, Group IIB
Temperature Code T3C, 320°F (160°C)

Standard Construction Features

Heat Exchanger – Efficient liquid-to-air design utilizes an all welded steel headers and finned tube construction with spiral wound aluminum fins. Industrial grade INDEECO heating elements are immersed in a nontoxic, inhibited, propylene glycol heat transfer fluid that provides freeze protection down to -49°F (-45°C). The heat exchanger is hydrostatically tested at 350 psig. A pressure relief valve provides excess pressure protection and is set at 70 psig.

Fan Motor Assembly – Consists of an explosion-proof motor fitted with an aluminum fan blade. The motor has double-shielded, permanently lubricated ball bearings and automatic reset line breaking thermal overload protection. Motors furnished on standard units operate at line voltage and are prewired to the control enclosure so separate field wiring to the motor is not required.

The standard motor is rated for Class I, Groups C and D, Class II, Groups F and G. The minimum operating temperature is -14°F (-25°C) and the minimum storage temperature is -49°F (-45°C). Optional motor ratings are described on page 9.

Cabinet/Louvers – Industrial grade, corrosion resistant construction fabricated from powder coated 14-gauge galvanized steel. The adjustable louvers have minimum opening safety stops.

Controls – Factory mounted on the unit heater. Standard built-in controls include automatic and manual reset over-temperature cutouts, controlling magnetic contactor, 24-volt control circuit transformer and incoming power terminal blocks housed in a NEMA 7, 9 cast aluminum enclosure.

Factory Built-in Options

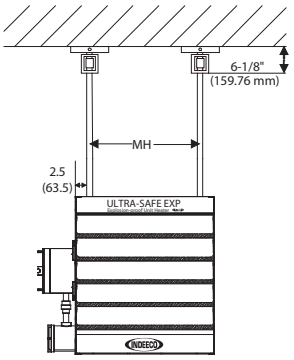
Code	Option	Description	Availability Code (2)
C1	316 Stainless Steel Corrosion Resistant Construction (Waste Water Treatment Plants)	316 Stainless steel heat exchanger with aluminum fins, 316 stainless steel cabinet; aluminum fan blade; cast aluminum NEMA 4X, 7, 9 control enclosure; corrosion-resistant hardware; corrosion-resistant protective coated motor which has passed the ASTM B117 salt-spray test.	C
C2	Dirty Duty Corrosion-Resistant Construction (Chemical Plants)	Epoxy-coated motor; Heresite® coated heat exchanger cabinet and fan blade; cast aluminum NEMA 4X, 7, 9 control enclosure; corrosion resistant hardware; corrosion-resistant protective coated motor which has passed the ASTM B117 salt-spray test.	C
D	Disconnect Switch	Factory installed on the unit heater beside the control enclosure. This is an inexpensive and positive way to meet NEC/CEC requirements for a disconnecting means within sight of the heater.	S
E	Group E (Metal Dust) Construction	Class II, Group E (Metal Dust) Construction Temperature Code T3C, 320°F (160°C)	C
H	50 Hertz Motor	Optional motors for international requirements. Contact factory for KW availability.	C
K	"Warning" Pilot Light	Indicates when the thermal cutouts have tripped and the unit heater needs servicing.	AS
L	"Heater On" Pilot Light	Indicates when the electric heating elements are energized.	AS
M	Manual Reset Thermal Cutout with Backup Contactor	A pilot duty manual reset thermal cutout with a backup contactor is provided for independent secondary overtemperature protection. This option cannot be provided if option Code S or V are also specified.	AS
S	Auto/Fan Selector Switch	A two-position switch wired to the control circuit for auto (automatic heat) and fan only control. This selector switch cannot be provided if option Code M or V are also specified.	AS
T	Adjustable Thermostat	Factory installed and prewired to the control enclosure. Thermostat is adjustable from 50° to 90°F (10° to 32°C) range.	S
V	120 Volt Control Circuit	Can be provided when required for special external thermostat circuit. This option cannot be provided if option Code S or M are also specified. Nor can both K and L be specified.	AS

(2) S = Stock, AS = Assembly Stock, C = Custom Stock heaters ordered with assembly stock or custom options subject to longer delivery.

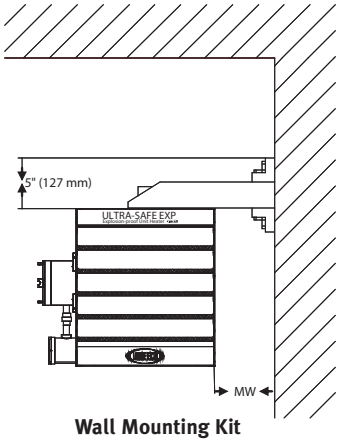
Accessory Items

ULTRA-SAFE™ EXP Heater Mounting Kits

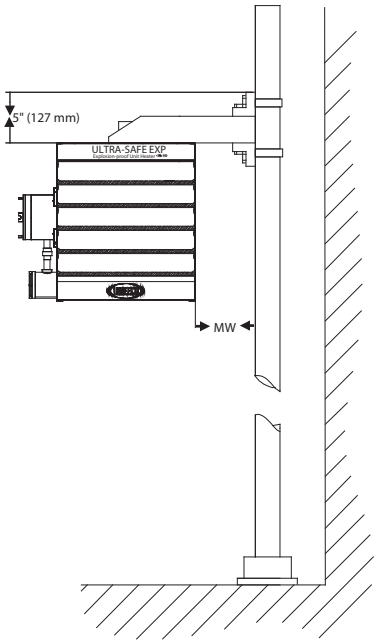
These are available for ceiling, wall and pole mounting configurations as described below. Specify type required and catalog number at time of order entry.



Ceiling Mounting Kit



Wall Mounting Kit



Pole Mounting Kit

Size	MH In. (mm)	MW In. (mm)
1	11.063 (281)	9 (228.6)
2	15.063 (382.6)	7 (177.8)
3	19.063 (484.2)	5 (127)

Unit Heater Mounting Kits (One kit required per heater)
Mounting Kits for use with Standard Heater Powder Coated Construction

Catalog Number	Description	Availability
1022451	Ceiling Mounting Kit, for Frame Sizes 1, 2, 3	1 Week
1022452	Wall Mounting Kit, for Frame Size 1, 2, 3	
1022455	Pole Mounting Kit, for Frame Size 1, 2, 3	

Unit Heater Mounting Kits (One kit required per heater)
Mounting Kits for use with Heaters which include optional Corrosion Resistant Codes C1 and C2

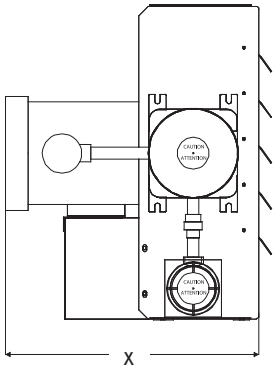
Catalog Number	Description	Availability
1022451-S	Corrosion Resistant Ceiling Mounting Kit, for Frame Sizes 1, 2, 3	1 Week
1022454-S	Corrosion Resistant Wall Mounting Kit, for Frame Size 1, 2, 3	
1022455-S	Corrosion Resistant Pole Mounting Kit, for Frame Size 1, 2, 3	

For corrosion resistant option, add - S to the end of item number.

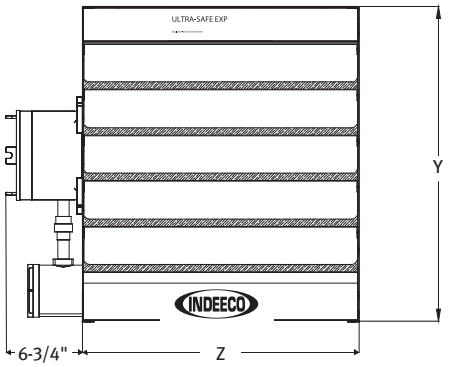
Remote Room Thermostat – Use catalog number 1007002. See page 95.

Dimensions, Airflows and Weights

	KW Range	Size 1		Size 2		Size 3	
		3-5 KW	7.5-10 KW	15 KW	20 KW	25 KW	30 KW
Overall Heater Dimensions	'X' In. (mm)	18.25 (463.55)		18.25 (463.55)		20.00 (508)	
	'Y' In. (mm)	19.375 (492.125)		23.375 (593.725)		27.375 (695.325)	
	'Z' In. (mm)	16.063 (408)		20.188 (512.775)		24.188 (614.375)	
Airflow Characteristics	CFM (M3/Hr)	650	850	1800		3110	3850
	Throw Ft. (m)	15 (4.5)	25 (7.6)	45 (13.7)		65 (19.8)	75 (22.8)
Motor/Fan	RPM	1725					
	HP	1/4		1/4		1/2	
	Fan Diameter In. (mm)	12 (304.8)		16 (406.4)		20 (508)	
Weight	Net Lbs (Kg)	110 (49.89)		150 (68.03)		190 (86.18)	
	Shipping Lbs (Kg)	130 (58.96)		169 (76.65)		216 (97.97)	



Side View



Front View

ULTRA-SAFE™ EXP Unit Heater Listing

Class I, Divisions 1 and 2, Groups C and D
Class II, Divisions 1 and 2, Groups F and G
Class I, Zones 1 and 2, Group IIB
Temperature Code T3C, 320°F (160°C)

KW	Volts	Phase	Total Amps (1)	Frame Size	Approximate Air Temperature Rise °F (°C)	Catalog Number	Availability
3	208	1	17	1	15 (8)	233-FA-0036C	1 Week
	240	1	15	1	15 (8)	233-FA-0036J	
	208	3	10	1	15 (8)	233-FA-0036D	
	240	3	9	1	15 (8)	233-FA-0036K	
	480	3	5	1	15 (8)	233-FA-0036U	
	600	3	4	1	15 (8)	233-FA-0036Z	
5	208	1	26	1	25 (13)	233-FA-0056C	
	240	1	23	1	25 (13)	233-FA-0056J	
	208	3	16	1	25 (13)	233-FA-0056D	
	240	3	14	1	25 (13)	233-FA-0056K	
	480	3	7	1	25 (13)	233-FA-0056U	
	600	3	6	1	25 (13)	233-FA-0056Z	
7.5	208	1	38	1	28 (16)	233-FA-0086C	
	240	1	34	1	28 (16)	233-FA-0086J	
	208	3	23	1	28 (16)	233-FA-0086D	
	240	3	20	1	28 (16)	233-FA-0086K	
	480	3	10	1	28 (16)	233-FA-0086U	
	600	3	9	1	28 (16)	233-FA-0086Z	
10	240	1	44	1	38 (21)	233-FA-0106J	
	208	3	30	1	38 (21)	233-FA-0106D	
	240	3	26	1	38 (21)	233-FA-0106K	
	480	3	13	1	38 (21)	233-FA-0106U	
	600	3	11	1	38 (21)	233-FA-0106Z	
15	208	3	44	2	27 (15)	233-FB-0156D	
	240	3	38	2	27 (15)	233-FB-0156K	
	480	3	19	2	27 (15)	233-FB-0156U	
	600	3	16	2	27 (15)	233-FB-0156Z	
20	480	3	25	2	35 (19)	233-FB-0206U	
	600	3	21	2	35 (19)	233-FB-0206Z	
25	480	3	31	3	26 (14)	233-FC-0256U	
	600	3	25	3	26 (14)	233-FC-0256Z	
30	480	3	37	3	25 (13)	233-FC-0306U	
	600	3	30	3	25 (13)	233-FC-0306Z	

(1) Total Amps = Heating element amps and motor amps.

Three Constructions to Choose From; Standard, Stainless Steel or Heresite®

Standard - Non-corrosive applications

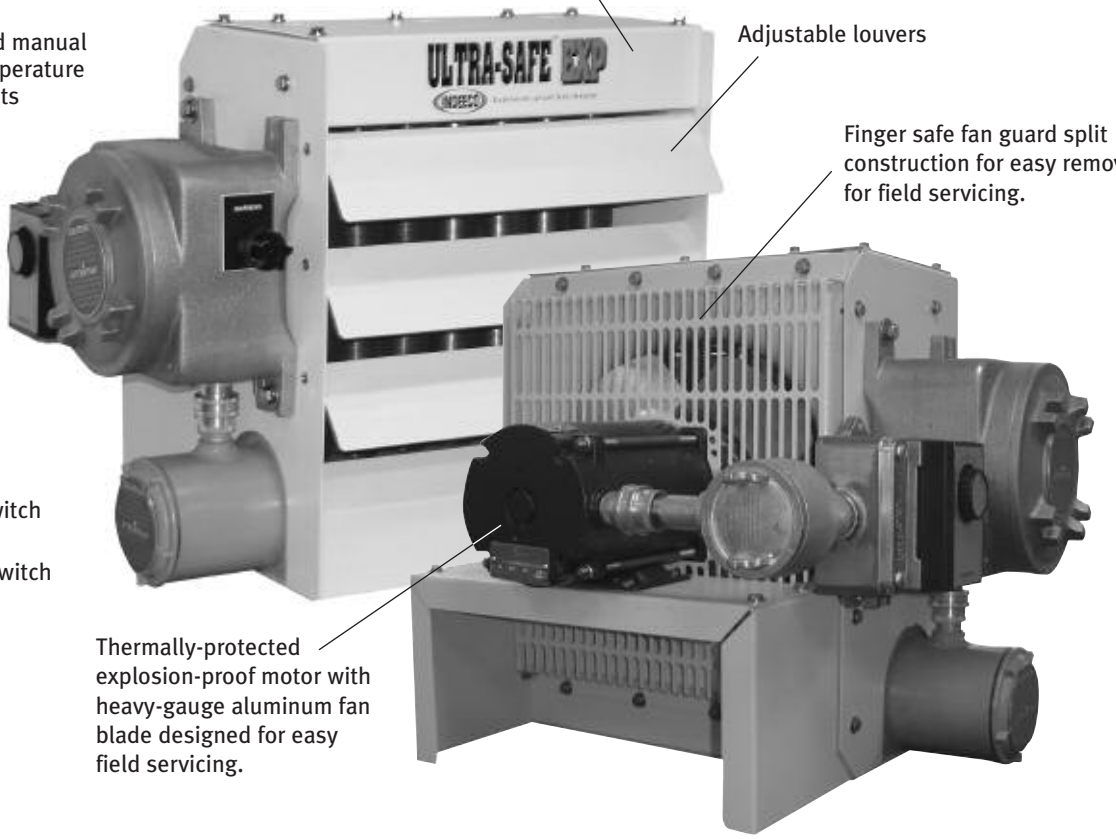
- Aircraft Hangars/Servicing Areas
- Coal Mines/Preparation Plants
- Gasoline Fueling/Storage Areas
- Paint Spraying/Storage Areas
- Utility Plants

Optional 316 Stainless Steel or Heresite® Coating

- Chemical Plants
- Chemical Storage/Handling Areas
- Food Processing Plants
- Oil Refineries
- Petrochemical Plants
- Sewage Treatment/Wastewater Treatment Plants

Heavy 14-Gauge Cabinet
- Powder coated - standard
- 316 stainless steel or Heresite® coated - options

Standard
- 24VAC transformer
- Contactor
- Automatic and manual reset overtemperature thermal cutouts



Adjustable louvers

Finger safe fan guard split construction for easy removal for field servicing.

Optional
- Disconnect switch with lockout
- Fan selector switch
- Thermostat

Thermally-protected explosion-proof motor with heavy-gauge aluminum fan blade designed for easy field servicing.

Designed for Easy Servicing
- Removable core
- Split fan guard
- Easy access to motor and fan
- Replaceable automatic and manual thermal cutouts
- Threaded control enclosure

Heater Core

All welded construction with:
- Painted steel heaters with steel tubes and spiral wound aluminum fins - standard
- 316 stainless or heresite® construction - options

Core can be easily removed through bottom of cabinet

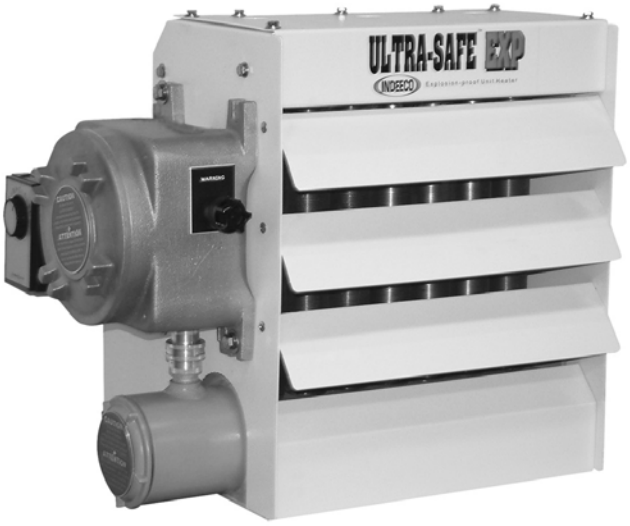
Heresite® is a registered trademark of Heresite® Protective Coatings, Inc.

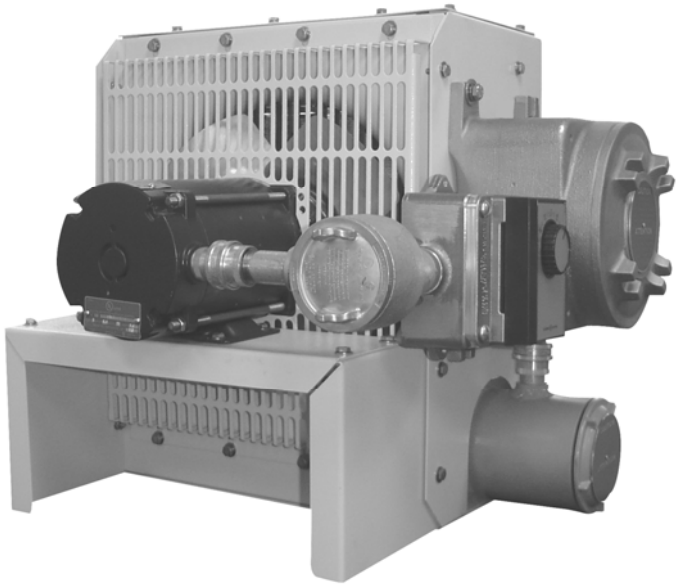
INDEECO

Owner's Manual

ULTRA-SAFE EXP Series

Electric Forced Air Heater for Hazardous Locations





This manual covers installation, maintenance and repair parts.

FM and CSA Approved for the following classified areas:
Class I, Divisions 1 & 2, Groups C & D
Class II, Divisions 1 & 2, Groups F & G
Operating Temperature Code T3C - 320°F (160°C)
Class I, Zones 1 & 2, Group IIB, T3 (FMUS & CSAUS only)
or
Class I, Divisions 1 & 2, Groups C & D
Class II, Divisions 1 & 2, Groups E, F & G
Operating Temperature Code T3C - 320ºF (160ºC)
Class I, Zones 1 & 2, Group IIB T3 (FMUS & CSAUS only)
See Data Plate for Specific Area Classification

For details on the particular hazardous environments having the potential for explosion, refer to Articles 500 through 516 of the National Electric Code, and/or Section 18 of the Canadian Electric Code, Part I.

C US

C FM US
APPROVED

23-2199-83-1

WARNINGS

Installation and maintenance personnel should familiarize themselves with this manual and all the **WARNINGS** before installing or working on this heater to avoid potential hazardous conditions, severe property damage, personal injury or death.

1. To reduce the risk of ignition of hazardous atmospheres: Do not install where the operating temperature code limit exceeds the ignition temperature of the hazardous atmosphere.
2. Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the OFF position and tag the circuit “Out for Maintenance” before working on this equipment.
3. Keep electrical enclosure covers tightly closed while in operation.
4. Hazard of Electric Shock. Heater must be grounded in accordance with the N.E.C. and/or C.E.C.
5. This heater should be installed by qualified personnel familiar with the National Electric Code and/or the Canadian Electrical Code requirements for hazardous locations. It is the responsibility of the installer to verify the safety and suitability of the installation.
6. Disassembly of the unit, for installation, is not required or authorized.
7. When connecting the room thermostat, be sure that the thermal cutouts remain connected in series with the controlling contactor. The unit must not operate without the thermal cutouts properly connected in the circuit.
8. Do not attempt to install a “Fan Only” switch on a standard unit heater and do not try to field modify a standard unit heater for this option. The heater must have been ordered for this option to have the necessary internal controls.
9. Replacement of electrical components should only be done by qualified personnel familiar with the requirements of maintaining electrical equipment in hazardous locations.
10. Replacement electrical components must be obtained from the factory in order to maintain the hazardous location rating.
11. The heat exchanger is a factory vacuum-sealed unit. Do not attempt to loosen or tighten any of the fill or drain plugs or attempt to operate the pressure relief valve. A loss of vacuum could cause nuisance tripping of the cutouts or high pressures which will cause the relief valve to actuate with an accompanying loss of liquid. Should leakage occur, remove unit from service and investigate cause.
12. The heat exchanger is filled with a mixture of water and inhibited propylene glycol. Contact with the fluid at operating temperatures may produce a burn hazard. The Material Safety Data sheets indicate that there is not a health hazard from coming in contact with the inhibited propylene glycol. Suggested first aid consists of flushing eyes with plenty of water and to wash off skin in flowing water or a shower.
13. Install and operate in an upright position only. Failure to comply will cause the overtemperature thermal cutouts to trip.
14. Installation minimum mounting clearances on nameplate must be maintained.
15. Use copper wire for supply connections according to size and rating on nameplate.
16. Do not attempt to override louver stops or operate unit with louvers fully closed.
17. “Warning Light”, if supplied, will turn on if the high temperature thermal cutout opens. This could result if the heat exchanger is dirty, inlet air is obstructed, vacuum loss in heat exchanger, fan not turning or incorrect supply voltage. Disconnect power to unit before servicing.
18. Crackling noises within the heat exchanger at startup are normal.

WARRANTY WILL BE VOID IF INSTRUCTIONS ARE NOT FOLLOWED.

GENERAL

The air heaters are designed for comfort heating and should not be used in ambient temperatures exceeding 104ºF (40ºC). The units may be wall, pole or ceiling mounted. They utilize a hermetically sealed, liquid-to-air heat exchanger containing immersion type electric heating elements. A mixture of nontoxic propylene glycol and water is place in the heater core to act as a heat transfer fluid. The propylene glycol provides freeze damage protection to -49ºF (-45ºC). The unit is designed to give years of safe, trouble-free operation when properly installed and maintained.

INSTALLATION

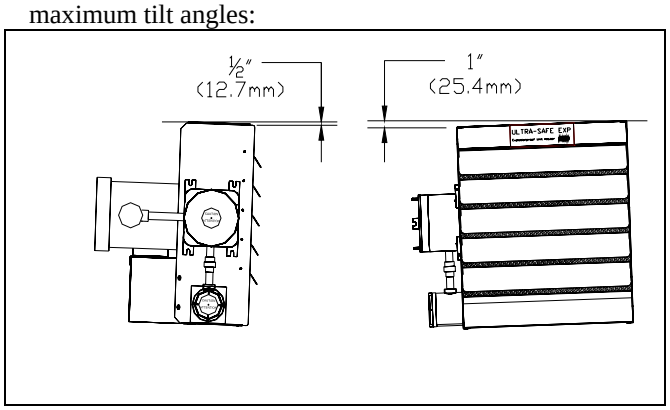
A. Site Selection:

The Heaters should not be mounted close to drapery or similar materials which could lay on the cabinet, or block the inlet or outlet of the heater. The heaters are intended for elevated mounting locations so that they blow warm air down to the floor area. A mounting height should be selected so that the heater is out of the way of possible moving equipment or personnel, yet low enough to deliver warm air to the selected area. See mechanical installation instructions for recommended installation heights.

B. Mechanical Installation:

Once an acceptable location has been determined, follow these instructions to complete the mechanical installation.

1. The Heaters are designed for use only while permanently mounted in an upright, level position. See figure below maximum tilt angles:



2. To ensure proper heating of floor surfaces, observe the following recommended maximum mounting heights (to bottom of heater):

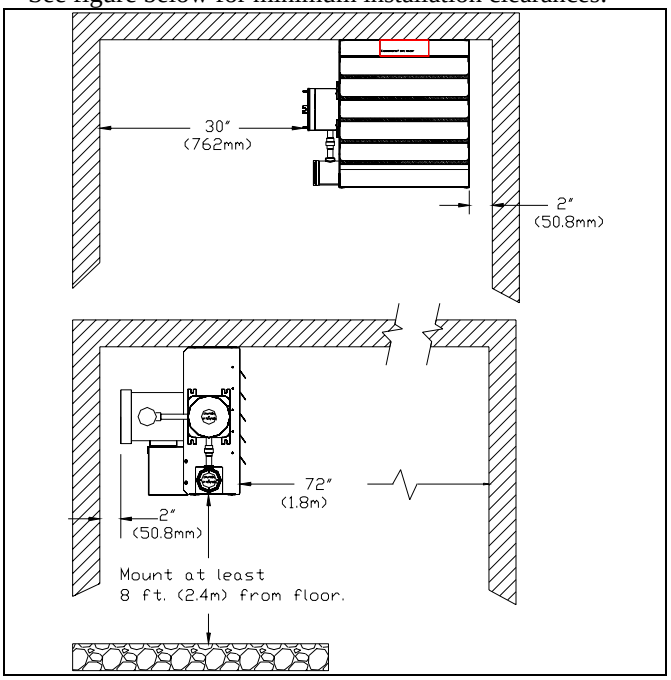
Maximum Mounting Height from Floor:

233-FA	233-FB	233-FC
9 ft.	10 ft.	13 ft.
(2.7m)	(3.0m)	(4.0m)

3. The supporting structure that the heater is attached to must have adequate strength to safely support the heater and be sufficient to keep the heater in its proper upright operating position. The maximum unit weights are:

MODEL	lbs	(kgs)
233-FA	150	68
233-FB	200	91
233-FC	250	114

4. See figure below for minimum installation clearances:



5. The heater may be suspended from overhead beams or mounted to a side wall or a 4" pipe using one of the approved mounting kits. Use of non-approved mounting kits voids all warranties, expressed or implied.
6. Wall mounting should be to structural steel. If the wall construction is plasterboard with wooden 2 X 4 framing or similar, it must be reinforced with angle iron or wooden cross braces.
7. Lock washers should be used on all mounting nuts and bolts to ensure they don't vibrate or work loose due to fan vibration or other vibration transmitted to the heater.

C. Electrical Installation:

Follow these instructions to complete the electrical installation:

1. External branch circuit protection is required. See nameplate ratings and follow Code recommendations.
2. Use only an approved explosion-proof means of wiring, such as mineral insulated cable or copper conductors in rigid conduit with conduit seals as required to make connection to the heater.
3. Follow the NEC and/or CEC and any local electrical and building codes related to the installation and intended use of the heater in an explosion-hazard area.
4. When doing any work on a heater, including the initial electrical connection, disconnect the electrical current at the main branch circuit switch, and lock the switch in the off (open) position and tag the circuit "Out for Maintenance" to prevent potential lethal shock hazards.
5. Confirm that the electrical power supply matches the nameplate voltage, phase, amperage and frequency rating of the heater to be connected.
6. Ensure conductors are of appropriate gauge size. The minimum gauge is stamped on the nameplate. Size all input conductors according to accepted standards consistent with the temperature rating of the wire being used. Use minimum 75°C rated wire.

7. Proper installation of the heater requires that an adequate grounding conductor be connected to the ground terminal. This terminal is painted green or marked with the letter "G" and is located on the inside of the control enclosure next to the power input opening.
8. Check and confirm all connections are securely fastened.
9. Before application of electrical power, check all connections to ensure compliance with the wiring diagram and any code requirements. Remove any foreign objects from the control boxes. Reinstall covers tightly.
10. On all 3-phase heaters, it is necessary to verify that the fan is rotating in the proper direction. If air delivery is not from the front of the heater, exchange any 2 input wires at the main contactor terminal located in the control enclosure.
11. The explosion-proof control box is designed with threaded joints and metal-to-metal contact at the lid or cover joint to prevent an explosion. Do not attempt to install gasket material of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.
12. See section titled "operation" before energizing the heater.

D. Field Installed Controls:

1. Power Disconnect Switch:
   The NEC requires that a power disconnect switch be mounted within sight of the heater. The CEC or local codes may require a disconnect switch within sight of the heater. Refer to the electrical diagram and follow these steps:
   a.) The remote power disconnect switch must be an explosion-proof disconnect switch rated for the area classification.
   b.) The switch must be indicating and have a locked off position.
   c.) The switch must be rated for the nameplate voltage and current per the NEC, CEC and any local codes.
   d.) Follow steps 6 through 12 of the electrical installation instructions to complete the installation.

2. Room Thermostat:
   Refer to the electrical wiring diagram and follow these steps:
   a.) Connect the remote thermostat across the leads marked "C" and "C1". The external thermostat will then be in series with the heater thermal high-limit switches and correct operation of the heater will result.
   b.) The wiring to the remote thermostat must be copper wire, 16 gauge minimum (for Class II) or 14 gauge minimum (Class I) and run in explosion-proof conduit with appropriate conduit seals installed per the NEC, CEC and any local codes.
   c.) Any room thermostat used with this heater must be of an explosion-proof type rated for the area classification, open on temperature rise, rated 250VAC, 75VA inductive capacity.
3. 'Fan Only' Switch:
   Refer to the electrical wiring diagram and follow these steps:
   a.) Do not attempt to install a "Fan Only" switch on a standard unit heater and do not try to field modify a standard unit heater for this option. The heater must have been ordered for this option to have the necessary internal controls.
   b.) Connect the remote 'fan only' selector switch across the leads marked "C" and "F".
   c.) The wiring to the fan selector switch must be copper wire, 16 gauge minimum (for Class II) or 14 gauge minimum (for Class I) and run in explosion-proof conduit with appropriate conduit seals installed per the NEC, CEC and any local codes.
   d.) Any selector switch used with this heater must be an explosion-proof switch rated for the area classification, maintained 2 position selector switch rated for 250 VAC, 75 VA inductive.

OPERATION

The unit heater may be operated normally at ambient temperatures of 104°F (40°C) or less and at altitudes of 3,300 feet (1000m) or less in atmospheres containing less than 21% oxygen by volume, and as classified on the nameplate. All of these conditions must be met before attempting to operate the heater. The heater should never be operated in an oxygen-enriched atmosphere or at ambient temperatures above 104°F, (40°C). The heater may be operated at higher altitudes if the ambient temperatures are below 104°F, (40°C).

A. Initial Operation:

Check to make sure the mechanical and electrical installation is complete and that it is safe to operate the heater.

1.) Heater without built on or remotely mounted fan switch:
   a.) Set the temperature control thermostat to a setting above the current room temperature.
   b.) Energize the heater electrical supply circuit.
   c.) The heater and fan should come on and in 5 to 15 minutes reach a stable operating temperature. If the room temperature is high and the installation is above 3,300 feet, the unit heater may cycle on the thermal high limits of the motor or the heater.
   d.) Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc. Note that crackling noises coming from the heat exchanger during warm up are normal.
   e.) Set the temperature control thermostat to the desired room temperature setting.
   f.) De-energize the heater electrical supply circuit until heater operation is required.
2.) Heater with fan switch:
   a.) Place the fan switch in the fan position.
   b.) Set the temperature control thermostat to a setting below the current room temperature.
   c.) Energize the heater electrical supply circuit.
   d.) The heater fan should come on but the heater should remain off.
   e.) Place the fan switch in the auto position.
   f.) The fan should go off.
   g.) Set the temperature control thermostat to a setting above the current room temperature.

h.) The fan and heater should operate. If the room temperature is high and the installation is above 3,300 feet (1000m), the unit heater may cycle on the thermal high limit cutouts of the motor or the heater.

i.) Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc.
Note that crackling noises coming from the heat exchanger during warm up are normal.

j.) Set the fan switch and temperature control thermostat to the desired operating positions.

B. Normal Operation:

Prior to the start of the heating season, perform the electrical and mechanical steps outlined in the section titled "maintenance".

a.) Perform the Operation steps for the applicable temperature control option.

b.) Place all switches in their normal operating position and place the unit heater in service.

MAINTENANCE

Maintenance and repair must be performed by qualified personnel only.

A. Electrical:

1. Inspect all terminal connections, contactor and conductor insulation for damage, looseness, fraying, etc., as applicable. Tighten any loose terminals and replace or repair wire with damaged or deteriorated insulation. If contactor contacts are badly pitted, welded together, or burned, replace the contactor. Check all explosion-proof conduit for visible damage and tightness.
2. If reduced heat output is suspected, perform the mechanical checks. If low heat output is still suspected after completing the mechanical checks, verify the condition of the heating elements by using an amperage meter to check the current draw of each input line. All input lines should draw approximately equal current which should agree with nameplate rating. If they do not, one or more of the heating elements could be burned out and the heater/core assembly should be replaced.
3. The electric motor is permanently lubricated and thermally protected. Check for smooth and quiet running at all inspections. Replace motor if excessive bearing play is detected. Contact the factory for instructions.

B. Mechanical:

1. Never attempt to fill, drain or check the liquid level of the heat exchanger or check the action of the pressure relief valve. Contact the factory for instructions.
2. The explosion-proof control box is designed with threaded joints and metal-to-metal contact at the lid or cover joints to prevent an explosion. Do not attempt to install gasket material of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.
3. Annually check the tightness of all visible bolts and nuts, in particular the support structure bolts and nuts. Similarly check the motor mounting bolts and nuts.
4. Periodically, check the motor, fan and heater core fins for cleanliness. A dirty heat exchanger can cause the unit to over heat and cycle on the thermal cutouts. If the dirt is loose dust, clean with a vacuum or by air jet. If the dirt can't be vacuumed or blown off, use a warm water spray directed to the inlet side of the heat exchanger then to the outlet side. A soft bristled brush may be required to loosen stubborn deposits. Be careful not to bend the aluminum fins on the heat exchanger or the fan blade propeller. Allow unit to dry before re-energizing.
5. Check louvers for position tightness and equal angle settings. Check motor and fan for smooth running operation. Any unusual noise or vibration must be investigated and rectified.
6. Should there be any evidence of fluid leakage from the heater core, the heater should be repaired immediately. The heater will not operate properly with a low fluid level. Contact the factory for replacement core.

REPAIR AND REPLACEMENT

Maintenance and repair must be performed by qualified personnel only.

A. Replacing the Heat Exchanger Core:

The heat exchanger core is not field repairable. Contact factory for replacement.

1. Disconnect the heater electrical power supply, unwire and lower the heater from it's mounting location. Set heater face down on a table or on the floor.
2. Remove the cabinet bottom, cabinet top, wiring and heater enclosure covers.
3. Disconnect all heater wires from the contactor in the wiring enclosure. Disconnect the control wiring from thermal cutout.
4. Thread conduit into wiring enclosure to disconnect the heater terminal box.
5. With an assistant supporting the weight of the heat exchanger, remove the 3 heat exchanger mounting bolts. Carefully remove the heat exchanger out of the bottom of the cabinet.
6. Locate rating tag on the heat exchanger and verify that electrical ratings of the core to be installed match the electrical ratings on the heater nameplate.
7. To reinstall, slide the core through the bottom of the cabinet while an assistant lines up and installs the 3 heat exchanger mounting bolts.
8. Guide the heater lead wires back into the wiring enclosure.
9. Reconnect the heater lead wires to the contactor and the conduit.
10. Reattach the cabinet bottom and enclosure covers before mounting heater and energizing.

B. Replacing the Temperature High-Limit Cutouts:

1. Disconnect the heater electrical power supply and remove the heater enclosure cover.

2. Remove the wire barrier to expose the high limit cutout.
3. Disconnect the wires from the high limit cutout and mark their location.
4. Remove the two nuts used to attach the temperature high limit cutout.
5. Lift and remove the sheetmetal mounting plate.
6. Carefully lift and remove the temperature high limit cutout.
7. Use only factory supply parts for safe operation.
8. Lightly coat the new manual and automatic cutout bulbs with the supplied thermal transfer compound. This is critical for proper cutout operation.
9. Carefully slide the automatic cutout bulb into the **left** thermowell and the manual cutout bulb into the **right** thermowell.
10. Reinstall the sheetmetal plate. Note that the sheetmetal plate also acts as a stop to keep the cutout bulbs from backing out of the wells.
11. Carefully install the temperature high limit control to avoid putting kinks into the capillary.
12. Reattach the wires to the cutout and reinstall the wire barrier.
13. Ensure heater enclosure cover is in place before energizing heater.

C. Resetting the Manual Cutout:

All unit heaters contain a built-in manual reset thermal cutout with or without backup contactor.

1. Disconnect the heater electrical power supply and remove the heater enclosure cover.
2. Determine the reason for the manual reset thermal cutout actuating and rectify the situation. See section titled “maintenance”.
3. Reset the manual reset thermal cutout by pressing on the red stem in the center of the control.
4. Replace the heater enclosure cover securely.
5. Energize the heater electrical supply circuit.
6. The heater and fan should come on and in 5 to 15 minutes reach a stable operating temperature.
7. Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc.
8. If heater operation appears normal, place the unit into normal operation.

D. Replacing the Fan Motor and Blade:

The fan motor is permanently lubricated and does not require any maintenance. If the fan motor is defective, a replacement must be obtained from the factory.

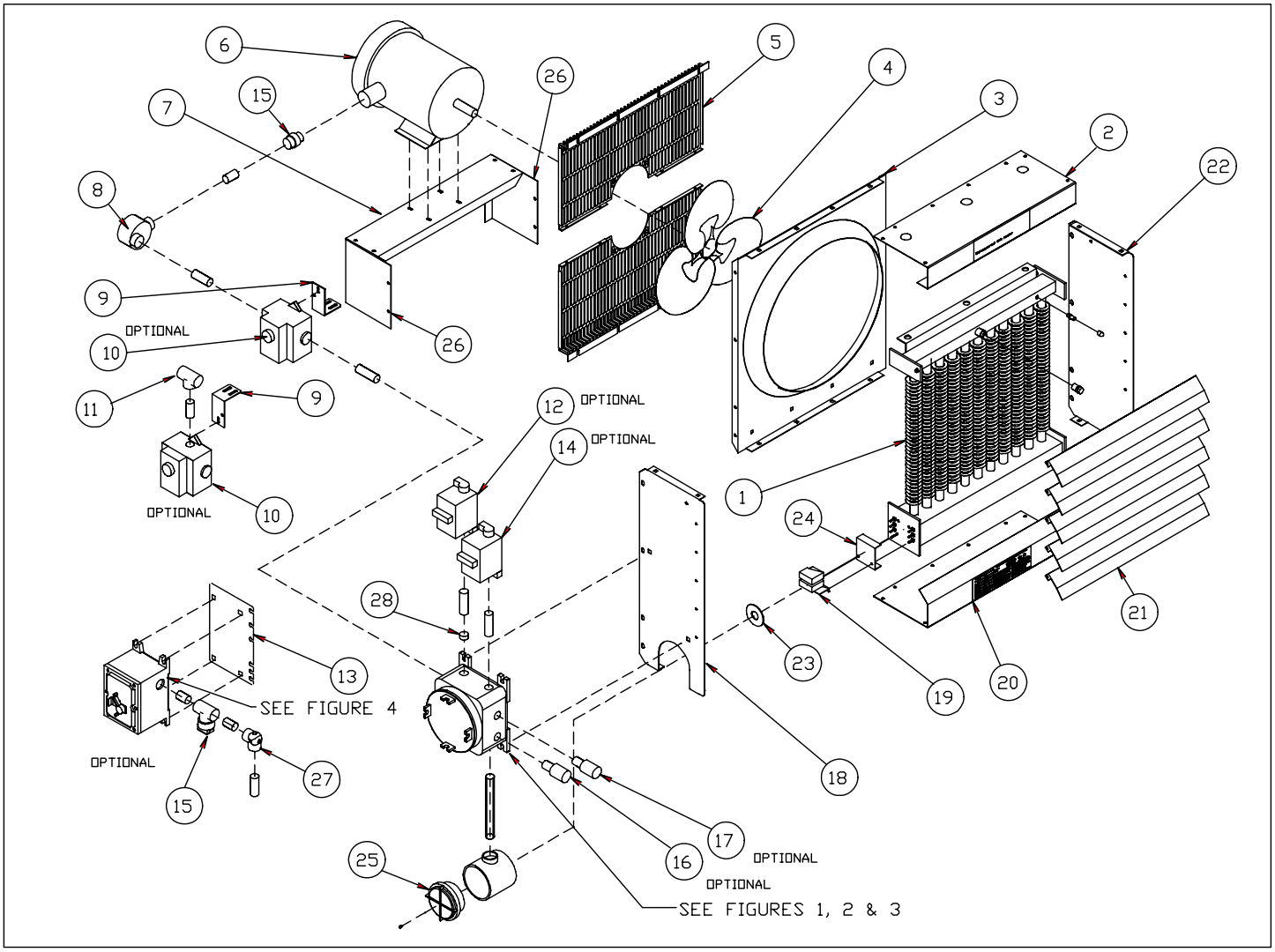
1. To replace the fan motor:
   a. Disconnect the heater electrical power supply.
   b. Disconnect the motor supply wires from the contactor in the wiring enclosure.
   c. Disassemble the conduit union located at the motor wiring hub.
   d. Remove top fan guard and motor mounting bolts.
   e. Lift motor out of heater assembly.
   f. Remove fan blade and conduit union from defective motor and install on new motor.
   g. Install new motor to heater using existing motor mounting hardware.
   h. Reinstall top fan guard and ensure that the fan blade rotates freely.
   i. Feed motor wires through conduit and into wiring enclosure.
   j. Reattach conduit union. Reconnect motor wires to contactor.
   k. Check fan rotation by momentarily energizing heater. Airflow should exit from front of heater cabinet. If rotation is incorrect, disconnect electrical power supply and reverse two of the motor lead wires at the contactor.
   l. Reattach wiring enclosure cover before placing heater back in service.

2. To replace the motor fan blade:
   a. Remove the top fan guard.
   b. Remove the four motor mounting bolts and disconnect the conduit union at the motor.
   c. Loosen the bolt that connects the fan blade to the motor shaft.
   d. Slide the motor back and tilt in order to remove the old blade & install a new one.
   e. Tighten the fan blade attachment bolt to the motor shaft.
   f. Reattach the motor conduit union and the four motor mounting bolts.
   g. Reinstall the top fan guard and ensure that the fan blade rotates freely.

REPLACEMENT PARTS

1. All replacements must be factory supplied to ensure safe heater operation.
2. Mark wires and refer to wiring diagram to ensure proper electrical connections.

Reference heater catalog number and item number in figures below when contacting factory for replacement parts. Contact factory for items not shown.



ITEM	DESCRIPTION
1	Heat Exchanger Core Assy.
2	Cabinet – Top
3	Fan Venturi
4	Fan Blade
5	Fan Guard
6	Fan Motor
7	Motor Support – Top
8	Motor Junction Box
9	Thermostat Support Bracket
10	Thermostat
11	Conduit Tee
12	Disconnect Switch – Small
13	Large Disconnect Support Bkt.
14	Fan Switch

ITEM	DESCRIPTION
15	Conduit Seal
16	Pilot Light – Bottom
17	Pilot Light – Top
18	Cabinet – Left Side
19	High Limit Cutout
20	Cabinet – Bottom
21	Cabinet - Louver
22	Cabinet – Right Side
23	High Limit Barrier
24	High Limit Mounting Bridge
25	Heater Enclosure Cover
26	Motor Support – Side
27	¾” Conduit Pull Elbow
28	Reducer Bushing

Select the Figure that corresponds to your heater.

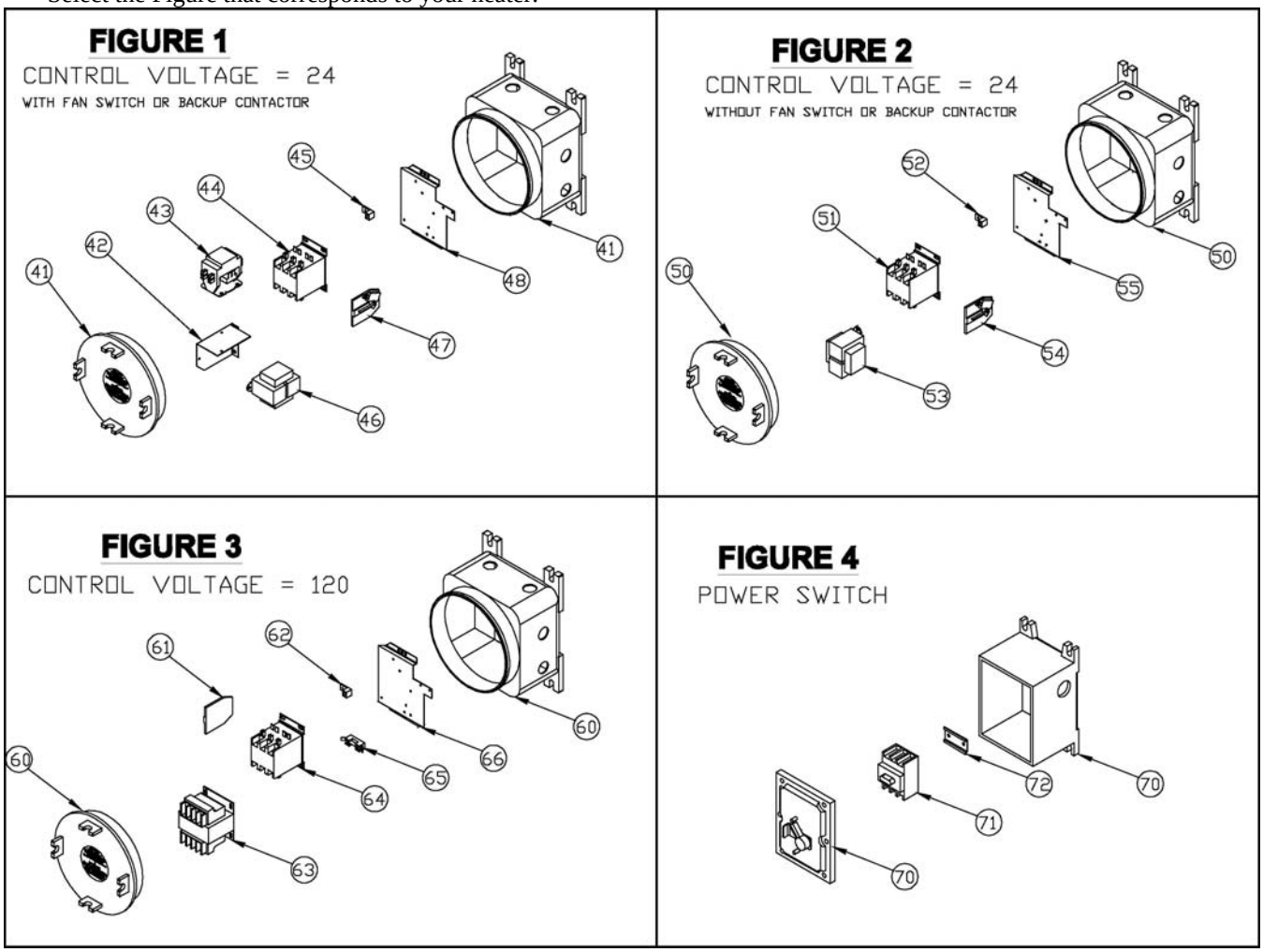


FIGURE 1:

ITEM	DESCRIPTION
41	Wiring Enclosure and Cover
42	Option Mounting Bridge
43	Option Contactor
44	Main Contactor
45	Ground Lug
46	Transformer
47	Auxiliary Contact
48	Main Mounting Bridge

FIGURE 2:

ITEM	DESCRIPTION
50	Wiring Enclosure and Cover
51	Main Contactor
52	Ground Lug
53	Transformer
54	Auxiliary Contact
55	Main Mounting Bridge

FIGURE 3:

ITEM	DESCRIPTION
60	Wiring Enclosure and Cover
61	Auxiliary Contact
62	Ground Lug
63	Transformer
64	Main Contactor
65	Transformer Fuse & Fuse Block
66	Main Mounting Bridge

FIGURE 4:

ITEM	DESCRIPTION
70	Switch Enclosure and Cover
71	Disconnect Switch
72	Disconnect Switch Track

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Standard - Non-corrosive applications

- Aircraft Hangars/Servicing Areas
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- Utility Plants

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- Oil Refineries
- Petrochemical Plants
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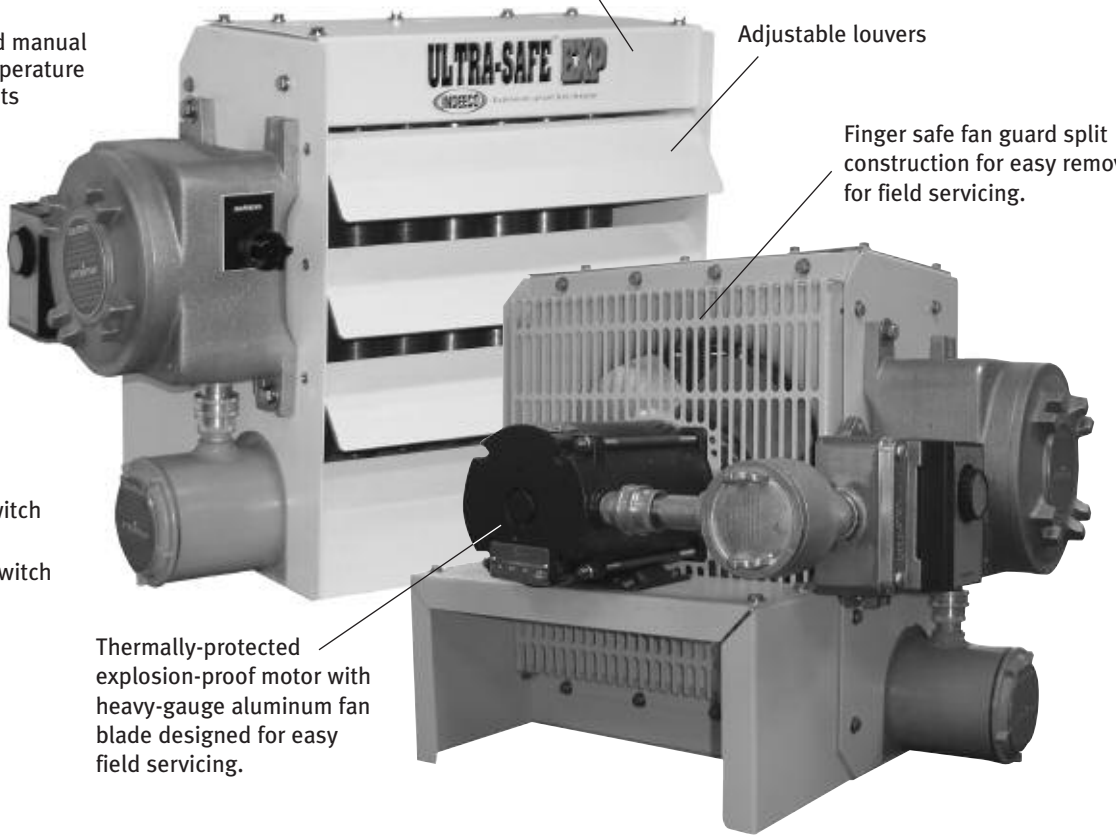
- Powder coated - standard
- 316 stainless steel or Heresite® coated - options

Standard
- 24VAC transformer
- Contactor
- Automatic and manual reset overtemperature thermal cutouts



Adjustable louvers

Finger safe fan guard split construction for easy removal for field servicing.

Optional
- Disconnect switch with lockout
- Fan selector switch
- Thermostat

Thermally-protected explosion-proof motor with heavy-gauge aluminum fan blade designed for easy field servicing.

Designed for Easy Servicing
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Heater Core

All welded construction with:
- Painted steel heaters with steel tubes and spiral wound aluminum fins - standard
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Core can be easily removed through bottom of cabinet

Heresite® is a registered trademark of Heresite® Protective Coatings, Inc.

Advantages/Applications

Experience

This catalog represents 75 years of experience in industrial electric heating – our specialty since INDEECO was founded in 1929. INDEECO has been manufacturing products for use in hazardous locations for over 50 years.

Complete Product Line

INDEECO offers the industry's most comprehensive line of space heating equipment. Explosion-proof unit heaters are available with ratings up to 30 KW and 600 volts. TRIAD® unit heaters provide heat in non-hazardous environments where moisture and corrosion are present. Standard unit heaters include a heavy duty industrial model, several commercial models, vertical, cabinet and portable designs. A wide range of floor, wall and ceiling heaters, including baseboard heaters and radiant ceiling panels, are available to meet any application requirement. INDEECO also offers the widest selection of built-in controls in the industry.

Quick Delivery

Popular stock unit heater and convector designs are available for 72 hour shipment. A wide selection of assembly stock designs with options are available in one or two weeks. Most comfort heating products will ship in two weeks.

Colors

Many of INDEECO's comfort heating products are available in a choice of colors. Standard and special colors are shown in the back of this catalog. Custom colors, including bronze or clear anodizing and matches to customer supplied paint samples, are also available on select heaters.

Safety

INDEECO explosion-proof unit heaters are Factory Mutual (FM) Approved and include redundant overtemperature protection which exceeds agency requirements. The ULTRA-SAFE™ EXP unit has the industry's lowest Ignition Temperature Code rating, 320°F (160°C), and is also CSA Approved.

INDEECO corrosion resistant heaters are available with UL and cUL Approvals. Explosion-proof and corrosion resistant heater designs are available for marine and shipboard use that are ABS Approved and meet U.S. Coast Guard requirements.

INDEECO commercial and industrial unit heaters are UL and cUL Approved for non-hazardous, non-corrosive environments. Comfort heating products are CSA_{US} or CSA Approved.

Hazardous and Corrosive Area Applications

- Aircraft Hangars/Service Areas
- Battery Storage Areas
- Chemical Plants
- Chemical Storage/Handling Areas
- Coal Mines/Preparation Plants
- Control Rooms
- Dry Cleaning Plants
- Dusty Areas Subject to Washdown
- Food Processing Plants (Washdown Areas)
- Foundries
- Gasoline Fueling/Storage Areas
- Grain Elevators
- Hydrogen Atmospheres
- Marine/Shipboard and Landbase Facilities
- Natural Gas (Methane) Atmospheres
- Oil Refineries
- Offshore Drilling Rigs
- Paint Spraying/Storage Areas
- Parking Garages
- Petrochemical Plants
- Pipeline Pumping Stations
- Pulp and Paper Mills
- Sewage/Wastewater Treatment Plants
- Solvent Recovery/ Storage Areas
- Utility Plants

Industrial and Commercial Applications

- Basements
- Classrooms
- Conference Rooms
- Entryways/Hallways
- Factories
- Lobbies
- Mechanical Rooms
- Offices
- Power Generating Stations
- Pump Houses
- Restrooms
- Service Stations/Garages
- Shipping and Receiving Areas
- Stairwells
- Storage Areas
- Vestibules
- Warehouses
- Workshops

Use of Electric Heaters
In Hazardous Locations

Introduction

Hazardous locations are those areas where a potential for explosion and fire exists due to the presence of flammable gases, vapors, pulverized dusts or ignitable fibers in the atmosphere. Hazardous locations are created from the normal processing of volatile chemicals, gases, coal, grains, etc., or from the accidental failure of storage systems for these materials.

Open flames are not permitted in these locations. The use of electric heating equipment is permitted with two major restrictions: 1) The surface temperature of the equipment cannot exceed the ignition temperature of the hazardous atmosphere and 2) all arc and spark producing devices must be isolated from the atmosphere in an appropriate enclosure.

Both people and equipment in hazardous locations can be heated safely and economically with electric heat. Electric heating is typically much less expensive to install and maintain than comparable remote oil or gas fired heating systems.

National Electrical Code Classification

Articles 500 through 516 of the National Electrical Code deal with the definition of hazardous areas and the use or design of electrical equipment used in these locations. Electric heating equipment for hazardous areas is specified based on the NEC class, division, group and ignition temperature or the alternate class and zone classification.

Class

Hazardous locations are divided into the three general classes of vapors/gases, dusts and fibers.

Class I – Locations where the potential for explosion and fire exists due to the presence of flammable gases or vapors in the air. Typical Class I locations include oil or natural gas drilling rigs, petroleum refining or pumping facilities, petrochemical plants, wastewater/sewage treatment plants, solvent extraction plants, paint spraying booths, locations where open tanks or vats of combustible liquids are present and storage areas for flammable materials.

Class II – Locations where the potential for explosion exists because of finely pulverized flammable dusts suspended in the atmosphere. Typical locations would include coal fired power plants, coal preparation/coal handling facilities, coal mines, grain elevators, flour and feed mills, packaging and handling of pulverized sugar and processing and storage of magnesium and aluminum powder.

Class III – This third classification is primarily a fire hazard where fibers or flyings suspended in the air create a hazard. This would include small pieces of thread-like fiber, sawdust, lint, etc. Typical applications would include textile mills, woodworking plants, cotton gins, cotton seed mills and flax producing plants.

Division

Class I, Class II and Class III areas are further defined in terms of when the hazard occurs. Division 1 and Division 2 occurrences are summarized below.

Division 1 – If the hazard is expected to be present under normal conditions, such as a production or processing facility, the occurrence is designated Division 1. The hazardous atmosphere may be present continuously, intermittently, periodically, or during normal repair or maintenance operations. Division 1 occurrences also include locations where a breakdown in the operation of processing equipment results in the release of hazardous vapors.

Division 2 – If the hazardous material is normally expected to be contained within a closed area, system or container, and would enter the ambient atmosphere only under an abnormal failure, then it is referred to as a Division 2 occurrence.

Use of Electric Heaters

In Hazardous Locations

Group

The nature and explosive characteristics of the hazardous material are defined by the NEC group to which it is assigned.

Class I – Hazardous gas locations include chemicals and other materials that have been divided into four groups based on their ignition temperature and explosive characteristics. (Groups A, B, C and D)

Class II – Hazardous dust locations are divided into three groups based on their ignition temperature and electrical conductivity of the suspended particles.

- **Group E** – Atmospheres containing metal dusts, such as aluminum and magnesium.
- **Group F** – Atmospheres containing coal, charcoal or coke dusts.
- **Group G** – Atmospheres with grain, flour, starch, combustible plastics or chemical dusts.

Class III – Locations have no group definitions.

Ignition Temperature

All electrical equipment is designed not to exceed the ignition temperature of the hazardous atmosphere. The maximum surface temperature for electric heaters is defined by the NEC.

Maximum Surface Temperature of Heater		NEC Ignition Temperature Code
°F	°C	
842	450	T1
572	300	T2
536	280	T2A
500	260	T2B
446	230	T2C
419	215	T2D
392	200	T3
356	180	T3A
329	165	T3B
320	160	T3C

Class and Zone Classifications

Class I, Zone 0 – Locations in which ignitable concentrations of flammable gases or vapors are present continuously or for long periods.

Class I, Zone 1 – Locations in which ignitable concentrations of flammable gases or vapors are likely to exist, may exist frequently or exist as a result of equipment breakdown or faulty operation. Applies to locations adjacent to a Class I, Zone 0 location.

Class I, Zone 2 – Locations in which ignitable concentrations of flammable gases or vapors are not likely to occur under normal operation, exist only for a short period or exist only as a result of accidental failure, such as rupture or breakdown of the container or system, abnormal operation of equipment, failure or abnormal operation of the ventilation equipment. Applies to locations adjacent to a Class I, Zone 1 location.

Material Groups

Group IIC – Atmospheres containing acetylene or hydrogen. Equivalent to a combination of Class I, Group A and Class I, Group B as described in NEC Article 500.

Group IIB – Atmospheres containing acetaldehyde. Equivalent to Class I, Group C as described in NEC Article 500.

Group IIA – Atmospheres containing acetone, ammonia, ethyl alcohol, gasoline, methane or propane. Equivalent to Class I, Group D as described in NEC Article 500.

Use of Electric Heaters
In Hazardous Locations

Special Requirements for Electric Heating Equipment used in Hazardous Areas

Electric heating equipment can be economically designed and safely used in hazardous areas if the following special requirements are observed.

1. The surface temperature of the electric heating equipment cannot exceed the ignition temperature of the hazardous atmosphere. To insure that the proper heater has been selected, it is essential that the correct NEC Ignition Temperature Code be specified.

   If the temperature code selected is too high, the electric heating system may operate above the ignition point of the application, creating a potentially hazardous condition.

2. All arc and spark-producing control devices must be isolated from the hazardous atmosphere. If it is not economically feasible to locate the control devices in the non-hazardous area, they must be housed in an enclosure that will withstand the pressure of a potential explosion from within the enclosure.

3. All electrical supply connections must be made according to the latest NEC and local code requirements for hazardous locations. This includes the requirement that conduit entering the enclosures must be provided with seals at the enclosure.

CLASS I — HAZARDOUS GAS ATMOSPHERES

Group	Material	Ignition Temp. °F	Ignition Temp. °C	NEC Code
A	Acetylene	581	305	T2
B	Acrolein (Inhibited)	428	220	T2D
	Butadiene	788	420	T2
	Ethylene Oxide	804	429	T2
	Hydrogen	932	500	T1
	Propylene Oxide	840	449	T2
	Propyl Nitrate	347	175	T3B
C	Acetaldehyde	347	175	T3B
	Allyl Alcohol	713	378	T2
	Carbon Monoxide	1128	609	T1
	Cyclopropane	928	498	T1
	Ethylene	842	450	T1
	Hydrogen Cyanide	1000	538	T1
	Hydrogen Sulfide	500	260	T2B
	2-Nitropropane	802	428	T2
	Tetrahydrofuran	610	321	T2
D	Acetic Acid (Glacia)	867	463	T1
	Acetone	869	465	T1
	Ammonia, Anhydrous	1204	651	T1
	Benzene	928	498	T1
	Butane	550	287	T2A
	1-Butanol (Butyl Alcohol)	650	343	T2
	2-Butanol (Secondary Butyl Alcohol)	761	405	T2
	Ethane	882	472	T1
	Ethanol (Ethyl Alcohol)	685	363	T2
	Ethyl Acetate	800	427	T2
	Ethylene Dichloride	775	413	T2
	Gasoline (56-60 Octane)	536	280	T2A
	Gasoline (100 Octane)	853	456	T1
	Heptanes	399	204	T3
	Hexanes	437	235	T2D
	Isoprene	428	220	T2D
	Isopropyl Ether	830	443	T2
	Methane (Natural Gas)	900-1170	482-632	T1
	Methanol (Methyl Alcohol)	867	464	T1
	3-Methyl-1-Butanol (Isoamyl Alcohol)	662	350	T2
	Methyl Ethyl Ketone	759	404	T2

CLASS I — HAZARDOUS GAS ATMOSPHERES (cont.)

Group	Material	Ignition Temp. °F	Ignition Temp. °C	NEC Code
D	Methyl Isobutyl Ketone	840	448	T2
	2-Methyl-1-Propanol (Isobutyl Alcohol)	780	415	T2
	Petroleum Naptha	550	288	T2A
	Pyridine	900	482	T1
	Octanes	403	206	T3
	Pentanes	500	260	T2B
	1-Pentanol (Amyl Alcohol)	650	343	T2
	Propane	842	450	T1
	1-Propanol (Propyl Alcohol)	775	412	T2
	2-Propanol (Isopropyl Alcohol)	750	399	T2
	Propylene	851	455	T1
	Styrene	914	490	T1
	Toluene	896	480	T1
	Vinyl Acetate	756	402	T2
	Vinyl Chloride	882	472	T1
	Xylenes	867-984	463-528	T1

CLASS II — HAZARDOUS DUST ATMOSPHERES

Group	Material	Ignition Temp. °F	Ignition Temp. °C	NEC Code
E	Aluminum, A422 Flake	608	320	T2
	Calcium Silicide	1004	540	T1
	Manganese	464	240	T2C
	Magnesium, Grade B, Milled	806	430	T2
F	Charcoal	356	180	T3A
	Coal, Kentucky Bituminous	356	180	T3A
	Coal, Pittsburgh Experimental	338	170	T3B
	Pitch, Petroleum	1166	630	T1
G	Alkyl Ketone Dimer Sizing Compound	320	160	T3C
	Corn	482	250	T2C
	Corn Starch, Modified	392	200	T3
	Polyurethane Foam, Fire Retardant	734	390	T2
	Shellac	752	400	T2
	Soy Flour	374	190	T3A
	Sugar, Powdered	698	370	T2
	Sulfur	428	220	T2D
	Wheat	428	220	T2D
	Wood Flour	500	260	T2B

The materials given are found in NFPA 497M, 1991 and NFPA 325, 1994.

AWD - Direct Drive

Fan Size	Catalog Number	Mtr. HP	Max. BHP	RPM	FA Sones	CFM vs. Static Pressure					
						0.000	0.125	0.250	0.375	0.500	0.750
12	12A17D	1/6	0.10	1725	13.4	1195	829	627	558		
16	16A11D	1/6	0.08	1140	8.1	1585	1022	663			
	16A11DA	1/6	0.15	1140	11.7	1987	1292	996			
	16A17D	1/4	0.26	1725	15.5	2398	2037	1644	1303	1079	
	16A17DB	1/2	0.61	1725	24	3007	2578	2108	1738	1592	1134
20	20A11D	1/6	0.20	1140	12.2	3179	2673	1991	1379		
	20A11DA	1/4	0.37	1140	14.2	3891	3290	2306	1775	1146	
	20A17D	1/4	0.29	1725	16.4	3010	2686	2374	2072	1755	1181
	20A17DA	1/3	0.39	1725	27	3602	3348	3121	2632	2321	
	20A17DB	1/2	0.66	1725	23	4811	4496	4160	3738	3299	
24	24A11D	1/4	0.29	1140	13.8	3663	3092	2625	2028	1666	
	24A11DA	1/3	0.40	1140	15.4	4522	3962	3338	2732	2158	
	24A11DB	1/2	0.62	1140	18.2	5969	5472	4703	3832	2958	
	24A11DC	3/4	0.74	1140	19.7	6570	6022	5168	4153	3237	
	24A11DD	1	1.10	1140	21	7185	6513	5431	4095	3519	2649
30	30A8D	3/4	0.80	860	18.6	8945	8045	6816	4671	3738	
	30A8DA	1	0.93	860	20	9830	8884	7168	5030		
	30A11D	3/4	0.83	1140	23	7822	7110	6308	5585	4709	
	30A11DA	1	1.13	1140	25	9359	8625	7870	7074	6131	
	30A11DB	1-1/2	1.66	1140	29	11099	10413	9692	8903	7687	
	30A11DC	2	2.18	1140	32	13030	12353	11563	10283	8950	5912
36	36A8D	1	1.02	860	22	11765	10629	9341	7719		
	36A8DA	1-1/2	1.59	860	25	14396	13226	11733	10363		
	36A11D	3/4	0.84	1140	27	9641	8391	7389	6424		
	36A11DA	1-1/2	1.56	1140	31	13151	12206	11254	10332	9295	
	36A11DB	2	2.23	1140	35	15595	14745	13873	12911	11851	
	36A11DC	3	3.43	1140	42	19084	18230	17291	16170	15085	
42	42A8D	1-1/2	1.71	860	27	16900	15549	14166	12703	11019	
	42A8DA	2	2.45	860	29	20547	19036	17452	16003	14400	
	42A8DB	3	3.17	860	33	22430	21228	19867	18288	16700	
	42A8DC	5	4.70	860	38	27000	25540	24010	22376	20470	
48	48A8D	2	2.25	860	30	21050	18978	17300	15643	13692	
	48A8DA	3	3.38	860	35	24800	23225	21571	19852	18055	
	48A8DB	5	5.72	860	42	33680	31846	30054	28301	26445	21342

Performance shown is for Installation Type A: free inlet, free outlet. Performance ratings do not include the effects of appurtenances in the airstream. The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for Installation Type A: free inlet fan sone levels.

COOK

Propeller Wall

Propeller Wall Fans

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

This publication contains the installation, operation and maintenance procedures for standard units of the *Propeller Wall and X.Stream- Propeller Wall Fans*.

- **APD**
- **APB**
- **SPB**
- **AWBS/AWBE**
- **EWBSM**
- **SPD**
- **SWDS**
- **EWB**
- **XLW/XMW/XLWS/XMWS**
- **EWD**
- **XLP/XMP/XLPS/XMPS**
- **EPB**
- **XLWHS/XMWHS**
- **EPD**
- **XLWH/XMWH**
- **SWD**
- **XLPH/XMPH**
- **XLPHS/XMPHS**

Carefully read this publication prior to any installation or maintenance procedure.

Loren Cook catalog, *Propeller Wall* and *X.Stream*, provides additional information describing the equipment, fan performance, available accessories and specification data.

For additional safety information, refer to AMCA publication 410-96, *Safety Practices for Users and Installers of Industrial and Commercial Fans*.

All of the publications listed above can be obtained from Loren Cook Company by phoning 417.869.6474, extension 166; by FAX at 417.832.9431; or by e-mail at info@lorencook.com.

For information and instructions on special equipment, contact Loren Cook Company at 417.869.6474.

Receiving and Inspection

Carefully inspect the fan and accessories for any damage and shortage immediately upon receipt of the fan.

- Turn the propeller by hand to ensure it turns freely and does not bind.
- Record on the *Delivery Receipt* any visible sign of damage.

Handling

Lift propeller wall fans by attachment to the power assembly or by the shipping carton. Never lift by the shaft, motor or housing.

Storage

If the fan is stored for any length of time prior to installation, coat the shaft with grease or a rust preventative compound. Store it in its original shipping crate and protect it from dust, debris and the weather.

Rotate the wheel several revolutions every three to five days to keep a coating of grease on all internal bearing parts.

WARNING

This unit has rotating parts. Safety precautions should be exercised at all times during installation, operation, and maintenance.
ALWAYS disconnect power prior to working on fan.

Installation

Fans mounted to a wall require a different wall opening size than fans mounted in wall collars or wall housings. For specific dimensions, refer to the submittal drawing for the specific fan type.

Motor Installation

To prevent damage to the fan during shipping, motors 5 HP and larger, and extremely heavy motors (cast iron or severe duty) are shipped loose and must be field mounted by bolting the motor on the motor mounting plate in the existing slots.

The motor should be mounted in order that the motor plate is between the fan shaft and the motor shaft.

a. Remove the motor plate mounting bolts and motor plate.
b. Remove the motor mounting bolts from the motor plate.
c. Mount the motor to the motor plate aligning the appropriate holes.
d. Place the motor plate on the power assembly and reinstall the mounting bolts.

Personal Safety

Disconnect switches are recommended. Place the disconnect switch near the fan in order that the power can be swiftly cut off in case of an emergency, and in order that maintenance personnel are provided complete control of the power source.

AWB

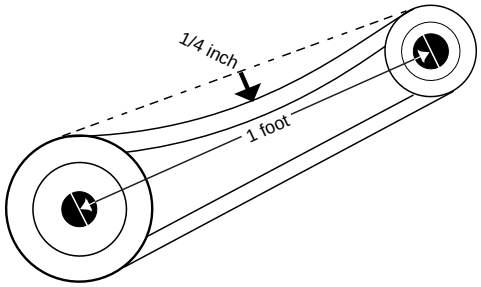


Figure 1

Belt and Pulley Installation

Belt tension is determined by the sound of the belts when the fan is first started. The belts will produce a loud squeal, which dissipates after the fan is operating at full capacity. If belt tension is too tight or too loose, lost efficiency and damage can occur.

Do not change the pulley pitch diameter to change tension. The change will result in a different fan speed.

a. Loosen the motor plate adjustment nuts on motor base and move motor plate in order that the belts can easily slip into the grooves on the pulleys. Never pry, roll, or force the belts over the rim of the pulley.
b. Adjust the motor plate until proper tension is reached. For proper tension, a deflection of approximately 1/4" per foot of center distance should be obtained by firmly pressing the belt. Refer to *Figure 1*.
c. Lock the motor plate adjustment nuts in place.
d. Ensure pulleys are properly aligned. Refer to *Figure 2*.

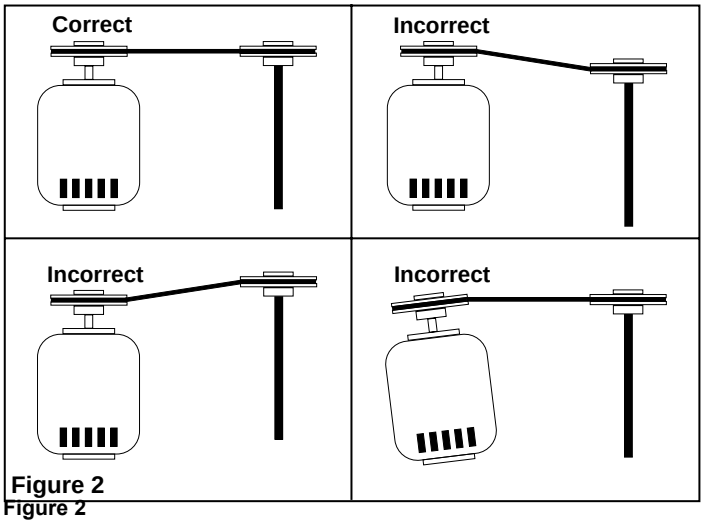


Figure 2

Figure 2

Pulley Alignment

Pulley alignment is adjusted by loosening the motor pulley setscrew and by moving the motor pulley on the motor shaft or by moving the entire motor along the motor mounting bracket.

Figure 2 illustrates correct and incorrect pulley alignment. A recommended method of inspecting the pulley alignment is shown in Figure 3. With the shorter leg of a carpenter's square or other straight edge lying along the case of the motor, adjust the position of the motor pulley (or the motor) until the longer leg of the square is parallel to the belt.

Fan Installation

Insert the fan into the wall opening and secure with lag screws, anchor bolts, or other suitable fasteners.

Always mount belt drive wall fans in order that the motor base is below the fan shaft.

Wiring Installation

All wiring should be in accordance with local ordinances and the National Electrical Code, NFPA 70. Ensure the power supply (voltage, frequency, and current carrying capacity of wires) is in accordance with the motor nameplate. Refer to the *Wiring Diagrams*, next page.

Lock off all power sources before unit is wired to power source.

Leave enough slack in the wiring to allow for motor movement when adjusting belt tension. Some fractional motors have to be removed in order to make the connection with the terminal box at the end of the motor.

Personal Safety

Disconnect switches are recommended. Place the disconnect switch near the fan in order that the power can be swiftly cut off in case of an emergency, and in order that maintenance personnel are provided complete control of the power source.

Follow the wiring diagram in the disconnect switch and the wiring diagram provided with the motor. Correctly label the circuit on the main power box and always identify a closed switch to promote safety (i.e., red tape over a closed switch).

Wall Fans

a. Extend wires to the fan.
b. Prevent excess wire from entering the shaft and propeller area by restraining the excess wire to a point outside the base.

Wall Fans with Wire Guard

a. Remove end panel from the wire guard to gain access to the motor.
b. Extend wires through a side panel of the wire guard to gain access to the motor.
c. Prevent excess wire from entering the shaft and propeller area by restraining the excess wire to a point outside the base.

Wall Fans with Wall Housing

a. Remove end guard from the wall housing.
b. Drill a hole through either side panel at a convenient location and pull the wires through. Do not pull wires through wire guard at the back panel.
c. Restrain the incoming wire at the side panel to prevent excess wire from entering the shaft and propeller area.

Shutter Installation

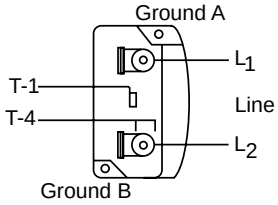
If your fan is supplied with a shutter, follow the direction below. If your fan is not supplied with a shutter, proceed to *Final Installation Steps*.

To ensure long-life, make a weather-proof seal by using a good quality silicon caulking under the shutter flange.

a. Place the shutter into the wall opening.
b. Mount the shutter to the supporting surface using Num-

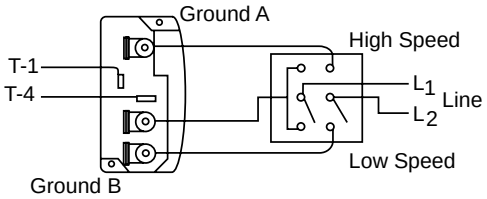
Wiring Diagrams

Single Speed, Single Phase Motor



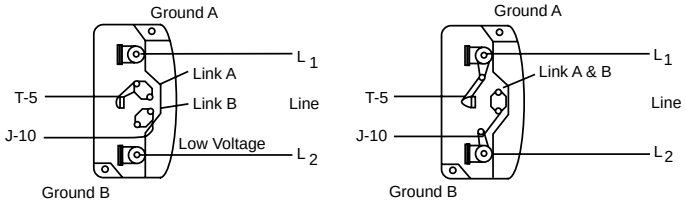
When ground is required, attach to ground A or B with no. 6 thread forming screw. To reverse, interchange T-1 and T-4.

2 Speed, 2 Winding, Single Phase Motor



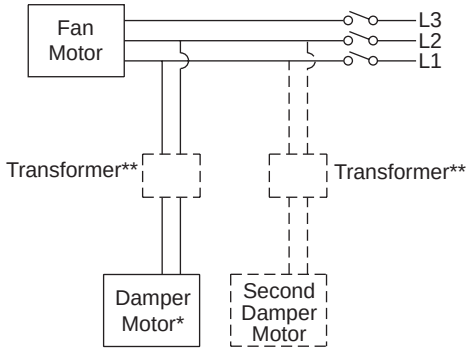
When ground required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

Single Speed, Single Phase, Dual Voltage



When ground required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-5 and J-10 leads.

Typical Damper Motor Schematic



b. Mount the shutter to the supporting surface using Number 12 sheet metal screws on six inch centers around the perimeter.

c. Manually operate the shutter to ensure the blades move freely.

Typical Installation

Refer to page 5.

Final Installation Steps

a. Inspect fasteners and setscrews, particularly fan mounting and bearing fasteners, and tighten according to the recommended torque shown in the table on page 4, *Recommended Torque for Setscrews/Bolts*.

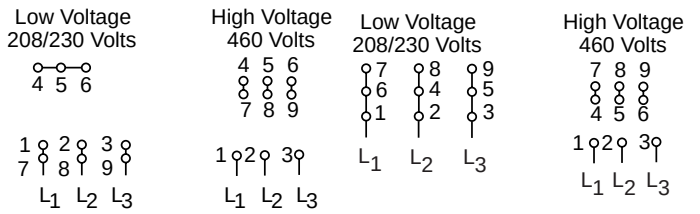
b. Inspect for correct voltage with voltmeter.

c. Ensure all accessories are installed.

d. Test the fan to be sure the rotation is the same as indicated by the arrow marked **Rotation**.

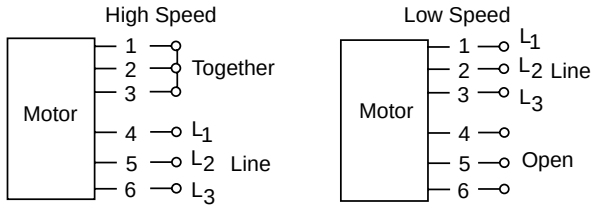
Wiring Diagrams

3 Phase, 9 Lead Motor



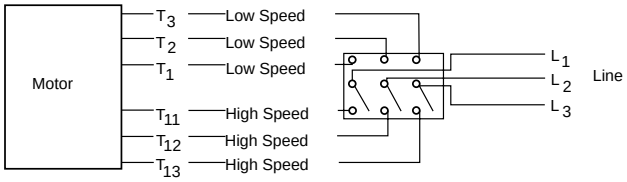
To reverse, interchange any 2 line leads.

2 Speed, 1 Winding, 3 Phase Motor



To reverse, interchange any 2 line leads. Motors require magnetic control.

2 Speed, 2 Winding, 3 Phase



To reverse: High Speed-interchange leads T_{11} and T_{12}.
Low Speed-interchange leads T_1 and T_2. Both Speeds-interchange any 2 line leads.

For 3 phase, damper motor voltage should be the same between L_1 and L_2. For single phase application, disregard L_3. *Damper motors may be available in 115, 230 and 460 volt models. The damper motor nameplate voltage should be verified prior to connection. **A transformer may be provided in some installations to correct the damper motor voltage to the specified voltage.

Do not allow the fan to run in the wrong direction. This will overheat the motor and cause serious damage. For 3-phase motors, if the fan is running in the wrong direction, check the control switch. It is possible to interchange two leads at this location so that the fan is operating in the correct direction.

Operation

Pre-Start Checks

a. Lock out all the primary and secondary power sources.

b. Inspect fasteners and setscrews, particularly those used for mounting the unit, and tighten if necessary.

c. Inspect belt tension and pulley alignment. (Remember, if belt tension is correct, a loud squeal occurs as the fan increases to full power.)

d. Inspect motor wiring.

e. Ensure the belt touches only the pulleys.

f. Rotate the prop to ensure it does not rub against the venturi.

g. Ensure fan and ductwork are clean and free of debris.
h. Test the fan to ensure the rotation of the propeller is the same as indicated by the rotation label.
i. Close and secure all access doors.
j. Restore power to unit.

Start Up

Turn the fan on. In variable speed units, set the fan to its lowest speed. Inspect for the following:

- Direction of rotation.
- Excessive vibration.
- Unusual noise.
- Bearing noise.
- Improper belt alignment or tension (listen for a continuous squealing noise).
- Improper motor amperage or voltage.

If a problem is discovered, immediately shut off the fan. Lock out all electrical power and check for the cause of the trouble. Refer to *Troubleshooting,* page 7.

Recommended Torque for Setscrews/Bolts (IN/LB.)

Setscrews				Hold Down Bolts	
Size	Key Hex Across Flats	Recommended Torque Inch-lbs.			
		Min.	Max.	Size	Wrench Torque (inch-lbs)
No.10	3/32”	28	33	3/8”-16	240
1/4”	1/8”	66	80	1/2”-13	600
5/16”	5/32”	126	156	5/8”-11	1200
3/8”	3/16”	228	275	3/4”-10	2100
7/16”	7/32”	348	384	7/8”-9	2040
1/2”	1/4”	504	600	1”-8	3000
5/8”	5/16”	1104	1200	1-1/8”-7	4200
3/4”	3/8”	1440	1800	1-1/4”-7	6000

Inspection

Inspection of the fan should be conducted at the first **30 minute, 8 hour** and **24 hour** intervals of satisfactory operation. During the inspections, stop the fan and inspect as per directions below.

30 Minute Interval

Inspect bolts, setscrews, and motor mounting bolts. Adjust and tighten as necessary.

8 Hour Interval

Inspect belt alignment and tension. Adjust and tighten as necessary.

24 Hour Interval

Inspect belt tension. Adjust and tighten as necessary.

Maintenance

Establish a schedule for inspecting all parts of the fan.The frequency of inspection depends on the operating conditions and location of the fan.

Inspect fans exhausting corrosive or contaminated air within the first month of operation. Fans exhausting contaminated air (airborne abrasives) should be inspected every three months. Clean the propeller and air inlets if material build-up is excessive. Excessive build-up can cause imbalance and failure of the propeller.

Regular inspections are recommended for fans exhausting non-contaminated air.

It is recommended the following inspections be conducted twice per year.

- Inspect bolts and setscrews for tightness. Tighten as necessary.
- Inspect belt wear and alignment. Replace worn belts with new belts and adjust alignment as needed. See *Belt and Pulley Installation*, on page 2.
- Bearings should be inspected as recommended in the *Conditions Chart*, below.
- Inspect for cleanliness. Clean exterior surfaces only. Removing dust and grease on motor housing assures proper motor cooling.

Lubricants

Loren Cook Company uses petroleum lubricant in a lithium base conforming to NLGI grade 2 consistency. Other grades of grease should not be used unless the bearings and lines have been flushed clean. If another grade of grease is used, it should be lithium-based.

A NLGI grade 2 grease is a light viscosity, low-torque, rust-inhibiting lubricant that is water resistant. Its temperature range is from -30°F to +200°F and capable of intermittent highs of +250°F.

Motor Bearings

Motor bearings are pre-lubricated and sealed. Under normal conditions they will not require further maintenance for a period of ten years. However, it is advisable to have your maintenance department remove and disassemble the motor, and lubricate the bearings after three years of operation in excessive heat and or in a contaminated airstream consisting of airborne abrasives.

Conditions Chart

RPM	Temperature	Fan Status	Greasing Interval
Up to 100	Up to 120°F	Clean	6 to 12 months
Up to 500	Up to 150°F	Clean	2 to 6 months
Up to 1000	Up to 210°F	Clean	2 weeks to 2 months
Up to 1500	Over 210°F	Clean	Weekly
Any Speed	Up to 150°F	Dirty	1 week to 1 month
Any Speed	Over 150°F	Dirty	Daily to 2 weeks
Any Speed	Any Temperature	Very Dirty	Daily to 2 weeks
Any Speed	Any Temperature	Extreme Conditions	Daily to 2 weeks

Fan Bearings

Greasable fan bearings are lubricated through a grease connector and should be lubricated by the schedule, *Conditions Chart*, on page 4.

For best results, lubricate the bearing while the fan is rotating. Slowly pump grease into the bearing until a slight bead forms around the bearing seals. Excessive grease can burst seals thus reduce bearing life.

In the event the bearing cannot be seen, use no more than three injections with a hand-operated grease gun.

Motor Services

Should the motor prove defective within a one-year period, contact your local Loren Cook representative or your nearest authorized electric motor service representative.

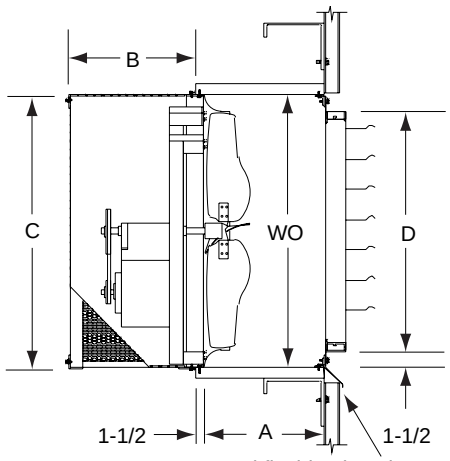
Changing Shaft Speed

All belt driven Propeller Wall fans with motors up to and including 5HP are equipped with variable pitch pulleys. To change the fan speed, perform the following:

a. Loosen setscrew on driver (motor) pulley and remove key, if equipped.

Exhaust wall fan with OSHA wire guard and shutter

Illustrated is the typical installation of an exhaust wall fan with an OSHA wire guard and shutter in a steel structure with corrugated siding. The installer will provide a sleeve of suitable material to support the fan at a correct distance from the shutter (minimum distance is the “A” dimension).

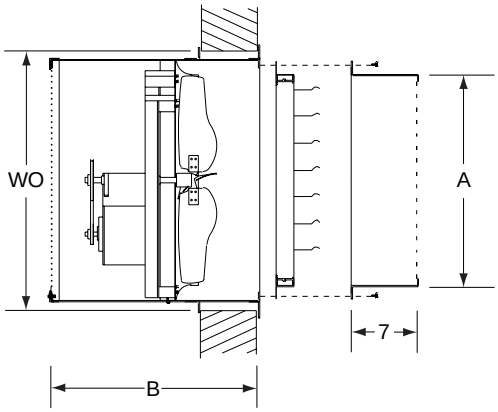


Fan support and flashing by others.

AWB, AWD SWD	XLW, XLWH XMW, XMWH	EWB EWD	A	B	C	D	E	WO	
								Std. Fan	Wire Gd.
8	-	-	11	13	12-3/4	10	1	12-1/2	13-1/4
10-12	-	-	12	13	16-3/4	14	1	16-7/16	17-1/4
14-16	-	-	12	13	20-3/4	18	1	20-7/16	21-1/4
18-20	-	-	13	12	24-3/4	22	1	24-7/16	25-1/4
-	20	-	13	21	24-3/4	22	1	24-7/16	25-1/4
24	-	-	15	21	30-3/4	27	1-1/2	30-7/16	31-1/4
-	24	-	15	13	30-3/4	27	1-1/2	30-7/16	31-1/4
30	30	24	16	21	36-3/4	33	1-1/2	36-7/16	37-1/4
36	36	30	16	21	42-3/4	39	1-1/2	42-7/16	43-1/4
42	42	36	17	26	48-7/8	45	1-1/2	48-7/16	49-1/4
48	48	42	17	26	54-7/8	51	1-1/2	54-7/16	55-5/16
-	54	48	17	28	60-7/8	57	1-1/2	60-7/16	61-5/16
-	60	54	17	28	66-7/8	63	1-1/2	66-7/16	67-1/2
-	-	60	17	28	72-7/8	69	1-1/2	72-7/16	73-1/2
-	-	72	17	31	84-7/8	81	1-1/2	84-7/16	85-1/2

Exhaust Pac-Fan with shutter guard

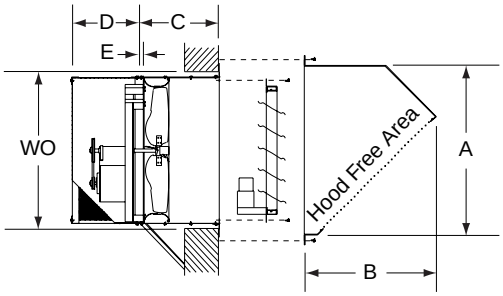
Illustrated is the typical installation of an exhaust PAC-Fan in a masonry wall with a shutter guard. The installer provides suitable fasteners (Hex bolts or Lag screws) to support the fan. It is recommended that 5/16” minimum bolts on 6” to 10” centers be used on the perimeter of the housing. Mounting flange should be caulked to exterior of the wall. Fans with motors in excess of 80 lbs. should be additionally supported by hanging rods or supports placed underneath the fan.



APB, APD, SPD	XLP, XLPH, XMP, XMPH	EPB, EPD	A	B- Direct	B-Belt	WO
8	-	-	10-5/8	13-5/8	-	13-1/4
10-12	-	-	14-5/8	17-5/8	-	17-1/4
14-16	-	-	18-5/8	20	-	21-1/4
18-20	20	-	22-5/8	22	34-1/4	25-1/4
24	24	-	27-7/8	23	34-1/4	31-1/4
30	30	24	33-7/8	24-3/8	37-7/8	37-1/4
36	36	30	39-7/8	28-3/8	39-3/8	43-1/4
42	42	36	45-7/8	33-5/8	40-5/8	49-1/4
48	48	42	51-7/8	39-5/8	50-5/8	55-5/16
-	54	48	57-7/8	40-1/8	47-3/4	61-5/16
-	60	54	63-7/8	44-3/4	47-3/4	67-1/2
-	-	60	69-7/8	-	47-3/4	73-1/2
-	-	72	81-7/8	-	50-3/4	85-1/2

Supply wall fan with wall collar, OSHA wire guard, motorized supply shutter and weather hood

Illustrated is the typical installation of a supply wall fan in a masonry wall with a wall collar, OSHA wire guard, motorized supply shutter and weather hood. The installer provides suitable fasteners to support the fan. Fasteners should be placed on 6” to 10 centers on the perimeter of the wall collar. Wall collar should be caulked to the exterior of the wall. The weather hood should be securely fastened and sealed to the wall. Fans with motors in excess of 80 lbs. should be additionally supported by hanging rods or supports placed underneath the fan.



AWB, AWD, SWD	XLW, XLWH XMW, XMWH	EWB, EWD	A	B	C	D	E	WO
8	-	-	18	16	12	13	1	13-1/4
10-12	-	-	22	18-3/4	14-3/8	13	1	17-1/4
14-16	-	-	26	21-3/4	15-3/8	13	1	21-1/4
18-20	-	-	30	24-1/2	17-5/8	13	1	25-1/4
-	20	-	30	24-1/2	17-5/8	21	1	25-1/4
24	-	-	30	24-1/2	17-5/8	13	1-1/2	31-1/4
-	24	-	34	27-1/4	18-3/4	21	1-1/2	31-1/4
30	30	24	40	31-1/2	18-3/4	21	1-1/2	37-1/4
36	36	30	46	35-3/4	19-1/2	21	1-1/2	43-1/4
42	42	36	52	40	19-1/2	26	1-1/2	49-1/4
48	48	42	58	44-1/4	19-3/4	26	1-1/2	55-5/16
-	54	48	64	48-1/2	19-3/4	28	1-1/2	61-5/16
-	60	54	70	52-3/4	19-3/4	28	1-1/2	67-1/2
-	-	60	76	57	19-3/4	28	1-1/2	73-1/2
-	-	72	88	67-1/2	19-3/4	31	1-1/2	85-1/2

Changing Shaft Speed continued

b. Turn the pulley rim to open or close the groove facing. If the pulley has multiple grooves, all must be adjusted to the same width.

c. After adjustment, inspect for proper belt tension.

Speed Reduction

Open the pulley in order that the belt rides deeper in the groove (smaller pitch diameter).

Speed Increase

Close the pulley in order that the belt rides higher in the groove (larger pitch diameter). Ensure that the RPM limits of the fan and the horsepower limits of the motor are maintained.

Pulley and Belt Replacement

Maximum RPM

SWD Size	Maximum RPM	EWB Size	Maximum RPM	AWB Size	Maximum RPM
8	1690	24	1675	24	1510
10	1550	30	1370	30	1145
12	1615	36	1310	36	990
14	1130	42	1175	42	905
16	1115	48	1215	48	900
18	1095	54	960	-	-
20	1075	60	890	-	-
24	1050	72	700	-	-

Maximum RPM

APB Size	Maximum RPM	XLP/XLPS Size	Maximum RPM	XLPH/XLPHS Size	Maximum RPM
24	1005	20	1280	-	-
30	800	24	1012	24	1110
36	645	30	666	30	930
42	660	36	566	36	714
48	605	42	424	42	610
-	-	48	356	48	512
-	-	54	316	54	472
-	-	60	260	60	446

Maximum RPM

XMP/XMPS Size	Maximum RPM	XMPH/ XMPHS Size	Maximum RPM	XLW/ XLWS Size	Maximum RPM
20	1280	-	-	20	1276
24	1276	24	1410	24	1018
30	830	30	1172	30	674
36	680	36	838	36	570
42	498	42	716	42	422
48	414	48	596	48	356
54	346	54	516	54	320
60	318	60	474	60	256

Maximum RPM

XLWH/ XLWHS Size	Maximum RPM	XMW/ XMWHS Size	Maximum RPM	XMWH/ XMWHS Size	Maximum RPM
-	-	20	1462	-	-
24	1126	24	1272	24	1400
30	932	30	860	30	1184
36	720	36	672	36	864
42	610	42	498	42	718
48	516	48	416	48	600
54	478	54	350	54	522
60	438	60	320	60	476

a. Clean the motor and fan shafts.

b. Loosen the motor plate mounting bolts to relieve the belt tension. Remove the belt.

c. Loosen the pulley setscrews and remove the pulleys from the shaft.

If excessive force is required to remove the pulleys, a three-jaw puller can be used. This tool, however, can easily warp a pulley. If the puller is used, inspect the trueness of the pulley after it is removed from the shaft. The pulley will need replacement if it is more than 0.020 inch out of true.

d. Clean the bores of the pulleys and place a light coat of oil on the bores.

e. Remove grease, rust and burrs from the shaft.

f. Place fan pulley on the fan shaft and the motor pulley on the motor shaft. Damage to the pulleys can occur when excessive force is used in placing the pulleys on their respective shafts.

g. After the pulleys have been correctly placed back onto their shafts, tighten the pulley setscrews.

h. Install the belts on the pulleys. Align and adjust the belts to the proper tension as described in *Belt and Pulley Installation*, page 2.

Bearing Replacement

The fan bearings are pillow block ball bearings.

a. Mark the position of the shaft in reference to both the bearing races and the propeller and pulley. Make a note of the clearance between the propeller and the frame.

b. Remove the pulley.

c. Remove the propeller from the shaft. A two-jaw puller may be needed to remove the propeller from the shaft.

d. Remove the bearing hold-down bolts. Remove the shaft and the bearings as one unit.

e. Remove the anti-corrosion coating from the shaft with a suitable degreaser.

f. Remove the bearing from the shaft using a bearing puller. If a bearing puller is not available, remove the bearing by using a wood block and hammer. An emery cloth or file may be needed to remove imperfections in the shaft left by the setscrews.

g. Clean the shaft and bearing bore thoroughly.

h. Place the bearings into position ensuring they are not on a worn section of the shaft. Tapping the inner ring face with a soft driver may be required. Do not hammer on the housing.

i. The outer ring of the bearing is spherical and swivels in the housing to compensate for misalignment. Slightly tighten the hold down bolts.

j. Align the setscrews on the bearings and tighten one setscrew on each bearing.

k. Rotate the shaft to allow the bearing outer rings to find the center of free movement.

l. Install the propeller on the shaft and adjust the bearing position to center the propeller in the opening.

m. Tighten the hold-down bolts to the proper torque. Refer to the *Torque Chart*, page 4.

n. Turn the shaft by hand. Resistance should be the same as it was before the hold-down bolts were fully tightened.

o. Tighten the bearing setscrews to the specified torque.

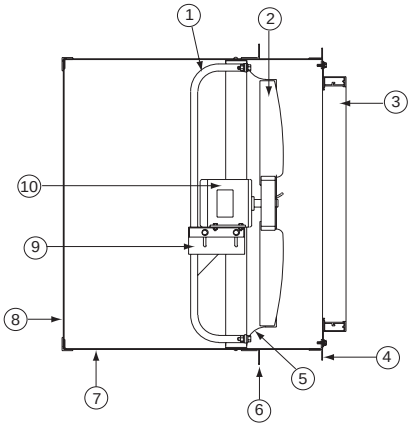
p. Install the pulley and adjust the belt tension.

After 24 hours of continuous operation, tighten the setscrews to the appropriate torque. This assures the full locking of the inner race to the shaft. Ensure the socket key or driver is in good condition with no rounded corners. The key should be fully engaged in the setscrew and held squarely to prevent the rounding out of the setscrew socket when applying maximum torque.

Troubleshooting

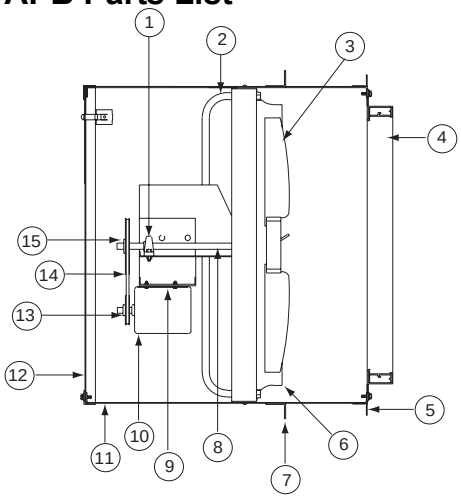
Problem and Potential Cause	
Low Capacity or Pressure •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Poor fan inlet conditions. There should be a straight clear duct at the inlet. •Improper propeller alignment.	**Overheated Motor** •Motor improperly wired. •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Cooling air diverted or blocked.
Excessive Vibration and Noise •Damaged or unbalanced propeller. •Belts too loose; worn or oily belts. •Speed too high. •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Bearings need lubrication or replacement. •Fan surge.	**Overheated Bearings** •Improper bearing lubrication •Excessive belt tension.

APD Parts List



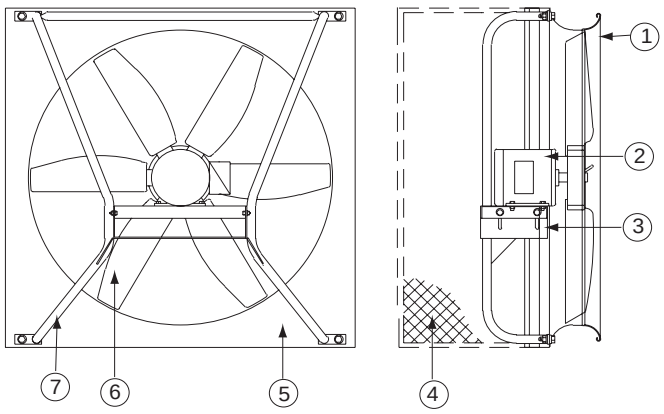
Parts No.	Description	Parts No.	Description
	APD Sizes 16-36		**APD Sizes 16-36**
1	Power Assembly	6	Anchor Angles (2)
2	Propeller	7	Fan Box Panel (4)
3	Shutter Assembly	8	End Wire Guard
4	Mounting Collar Angles (4)	9	Motor Plate
5	Wall Base	10	Motor

APB Parts List



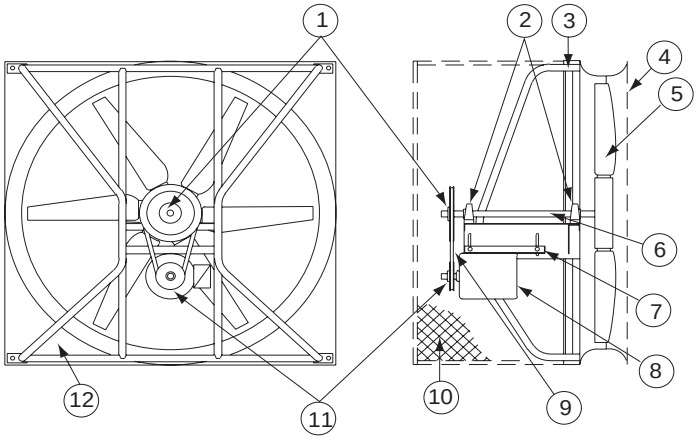
Parts No.	Description	Parts No.	Description
	APB Sizes 24-48		**APB Sizes 24-48**
1	Bearings (2)	9	Motor Plate
2	Power Assembly	10	Motor
3	Propeller	11	Fan Box Panel (4)
4	Shutter Assembly	12	End Wire Guard
5	Mounting Collar Angles (4)	13	Driver Sheave
6	Wall Base	14	Belt Set
7	Anchor Angles (2)	15	Driven Sheave
8	Shaft		

AWDS and AWDE Parts List



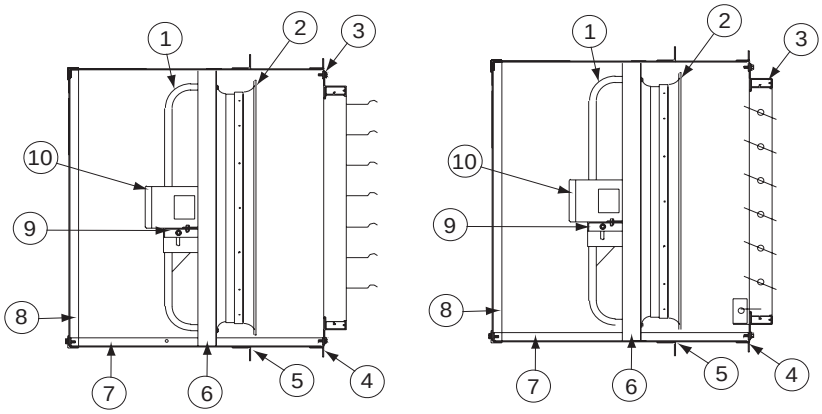
Parts No.	Description	
	AWDS	**AWDE**
1	Supply Venturi	—
2	Motor	Motor
3	Motor Plate	Motor Plate
4	Optional Wire Guard	Birdscreen
5	Wall Base	Wall Base
6	Cast Aluminum Propeller	Cast Aluminum Propeller
7	Power Assembly	Power Assembly

AWBS and AWBE Parts List



Part No.	Description	
	AWBS	AWBE
1	Driven Sheave	Driven Sheave
2	Bearings (2)	Bearings (2)
3	Power Assembly	Power Assembly
4	Supply Venturi	—
5	Propeller	Propeller
6	Shaft	Shaft
7	Motor Plate	Motor Plate
8	Motor	Motor
9	Belt Set	Belt Set
10	Optional Wire Guard	Birdscreen
11	Driver Sheave	Driver Sheave
12	Wall Base	Wall Base

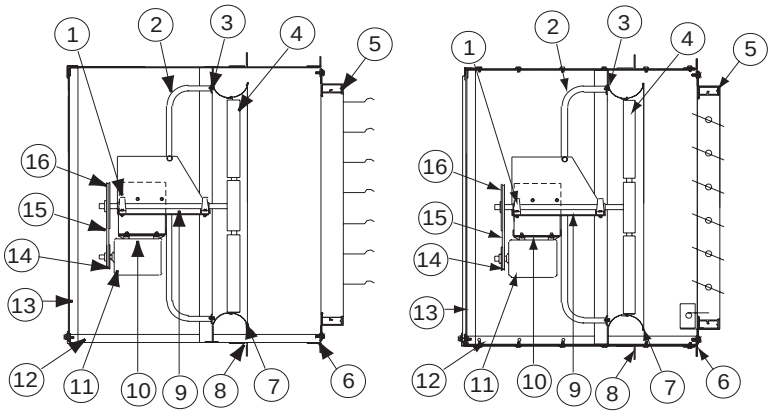
EPD Parts List



Supply

Part No.	Description
	EPD
1	Power Assembly
2	Supplemental Venturi
3	Shutter Assembly
4	Mounting Collar Angles (4)
5	Anchor Angles (2)
6	Wall Base
7	Fan Box Panel (4)
8	End Wire Guard
9	Motor Plate
10	Motor
11	Wall Base
	Propeller (Not Shown)

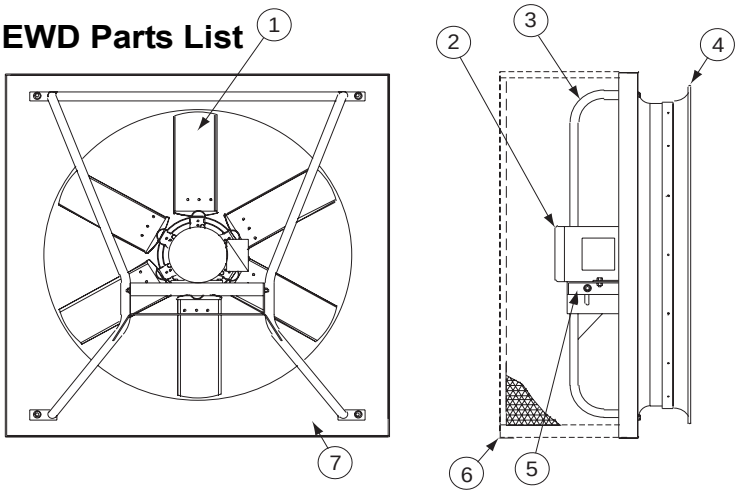
EPB Parts List



Supply

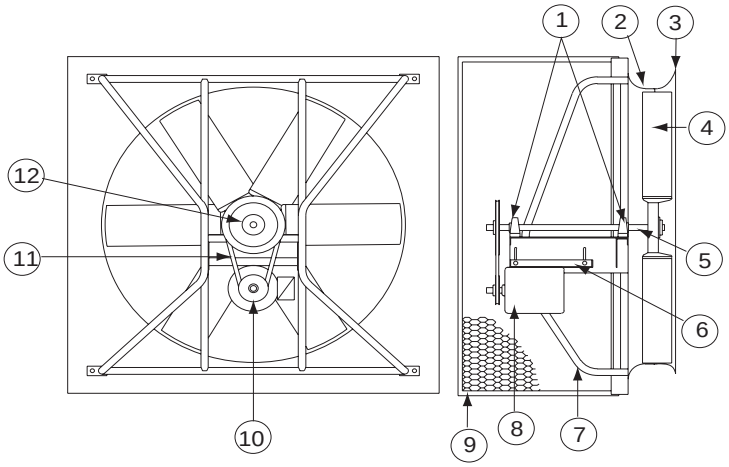
Part No.	Description
	EPB
1	Bearings (2)
2	Power Assembly
3	Wall Base
4	Propeller
5	Shutter Assembly
6	Mounting Collar Angles (4)
7	Supplemental Venturi
8	Anchor Angles (2)
9	Shaft
10	Motor Plate
11	Motor
12	Fan Box Panel (4)
13	End Wire Guard
14	Driver Sheave
15	Belt Set
16	Driven Sheave

EWD Parts List



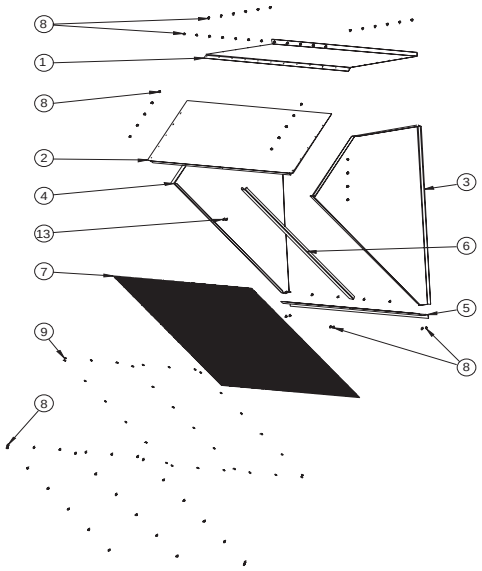
Part No.	Description
	EWD
1	Propeller
2	Motor
3	Power Assembly
4	Supplemental Venturi
5	Motor Plate
6	Optional Wire Guard
7	Wall Base

EWB Parts List



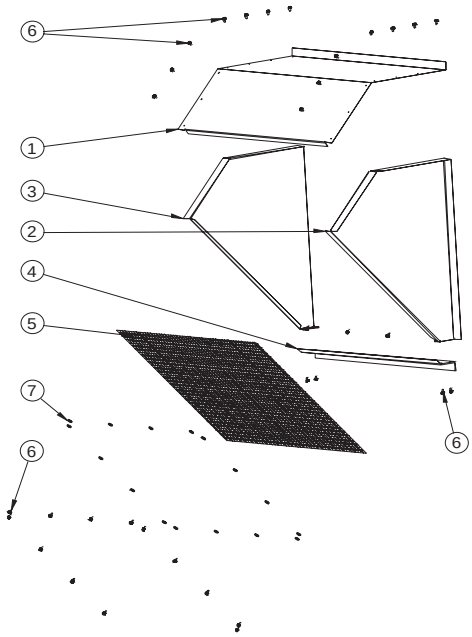
Part No.	Description
	EWB
1	Bearings (2)
2	Wall Base
3	Supply Venturi
4	Steel Propeller
5	Shaft
6	Motor Plate
7	Power Assembly
8	Motor
9	Optional Wire Guard
10	Driver Sheave
11	Belt Set
12	Driven Sheave

36-60 Wall Propeller Weather Hood Parts List



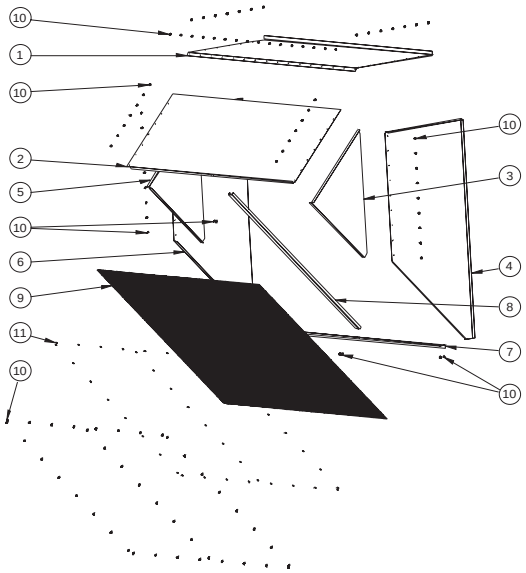
Part No.	Description
	36-60 Wall Prop
1	Top Panel, Piece 1
2	Top Panel, Piece 2
3	Right Side Panel
4	Left Side Panel
5	Bottom Panel
6	Bird Screen Support
7	1/2” Mesh Galvanized Bird Screen
8	1/4” X 1/2” Speed Screw
9	5/16 SAE Steel Washer

8-30 Wall Propeller Weather Hood Parts List



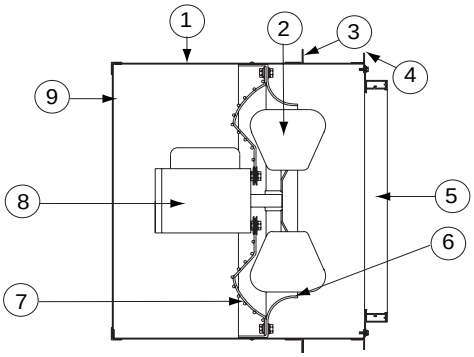
Part No.	Description
	8-30 Wall Prop
1	Top Panel
2	Right Side Panel
3	Left Side Panel
4	Bottom Panel
5	1/2” Mesh Galvanized Bird Screen
6	1/4” X 1/2” Speed Screw
7	5/16 SAE Steel Washer

72 EWB Weather Hood Parts List



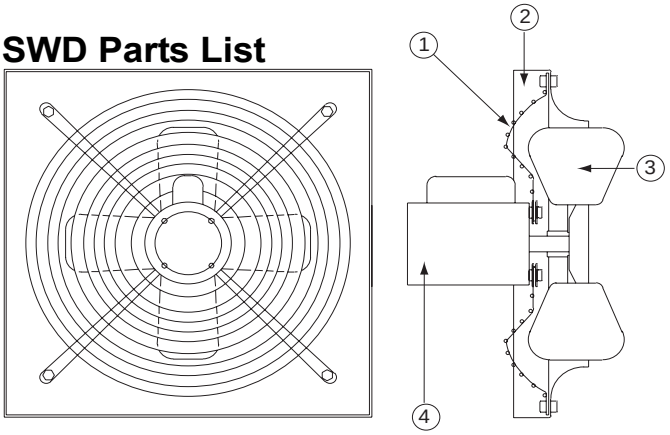
Part No.	Description
	72 EWB
1	Top Panel, Piece 1
2	Top Panel, Piece 2
3	Right Side Panel Tip
4	Right Side Panel
5	Left Side Panel Tip
6	Left Side Panel
7	Bottom Panel
8	Bird Screen Support
9	1/2” Mesh Galvanized Bird Screen
10	1/4” X 1/2” Speed Screw
11	5/16 SAE Steel Washer

SPD Parts List



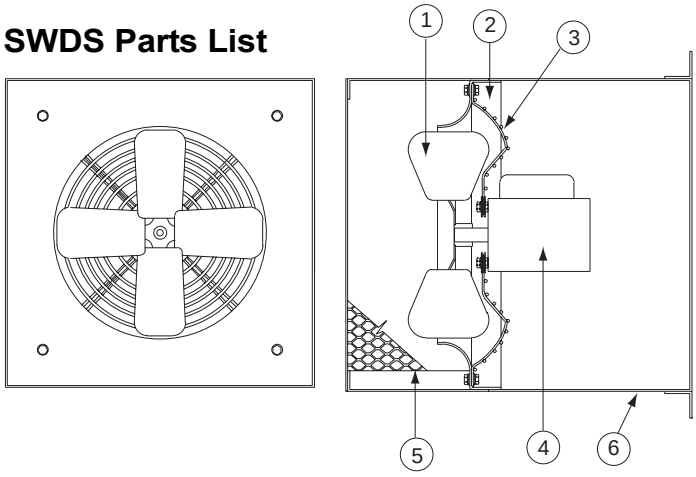
Part No.	Description
	SPD
1	Fan Box Panel (4)
2	Stamped Aluminum Propeller
3	Anchor Angle (4)
4	Mounting Collar Angle (2)
5	Automatic Louver
6	Wall Base
7	Mounting Grille
8	Motor
9	Mesh Guard

SWD Parts List



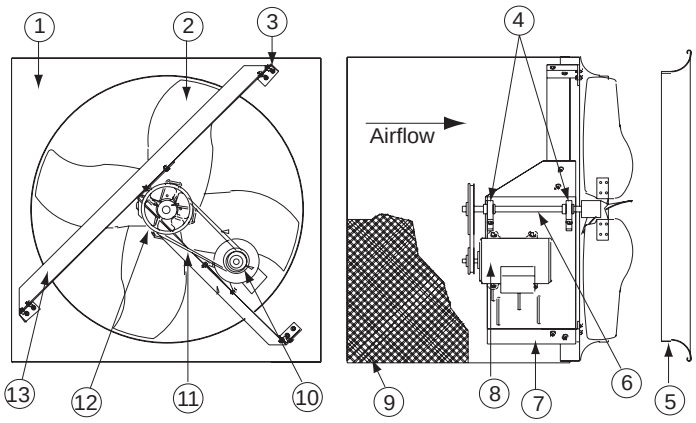
Part No.	Description
	SWD
1	Wire Guard
2	Wall Base
3	Stamped Aluminum Propeller
4	Motor

SWDS Parts List



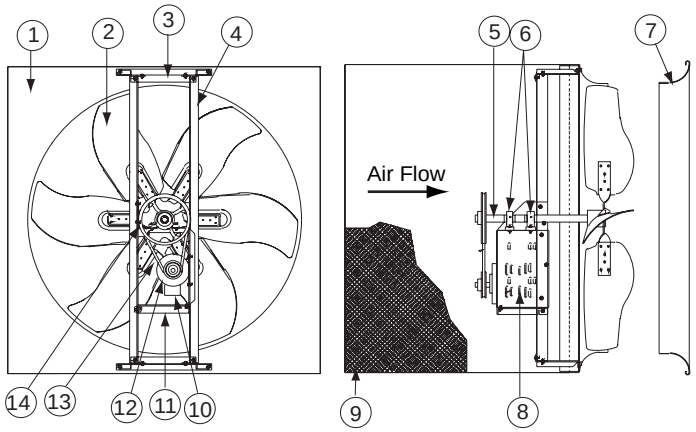
Part No.	Description
	SWDS
1	Stamped Aluminum Propeller
2	Wall Base
3	Wire Guard
4	Motor
5	End Wire Guard
6	Wall Collar

XLW, XMW, XLWS, XMWS 20 - 36 Parts List



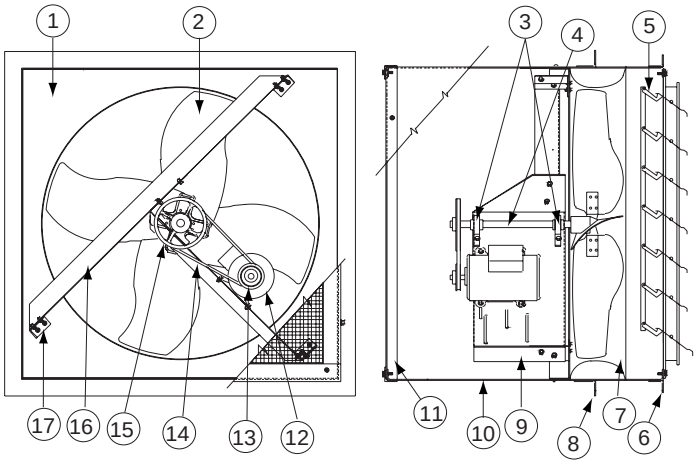
Part No.	Description	Part No.	Description
1	Wall Venturi Base	8	Motor
2	Prop Assembly	9	Optional Wire Guard
3	Power Assembly Foot (3)	10	Drive Sheave
4	Bearings (2)	11	Belt Set
5	Inlet Venturi (Supply only)	12	Driven Sheave
6	Fan Shaft	13	Power Assembly Rail
7	Motor/Bearing Plate		

XLW, XMW, XLWS, XMWS 42 - 60 Parts List



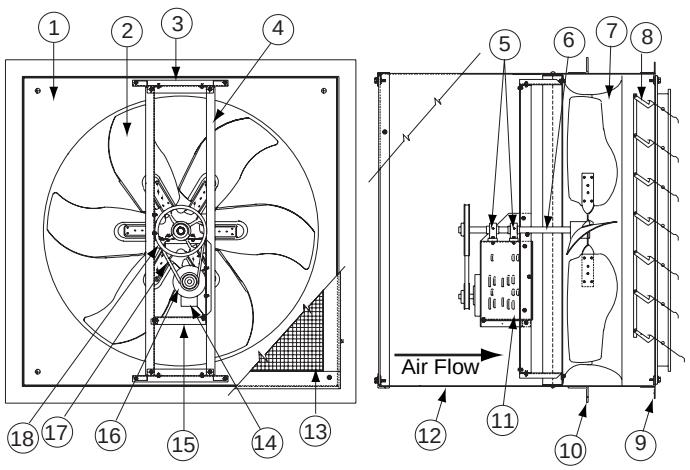
Part No.	Description	Part No.	Description
1	Wall Venturi Base	8	Motor/Bearing Plate
2	Prop Assembly	9	Optional Wire Guard
3	Power Assembly Foot (2)	10	Motor
4	Power Assembly Rail (2)	11	Motor Plate Brace
5	Fan Shaft	12	Drive Sheave
6	Bearings (2)	13	Belt Set
7	Inlet Venturi (Supply Only)	14	Driven Sheave

XLP, XMP, XLPS, XMPS 20 -36 Parts List



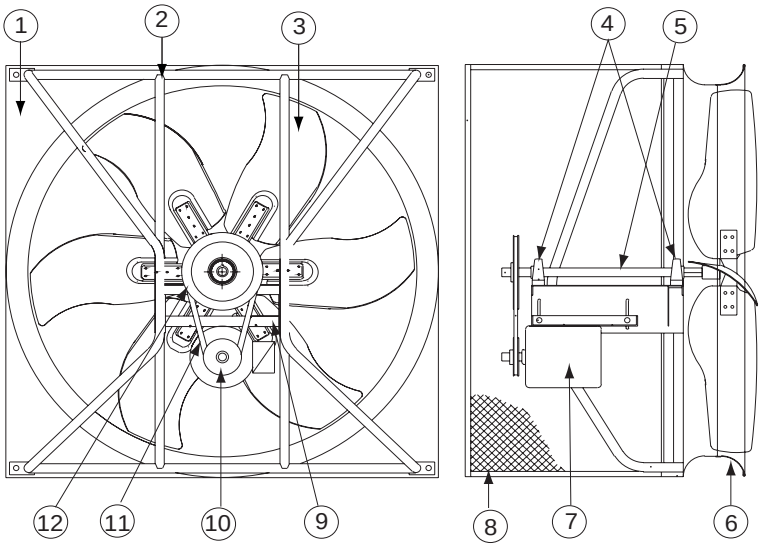
Part No.	Description	Part No.	Description
1	Wall Venturi Base	9	Motor/Bearing Plate
2	Prop Assembly	10	Housing Wrapper Panel (4)
3	Bearings (2)	11	End Safety Guard
4	Fan Shaft	12	Motor
5	Exhaust Shutter (Exhaust Only) Supply Shutter (Supply Only)	13	Drive Sheave
		14	Belt Set
6	Mounting Collar Angle (4)	15	Driven Sheave
7	Inlet Venturi (Supply Only)	16	Power Assembly Rail
8	Wall Mounting Angle (2)	17	Power Assembly Foot (3)

XLP, XMP, XLPS, XMPS 42 - 60 Parts List



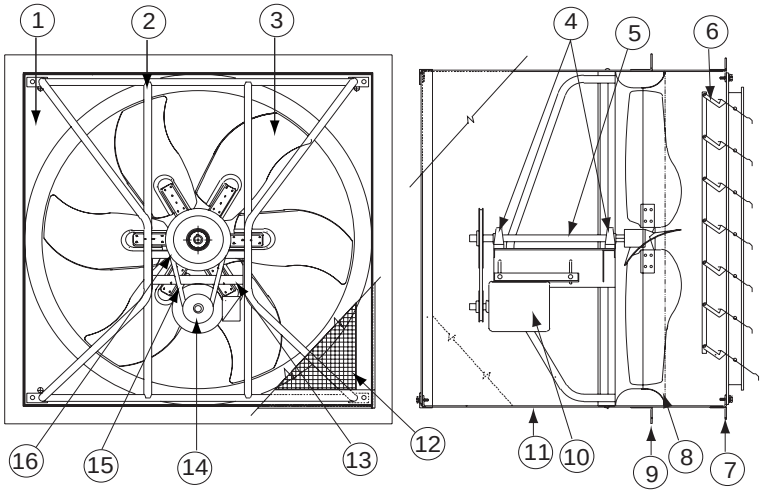
Part No.	Description	Part No.	Description
1	Wall Venturi Base	10	Wall Mounting Angle (2)
2	Prop Assembly	11	Motor/Bearing Plate
3	Power Assembly Foot (2)	12	Housing Wrapper Panel (4)
4	Power Assembly Rail (2)	13	End Safety Guard
5	Bearings (2)	14	Motor
6	Fan Shaft	15	Motor Plate Brace
7	Inlet Venturi (Supply Only)	16	Drive Sheave
8	Exhaust Shutter (Exhaust Only) Supply Shutter (Supply Only)	17	Belt Set
		18	Driven Sheave
9	Mounting Collar Angle (4)		

XLWHS, XMWHS, XLWH, XMWH
24 - 60 Parts List



Part No.	Description	Part No.	Description
1	Wall Venturi Base	7	Motor
2	Power Assembly	8	Optional Wire Guard
3	Prop Assembly	9	Motor Plate
4	Bearings (2)	10	Drive Sheave
5	Fan Shaft	11	Belt Set
6	Inlet Venturi (Supply Only)	12	Driven Sheave

XLPH, XMPH, XLPHS, XMPHS
24 - 60 Parts List



Part No.	Description	Part No.	Description
1	Wall Venturi Base	9	Wall Mounting Angle (2)
2	Power Assembly	10	Motor
3	Prop Assembly	11	Housing Wrapper Panel
4	Bearings	12	End Safety Guard
5	Fan Shaft	13	Motor Plate
6	Exhaust Shutter (Exhaust Only) Supply Shutter (Supply Only)	14	Drive Sheave
		15	Belt Set
7	Mounting Collar Angle (4)	16	Driven Sheave
8	Inlet Venturi (Supply Only)		

Limited Warranty

Loren Cook Company warrants that your Loren Cook fan was manufactured free of defects in materials and workmanship, to the extent stated herein. For a period of one (1) year after date of shipment, we will replace any parts found to be defective without charge, except for shipping costs which will be paid by you. This warranty is granted only to the original purchaser placing the fan in service. This warranty is void if the fan or any part thereof has been altered or modified from its original design or has been abused, misused, damaged or is in worn condition or if the fan has been used other than for the uses described in the company manual. This warranty does not cover defects resulting from normal wear and tear. To make a warranty claim, notify Loren Cook Company, General Offices, 2015 East Dale Street, Springfield, Missouri 65803-4637, explaining in writing, in detail, your complaint and referring to the specific model and serial numbers of your fan. Upon receipt by Loren Cook Company of your written complaint, you will be notified, within thirty (30) days of our receipt of your complaint, in writing, as to the manner in which your claim will be handled. If you are entitled to warranty relief, a warranty adjustment will be completed within sixty (60) business days of the receipt of your written complaint by Loren Cook Company. This warranty gives only the original purchaser placing the fan in service specifically the right. You may have other legal rights which vary from state to state.

LOREN COOK COMPANY

Corporate Offices: 2015 E. Dale Street Springfield, MO 65803 417.869.6474

lorencook.com

Shutter, Wall, 12 In

Exhaust Shutter, Gravity Operated, Single Panel, Fits Fan Dia 12 In, Overall Square 15 In, Opening Required 12 1/2 x 12 1/2 In, Frame Depth 2 1/2 In, Open Depth 5 3/4 In, Flange Width 1 1/2 In, Free Area 0.786 Square-Ft, Max Velocity 2500 FPM, Vertical Mounting Position, Blade Material White Painted Aluminum, Extruded Aluminum Frame and G-90 Glavanized Tie Rod, For Use With Vertical Mounted Exhaust Fans

Grainger Item #	4C556
Price (ea.)	**$37.50**
Brand	DAYTON
Mfr. Model #	4C556
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	4.0
Usually Ships	Today
Catalog Page No.	3915

Price shown may not reflect your price. Log in or register.

Additional Info

Single- and Double-Panel Exhaust Shutters

Efficient shutters for direct- or belt-driven exhaust fans are designed to prevent air backflow when the fan is off.

Counterbalanced louvers with felted edges (except fiberglass models) open easily and seal quietly. Units with 54" and 60" galvanized and aluminum shutters have 4 additional tie rods on the discharge side for smooth, quiet operation.

- Exhaust only
- Mount: vertical
- Max. velocity: 2500 FPM
- 1 1/2" flange

Aluminum Frame

For areas where corrosion may be a problem.

Aluminum louvers have white enamel finish, galvanized steel reinforcement strip, and stainless steel rivets. 16-ga. extruded aluminum frame. Frame depth: 2 1/2" for 10 to 24" models, 3" for models 30" and up.

Tech Specs

Item: Exhaust Shutter
Type: Gravity Operated, Single Panel
Fits Fan Dia. (In.): 12
Overall Square (In.): 15
Opening Required (In.): 12 1/2 x 12 1/2
Frame Depth (In.): 2 1/2
Open Depth (In.): 5 3/4
Flange Width (In.): 1 1/2
Mounting Hole Size (In.): 9/32 x 1/2
Free Area (Square-Ft.): 0.786
Max. Velocity (FPM): 2500
Mounting Position: Vertical
Blade Material: White Painted Aluminum
Construction Material: Extruded Aluminum Frame and G-90 Galvanized Tie Rod
For Use With: Vertical Mounted Exhaust Fans

Notes & Restrictions

There are currently no notes or restrictions for this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Optional Accessories

Shutter Motor

Item #: 2C831
Brand: DAYTON
Usually Ships: Today
Price (ea): $89.80

Pull Chain Kit, Single Pannel Shutters

Item #: 2FTW3
Brand: DAYTON
Usually Ships: Today
Price (ea): $25.30

Alternate Products

Fan Shutter, 12 1/2 In

Item #: 1C742
Brand: DAYTON
Usually Ships: Today
Price (ea): $34.05

Fan Shutter, 12 In, Beige Fiberglass

Item #: 5C211
Brand: DAYTON
Usually Ships: Today
Price (ea): $62.65

Repair Parts

A Repair Part may be available for this item. Visit our Repair Parts Center or contact your local branch for more information.

GRAINGER
FOR THE ONES WHO GET IT DONE

printed February 10, 2010

Shutter, Wall, 16 In

Exhaust Shutter, Gravity Operated, Single Panel, Fits Fan Dia 16 In, Overall Square 19 In, Opening Required 16 1/2 x 16 1/2 In, Frame Depth 2 1/2 In, Open Depth 5 3/4 In, Flange Width 1 1/2 In, Free Area 1.436 Square-Ft, Max Velocity 2500 FPM, Vertical Mounting Position, Blade Material White Painted Aluminum, Extruded Aluminum Frame and G-90 Glavanized Tie Rod, For Use With Vertical Mounted Exhaust Fans

Grainger Item #	4C557
Price (ea.)	**$46.75**
Brand	DAYTON
Mfr. Model #	4C557
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	4.4
Usually Ships	Today
Catalog Page No.	3915

Price shown may not reflect your price. Log in or register.

Additional Info

Single- and Double-Panel Exhaust Shutters

Efficient shutters for direct- or belt-driven exhaust fans are designed to prevent air backflow when the fan is off.

Counterbalanced louvers with felted edges (except fiberglass models) open easily and seal quietly. Units with 54" and 60" galvanized and aluminum shutters have 4 additional tie rods on the discharge side for smooth, quiet operation.

- Exhaust only
- Mount: vertical
- Max. velocity: 2500 FPM
- 1 1/2" flange

Aluminum Frame

For areas where corrosion may be a problem.

Aluminum louvers have white enamel finish, galvanized steel reinforcement strip, and stainless steel rivets. 16-ga. extruded aluminum frame. Frame depth: 2 1/2" for 10 to 24" models, 3" for models 30" and up.

Tech Specs

Item: Exhaust Shutter
Type: Gravity Operated, Single Panel
Fits Fan Dia. (In.): 16
Overall Square (In.): 19
Opening Required (In.): 16 1/2 x 16 1/2
Frame Depth (In.): 2 1/2
Open Depth (In.): 5 3/4
Flange Width (In.): 1 1/2
Mounting Hole Size (In.): 9/32 x 1/2
Free Area (Square-Ft.): 1.436
Max. Velocity (FPM): 2500
Mounting Position: Vertical
Blade Material: White Painted Aluminum
Construction Material: Extruded Aluminum Frame and G-90 Galvanized Tie Rod
For Use With: Vertical Mounted Exhaust Fans

Notes & Restrictions

There are currently no notes or restrictions for this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Optional Accessories

Shutter Motor

Item #: 2C831
Brand: DAYTON
Usually Ships: Today
Price (ea): $89.80

Pull Chain Kit, Single Pannel Shutters

Item #: 2FTW3
Brand: DAYTON
Usually Ships: Today
Price (ea): $25.30

Alternate Products

Fan Shutter, 16 1/2 In

Item #: 1C743
Brand: DAYTON
Usually Ships: Today
Price (ea): $42.45

Fan Shutter, 16 In, Beige Fiberglass

Item #: 5C212
Brand: DAYTON
Usually Ships: Today
Price (ea): $82.10

Exh Shutter, Fits Fan Dia 16 In, Aluminum

Item #: 4FZH4
Brand: DAYTON
Usually Ships: 1-3 Days
Price (ea): $65.45

Repair Parts

A Repair Part may be available for this item. Visit our Repair Parts Center or contact your local branch for more information.

Print *printed* November 15, 2010

Shutter, Wall, 18 In

Exhaust Shutter, Gravity Operated, Single Panel, Fits Fan Dia 18 In, Overall Square 21 In, Opening Required 18 1/2 x 18 1/2 In, Frame Depth 2 1/2 In, Open Depth 5 3/4 In, Flange Width 1 1/2 In, Free Area 2.043 Square-Ft, Max Velocity 2500 FPM, Vertical Mounting Position, Blade Material White Painted Aluminum, Extruded Aluminum Frame and G-90 Glavanized Tie Rod, For Use With Vertical Mounted Exhaust Fans

Grainger Item #	4C558
Price (ea.)	**$52.75**
Brand	DAYTON
Mfr. Model #	4C558
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	5.35
Usually Ships	Today
Catalog Page No.	3915

Price shown may not reflect your price. Log in or register.

Additional Info

- **Single- and Double-Panel Exhaust Shutters**
- Efficient shutters for direct- or belt-driven exhaust fans are designed to prevent air backflow when the fan is off.
- Counterbalanced louvers with felted edges (except fiberglass models) open easily and seal quietly. Units with 54" and 60" galvanized and aluminum shutters have 4 additional tie rods on the discharge side for smooth, quiet operation.
- Exhaust only
- Mount: vertical
- Max. velocity: 2500 FPM
- 1 1/2" flange
- **Aluminum Frame**
- For areas where corrosion may be a problem.
- Aluminum louvers have white enamel finish, galvanized steel reinforcement strip, and stainless steel rivets. 16-ga. extruded aluminum frame. Frame depth: 2 1/2" for 10 to 24" models, 3" for models 30" and up.

Tech Specs

- **Item:** Exhaust Shutter

- **Type:** Gravity Operated, Single Panel
- **Fits Fan Dia. (In.):** 18
- **Overall Square (In.):** 21
- **Opening Required (In.):** 18-1/2 x 18-1/2
- **Frame Depth (In.):** 2-1/2
- **Open Depth (In.):** 5-3/4
- **Flange Width (In.):** 1-1/2
- **Mounting Hole Size (In.):** 9/32 x 1/2
- **Free Area (Square-Ft.):** 2.043
- **Max. Velocity (FPM):** 2500
- **Mounting Position:** Vertical
- **Blade Material:** White Painted Aluminum
- **Construction Material:** Extruded Aluminum Frame and G-90 Galvanized Tie Rod
- **For Use With:** Vertical Mounted Exhaust Fans

Notes & Restrictions

There are currently no notes or restrictions for this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Optional Accessories

Shutter Motor

Item #: 2C831
Brand: DAYTON
Usually Ships: Today
Price (ea): $89.80

Pull Chain Kit, Single Pannel Shutters

Item #: 2FTW3
Brand: DAYTON
Usually Ships: Today
Price (ea): $25.30

Alternate Products

Fan Shutter, 18 In, Beige Fiberglass

Item #: 5C213
Brand: DAYTON
Usually Ships: Today
Price (ea): $91.80

Exh Shutter, Fits Fan Dia 18 In, Aluminum

Item #: 4FZH5
Brand: DAYTON
Usually Ships: 1-3 Days
Price (ea): $74.95

Repair Parts

A Repair Part may be available for this item. Visit our Repair Parts Center or contact your local branch for more information.

AST4400 *Class 1 Div 1 IS Groups C, D with Approved Barrier*

Stainless Steel Media Isolated Pressure Sensor

Overview

The AST4400 is a media isolated stainless steel pressure sensor with a wide variety of options. With its rugged construction and best price-to-performance ratio in the industry, the AST4400 is the solution for pressure measurement in Intrinsically Safe areas.

Benefits

- **UL/cUL 913 (CSA 157)** Class 1 Div 1 Groups C, D when installed with an approved barrier
- High Strength Stainless Steel Construction
- No Oil, Welds or Internal O-rings
- Wide Operating Temperature Range
- Ranges up to 10,000 PSI
- Low Static and Thermal Errors
- Unparalleled Price and Performance
- Compatible with Wide Range of Liquids and Gases
- EMI/RFI Protection

Applications

- Industrial OEM Equipment
- Water Management
- Pneumatics
- Data Loggers
- HVAC/R Equipment
- Control Panels
- Hydraulic Systems

Performance @ 25°C (77°F)

Accuracy*	< ±0.25% BFSL (< ±0.5% BFSL for 7,500 & 10,000 PSI)
Stability (1 year)	±0.25% FS, typical
Over Range Protection	2X Rated Pressure
Burst Pressure	5X or 20,000 PSI (whichever is less)
Pressure Cycles	> 100 Million

* Accuracy includes non-linearity, hysteresis & non-repeatability

Environmental Data

Temperature	
Operating	-40 to 85°C (-40 to 185°F)
Storage	-40 to 100°C (-40 to 212°F)
Thermal Limits	
Compensated Range	0 to 55°C (30 to 130°F)
TC Zero	<±1.5% of FS
TC Span	<±1.5% of FS
Other	
Shock	100G, 11 msec, 1/2 sine
Vibration	10G peak, 20 to 2000 Hz.
EMI/RFI Protection:	Yes
Rating:	IP-66

Electrical Data

Output	**4-20mA**	**1-5VDC, 1-6VDC**	**0-50mV (10mV/V)**	**0.5-4.5V Ratiometric**
Excitation	10-28VDC	10-28VDC	5VDC, typical	5VDC, regulated
Output Impedance	>10k Ohms	<100 Ohms, Nominal	1100 Ohms, Nominal	<100 Ohms, Nominal
Current Consumption:	20mA, typical	5mA, typical	<5mA	5mA, typical
Bandwidth	(-3dB): DC to 250 Hz	(-3dB): DC to 1kHz	(-3dB): DC to 5kHz, min	(-3dB): DC to 1kHz
Output Noise:	-	<2mV RMS	-	<2mV RMS
Zero Offset:	<±1% of FS	<±1% of FS	< ±2% of FS	<±1% of FS
Span Tolerance:	<±2% of FS	<±1.5% of FS	< ±2% of FS	<±1.5% of FS
Output Load:	0-800 Ohms@10-28VDC	10k Ohms, Min.	>1M Ohms	10K Ohms, Min.
Reverse Polarity Protection	Yes	Yes	-	Yes

American Sensor Technologies · 450 Clark Dr., Mt. Olive, NJ 07828 · phone (973) 448-1901 · fax (973) 448-1905 · email: *info@astsensors.com*

Ordering Information

AST4400 A 00500 P 4 E 0 000

Series Type

Process Connection
A= 1/4" NPT Male
B= 1/8" NPT Male*
C= 1/4" BSPP Male
F= 7/16" - 20 UNF Male*
I= 1/4" NPT Female

Pressure Range
Insert pressure range from chart

Pressure Unit
B= Bar K= kg/cm2r P= PSI

Outputs
1= 0.5-4.5V ratiometric 6= 1-6V
3= 1-5V A= 0-50mV (10mV/V)
4= 4-20mA (2 wire loop powered)

Electrical**
A= 2 ft. (0.6 m) I= DIN 43650A (mate included)+
B= 4 ft. (1.2 m) L= Conduit fitting, Cable 2 ft.+
C= 6 ft. (1.8 m) M= Conduit fitting, Cable 4 ft.+
D= 10 ft. (3.0 m) N= Conduit fitting, Cable 6 ft.+
E= Mini DIN 43650 P= Conduit fitting, Cable 10 ft.+
F= Packard Metripack 150 3-Pin Conn. Y= M12 Eurofast

Wetted Material
0=17-4PH 1=316 L 2= Inconel 718 (consult factory on availability)

Options
000= No special options

*Not available under 50PSI, or in 316L
**Wiring information available at: *http://www.astsensors.com/mediacenter.php*
+Also approved to UL/cUL 1604 Class 1 Div 1, Group A, B, C, D without requiring a barrier

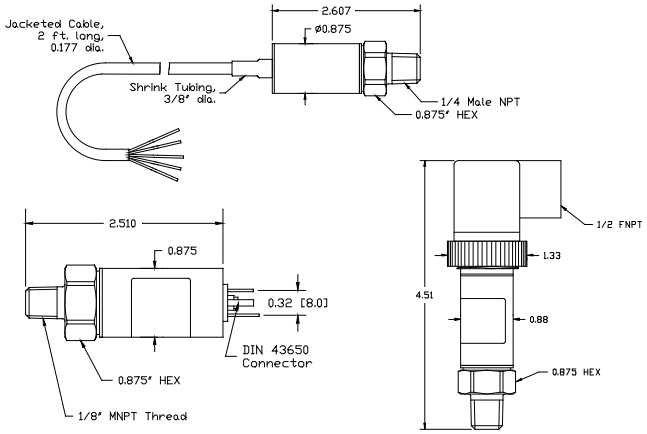
Pressure Ranges

PSIG Measurement Range	Pressure Range Code	BARG Measurement Range	Pressure Range Code
-14.7 to 30++	V0030	-1 to 2++	V0002
0-25	00025	0-2	00002
0-50	00050	0-5	00005
0-100	00100	0-10	00010
0-200	00200	0-20	00020
0-250	00250	0-50	00050
0-300	00300	0-100	00100
0-500	00500	0-250	00250
0-1,000	01000	0-350	00350
0-1,500	01500	0-500	00500
0-2,500	02500	0-700	00700
0-3,000	03000		
0-5,000	05000		
0-7,500	07500		
0-10,000	10000		

Typical ranges. All ranges between 0-25 PSI and 0-10,000 PSI available.

++Compound ranges up to -14.7 to 500 PSI available. Please consult factory.

Dimensional Data



Barrier Installation

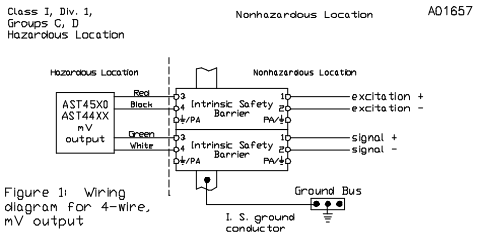


Figure 1: Wiring diagram for 4-wire, mV output

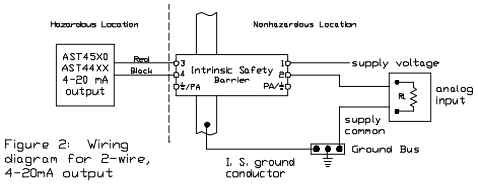


Figure 2: Wiring diagram for 2-wire, 4-20mA output

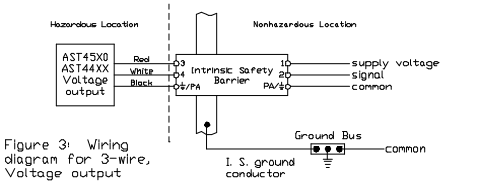


Figure 3: Wiring diagram for 3-wire, Voltage output

The transducers listed below are designed for installation in a Class I, Division 1, Groups C and D, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

Entity Parameters
Vmax = 28Vdc
Imax = 175mA Imax is the total current available from the Associated Apparatus under any condition.
C_i = 0.44uf
L_i = 0

Notes:
1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.
Voc or Vt ≤ Vmax Co ≥ C_i + Cleads
Isc or It ≤ Imax Lo ≥ L_i + Lleads

2. Control Room aparatus shall not generate in excess of 250V (Umax).

3. Installation should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.

Warranty

Workmanship - AST, Inc. pressure transmitters have a limited one-year warranty to the original purchaser. AST, Inc. will replace or repair, free of charge, any defective transmitter. This warranty does not apply to any units that have been modified; misused, neglected or installed where the application exceeds published ratings. AST4400 is not recommended for use with hydrogen. For Hydrogen storage and applications, contact AST for AST4300, AST4401, & AST4600 model information. AST's sensors are made with pride in New Jersey, USA. If in the area please feel free to stop by for a visit!

Installation/Applications - The purchaser is responsible for media compatibility, functional adequacy, and correct installation of the transmitter.

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All specifications subject to change without notice.

AST44LP *Class 1 Div 1 IS Groups C, D with Approved Barrier*

Stainless Steel Media Isolated Low Pressure Sensor

OVERVIEW

The AST44LP is a media isolated stainless steel pressure sensor with a wide variety of options. With its rugged construction and the best price-to-performance ratio in the industry, the AST44LP is the solution for low pressure measurement in Intrinsically Safe areas.

BENEFITS

- **UL/cUL 913 (CSA 157) Class 1 Div 1 Groups C,D** when installed with an approved barrier
- High Strength Stainless Steel Construction
- No Welds or Internal O-rings
- Wide Operating Temperature Range
- Ranges from 0-2.5 to 0-15 PSI
- Low Static and Thermal Errors
- Unparalleled Price and Performance
- Compatible with Wide Range of Liquids and Gases
- EMI/RFI Protection

APPLICATIONS

- Industrial OEM Equipment
- Water Management
- Pneumatics
- Vapor Recovery
- External Tank Levels
- HVAC/R Equipment
- Control Panels
- Hydraulic Systems
- Data Loggers

Performance @ 25°C (77°F)

Accuracy*	< ±0.25% BFSL (< ±0.5% BFSL for 0-1 PSI)
Stability (1 year)	±0.25% FS, typical
Over Range Protection	2X Rated Pressure
Burst Pressure	5X or 75 PSI (whichever is less)
Pressure Cycles	> 100 Million

* Accuracy includes non-linearity, hysteresis & non-repeatability

Environmental Data

Temperature	
Operating	-40 to 85°C (-40 to 185°F)
Storage	-40 to 100°C (-40 to 212°F)
Thermal Limits	
Compensated Range	0 to 55°C (30 to 130°F)
TC Zero	<±1.5% of FS
TC Span	<±1.5% of FS
Other	
Shock	100G, 11 msec, 1/2 sine
Vibration	10G peak, 20 to 2000 Hz.
EMI/RFI Protection:	Yes
Rating:	IP-66

Electrical Data

Output	**4-20mA**	**1-5VDC, 1-6VDC**	**0-50mV (10mV/V)**
Excitation	10-28VDC	10-28VDC	5VDC, typical
Output Impedance	>10k Ohms	<100 Ohms, Nominal	1100 Ohms, Nominal
Current Consumption:	20mA, typical	5mA, typical	<5mA
Bandwidth	(-3dB): DC to 250 Hz	(-3dB): DC to 1kHz	(-3dB): DC to 5kHz, min
Output Noise:	-	<2mV RMS	-
Zero Offset:	<±1% of FS	<±1% of FS	< ±2% of FS
Span Tolerance:	<±2% of FS	<±1.5% of FS	< ±2% of FS
Output Load:	0-800 Ohms@10-28VDC	10k Ohms, Min.	>1M Ohms
Reverse Polarity Protection	Yes	Yes	-

American Sensor Technologies · 450 Clark Dr., Mt. Olive, NJ 07828 · phone (973) 448-1901 · fax (973) 448-1905 · email: *info@astsensors.com*

Ordering Information

AST44LP **A** **00005** **P** **4** **E** **1** **000**

Series Type

Process Connection
A= 1/4" NPT Male
C= 1/4 BSPP Male
I= 1/4" NPT Female
P= 1/2 MNPT

Pressure Range
Insert pressure range from chart

Pressure Unit
H= Inches H_2O P= PSI

Outputs
3= 1-5V
4= 4-20mA (2 wire loop powered)
6= 1-6V
A= 10mV/V

Electrical*
A= 2 ft. (0.6 m)
B= 4 ft. (1.2 m)
C= 6 ft. (1.8 m)
D= 10 ft. (3.0 m)
E= Mini DIN 43650C
F= Packard Metripack 150
I= DIN 43650A
L= Conduit, Cable 2 ft.
M= Conduit, Cable 4 ft.
N= Conduit, Cable 6 ft.
P= Conduit, Cable 10 ft.
R= 6 Pin Bendix

Wetted Material
1=316 L

Options
000 -No special options

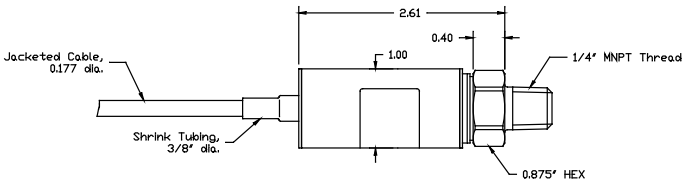
*Wiring information available at: *http://www.astsensors.com/mediacenter.php*

Pressure Ranges

Gage PSIG	Pressure Range Code
0-1	00001
0-2.5	00069*
0-5	00005
0-7.5	00208*
0-10	00010
0-15	00015

*2.5 and 7.5 PSI Sensor must be ordered in inches of H_2O.

Dimensional Data



Barrier Installation

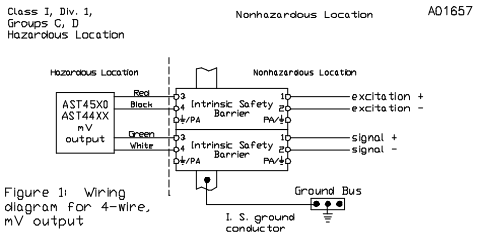


Figure 1: Wiring diagram for 4-wire, mV output

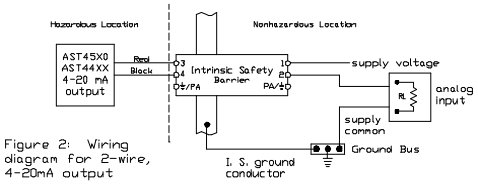


Figure 2: Wiring diagram for 2-wire, 4-20mA output

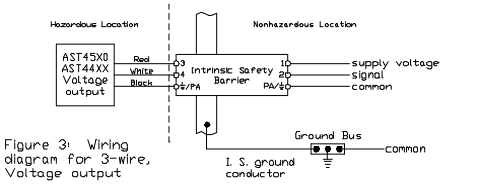


Figure 3: Wiring diagram for 3-wire, Voltage output

The transducers listed below are designed for installation in a Class I, Division 1, Groups C and D, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

Entity Parameters
Vmax = 28Vdc
Imax = 175mA
C_i = 0.44uf
L_i = 0

Imax is the total current available from the Associated Apparatus under any condition.

Notes:
1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.
Voc or Vt ≤ Vmax Ca ≥ C_i + Cleads
Isc or It ≤ Imax La ≥ L_i + Lleads

2. Control Room aparatus shall not generate in excess of 250V (Umax).

3. Installation should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.

Warranty

Workmanship - AST, Inc. pressure transmitters have a limited one-year warranty to the original purchaser. AST, Inc. will replace or repair, free of charge, any defective transmitter. This warranty does not apply to any units that have been modified; misused, neglected or installed where the application exceeds published ratings. AST4400 is not recommended for use with hydrogen. For Hydrogen storage and applications, contact AST for AST4300, AST4401, & AST4600 model information. AST's sensors are made with pride in New Jersey, USA. If in the area please feel free to stop by for a visit!

Installation/Applications - The purchaser is responsible for media compatibility, functional adequacy, and correct installation of the transmitter.

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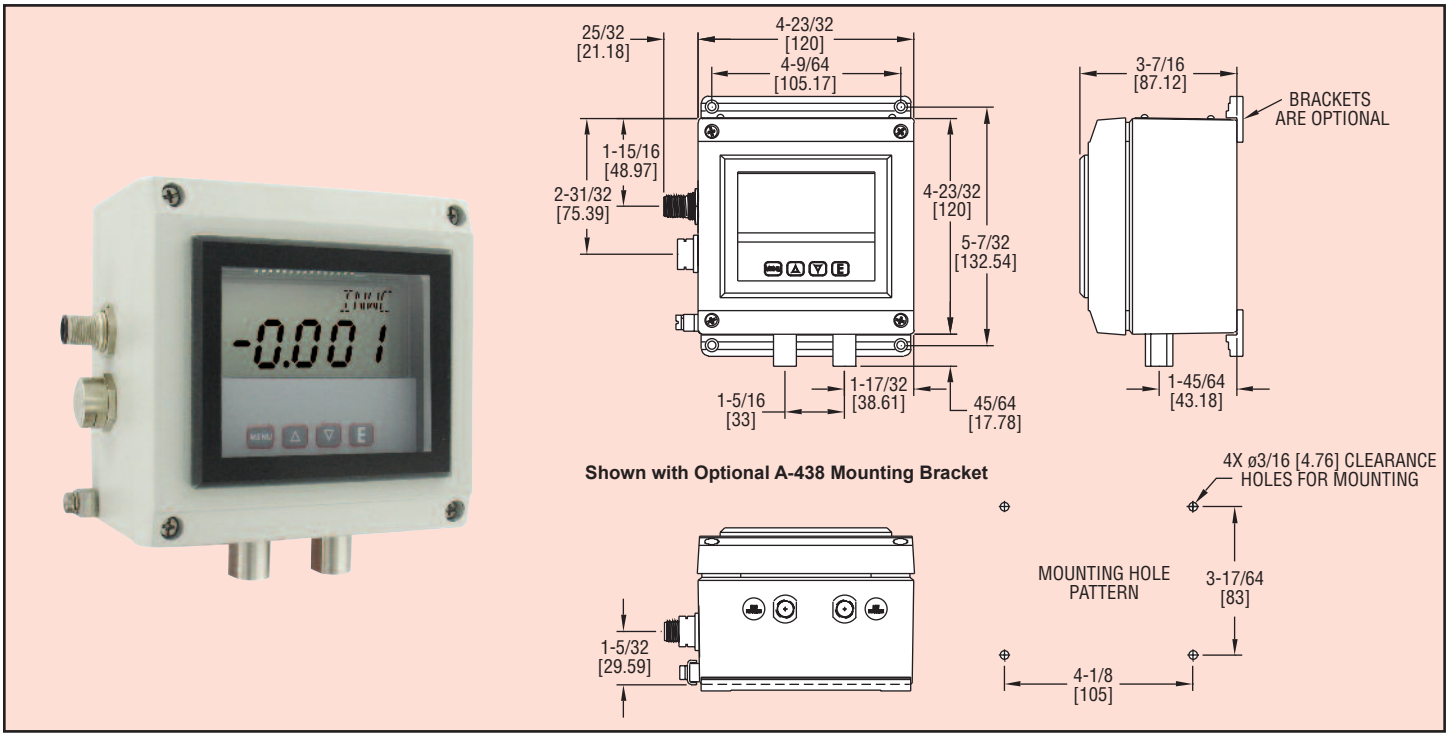
All specifications subject to change without notice.

Series ISDP

Intrinsically Safe Differential Pressure Transmitter

For Hazardous Zone Pressure and Flow Applications



The ISDP Differential Pressure Transmitter provides a 4-20 mA process output, a robust NEMA 4X enclosure, plus a large LCD display that can be programmed to read in pressure, velocity or flow. The ISDP offers simplified programming via a Menu key that enables the user to select: security level; English or Metric engineering units; pressure, velocity or flow operation, K-factor for use with various Pitot tubes and flow sensors, circular or rectangular duct size for volumetric flow operation plus many more. The Series ISDP Differential Pressure Transmitter is powered on its two wire loop with 10-35 VDC via its integral M-12 four pin male connector. The ISDP provides a 0.5% full scale accuracy on ranges from 0.25˝ w.c. to 100˝ w.c. as well as bi-directional models up to 10˝ w.c. These features make the Series ISDP Differential Pressure Transmitter the ideal instrument for monitoring pressures or air flows in hazardous zones having a Class I Div. I Groups A, B, C, D; Class II Div. I Groups E, F, G; Class III Div. I ratings.

Model	Range
ISDP-002	0 - 0.25 in w.c.
ISDP-004	0 - 1 in w.c.
ISDP-006	0 - 5 in w.c.
ISDP-007	0 - 10 in w.c.
ISDP-008	0 - 25 in w.c.
ISDP-009	0 - 50 in w.c.
ISDP-010	0 - 100 in w.c.
ISDP-012	-0.25 / +0.25 in w.c.
ISDP-014	-1.0 / +1.0 in w.c.
ISDP-015	-2.5 / +2.5 in w.c.
ISDP-016	-5.0 / +5.0 in w.c.
ISDP-017	-10 / +10 in w.c.

ACCESSORIES

A-231, 16´ (5 m) Shielded Cable with 4 Pin Female M-12 Connection
A-486, 4.9´ (1 m) Shielded Cable with 4 Pin Female M-12 Connection
A-487, 9.8´ (3 m) Shielded Cable with 4 Pin Female M-12 Connection
A-488, 33´ (10 m) Shielded Cable with 4 Pin Female M-12 Connection
A-295, Female 4 Pin M-12 to Cable Gland Connector
MTL5041, Intrinsically Safe Galvanic Isolator
MTL7706, Intrinsically Safe Zener Barrier
A-438, Surface Mounting Brackets

SPECIFICATIONS

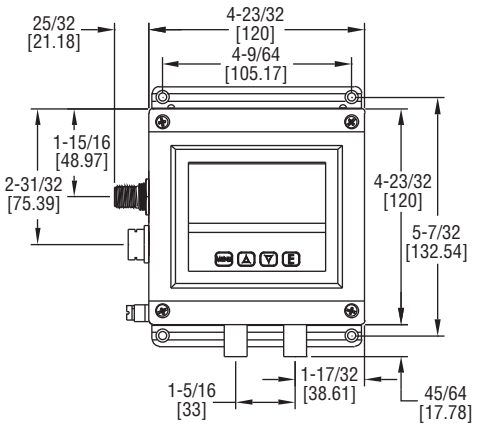
Service: Air and non-corrosive gases.
Wetted Materials: Ranges 5˝ and greater: glass, PVC, silicon, alumina ceramic, epoxy, RTV, gold, aluminum, stainless steel and nickel; Ranges 1˝ and lower: stainless steel, silicone, gold and ceramic.
Housing Materials: Aluminum, glass.
Accuracy: ±0.5% at 77°F (25°C) including hysteresis and repeatability (after 1 hour warm-up).
Stability: < ±1% per year.
Pressure Limits: Ranges ≤ 2.5 in. w.c. = 2 psi; 5˝: 5 psi; 10˝: 5 psi; 25˝: 5 psi; 50˝: 5 psi; 100˝: 9 psi.
Temperature Limits: 32 to 140°F (0 to 60°C).
Compensated Temperature Limits: 32 to 140°F (0 to 60°C).
Thermal Effects: 0.020%/°F (0.036/°C) from 77°F (25°C).
Power Requirements: 10-35 VDC.
Output Signal: 4-20 mA DC.
Zero & Span Adjustments: Accessible via menus.
Response Time: 250 ms (damping set to 1).
Display: 4 digit LCD 0.6˝ height.
Electrical Connections: M-12 4 PIN Connector.
Process Connections: 1/8˝ female NPT.
Enclosure Rating: Designed to meet NEMA 4X (IP66).
Mounting Orientation: Mount unit in horizontal plane.
Weight: 2 lb 10 oz (1.19 kg).
Agency Approvals: FM Intrinsically Safe CLI Div I GR: A, B, C, D; CLII Div I GR: E, F, G; CLIII Div I. CE: CENELEC EN 61326/55024: 2003; IEC 61000-4-2/3/4/6: 2001/2006/2004/2005; CENELEC EN 55011: 2006; 2004/108/EC EMC Directive.

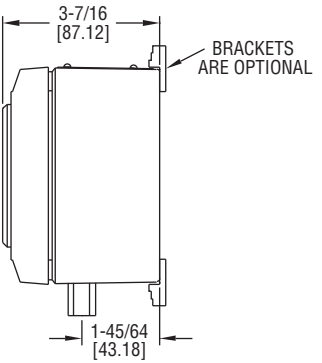
Series ISDP Intrinsically Safe Differential Pressure Transmitter

Specifications - Installation and Operating Instructions

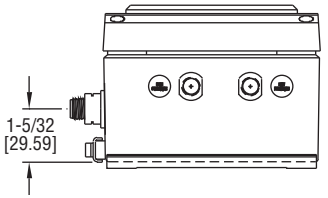
DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, IN 46361, U.S.A.
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

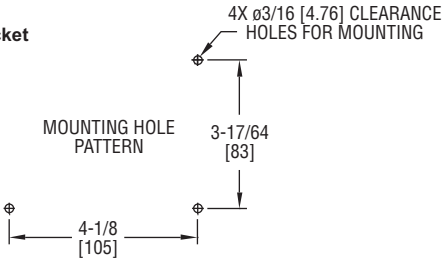
DIMENSIONS



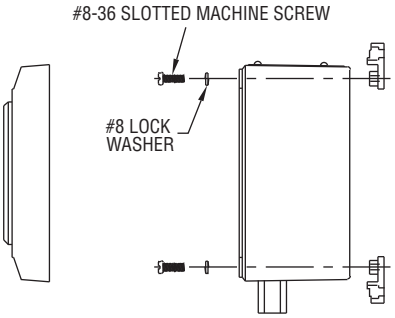


Shown with Optional A-438 Mounting Bracket





OPTIONAL A-438 BRACKET MOUNTING DIAGRAM



BRACKET ASSEMBLY

SPECIFICATIONS
Service: Air and non-corrosive gases.
Wetted Materials: Ranges 5″ and greater: glass, PVC, silicon, alumina ceramic, epoxy, RTV, gold, aluminum, stainless steel and nickel; Ranges 1″ and lower: stainless steel, silicone, gold and ceramic.
Housing Materials: Aluminum, glass.
Accuracy: ±0.5% at 77°F (25°C) including hysteresis and repeatability (after 1 hour warm-up).
Stability: < ±1% per year.
Pressure Limits: Ranges ≤ 2.5 in. w.c. = 2 psi;
5″: 5 psi; 10″: 5 psi; 25″: 5 psi; 50″: 5 psi; 100″: 9 psi.
Temperature Limits: 32 to 140°F (0 to 60°C).
Compensated Temperature Limits: 32 to 140°F (0 to 60°C).
Thermal Effects: 0.020%/°F (0.036/°C) from 77°F (25°C).
Power Requirements: 10-35 VDC.
Output Signal: 4-20 mA DC.
Zero & Span Adjustments: Accessible via menus.
Response Time: 250 ms (dampening set to 1).
Display: 4 digit LCD 0.6″ height.
Electrical Connections: M12 4 PIN Connector.
Process Connections: 1/8 female NPT.
Enclosure Rating: Designed to meet NEMA 4x (IP66).
Mounting Orientation: Mount unit in horizontal plane.
Size: 4.73″ x 4.73″ x 3.43″ (120 mm x 120 mm x 87.1 mm).
Weight: 2 lb 10 oz (1.19 kg).
Agency Approvals: FM, C-FM Intrinsically Safe CL1 Div 1 GR: A, B, C, D; CL2 Div 1 GR: E, F, G; CL3 Div 1 CE. CENELEC EN 61326/55024: 2003; IEC 61000-4-2/3/4/6: 2001/2006/2004/2005; CENELEC EN 55011: 2006; 2004/108/EC EMC Directive.

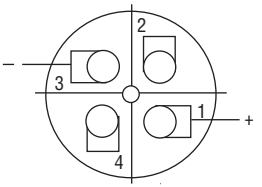
Intrinsic Safety Information

Entity Parameters
Ui = 28VDC
Ii = 93mA
Ci = 22 nF
Li = 400 uH
Pi = 651mW

Intrinsically Safe for the following hazardous areas:
CLASS I DIV. 1 GROUPS A, B, C, D
CLASS II DIV. 1 GROUPS E, F, G
CLASS III DIV. 1 T4

Notes:
1. Remove power from the instrument before carrying out any servicing.
2. Return the instrument to the manufacturer for any repair. Any unauthorized repairs may impair the intrinsic safety of the instrument.
3. Use only FM approved Associated Apparatus.
4. Install in accordance with ANSI/ISA RP12.06.01, the National Electric Code ANSI/NFPA 70, in the US, and the Canadian electrical code in Canada.
5. The earth terminal on the housing must be wired to a local earth ground in the hazardous area.

M-12 Connector



A-231 M-12 Cable Colors
PIN 1 is Brown (positive)
PIN 3 is Blue (negative)

Use Model A-231 shielded cable with 4 pin Female M-12 connection.

2-WIRE CONNECTION

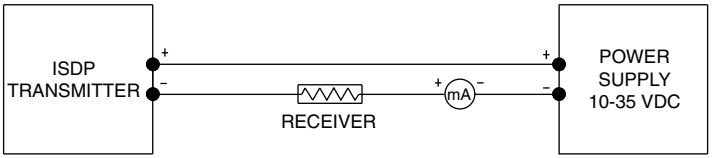


Fig. C

2-Wire Operation- An external power supply delivering 10 - 35 VDC with minimum current capability of 40 mA DC (per transmitter) must be used to power the control loop. See Fig. C for connection of the power supply, transmitter, and receiver. The range of the appropriate receiver load resistance (RL) for the DC power supply voltage available is expressed by the formula and graph in Fig. D.

POWER SUPPLY VOLTAGE - VDC (2-WIRE CONNECTION)

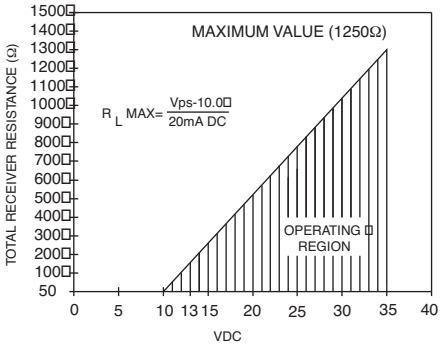


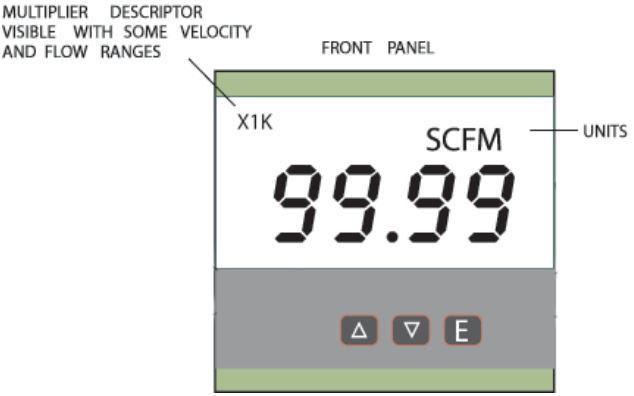
Fig. D

INSTALLATION

Mount the instrument in a location that will not be subject to excessive temperature, shock or vibration.

Pressure Connections

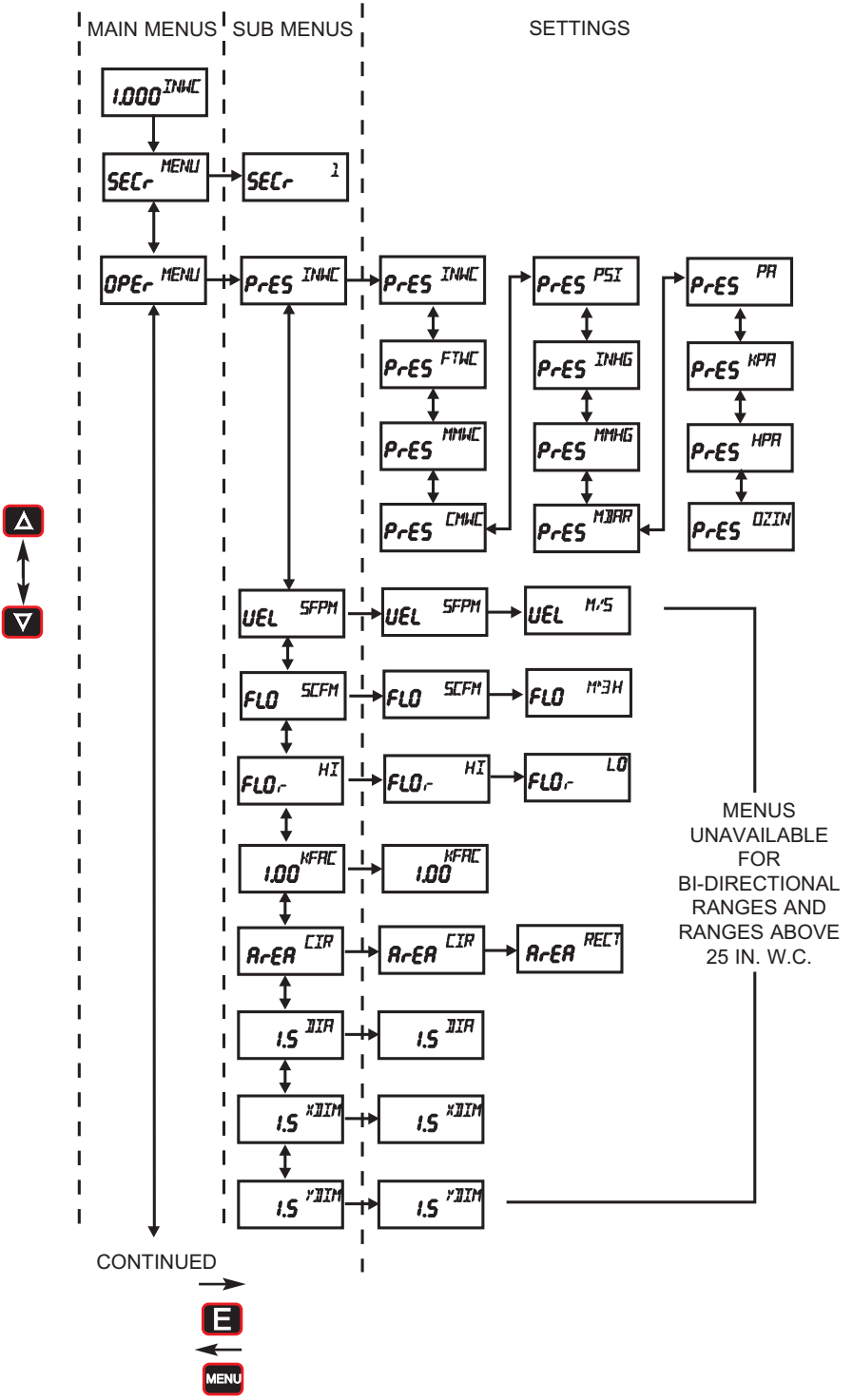
Use 1/8″ male NPT fittings. When tightening fittings, grasp the brass fitting on the ISDP with a 1/2″ wrench to prevent the fitting on the ISDP from turning.

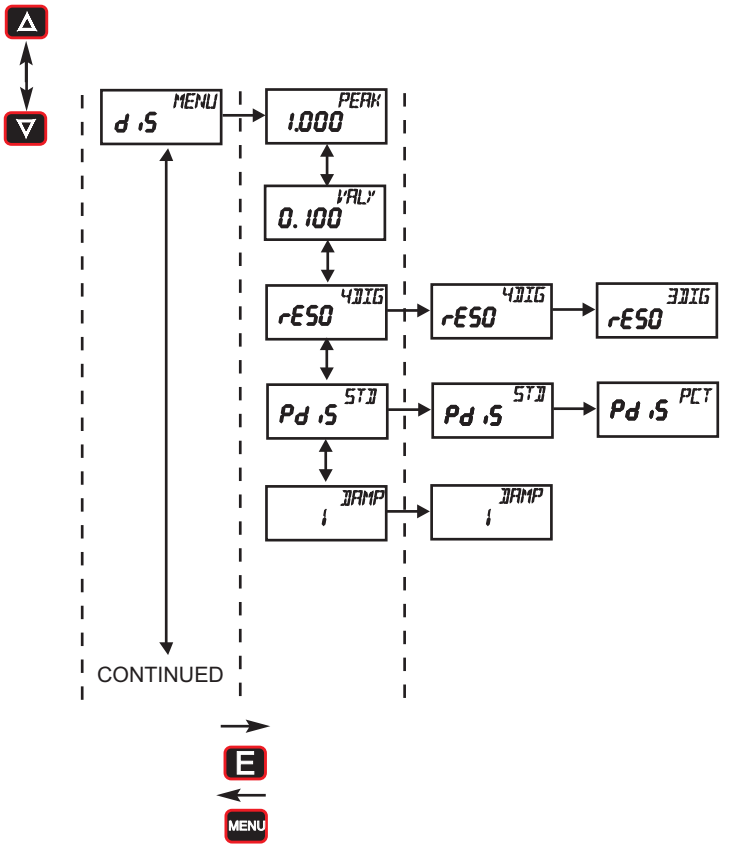


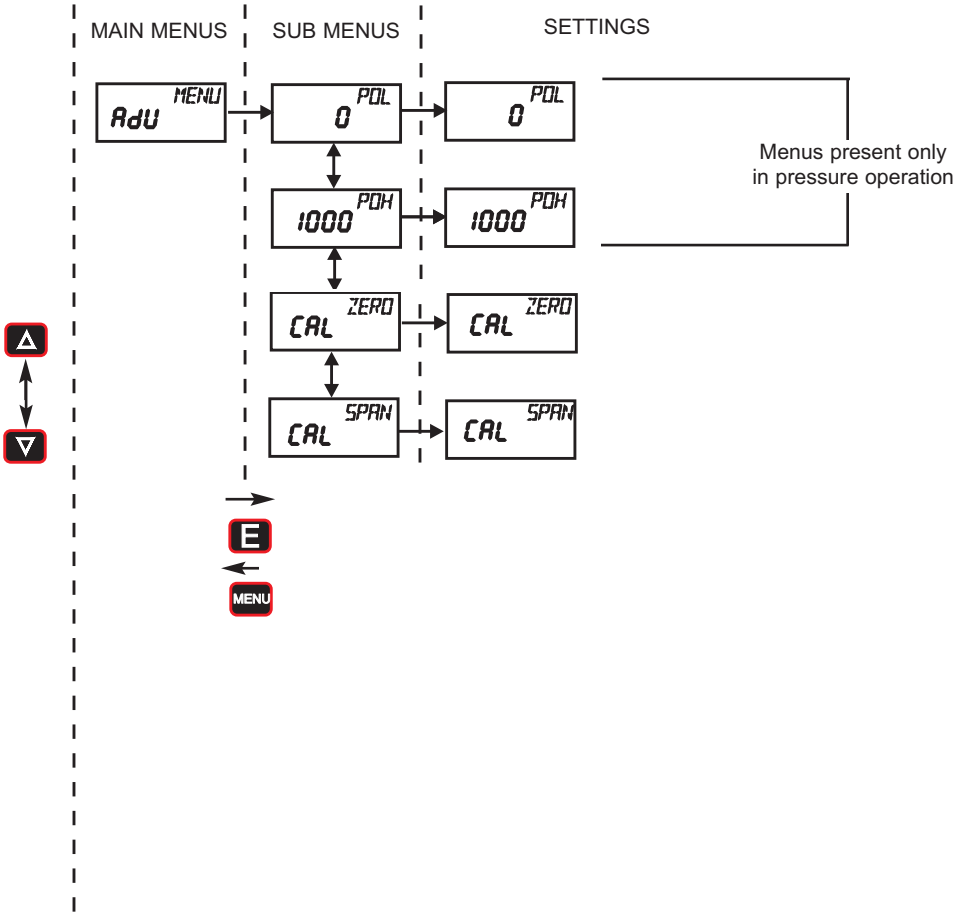
KEY FUNCTIONS

	HOME POSITION FUNCTION	MAIN MENU FUNCTION	SUB MENU FUNCTION
MENU	Allows access to the menus	Return to home position	Return to previous menu
UP ARROW		Sequences through menus	Increments a value
DOWN ARROW		Sequences through menus	Decrements a value
ENTER	Displays full scale range of unit	Enter into SUB MENU	Changes a value or setting. Press ENTER and display will blink. Adjust with UP or DOWN arrows. Press ENTER to store. Display will stop blinking. Peak/Valley SUB MENU resets display to present value.

MENU MAP


MAIN MENUS
SUB MENUS
SETTINGS
1.000 INWC
SECr MENU
SECr 1
OPEr MENU
PrES INWC
PrES INWC
PrES FTWC
PrES MMWC
PrES CMWC
PrES PSI
PrES INHG
PrES MMHG
PrES MBAR
PrES PA
PrES KPA
PrES HPA
PrES OZIN
UEL SFPM
UEL SFPM
UEL M/S
FLO SCFM
FLO SCFM
FLO M^3H
FLOr HI
FLOr HI
FLOr LO
1.00 KFAC
1.00 KFAC
ArEA CIR
ArEA CIR
ArEA RECT
1.5 DIA
1.5 DIA
1.5 XDIM
1.5 XDIM
1.5 YDIM
1.5 YDIM
MENUS UNAVAILABLE FOR BI-DIRECTIONAL RANGES AND RANGES ABOVE 25 IN. W.C.
CONTINUED
E
MENU


MENU
d ,S
PEAK
1.000
VALY
0.100
rESO
4DIG
rESO
4DIG
rESO
3DIG
Pd ,S
STD
Pd ,S
STD
Pd ,S
PCT
DAMP
1
DAMP
1
CONTINUED
E
MENU


MAIN MENUS
SUB MENUS
SETTINGS
MENU
AdU
POL
0
POL
0
POH
1000
POH
1000
ZERO
CAL
ZERO
CAL
SPAN
CAL
SPAN
CAL
Menus present only
in pressure operation
E
MENU

Model Chart	
Model	**Range**
ISDP-002	0-0.25″
ISDP-004	0-1″ WC
ISDP-005	0-2.5″ WC
ISDP-006	0-5″ WC
ISDP-007	0-10″ WC
IDSP-008	0-25″ WC
ISDP-009	0-50″ WC
ISDP-010	0-100″ WC
ISDP-011	-0.1/+0.1″ WC
ISDP-012	-0.25/+0.25″ WC
ISDP-013	-0.5/+0.5″ WC
ISDP-014	-1.0/+1.0″ WC
ISDP-015	-2.5/+2.5″ WC
ISDP-016	-5.0/+5.0″ WC
ISDP-017	-10/+10″ WC

Main Menu Selections (Upper Right Display Reads *MENU*)

SECr Security - Lock out access to menus and settings.

OPEr Operation - Selection of Pressure, Velocity or Flow and corresponding engineering units.

diS Display - Monitor and adjust display related settings: Peak, Valley, display resolution, % output and dampening.

AdJ Advanced functions - Modify advanced function parameters, transmitter output scaling, and calibration.

MAIN MENUS and SUB MENUS

SECr (Security) MAIN MENU

SECr is the only SUB MENU in the security MENU. When the security SUB MENU is selected, the present security level is displayed in the upper right hand display. To change the security level, adjust the number displayed to the number shown in the following table for the desired security level.

Security Level Displayed	Access	Password Value to Enter
1	All menus access	10
2	All settings locked	70

The password values shown in the table cannot be altered, so retain a copy of these pages for future reference.

OPEr (Operation) MAIN MENU

The OPEr MENU selects the measurement type of the instrument.
The SUB MENUS are:

PrES - Pressure
KFAC - K Factor
XDIM - X Dimension
VEL - Velocity
ArEA - Area
YDIM - Y Dimension
FLO - Flow
DIA - Diameter

If the instrument is set for Velocity, the OPEr MENU will have an additional KFAC SUB MENU. If the instrument is set for Flow, the OPEr MENU will have additional KFAC and ArEA SUB MENUS. These will be discussed under Velocity and Flow. When scrolling through the OPEr SUB MENUS, the measurement type the unit is currently set for will show the units in the upper right display. The other measurement types will have a blank upper right display.

Units visible, so unit is presently set to measure pressure

Units not visible

Units not visible

P-ES (Pressure) SUB MENU

For pressure measurement, the following units are available:

INWC - Inches of water column
FTWC - Feet of water column
MMWC - Millimeters of water column
CMWC - Centimeters of water column
PSI - Pounds per square inch
INHG - Inches of mercury
MMHG - Millimeters of mercury
MBAR - Millibar
PA - Pascal
KPA - Kilopascals
HPA - Hectopascals
OZIN - Ounce inches

Table 1 Pressure Range vs. Available Units

INWC	FTWC	MMWC	CMWC	PSI	INHG	MMHG	MBAR	PA	KPA	HPA	OZIN
.1000		2.540	.2540			.1868	.2491	24.91		.2491	
.2500		6.350	.6350			.4671	.6227	62.27		.6227	.1445
.5000		12.70	1.270			.9342	1.245	124.5	.1245	1.245	.2890
1.000		25.40	2.540			1.868	2.491	249.1	.2491	2.491	.5780
2.500	.2083	63.50	6.350		.1839	4.671	6.227	622.7	.6227	6.227	1.445
5.000	.4167	127.0	12.70	.1806	.3678	9.342	12.45	1245	1.245	12.45	2.890
10.00	.8333	254.0	25.40	.3613	.7356	18.68	24.91	2491	2.491	24.91	5.780
25.00	2.083	635.0	63.50	.9032	1.839	46.71	62.27	6227	6.227	62.27	14.45
50.00	4.167	1270	127.0	1.806	3.678	93.42	124.5		12.45	124.5	28.90
100.0	8.333	2540	254.0	3.613	7.356	186.8	249.1		24.91	249.1	57.80

NOTE: OVFL (over flow) or UnFL (under flow) will appear when the ranges have been exceeded above or below full scale by 2%.

VEL (Velocity) SUB MENU

For velocity measurement, the following units are available:

SFPM - Standard feet per minute
M/S - Meters per second

Table 2 Available Velocity Ranges

INPUT RANGE INWC	SFPM RANGE	M/S RANGE
0 - 0.1	0 - 1266	0 - 6.431
0 - 0.25	0 - 2002	0 - 10.17
0 - 0.5	0 - 2832	0 - 14.39
0 - 1	0 - 4004	0 - 20.35
0 - 2.5	0 - 6332	0 - 32.17
0 - 5	0 - 8954	0 - 45.48
0 - 10	0 - 12.66 x IK	0 - 64.33
0 - 25	0 - 20.02 x IK	0 - 101.7

NOTE: Air velocity and flow readings are based upon standard dry air conditions with an ambient temperature of 70°F and a barometric pressure of 29.92 INHG.

FLO **(Flow) SUB MENU**

For flow measurements the following units are available:

SCFM - Standard cubic feet per minute

M^3H - Cubic meters per hour

FLO_r **(Flow Range) SUB MENU**

LO - 99.99 x 1K flow range

HI - 999.9 x 1K flow range

Tables 3 -6 show the flow ranges available, and the maximum duct size that can be set for each input range.

Table 3

FLOr **= LO Maximum Duct Size (English)**

RANGE IN WC	SCFM RANGE	MAX. DUCT SIZE, SQ. FT.
0.1	99.99 x 1K	78.9
0.25	99.99 x 1K	49.9
0.5	99.99 x 1K	35.3
1	99.99 x 1K	24.9
2.5	99.99 x 1K	15.7
5	99.99 x 1K	11.1
10	99.99 x 1K	7.8
25	99.99 x 1K	4.9

Table 4

FLOr **= HI Maximum Duct Size (English)**

RANGE IN WC	SCFM RANGE	MAX. DUCT SIZE, SQ. FT.
0.1	999.9 x 1K	789.8
0.25	999.9 x 1K	499.5
0.5	999.9 x 1K	353.1
1	999.9 x 1K	249.7
2.5	999.9 x 1K	157.9
5	999.9 x 1K	111.7
10	999.9 x 1K	78.9
25	999.9 x 1K	49.9

Table 5

FLOr **= LO Maximum Duct Size (Metric)**

RANGE IN WC	M^3/Hr RANGE	MAX. DUCT SIZE M^2
0.1	99.99 x 1K	4.32
0.25	99.99 x 1K	2.73
0.5	99.99 x 1K	1.93
1	99.99 x 1K	1.37
2.5	99.99 x 1K	0.86
5	99.99 x 1K	0.61
10	99.99 x 1K	0.43
25	99.99 x 1K	0.27

Table 6

FLOr **= HI Maximum Duct Size (Metric)**

RANGE IN WC	M^3/Hr Range	MAX. DUCT SIZE, M^2
0.1	999.9 x 1K	43.19
0.25	999.9 x 1K	27.31
0.5	999.9 x 1K	19.3
1	999.9 x 1K	13.64
2.5	999.9 x 1K	8.63
5	999.9 x 1K	6.10
10	999.9 x 1K	4.31
25	999.9 x 1K	2.73

KFAC **SUB MENU**

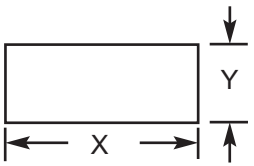
KFAC K Factor - becomes accessible if the instrument is set for Velocity or Flow. When the Digihelic® II Controller is used with a Pitot tube, the manufacturer may specify a K Factor. The adjustment range is 0.01 to 2.00. The factory setting is 1.

AREA, DIA, XDIM and YDIM SUB MENUS

These SUB MENUS become accessible if the instrument is set for flow. When measuring flow, the area of the duct must be specified. Tables 3 and 4 show the input range vs maximum flow and duct size. For a rectangular duct the maximum size is specified in square feet or meters. For a circular duct the maximum size is specified as the diameter. X, Y and circular dimensions are entered in feet with 0.01 foot resolution for FLOr = LO and 0.1 foot resolution for FLOr = HI, or entered in millimeters with 1 millimeter resolution.

AREA - Area, select CIR for a circular duct or RECT for a rectangular duct. If a circular duct is selected, the DIA SUB MENU will be activated. If a rectangular duct is selected, the XDIM and YDIM SUB MENUS will be activated.

DIA - Diameter, enter the diameter of a duct
XDIM - Enter the "X" dimension of a duct
YDIM - Enter the "Y" dimension of a duct



d.S (Display) MAIN MENU

PEAK - Peak value
VALy - Valley value
ZERO - Zero
rESO - Resolution
Pd.S - Process display
DAMP - Dampening level

PEAK (Peak) SUB MENU

The Peak feature stores the highest pressure reading the instrument has measured since the last reset or power up. At power up PEAK is reset to the present pressure reading. To manually reset the PEAK value, press the ENTER key while in the PEAK SUB MENU.

VALy (Valley) SUB MENU

The valley feature stores the lowest pressure reading the instrument has measured since the last reset or power up. At power up VALy is reset to the present pressure reading. To manually reset the VALy value, press the ENTER key while in the VALy SUB MENU.

rESO (Resolution) SUB MENU

The Series ISDP Controller is capable of displaying four digits of resolution.
However, at very low pressures the instability of the pressure may cause fluctuations in the least significant digit causing the least significant digit to be of little value.
Three digit resolution (3DIG) can only be active when there is at least one digit to the right of a decimal.

3DIG - Set display for 3 digit resolution
4DIG - Set display for 4 digit resolution

Pd.S (Process Display) SUB MENU

STD - Display reads pressure, velocity, or flow values
PCT - Display reads % of full scale value

When the display is reading percent, PCT is displayed in the upper right of the display. The percent display is only available in pressure operation.

DAMP (Dampening) SUB MENU

Adjust from 1-16

Dampening stabilizes the display from instabilities due to things such as vibration and excessive pressure fluctuations. The dampening setting adjusts the amount of readings that are averaged for each display update. Adjust the dampening value until the display reads a stable value for the application.

AdJ (Advanced) MAIN MENU

POL - Process output low
POH - Process output high
ZERO - Zero calibration
SPAN - Span calibration

POL and POH (Process Output Low and High) SUB MENUS

This feature is used in pressure operation only.

Process output low and high are used to scale the 4-20 mA output. Set POL to the desired display reading for 4mA output, and set POH to the desired display reading for 20 mA output. POH must be higher than POL. POL may be adjusted 2% BELOW minimum scale up to POH. POH may be adjusted from POL to 2% ABOVE maximum scale.

ZERO and SPAN (Calibration of Zero and Span) SUB MENUS

The lower display reads CAL in this mode.

ZERO Calibration

NOTE: For accurate calibration, DO NOT apply any pressure when performing this function.

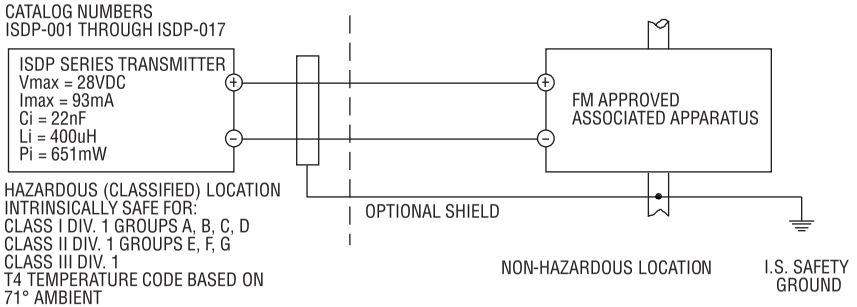
With the display reading ZERO, press the ENTER key. The upper display will blink. Press ENTER again to complete the zeroing of the instrument or press the MENU key to cancel.

SPAN Calibration

With the display set to SPAN, apply full scale pressure to the unit. Press the ENTER key. The upper display will blink. Press ENTER again to complete the calibration or press the MENU key to cancel.

Maintenance

Upon final installation of the Series ISDP intrinsically Safe Differential Pressure Transmitter, no routine maintenance is required. The Series ISDP is not field serviceable and should not be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.



1. THE INTRINSIC SAFE ENTITY CONCEPT ALLOWS THE INTERCONNECTION OF TWO FM APPROVED INTRINSICALLY SAFE DEVICES WITH ENTRY PARAMETERS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM WHEN: Voc OR Uo OR Vt ≤ Vmax, Isc OR It ≤ Imax ≤ Ca or Co ≥ Ci + Ccable, La OR Lo ≥ Li + Lcable, Po ≤ Pi
2. EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Vrms OR VDC.
3. INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NFPA 70, ARTICLE 504) IN US, CANADIAN ELECTRICAL CODE IN CANADA AND ANSI/ISA-RP12.6.
4. NO REVISIONS WITHOUT PRIOR APPROVAL FROM FM RESEARCH.
5. THE ASSOCIATED APPARATUS MANUFACTURERS INSTALLATION INSTRUCTIONS MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.

F M C O N T R O L D R A W I N G

(CD) = CRITICAL DIMENSION
STANDARD TOLERANCES UNLESS NOTED:
ALL DECIMAL DIMENSIONS ± .005
ALL ANGLES ± 1°

SCALE 1:1

NO.	CHANGES	BY/DATE
3	REVISED NOTE 3 TO ADD CANADIAN ELECTRICAL CODE PER ECR #25003	KAS 05-05-09
2	ADDED CLASS II AND III RATINGS PER ECR #23754	AJB 8-6-08
1	CLASS II AND CLASS III RATINGS REMOVED ITEM 6 PER ECR #22759	KAS 01-15-08

DATE 01-02-08
DWN BY KAS
CHKD CAR
APPD LRR

NAME: FM CONTROL DRAWING ISDP
ACAD2002

MATERIAL
FINISH

DWYER INSTRUMENTS, INC.
MICHIGAN CITY, INDIANA 46360 U.S.A.

FR. NO. 19-443480-50

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3

19-443480-50

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, IN 46361, U.S.A.
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

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DIFFERENTIAL PRESSURE TRANSMITTER

Models 115, 215, 315, 115X/P, 215X/P, 315X/P/Z

(Shown with "315X" + "HM" option)

FEATURES:

- Rugged, all welded, totally encapsulated electronics
- Leakproof. No O-ring construction
- Small size
- All SST wetted parts
- Base pressure to 10,000 psi (with option HM)
- Explosion Proof & Intrinsically Safe Approvals

PRESSURE RANGES:

- From 30 to 5000 psid
- From 2 to 300 bar
- (Bi-directional available)

Approvals

WIRING:	115	215	315
A/1 RED	+EXC.	+EXC.	+EXC./SIGNAL
B/2 GREEN	+SIGNAL	+SIGNAL	NC
C/3 WHITE	-SIGNAL	NC	NC
D/4 BLACK	-EXC.	-EXC./SIGNAL	-EXC./SIGNAL
E/5 BLUE	NC OPTION GH	NC OPTION GH	NC OPTION GH
F/6 BROWN	NC OPTION GH	NC OPTION GH	NC OPTION GH
SHIELD	OPEN	OPEN	OPEN

Zero Balance:

(Model 115) 0.0 mV/V ±2% FSOat 70°F at 10 Vdc
(Model 215) 0.0 Vdc ±2% FSO at 70°F at 24 Vdc
(Model 315) 4.0 mA ±2% FSO at 70°F at 24 Vdc

Temperature Compensation:

- Effect on Zero / Span ≤ ±2.0% FSO/100°F for each

Electricals:

(Consult factory for ATEX approval)

- Excitation Voltage:
  (Model 115) 3.5-15 Vdc
  (Models 215/215X) 9-40 Vdc / 10.5-32 Vdc
  (Models 315/315Z) 9-36 Vdc
  (Model 315X) 13-36 Vdc
- Output Current:
  (Model 215) 2.0 mA maximum for less than 0.1% FSO attenuation.
- Output at 70°F:
  (Model 115) 3 mV/V ±2% FSO
  (Models 215/215X) 5 Vdc ±2% FSO
  (Models 315/315X/315Z) 4-20 mA ±2% FSO
- Load Impedance:
  (Model 115) 50,000 ohms min. for less than 0.1% FSO attenuation
  (Model 215) 750 ohms maximum at 24 Vdc & 1350 ohms at 36 Vdc
- Input Impedance:
  (Model 115) 5000 ohms nominal
- Input Current:
  (Model 215) 10 mA nominal

Temperature Limits:

- Compensated: +70º to +180º F
- Operating: -20º to +190º F
- Storage: -65º to +250º F

Mechanicals:

- Proof Pressure: 10 X full scale pressure range or 3000 psi, whichever is less.
- Burst Pressure: 15 X full scale pressure range or 4000 psi, whichever is less.
- Weight: 16 oz. nominal.
- Static Line Pressure: 2000 psi maximum (10,000 psi option)
- Static Line Shift (Zero Shift): ≤ ±1% FSO/1000 PSI
- Wetted Materials: 316 SST
- Enclosure Material: 17-4 and 316 SST
- Mounting: Pressure Port

Connections:

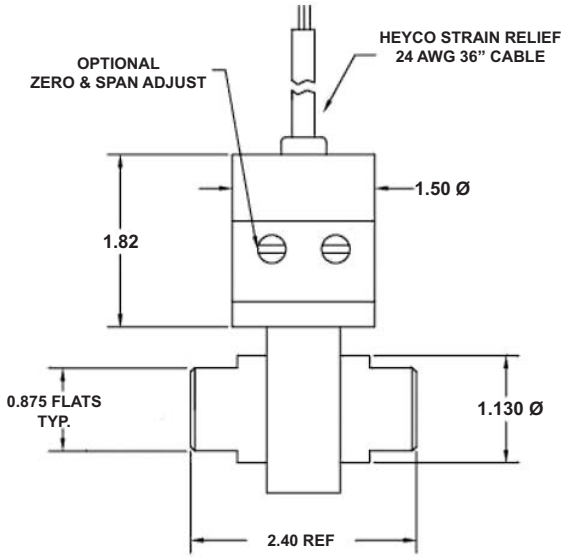
- Pressure: 1/4" NPT (F)
- Electrical Cable:
  (Model 115, 215) 36" long, 4 conductor
  (Model 315) 36" long, 2 conductor

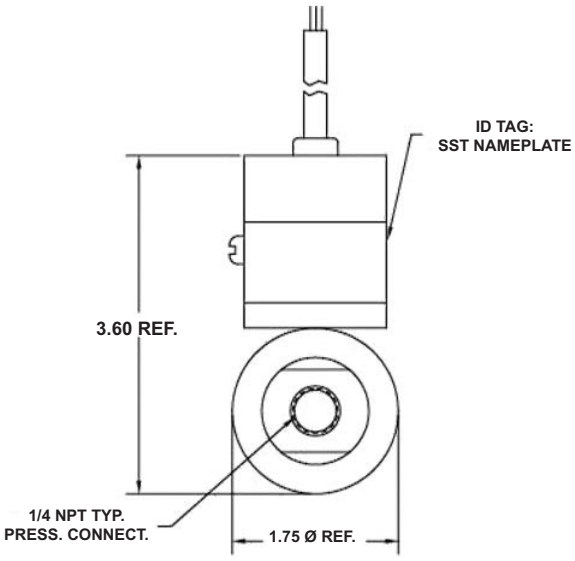
GP:50 reserves the right to make product improvements and amendments to the product specifications stated throughout this brochure without prior notification. Please contact the factory on all critical dimensions and specifications for verification.

DIFFERENTIAL PRESSURE TRANSMITTER

Models 115, 215, 315, 115X/P, 215X/P, 315X/P/Z

Some options will affect dimensions. Consult factory if important.





NOTE:
Specifications reflect standard product, improved performance / mechanical options available.

Modifications may alter specs, consult factory for more information.

INTERTECHNOLOGY INC.
19 Waterman Ave, Toronto,Ont. M4B1Y2
Ph#416-445-5500 Fax#416-445-1170
Toll Free:1-800-465-1600
Email:sales@intertechnology.com
Website:www.intertechnology.com

MODEL:

115	3 mV/V
215	0-5 Vdc
315	4-20 mA
215X	0-5 Vdc Explosion Proof
315X	4-20 mA Explosion Proof
315Z	4-20 mA Intrinsically Safe

ACCURACY:
A - 1.0% FSO / **B -** 0.5% FSO / **C -** 0.2% FSO

PRESSURE RANGE (PSI): **Available with option HM only

PT	30	**RF**	300	**RS**	2500
PV	50	**RH**	500	**RT**	3000**
PX	75	**RJ**	600	**RV**	5000**
PZ	100	**RK**	750	**RW**	6000**
RB	150	**RM**	1000	**RX**	7500**
RD	200	**RO**	1500	**SZ**	Other
RE	250	**RR**	2000		

OPTIONS

AA	None (standard connector)

ALTERNATE CONNECTOR OR CABLE

CA	Bendix PTIH-10-6P (Mate:PTO6E-10-6S [SR], not supplied)
CB	Bendix CF3102E-14S-6P(Mate: CF 3106E-14A-6S (not supplied))
CE	Terminal Block
CF	1/2" NPT(M) thread w/24" potted leads. (Std. on exp. proof models)
CH	NEMA-4X cable, 8' vented polyurethane jacket cable
CJ	DIN 43650 (includes mate)
CL	1/2" NPT (M) conduit, 2' vented polyurethane jacket cable
CO	Junction Box (thermocouple type) and Terminal Block
CT	Teflon jacketed cable, Tefzel used on submersible units, (Options CH, CL, DE)

ALTERNATE PRESSURE PORT

FA	MS33649-4 (1/4 AND-10050, [F])
FC	3/8" NPT (F)
FZ	Non-Standard Pressure Port

GENERAL

CW	Submersible non-vented cable (max. 500 psi external)
DE	IP-67 (NEMA-6) vented polyurethane cable, neoprene grommet
GA	Standardized Output to ±0.5% FSO
GB	Alternate Full Scale, Outputs that are non-standard
GE	Improved Temp. Compensation to ±0.5% FSO/100°F for Zero & Span
GF	Expanded process temperature range, -65 to 250°F (±2% FSO/100°F)
GG	Alternate Calibration Resistor Signal
GH	Internal Calibration Resistor, set to 100% ±0.5% FSO
GJ	Zero & Span Controls (Approximately ±20% FSO) 215 & 315 only
GL	Cleaned for Oxygen Service
GS	0-10 Vdc FSO, Model 215. (Requires 16-40 Vdc excitation)
HK	NEMA-4X rating
HL	RFI Protection (for unit in proximity to radio transmitter).
HM	10,000 psi Base Pressure Flange Girdle. Proof pressure 10 x full scale range or 10,000 psi, whichever is less. Burst pressure 15 x full scale range or 10,500 psi, whichever is less.
HR	±15 Vdc Excitation, Model 215
MD	Zero and Span Controls for Explosion-Proof Units.
MS	Bi-Directional Differential Pressure allows for both positive & Negative signal (Model 315 has a 12 mA zero)

201L LIQUID FILLED

Our '200' series gauge line is a high quality line of liquid filled gauges. The glycerine filling helps dampen the effects of pulsation and vibration, while also perpetually lubricating the movement (and keeping contaminates such as dirt away from all moving parts) which will extend the life of the gauge.

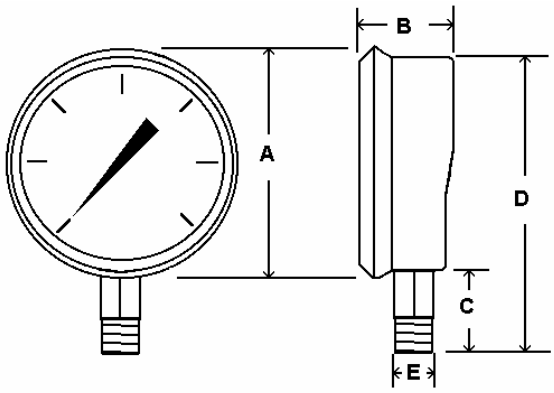
This gauge has been specifically designed with original equipment manufacturers in mind and are typically used on hydraulic & pneumatic systems as well as any commercial or industrial application not corrosive to brass and bronze wetted parts where glycerine filling is suitable for use.

SPECIFICATIONS:

- **Available Dial Sizes:** 1 ½", 2", 2 ½", 4", 6"
- **Available Connection Sizes:**
  1/8"MNPT on 1 ½" and 2"
  1/4"MNPT on 2", 2 ½" and 4"
  1/2"MNPT on 4" and 6"
- **Stainless Steel Case And Bezel**
- **Brass Internals & Connection**
- **Phosphour Bronze Bourdon Tube**
- **Liquid Filled (Dry Available)**
- **Accuracy :** 1 ½" or 2"Dial Size = 3-2-3 %
  2 ½"Dial Size = 1.5 %
  4" or 6"Dial Size = 1 %
- **Dual Scale: PSI & Bar (x100=kPa)**
  Single Scale available from stock
- **Ambient temperature:** FILLED: 30'F to 160'F
  DRY: -30'F to 180'F

RANGE	CODE	Major In	Minor In
30/0"VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	4
0/300	H	50	5
0/400	I	50	5
0/500	J	100	10
0/600	K	100	10
0/800	L	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/4000	Q	500	50
0/5000	R	1000	100
0/6000	S	2000	200
0/10,000	U	2000	200
0/15,000	V	2000	200

Some ranges not available in all dial sizes, please call with your particular application



		A	B	C	D	E
1 ½" Dial	In	1.88	1.06	.89	2.77	1/8" NPT
	MM	48	27	23	58	
2" Dial	In	2.24	1.27	.71	2.80	1/8" or ¼" NPT
	MM	57	32	23	71	
2 ½" Dial	In	2.80	1.28	1.07	3.55	1/4" NPT
	MM	71	33	27	90	
4" Dial	In	4.32	1.63	1.25	5.57	1/4" or ½" NPT
	MM	110	42	32	141	
6" Dial	In	6.54	1.70	1.68	8.22	1/4" or ½" NPT
	MM	166	43	43	210	

202L LIQUID FILLED

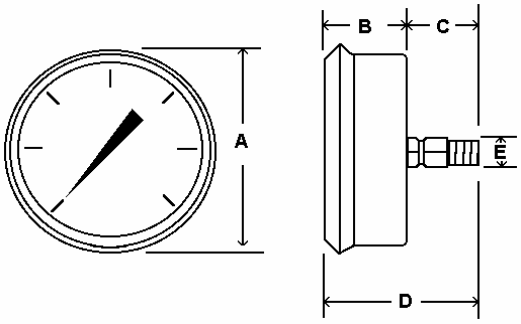
Our '200' series gauge line is a high quality line of liquid filled gauges. The glycerine filling and built in snubber helps dampen the effects of pulsation and vibration, while also perpetually lubricating the movement (and keeping contaminates such as dirt away from all moving parts) which will extend the life of the gauge.

This gauge has been specifically designed with the original equipment manufacturers in mind and are typically used on hydraulic & pneumatic systems as well as any commercial or industrial application not corrosive to brass and bronze wetted parts where glycerine filling is suitable for use.

SPECIFICATIONS:

- **Available Dial Sizes:** 1 ½", 2", 2 ½", 3 ½", 4"
- **Available Connection Sizes:** (includes built-in snubber)
  1/8"MNPT on 1 ½" and 2"
  1/4"MNPT on 2", 2 ½", 3 ½" and 4"
- **Stainless Steel Case And Bezel**
- **Brass Internals & Connection**
- **Phosphor Bronze Bourdon Tube**
- **Plastic Lens Standard (Glass Available)**
- **Liquid Filled (Dry Available)**
- **Accuracy :** 1 ½" and 2" Dial = 3-2-3 %
  2 ½" Dial Size = 1.5 %
  3 ½" and 4" Dial Size = 1 %
- **Dual Scale: PSI & Bar (x100=kPa)**
  Single Scale available from stock
- **Ambient temperature:** FILLED: 30'F to 160'F
  DRY: -30'F to 180'F

RANGE	CODE	Major In	Minor In
30/0"VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	5
0/300	H	50	5
0/400	I	50	5
0/600	K	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/5000	R	1000	100
0/10,000	U	1000	100
0/15,000	V	2000	200



		A	B	C	D	E
1 ½" Dial	In	1.88	1.06	.89	1.95	1/8" Npt
	MM	48	27	23	50	
2" Dial	In	2.23	1.09	.71	1.99	1/8" or ¼"npt
	MM	57	28	23	51	
2 ½" Dial	In	2.80	1.28	1.18	2.46	1/4" NPT
	MM	71	33	30	63	
3 ½" Dial	In	3.83	1.14	1.08	2.20	1/4" NPT
	MM	97	29	27	56	
4" Dial	In	4.32	1.63	1.14	2.77	1/4" NPT
	MM	110	42	29	71	

LP SERIES LOW PRESSURE

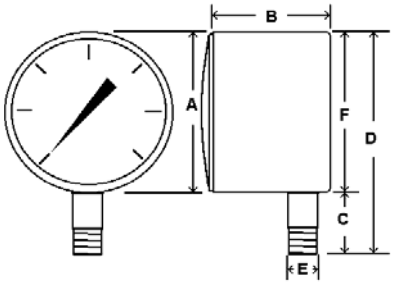
SPECIFICATIONS

- Chrome plated case
- Black steel case (u-clamp panel mnt)
- Brass internals and connection
- Dry non-fillable
- +/- 1.5 % accuracy

FEATURES

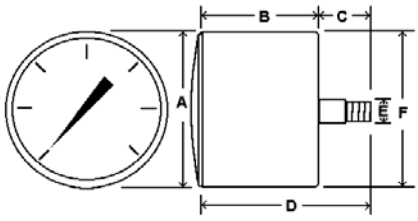
- 2 1/2"dial size with twist lock plastic lens
- zero adjustment screw on back of case
- 1/4"mnpt bottom or back connection
- Capsule type diaphragm to measure low pressures

LP1



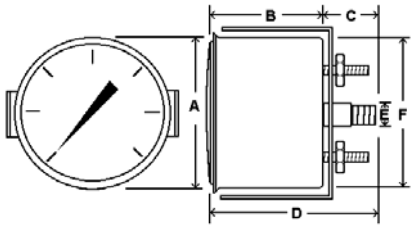
	2 ½"		4"	
	IN	MM	IN	MM
A	2.60"	66	3.98"	101
B	1.70"	44	2.21"	56
C	.85"	22	1.56"	40
D	3.45"	87.5	5.49"	139
E	1/4"NPT		1/4" OR 1/2" NPT	
F	2.60"	66	3.98"	101
G				

LP2



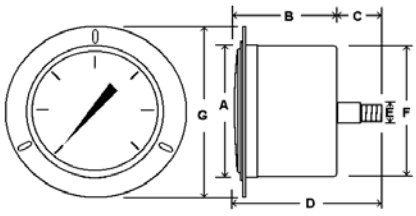
	2 ½"		4"	
	IN	MM	IN	MM
A	2.62"	66.5	----	----
B	1.92"	49	----	----
C	.84"	21.5	----	----
D	2.75"	71	----	----
E	1/4"NPT		----	----
F	2.60"	66	----	----
G			----	----

LP3



	2 ½"		4"	
	IN	MM	IN	MM
A	2.84"	72	----	----
B	1.88"	48	----	----
C	.84"	21.5	----	----
D	2.74"	69.5	----	----
E	1/4"NPT		----	----
F	2.60"	66.2	----	----
G	2.84	72	----	----

LP4



	2 ½"		4"	
	IN	MM	IN	MM
A	2.61	66	----	----
B	1.89	48	----	----
C	.875	22.2	----	----
D	2.74	69.5	----	----
E	1/4"NPT		----	----
F	2.67	68	----	----
G	3.44	87.4	----	----

AVAILABLE RANGES:

200-0"wc Vacuum (2"Minor inc)
160-0"wc Vacuum (2"Minor inc.)
100-0"wc Vacuum (1"Minor inc.)
60-0"wc vacuum (1"Minor Inc.)
30-0"wc vacuum (.5"wc minor)
0-10"wc (.5"wc minor inc.)
0-15"wc (.2"wc minor inc.)
0-30"wc (.5"wc minor inc.)
20 oz./35"wc (.5"wc minor inc.)
35 oz./60"wc (1"wc minor inc.)
0-60"wc (1"wc minor inc.)
0-100"wc (2"wc minor inc.)
0-160"wc (5"wc minor inc.)
0-200"wc (5"wc minor inc.)
0-3 psi (.05 psi minor inc.)
0-5 psi (.1 psi minor inc.)
0-10 psi (.2 psi minor inc.)

NOTE: OTHER RANGES AVAILABLE UPON REQUEST, PLEASE CALL WITH ANY INQUIRIES

Valworx®

Pneumatic Actuators

Quarter Turn Rack & Pinion
Double Acting and Spring Return

SERIES
5300
5301

Features

- Prelubricated and tested to minimum 1,000,000 operations
- Direct valve mounting per ISO 5211
- Visual valve position indicator
- Extruded aluminum body with 50 micron hard anodizing
- Aluminum polyester powder coated end covers for maximum corrosion resistance
- Epoxy coated pre-compressed spring cartridges used with all spring return models
- Namur mounting for direct mounted solenoid valves
- Standard VDI/VDE 3845 mounting for top mounted accessories
- Independent end of travel stops +/- 5 degrees each direction

Applications

Pneumatic actuators typically used to operate quarter turn ball valves, butterfly valves and plug valves, but they can be applied virtually anywhere a 90 degree rotation is required such as dampers. Quick and easy to install with standard ISO 5211/DIN 3337 mounting dimensions and a double square female output shaft (star drive). The operating temperature range of the actuator is 0 to 175° F.

Operation

Double acting actuators require air pressure to open and air pressure to close (pilot air typically supplied by a 4-way valve). Spring return actuators require air pressure to open and use springs to close (pilot air typically supplied by a 3-way valve). Dry or lubricated filtered compressed air supply pilot pressure between 40 and 120 PSI.

Description

Compact heavy duty quarter turn (90 degree) air actuators designed for long life and tested for a minimum 1,000,000 operations. Actuator meets international ISO 5211 standards for easy valve mounting and replacement. Many options are available and easily mounted to the actuator with the standard VDI/VDE-3845 mounting pattern.

Construction

Body	ASTM 6063 extruded aluminium, 50 micron anodizing
End Covers	ASTM B179 die-cast aluminium, 60-80 micron polyester coating
Drive Shaft	Carbon steel, 20 micron nickel plated
Valve Position Indicator	Glass filled Polyamide
Seals	NBR (Buna-N)
Springs (spring return act.)	Pre-compressed cartridges, 60-80 micron polyester coating
Pistons	ASTM B179 die-casted aluminium alloy
Fasteners	Stainless Steel

Options

- Direct mount solenoid valves
- Position indicator switches
- Pneumatic valve positioners

Double Acting "DA" Torque Ratings (inch lbs.) - English Units

STOCK NO.	SIZE	AIR SUPPLY IN PSI						
		36	43	58	72	80	87	100
530032	32	-	-	44	56	61	67	78
530050	50	67	81	109	135	150	164	190
530063	63	122	146	195	243	267	292	341
530075	75	259	311	414	518	570	622	725
530085	85	394	473	631	788	867	947	1105
530090	100	613	826	982	1228	1351	1474	1720
530095	115	1013	1215	1261	2026	2229	2432	2835

Double Acting "DA" Torque Ratings (Nm) - Metric Units

STOCK NO.	SIZE	AIR SUPPLY IN BAR					
		3	4	5	6	7	8
530032	32	-	5.0	6.3	7.6	8.8	10
530050	50	9.2	12.3	15.4	18.5	21.5	24.6
530063	63	16.5	22	27.5	33	38.5	44
530075	75	35.1	46.8	58.5	70.2	81.9	93.6
530085	85	53.4	71.2	89	106.9	124.7	142.4
530090	100	83.2	110.9	138.6	166.4	194.1	221.8
530095	115	137.2	183	228.7	274.5	320.2	366

SIZE	DA Actuator Weights						
	32	50	63	75	85	100	115
Lbs.	1.2	2.5	3.6	6.4	9.3	12.8	20.3
Kg.	0.6	1.2	1.6	2.9	4.2	5.8	9.2

Spring Return "SR" Torque Ratings (inch lbs.) - English Units

STOCK NO.	SIZE	AIR SUPPLY IN PSI								SPRINGS TORQUE	
		72		80		87		100			
		0°	90°	0°	90°	0°	90°	0°	90°	90°	0°
530150	50	85	51	98	56	112	78	139	105	85	51
530163	63	136	92	185	116	234	140	282	189	141	107
530175	75	333	186	385	238	436	290	540	391	333	186
530185	85	510	279	589	358	668	436	825	594	510	279
530190	100	785	443	908	565	1031	688	1277	933	785	443
530195	115	1244	782	1447	985	1650	1188	2055	1593	1244	782
530196	125	1725	941	1992	1208	2258	1474	2791	2007	1725	941
530197	145	2357	1375	2739	1757	3125	2143	3902	2920	2500	1518

0° = closed pistons, extended springs 90° = open pistons, compressed springs

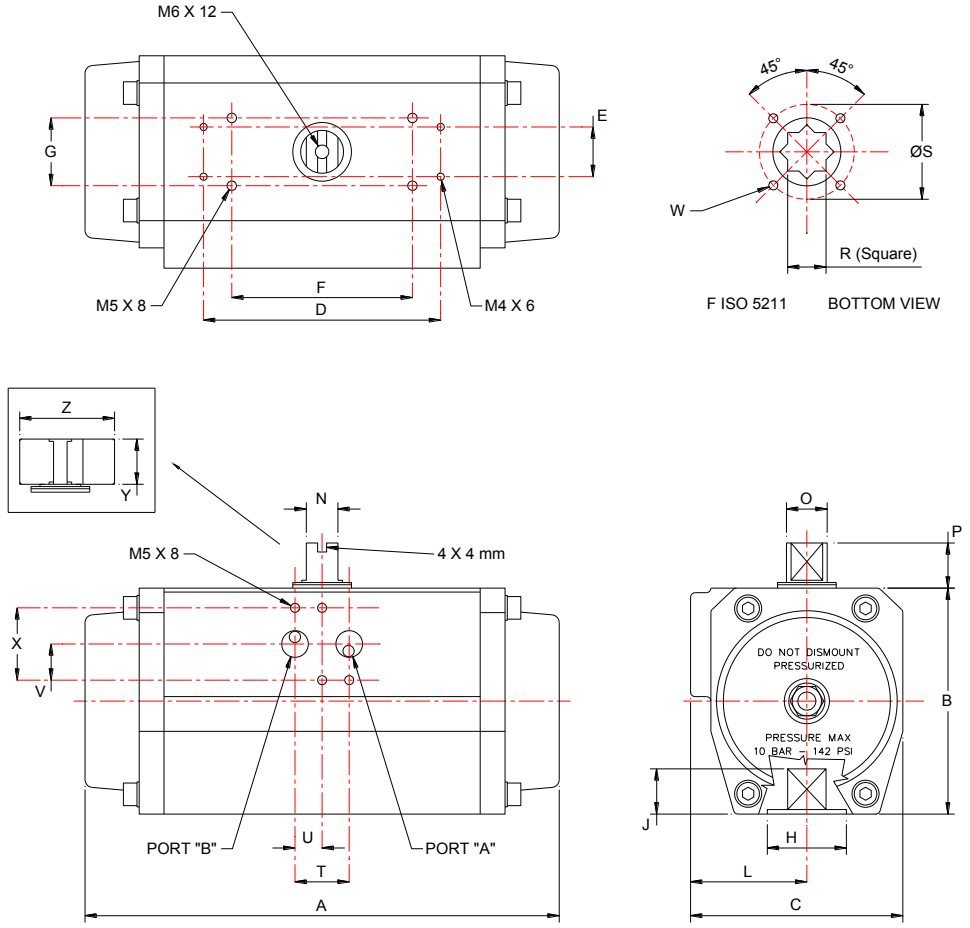
Spring Return "SR" Torque Ratings (Nm) - Metric Units

STOCK NO.	SIZE	AIR SUPPLY IN BAR								SPRINGS TORQUE	
		5		6		7		8			
		0°	90°	0°	90°	0°	90°	0°	90°	90°	0°
530150	50	9.6	5.8	12.7	8.9	15.7	11.9	18.8	15	9.6	5.8
530163	63	15.4	10.4	20.9	15.9	26.4	21.4	31.9	26.9	17.1	12.1
530175	75	37.6	21.1	49.3	32.8	61.0	44.5	72.7	56.2	37.6	21.1
530185	85	57.6	31.5	75.4	49.3	93.2	67.1	111	84.9	57.6	31.5
530190	100	88.7	50	116	77.7	144	105	171	133	88.7	50
530195	115	140	88	186	134	231	179	277	225	140	88
530196	125	194	106	254	166	315	226	375	286	194	106
530197	145	264	154	350	240	437	327	524	414	280	170

0° = closed pistons, extended springs 90° = open pistons, compressed springs

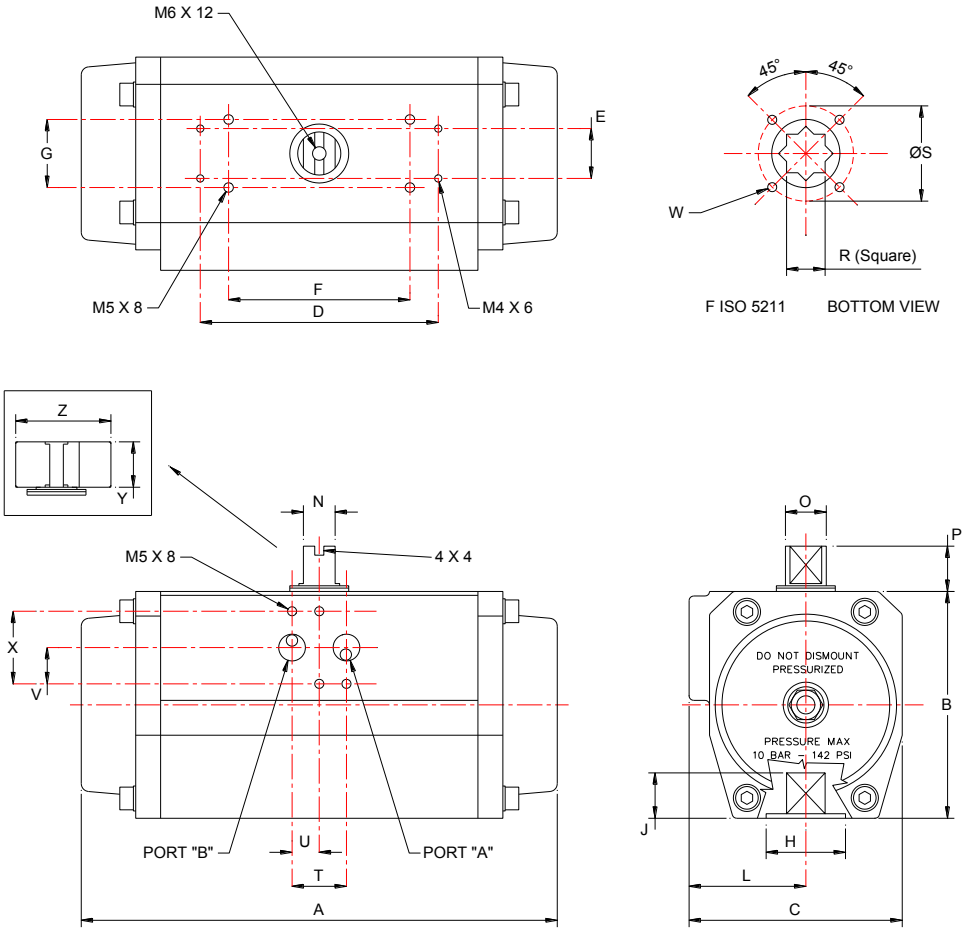
SIZE	SR Actuator Weights							
	50	**63**	**75**	**85**	**100**	**115**	**125**	**145**
Lbs.	2.8	4.2	7.3	10.4	14.7	22.3	30.5	41.1
Kg.	1.3	1.9	3.3	4.8	6.7	10.1	13.8	18.7

Dimensions Sizes 50-145: (inches)



Size	A	B	C	D	E	F	G	H	J	L	N	O	P	R	T	U	V	X	Y	Z	Ports (NPT)	F ISO 5211	S	W
50	5.5	2.6	3.0	–	–	3.15	1.18	1.0	0.4	1.63	0.31	0.47	0.79	0.35	0.97	0.47	0.63	1.26	0.8	1.4	1/8	F03	1.42	M5 X 8
63	6.1	3.3	3.4	–	–	3.15	1.18	1.2	0.5	1.89	0.31	0.47	0.79	0.43	0.94	0.47	0.63	1.26	0.8	1.4	1/4	F03 F05	1.42 1.97	M5 X 8 M6 X 9
75	8.3	3.9	3.7	4.13	0.87	3.15	1.18	1.4	0.6	2.03	0.55	0.71	0.79	0.55	0.94	0.47	0.63	1.26	0.8	1.7	1/4	F05 F07	1.97 2.76	M6 X 9 M8 X 12
85	9.1	4.3	4.1	4.13	0.87	3.15	1.18	1.6	0.8	2.17	0.55	0.71	0.79	0.67	0.94	0.47	0.63	1.26	0.8	1.7	1/4	F05 F07	1.97 2.76	M6 X 9 M8 X 12
100	11.0	4.9	4.7	4.13	0.87	3.15	1.18	2.2	0.8	2.56	0.55	0.71	0.79	0.67	0.94	0.47	0.63	1.26	0.8	1.7	1/4	F05 F07 F10	1.97 2.76 4.02	M6 X 9 M8 X 12 M10 X 15
115	12.2	5.6	5.3	5.47	0.87	5.12	1.18	2.2	1.0	2.78	1.06	1.42	1.18	0.87	0.94	0.47	0.63	1.26	0.8	2.7	1/4	F07 F10	2.76 4.02	M8 X 12 M10 X 15
125	14.3	6.1	5.6	5.47	0.87	5.12	1.18	2.2	1.0	2.81	1.06	1.42	1.18	0.87	0.94	0.47	0.63	1.26	0.8	2.7	1/4	F07 F10	2.76 4.02	M8 X 12 M10 X 15
145	15.4	6.9	6.4	5.47	0.87	5.12	1.18	2.8	1.2	3.27	1.06	1.42	1.18	1.06	0.94	0.47	0.63	1.26	0.8	2.7	1/4	F10 F12	4.02 4.92	M10 X 15 M12 X 18

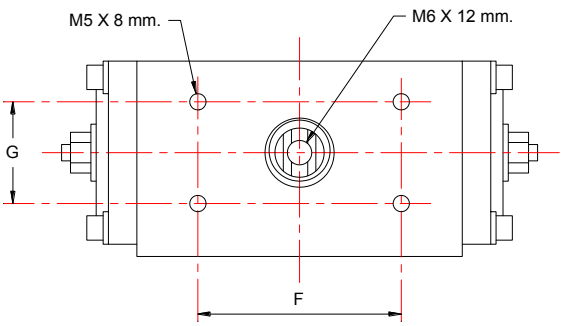
Dimensions Sizes 50-145: (mm)

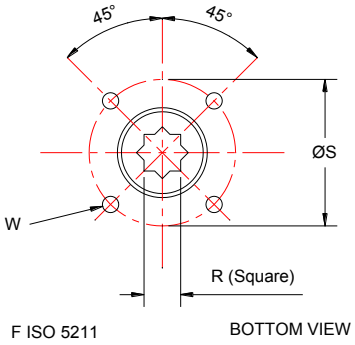


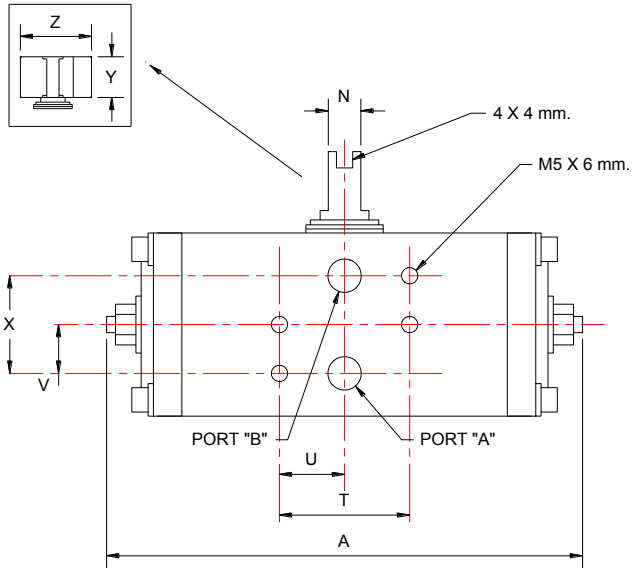
Size	A	B	C	D	E	F	G	H	J	L	N	O	P	R	T	U	V	X	Y	Z	Ports (NPT)	F ISO 5211	S	W
50	139	67	75	–	–	80	30	25	10	41.5	8	12	20	9	24	12	16	32	20	35	1/8	F03	36	M5 X 8
63	155.5	83	86	–	–	80	30	30	13	48	8	12	20	11	24	12	16	32	20	35	1/4	F03 F05	36 50	M5 X 8 M6 X 9
75	210	100	94	105	22	80	30	35	16	51.5	14	18	20	14	24	12	16	32	20	42	1/4	F05 F07	50 70	M6 X 9 M8 X 12
85	230	110	104	105	22	80	30	40	20	55	14	18	20	17	24	12	16	32	20	42	1/4	F05 F07	50 70	M6 X 9 M8 X 12
100	280	125	120	105	22	80	30	55	20	65	14	18	20	17	24	12	16	32	20	42	1/4	F05 F07 F10	50 70 102	M6 X 9 M8 X 12 M10 X 15
115	310	142	134	139	22	130	30	55	25	70.5	27	36	30	22	24	12	16	32	20	68	1/4	F07 F10	70 102	M8 X 12 M10 X 15
125	362	155	141	139	22	130	30	55	25	71.5	27	36	30	22	24	12	16	32	20	68	1/4	F07 F10	70 102	M8 X 12 M10 X 15
145	390	175	163	139	22	130	30	70	30	83	27	36	30	27	24	12	16	32	20	68	1/4	F10 F12	102 125	M10 X 15 M12 X 18

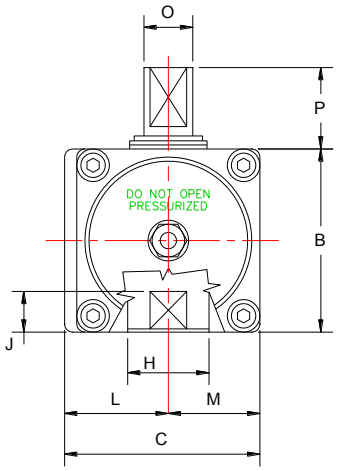
Dimensions Size 32: inches (mm)

Size	32
A	4.61 (117)
B	1.77 (45)
C	1.89 (48)
F	1.97 (50)
G	0.98 (25)
J	0.39 (10)
L	1.00 (25.5)
M	0.89 (22.5)
N	0.31 (8)
O	0.47 (12)
P	0.79 (20)
R	0.35 (9)
T	1.26 (32)
U	0.63 (16)
V	0.47 (12)
X	0.94 (24)
Y	0.79 (20)
Z	1.38 (35)
Ports A & B	1/8 NPT
F ISO 5211	F03
S	1.42 (36)
W	M5 X 8
H	0.98 (25)









Soft Seated Butterfly Valves

Ductile Iron Lug Body ANSI/ASME 150
2" to 6" Sizes

SERIES
5645
5647

Features

- ISO5211 mounting for manual, air or electric actuators
- Unique wave line seat reduces torque and extends seal life
- Ductile iron body with 3-layer epoxy coating
- 316SS disc with 2-piece stem design enhances flow capacity
- Seat vulcanized to valve body
- V-ring stem/shaft seals, same material as seat
- PTFE graphite reinforced stem bearings
- Pressure rated 230 PSI (16 Bar)
- Easily mounts between ANSI/ASME Class 125/150 flanges

Applications

Lug body butterfly valves with EPDM seals are typically used for on-off control of water and other media compatible with the materials of construction. Buna-N seals are typically used for air, oil, vacuum and other media compatible with the materials of construction.

Temperature Range

EPDM Seals: 0 to 266° F (-18 to 130°C)

Buna-N Seals: 0 to 185° F (-18 to 85°C)

Construction

Valve Body	3-layer Epoxy/Epoxy/PUR coated ductile iron GGG40
Disc	316 stainless steel CF8M
Disc Seat/Liner	EPDM or Buna-N
Stem Seals	V-ring (same material as seat)
Stem	420SS
Bearings	PTFE Graphite reinforced/Nylon
Fasteners	Stainless Steel

Operation

Direct mount lug butterfly valves can be easily fitted with optional manual operator, air actuator or electric actuator using standard ISO5211 top mounting. Turning the square stem one quarter turn rotates the stainless steel disc and opens or closes the valve. Unique wave line soft seat reduces the torque required to close the valve and extends the seal life.

Description

Lug butterfly valves with epoxy- coated ductile iron body are designed to control various media in commercial and industrial applications. Valve mounts between two standard ANSI/ASME Class 125/ 150 flanges. Seat to flange seal, eliminates the need for flange gaskets. Disc is precision machined 316SS for maximum corrosion resistance. Two piece stem and disc design enhances the flow capacity and reduces turbulence.

Options

- Hand lever with 10 position locking
- Gear Operators (6" sizes)
- Air Actuators
- Electric Actuators

Specifications (English units)

Stock Number	Pipe Size (inch)	Orifice Diam. (inch)	Cv Flow Factor	Pressure Max.(PSI)	Fluid Media*	Body	Disc
Lug Body EPDM Seals: BARE STEM							
564516	2	2.00	124	230	Water	Ductile Iron	316SS
564520	2-1/2	2.50	247	230	Water	Ductile Iron	316SS
564524	3	3.00	470	230	Water	Ductile Iron	316SS
564532	4	4.00	929	230	Water	Ductile Iron	316SS
564548	6	6.00	2243	230	Water	Ductile Iron	316SS
Lug Body BUNA-N Seals: BARE STEM							
564716	2	2.00	124	230	Air, Oil, Vacuum	Ductile Iron	316SS
564720	2-1/2	2.50	247	230	Air, Oil, Vacuum	Ductile Iron	316SS
564724	3	3.00	470	230	Air, Oil, Vacuum	Ductile Iron	316SS
564732	4	4.00	929	230	Air, Oil, Vacuum	Ductile Iron	316SS
564748	6	6.00	2243	230	Air, Oil, Vacuum	Ductile Iron	316SS

Cv = The GPM of water at 60° F that will pass through the valve with 1 PSI pressure drop

* Consult compatibility chart for other fluid media. Suitable for vacuum up to 29 inHg

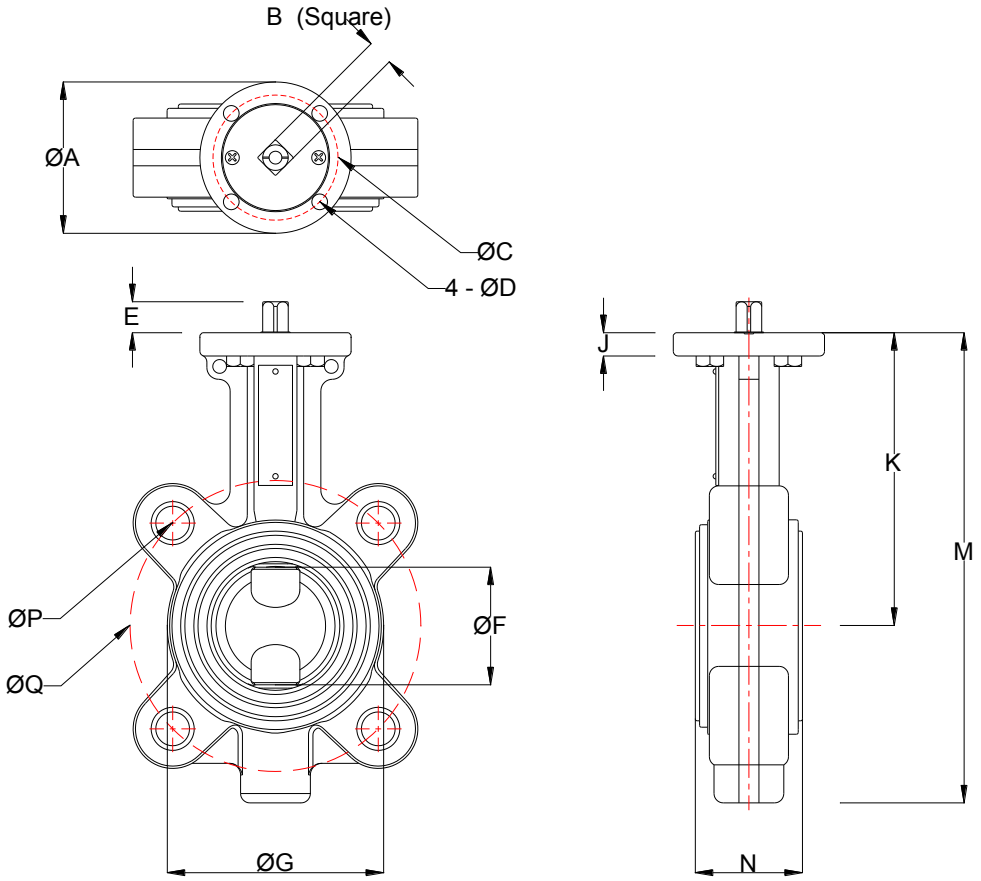
Specifications (Metric units)

Stock Number	Pipe Size (DN)	Orifice Diam. (mm)	Kv Flow Factor	Pressure Max.(Bar)	Fluid Media*	Body	Disc
Wafer Body EPDM Seals: BARE STEM							
564516	50	50	107	16	Water	Ductile Iron	316SS
564520	65	65	212	16	Water	Ductile Iron	316SS
564524	80	80	404	16	Water	Ductile Iron	316SS
564532	100	100	799	16	Water	Ductile Iron	316SS
564548	150	150	1929	16	Water	Ductile Iron	316SS
Wafer Body BUNA-N Seals: BARE STEM							
564716	50	50	107	16	Air, Oil, Vacuum	Ductile Iron	316SS
564720	65	65	212	16	Air, Oil, Vacuum	Ductile Iron	316SS
564724	80	80	404	16	Air, Oil, Vacuum	Ductile Iron	316SS
564732	100	100	799	16	Air, Oil, Vacuum	Ductile Iron	316SS
564748	150	150	1929	16	Air, Oil, Vacuum	Ductile Iron	316SS

Kv = The number of m^3 per hour of 20° C water at 1 bar pressure drop

* Consult compatibility chart for other fluid media. Suitable for vacuum up to 29 inHg

Dimensions 2" to 6" Sizes



Suitable between flanges:

- ANSI/ASME B16.5 CLASS150
- ANSI/ASME B16.1 CLASS125

Pipe Size		A	B	C	D	E	F	G	J	K	M	N	P	Q	ISO	Weight
2	inch	2.56	0.43	1.97	0.28	0.53	1.97	3.74	0.39	4.96	7.95	1.81	4) 5/8-11	4.74	F05	6.6 lb
	mm	65	11	50	7	13.5	50	95	10	126	202	46	–	120.5		3.0 kg
2-1/2	inch	2.56	0.43	1.97	0.28	0.53	2.56	4.13	0.39	5.28	8.50	1.93	4) 5/8-11	5.50	F05	8.4 lb
	mm	65	11	50	7	13.5	65	105	10	134	216	49	–	139.7		3.8 kg
3	inch	2.56	0.43	1.97	0.28	0.53	3.15	4.72	0.39	6.18	9.96	1.93	4) 5/8-11	6.00	F05	11.2 lb
	mm	65	11	50	7	13.5	80	120	10	157	253	49	–	152.4		5.1 kg
4	inch	2.56	0.43	1.97	0.28	0.53	3.94	5.79	0.51	6.57	11.06	2.19	8) 5/8-11	7.50	F05	15.9 lb
	mm	65	11	50	7	13.5	100	147	13	167	281	56	–	190.5		7.2 kg
6	inch	3.54	0.67	2.76	0.35	0.73	5.91	8.07	0.51	7.99	13.58	2.31	8) 3/4-10	9.50	F07	29.8 lb
	mm	90	17	70	9	18.5	150	205	13	203	345	59	–	241.3		13.5 kg

Valve Seating Torques (inch lbs)

SIZE	Maximum Differential Pressure (PSI)				
	50	100	145	200	230
2	62	62	71	71	71
2-1/2	97	97	106	115	115
3	124	133	151	159	168
4	186	195	212	239	248
6	400	434	487	558	593

Valve Seating Torques (NM)

SIZE	Maximum Differential Pressure (Bar)				
	3.5	7	10	14	16
DN50	7	7	8	8	8
DN65	11	11	12	13	13
DN80	14	15	17	18	19
DN100	21	22	24	27	28
DN150	45	49	55	63	67

Torques shown are for on-off "wet" service (ex: water), For dry service (ex: air) multiply above values by 1.25. Valves disc turned clockwise and activated at least once per month. The effect of dynamic torque is not considered in calculation.

Flow Capacity (Cv)

SIZE	Disc Open Angle							
	20°	30°	40°	50°	60°	70°	80°	90°
2	1	5.5	16	33	54	82	113	124
2-1/2	2.7	13	31	57	89	141	199	247
3	7	32	62	106	163	248	350	470
4	16	66	125	203	225	470	691	929
6	59	150	260	422	665	1136	1785	2243

Cv = The number of US gallons per minute of 60° F water at 1 psi pressure drop

Flow Capacity (Kv)

SIZE	Disc Open Angle							
	20°	30°	40°	50°	60°	70°	80°	90°
DN50	0.9	4.7	13	29	47	71	97	107
DN65	2.3	11	26	49	77	121	170	212
DN80	6	28	54	91	140	213	301	404
DN100	14	57	108	175	262	404	594	799
DN150	51	129	224	363	572	977	1535	1929

Kv = The number of m^3 per hour of 20° C water at 1 bar pressure drop

Valworx

Hand Lever

Wafer or Lug Style Butterfly Valves
2″ to 6″ Sizes

ACCESSORY
5650

Features

- Powder epoxy coated steel hand lever
- 10 position locking handle
- Convenient installation and usage
- 304SS bolts and nuts

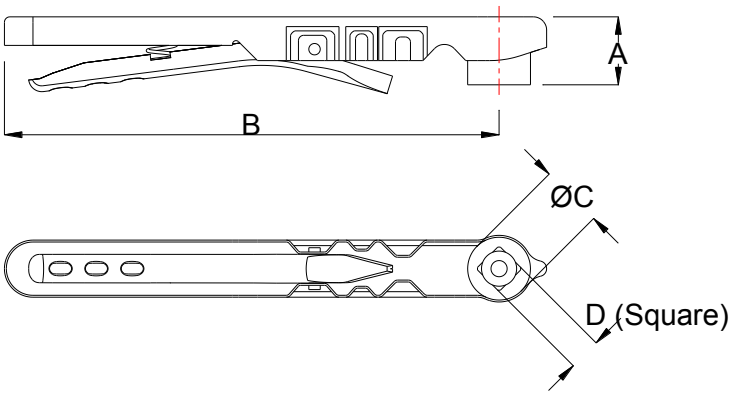
Appication

Hand lever operator for wafer and lug style butterfly valves. The valve disc can be locked in any one of 10 positions with spring loaded lever. Hand lever kit includes lever, gear locking plate and stainless hardware for mounting.

Specifications

Stock No.	Description
565001	Hand lever for valve sizes 2″, 2-1/2″, 3″ and 4″ (DN50, DN65, DN80, DN100)
565003	Hand lever for valve size 6″ (DN150)

Dimensions



Pipe Size		A	B	C	D	ISO	Weight
2, 2-1/2, 3, 4 (DN50, 65, 80, 100)	inch	1.14	7.28	1.10	0.43	F05	0.90 lbs
	mm	29	185	28	11		0.41 kg
6 (DN150)	inch	1.18	10.24	1.10	0.67	F07	1.15 lbs
	mm	30	260	30	17		0.52 kg

Hand Wheel Gear Operator

Wafer or Lug Style Butterfly Valves
2" to 6" Sizes

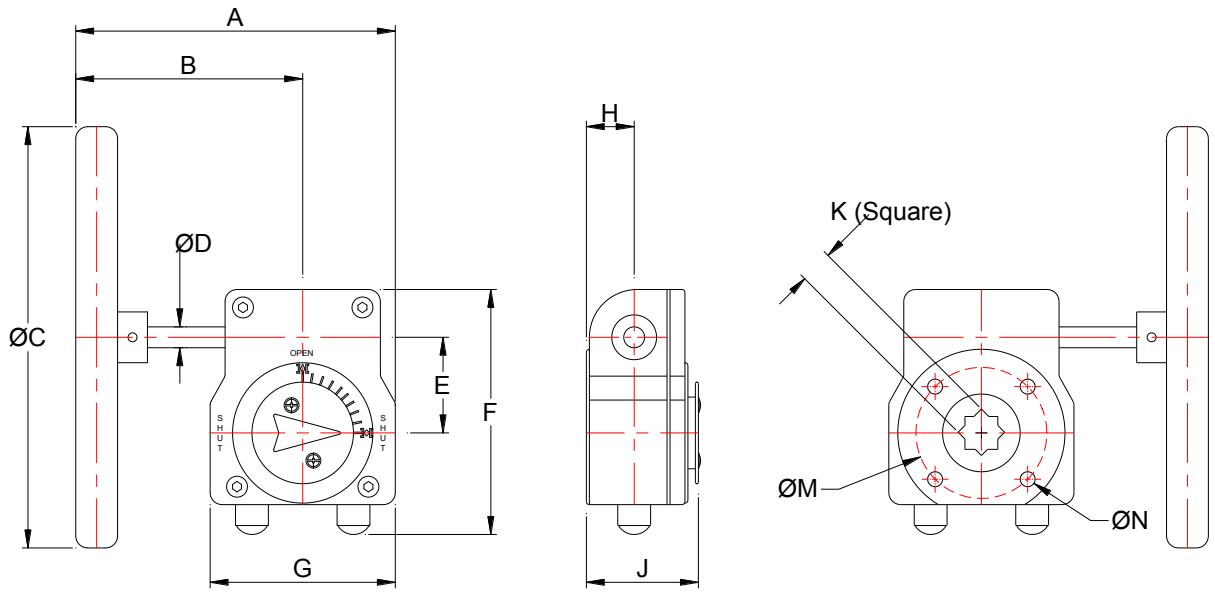
Accessory
5650

Features

- Aluminum alloy housing
- Hand wheel control
- Steel input shaft and worm gear drive
- Easy ISO5211 mounting
- Waterproof enclosure
- Adjustable travel stops are standard and factory set
- 304SS bolts and nuts

Specifications

Stock No.	Description
565006	Hand wheel gear operator for valve sizes 2", 2-1/2", 3" and 4" (DN50, DN65, DN80, DN100)
565008	Hand wheel gear operator for valve size 6" (DN150)



Pipe Size		A	B	C	D	E	F	G	H	J	K	M	N	ISO	Weight
2, 2-1/2, 3, 4	inch	5.55	4.25	4.72	0.47	1.69	4.41	3.15	1.02	2.05	0.43	1.97	-	F05	2.9 lbs
(DN50, 65, 80, 100)	mm	141	108	120	12	43	112	80	26	52	11	50	M6x10 depth		1.32 kg
6	inch	6.77	4.69	7.87	0.47	2.01	5.12	3.94	1.02	2.05	0.67	2.76	-	F07	4.9 lbs
(DN150)	mm	172	119	200	12	51	130	100	26	52	17	70	M8x12 depth		2.22 kg

Brass Gate Valve

Brass Body • Non-Rising Stem • Full Port

200 PSI/14 Bar Non-Shock Cold Working Pressure
Truesdail LAB listed to NSF/ANSI 61-8

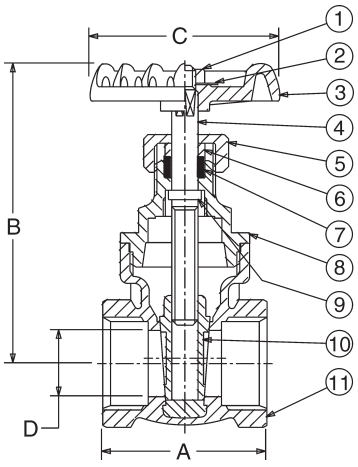
TI-8
Threaded

SI-8
Solder

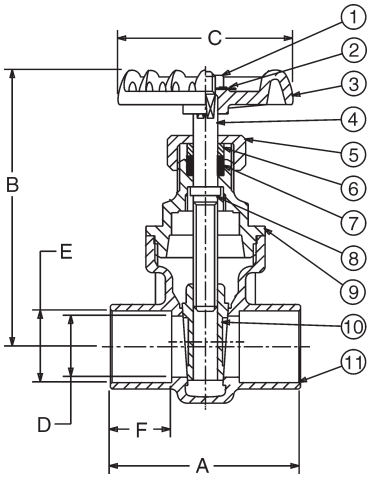
MATERIAL LIST

	PART	SPECIFICATION
1.	Nut	Steel plated ASTM A 108 Alloy G10100
2.	Name Plate	Aluminum ASTM B 209 Alloy 1100
3.	Handwheel	Cast Iron ASTM A 48 Class No. 35
4.	Stem	Brass ASTM B 16 Alloy C36000
5.	Packing Nut	Brass ASTM B 16 Alloy C36000 or B 584 Alloy C85700
*6.	Gland	Brass ASTM B 16 Alloy C36000
7.	Packing	Graphite/Rubber Non-Asbestos
8.	Bonnet	Brass ASTM B 584 Alloy C85700
9.	Lock Nut	Brass ASTM B 16 Alloy C 36000
10.	Wedge	Brass ASTM B 584 Alloy C85700
11.	Body	Brass ASTM B 584 Alloy C85700

*** Packing gland only for valves 1½" and larger.**
† Available with Drain in sizes ½" and ¾" for TI-8. Specify TI-8D on order.



TI-8
NPT x NPT



SI-8
Cup x Cup

DIMENSIONS—WEIGHTS

Size		Dimensions TI-8 A		SI-8 A		TI-8 B		SI-8 B		TI-8 C		SI-8 C		TI-8 D		SI-8 D		SI-8 E		SI-8 F		WEIGHT TI-8		WEIGHT SI-8	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.
¼	8	1.61	41	—	—	2.76	70	—	—	2.13	54	—	—	0.39	10	—	—	—	—	—	—	0.55	0.25	—	—
⅜	10	1.61	41	1.57	40	2.76	70	2.76	70	2.13	54	2.13	54	0.39	10	0.39	10	.50	13	0.38	10	0.55	0.25	0.55	0.25
½	15	1.69	43	1.77	45	2.83	72	2.83	72	2.13	54	2.13	54	0.50	12	0.50	13	.63	16	0.50	13	0.59	0.27	0.59	0.27
¾	20	1.85	47	2.32	59	3.31	84	3.31	84	2.13	54	2.13	54	0.75	19	0.75	19	.88	22	0.75	19	0.77	0.35	0.77	.035
1	25	2.13	54	2.76	70	3.86	98	3.86	98	2.40	61	2.40	61	0.94	24	0.94	24	1.13	29	0.91	23	1.06	0.48	1.06	0.48
1¼	32	2.40	61	2.87	73	4.57	116	4.57	116	3.03	77	3.03	77	1.25	32	1.25	32	1.38	35	0.97	25	1.54	0.70	1.54	0.70
1½	40	2.44	62	3.19	81	4.92	125	4.92	125	3.03	77	3.03	77	1.48	38	1.48	38	1.63	41	1.09	28	2.11	0.96	2.11	0.96
2	50	2.83	72	3.90	99	6.02	153	6.02	153	3.27	83	3.27	83	1.94	49	1.94	49	2.13	54	1.34	34	3.17	1.44	3.17	1.44
*2½	65	3.50	89	4.61	117	7.32	186	7.32	186	4.13	105	4.13	105	2.48	63	2.48	63	2.63	67	1.47	37	3.79	2.63	5.79	2.63
*3	80	3.98	101	5.20	132	8.70	221	8.70	221	4.41	112	4.41	112	2.95	75	2.95	75	3.13	80	1.66	42	8.10	3.68	8.10	3.68
*4	100	4.57	116	—	—	10.16	258	—	—	6.67	172	—	—	3.62	92	—	—	—	—	—	—	20.94	9.52	—	—

***Conventional Port only**

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DelVal® SERIES 56/57

High Flow Resilient Seated Butterfly Valves

Wafer & Lug , Sizes 2″-24″ / DN50-DN600

2″-12″ Class 150 / 285 PSI

14″-24″ PN16 / 230 PSI

DelTech

Leading the Industry with Innovation by Design

DelTech Controls is pleased to offer top-of-the-line products in pipeline flow control. The DelVal Series 56 (wafer body) and Series 57 (lug body) Butterfly Valves have been developed with extensive application, design and manufacturing expertise. These products are produced by employing modern manufacturing practices under a robust quality assurance system. These practices ensure consistent product quality and dependable performance. The DelVal Series 56/57 Butterfly Valves have been designed to include state-of-the-art features that are described in this bulletin.

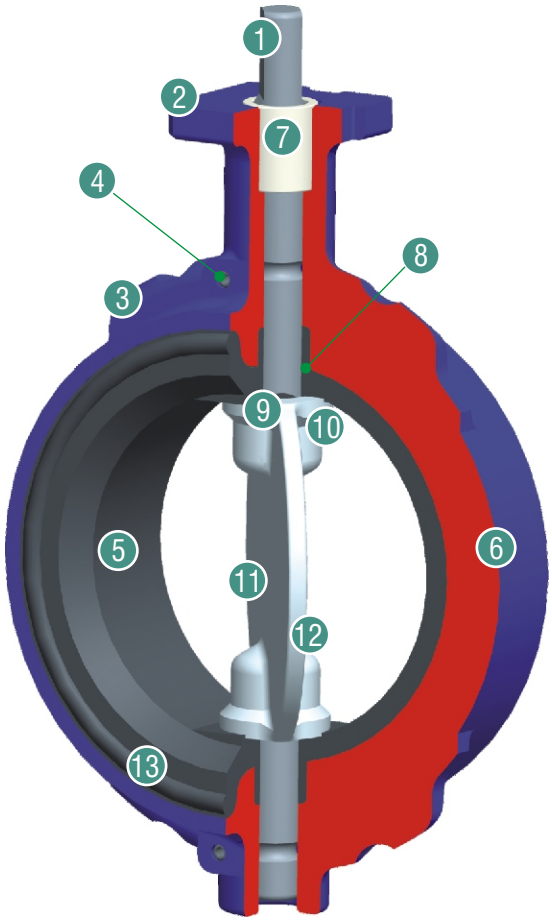
Features

1. High Strength Stem - Stem connection available in standard DelVal sizes .

2. Top plate drilled to fit ISO 5211 dimensions. All handles, gear operators, pneumatic and electric DelTorq actuators are designed to mount directly to DelVal Valves.

3. Four flange locating ribs for sizes up to 12" and four flange locating holes from size 14" to 24" for easy alignment of valve during installation. They meet ANSI #125 /150 or other world drilling standards.

4. Unique stem retention system to provide blow-out proof stem and easy assembly and disassembly of valve.



5. Unique "integral rubber rich seat" in various elastomeric materials provides ultimate sealing in a wide variety of applications. Integral rubber rich seat offers all the advantages of a cartridge seat and the integrity of one-piece body/seat design. This construction allows easy installation between tightly spaced flanges without using flange spreader. Offers 100% bi-directional sealing against vacuum and dead end service to full rated pressure without the use of a downstream flange.

6. Heavy duty one-piece body. Standard coating is two coats of hard, zinc-rich epoxy for excellent corrosion resistance.

7. Heavy duty acetal bushing absorbs the forces acting on the stem/disc assembly due to line pressure.

8. The secondary sealing is achieved through double integrally molded 'O' rings which are compressed around the stem.

9. Positive disc stem engagement by a precision machined square drive, eliminating potential leak path and failure of stem joint.

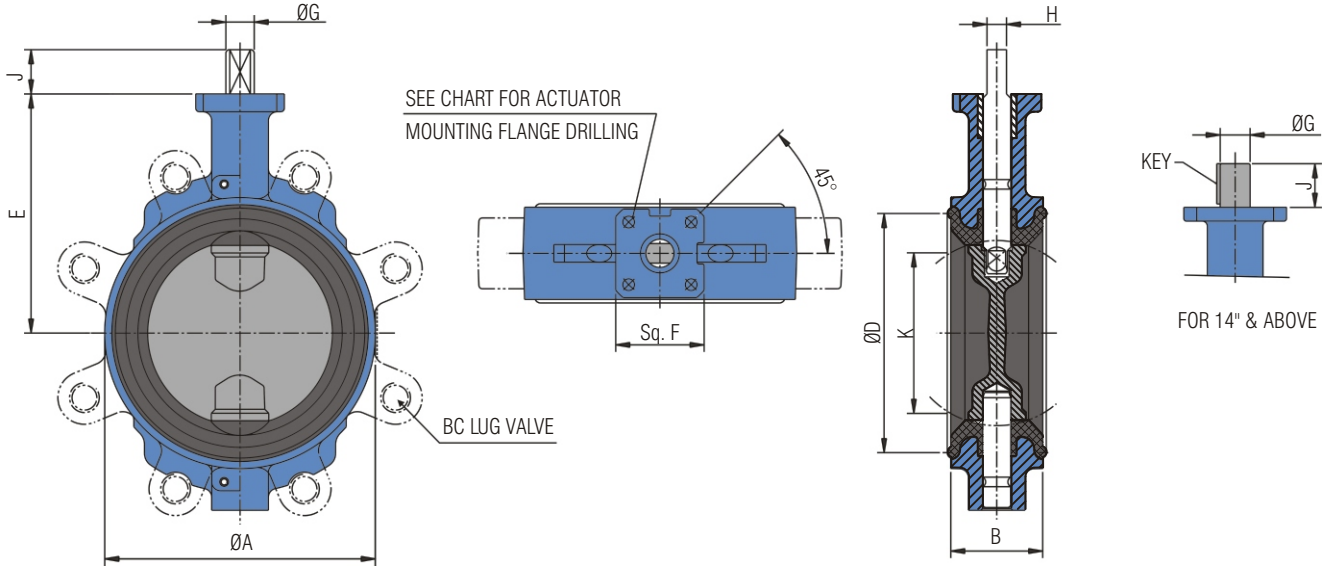
10. Precision machined radius on the upper and lower disc hubs is pressed against upper and lower seat sealing faces for achieving primary sealing between disc and seat.

11. High flow disc design provides a streamlined flow passage, enhanced flow characteristics and reduced resistance to flow especially for control applications.

12. Nylon PA 12 coated disc option ensures excellent corrosion resistance to several chemical media. The hard, non-porous sintered polymer has very low hygroscopicity and is suitable for use in drinking water and food grade applications.

13. Flange gasket ('O' ring) is integral to the body lining which eliminates the need of separate gasket.

Engineering



DIMENSIONS (Inch)

Valve Size		ØA	∗B	ØD	E	Sq'F'	TOP FLANGE DRILLING			ØG	H	J	Key Size	K	LUG BOLTING DATA			Weights In Lbs	
Inches	DN						BC	NO. OF HOLES	HOLE DIA.						BC	NO. OF HOLES	THREADS UNC/UN-2B	Wafer (Series 56)	Lug (Series 57)
2	50	3.54	1.69	2.83	4.13	1.96	1.96	4	0.27	0.55	0.39	0.78	-	1.29	4.75	4	5/8-11	4.96	6.61
2 1/2	65	4.13	1.81	3.46	4.48	1.96	1.96	4	0.27	0.55	0.39	0.78	-	2.02	5.50	4	5/8-11	5.73	7.82
3	80	4.80	1.81	4.13	4.72	1.96	1.96	4	0.27	0.55	0.39	0.78	-	2.67	6.00	4	5/8-11	6.83	8.92
4	100	6.02	2.06	5.31	5.31	1.96	1.96	4	0.27	0.63	0.43	0.78	-	3.52	7.50	8	5/8-11	9.92	15.43
5	125	7.24	2.19	6.45	5.90	2.75	2.76	4	0.39	0.75	0.51	1.25	-	4.54	8.50	8	3/4-10	15.87	23.58
6	150	8.26	2.19	7.40	6.49	2.75	2.76	4	0.39	0.75	0.51	1.25	-	5.45	9.50	8	3/4-10	17.19	26.23
8	200	10.39	2.38	9.52	8.07	3.93	2.76/4.01	4	0.39/0.47	0.87	0.63	1.25	-	7.38	11.75	8	3/4-10	31.41	41.33
10	250	12.44	2.69	11.49	9.25	3.93	4.01	4	0.47	1.18	0.87	2.0	-	9.30	14.25	12	7/8-9	47.61	65.25
12	300	14.56	3.06	13.62	10.82	3.93	4.01	4	0.47	1.18	0.87	2.0	-	11.11	17.00	12	7/8-9	66.13	97.00
14	350	16.22	3.06	15.11	12.20	4.72	4.92	4	0.55	1.38	-	2.00	0.39x0.39	12.70	18.75	12	1-8	88.18	123.01
16	400	18.42	4.00	17.24	13.38	4.72	4.92	4	0.55	1.38	-	2.00	0.39x0.39	14.65	21.25	16	1-8	132.71	186.51
18	450	20.66	4.48	19.40	14.56	Ø6.89	5.51	4	0.70	1.57	-	2.36	0.31x0.47	16.52	22.75	16	1 1/8-8	196.21	240.30
20	500	22.75	5.00	21.57	15.74	Ø6.89	5.51	4	0.70	1.57	-	2.36	0.31x0.47	18.43	25.00	20	1 1/8-8	239.20	309.08
24	600	26.96	6.06	25.59	18.30	Ø8.27	6.50	4	0.83	1.97	-	2.76	0.39x0.47	22.55	29.50	20	1 1/4-8	385.80	477.07

DIMENSIONS (mm)

Valve Size		ØA	∗B	ØD	E	Sq'F'	TOP FLANGE DRILLING			ØG	H	J	Key Size	K	LUG BOLTING DATA			Weights In Kg	
Inches	DN						BC	NO. OF HOLES	HOLE DIA.						BC	NO. OF HOLES	THREADS UNC/UN-2B	Wafer (Series 56)	Lug (Series 57)
2	50	90	43	72	105	50	50	4	7	14	10	20	-	32.7	120.7	4	5/8-11	2.25	3.00
2.5	65	105	46	88	114	50	50	4	7	14	10	20	-	51.4	139.7	4	5/8-11	2.60	3.55
3	80	122	46	105	120	50	50	4	7	14	10	20	-	67.8	152.4	4	5/8-11	3.10	4.05
4	100	153	52	135	135	50	50	4	7	16	11	20	-	89.5	190.5	8	5/8-11	4.50	7.00
5	125	184	56	164	150	70	70	4	10	19	13	32	-	115.3	215.9	8	3/4-10	7.20	10.70
6	150	210	56	188	165	70	70	4	10	19	13	32	-	138.4	241.3	8	3/4-10	7.80	11.90
8	200	264	60	242	205	100	70/102	4	10/12	22	16	32	-	187.6	298.5	8	3/4-10	14.25	18.75
10	250	316	68	292	235	100	102	4	12	30	22	51	-	236.4	362.0	12	7/8-9	21.60	29.60
12	300	370	78	346	275	100	102	4	12	30	22	51	-	282.4	431.8	12	7/8-9	30.00	44.00
14	350	412	78	384	310	120	125	4	14	35	-	51	10x10	322.4	476.2	12	1-8	40.00	55.80
16	400	468	102	438	340	120	125	4	14	35	-	51	10x10	372.3	539.7	16	1-8	60.20	84.60
18	450	525	114	493	370	Ø175	140	4	18	40	-	60	8x12	419.8	577.8	16	1 1/8-8	89.00	109.00
20	500	578	127	548	400	Ø175	140	4	18	40	-	60	8x12	468.1	635.0	20	1 1/8-8	108.50	140.20
24	600	685	154	650	465	Ø210	165	4	21	50	-	70	10x12	572.7	749.3	20	1 1/4-8	175.00	216.40

* Face to Face dimension "B", generally conforming to API 609 Category A//BS EN 558-1 Series 20/ISO 5752 Series 20/MSS SP 67/ASME B 16.10
All bolt holes 1 1/8" and larger have a 8-UN thread series as per API 609

TORQUE (Lb.-Inch)

Valve Size		2"	2.5"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
Full Rated Pressure Valve △P, PSI	50	62	106	115	241	360	484	878	1409	2366	3064	3684	5795	6741	9601
	100	72	124	142	256	393	545	977	1586	2677	3527	4428	7273	8441	12482
	150	80	142	177	271	426	582	1083	1756	2987	3980	5178	8756	10126	15576
	230	150	212	283	478	575	1062	1859	2823	4142	6106	8187	10550	13329	26809
	285	177	248	354	540	637	1150	2168	3098	4673	-	-	-	-	-
Reduced Disc Dia. △P, PSI	50	-	-	-	133	187	267	623	771	1259	2159	2627	3649	4285	6500

TORQUE (Nm)

Full Rated Pressure Valve △P, Bar	3.5	7	12	13	27	41	55	99	159	267	346	416	655	762	1085
	7	8	14	16	29	44	62	110	179	302	398	500	822	954	1410
	10	9	16	20	31	48	66	122	198	337	450	585	989	1144	1760
	16	17	24	32	54	65	120	210	319	468	690	925	1192	1506	3029
	Class 150	20	28	40	61	72	130	245	350	528	-	-	-	-	-
Reduced Disc Dia. △P, Bar	3.5	-	-	-	15	21	30	70	87	142	244	297	412	484	734

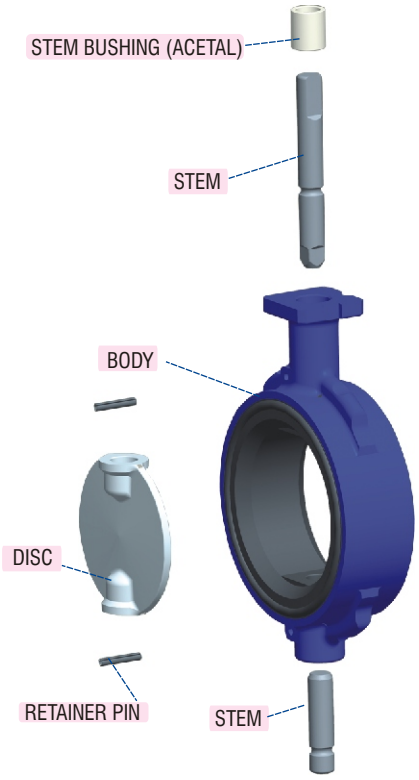
Material of Construction

Body
- Cast Iron ASTM A126 Class B
- Ductile Iron ASTM A536 Grade 65-45-12

Disc
- DI ASTM A 536 Grade 65-45-12 + Epoxy coated
- 316 Stainless Steel ASTM A351 Grade CF8M
- Nylon 12 Coated Ductile Iron ASTM A536 Grade 65-45-12 (Optional)

Stem
- 410 Stainless Steel ASTM A479 Type 410
- ASTM A564 17-4-PH

Seat
- EPDM - Food Grade
- Buna-N - Food Grade



General Design and Manufacturing Standard: API 609 / BS EN -593

Testing Standard: API 598 / BS EN 12266-1

Seat Temperature Range:

Seat Type	Temperature Range	
	Min.	Max.
EPDM	-13^{0}F (-25^{0}C)	302^0 F (150^{0}C)
BUNA-N	-13^0 F (-25^{0}C)	212^0 F (100^{0}C)

Pressure Rating:

For bi-directional bubble tight shut off and full vacuum service with disc in the closed position.

Inch	DN	PSIG	BARG
2"- 24"	50-600	50	3.5
2"- 24"	50-600	150	10
2"- 24"	50-600	230	16
2"- 12"	50-300	285	Class150

Dead-End Service : Without a downstream flange installed, the dead-end pressure ratings are equal to the values stated above.

Operators

Valves up to size 8" can be supplied with lever handles for manual operation. Optional accessories for hand-lever operation can be provided for various flow control requirements. Pad locking can also be provided for preventing unauthorized operation.

Valves up to size 24" can be direct mounted with gear operators for manual operation. Gear operators can also be attached with chain-wheel operators for opening or closing valves located on pipelines at high elevations.

All valves can be direct mounted with pneumatic actuators or electric actuators and accessories for complete automation options such as fail open/close & positioner controlled. Valves can be mounted with manual overrides.

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Distributor

DelTech Controls LLC
6068 Highway 73
Geismar, LA 70734
USA

Phone: (225) 744-4326

Fax: (225) 744-4328

Email : sales@deltechcontrols.com

DelVal Flow Controls Pvt. Ltd.
(A division of DelTech Controls LLC, USA)
Office & Works : Gat. No 625/1/2,
Kuruli, Tal. Khed, Pune-Nasik Highway,
Pune 410501, INDIA

Phone :+91-2135-662700
Fax: +91-2135-662727

Email : salesindia@deltechcontrols.com

Website : www.deltechcontrols.com

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I845300

APOLLO®

Installation, Operation, and Maintenance Guide

For Apollo Series Valves:

2 Piece Threaded
and Solder End
Ball Valves

CONBRACO
Ball Valve Division

P.O. BOX 125 PAGELAND, S.C. 29728 803-672-6161

INSTALLATION, OPERATION AND MAINTENANCE OF THREADED AND SOLDER END APOLLO BALL VALVES

Valves must be installed in piping systems that comply to the applicable A.N.S.I. B31 Standard. Special considerations must be taken with respect to pipe line expansions and contractions and the media expansions and contractions within the piping system.

THREADED END INSTALLATION

1. Pipe connections to be threaded into these valves should be accurately threaded, clean and free of dirt and metal shavings.
2. Teflon tape is recommended for use as the pipe joint sealant.
3. Use two wrenches when making the pipe joint. Apply one wrench on the hex pads nearest the joint being tightened to prevent breaking the retainer-to-body seal.
4. UNION END VALVES: Remove the union nut from valve and place onto pipe. Thread the tailpiece onto the pipe using a smooth jaw wrench. Thread the union nut onto the valve body and *lightly* torque.

SOLDER END INSTALLATION

1. Piping connections to be soldered into these valves should be cut square and then cleaned with an appropriate cleaner or flux.
2. These valves are designed to be soft soldered. Apply heat with the flame directed *away* from the center of the valve body. Excessive heat can harm the Teflon seats. Solder valves only in the fully open position.
3. UNION END VALVES: Remove the union nut from valve and place onto pipe. Solder the tailpiece onto pipe, thread union nut onto valve body and *lightly* torque.

OPERATION

The valve is marked showing proper rotation direction for “ON” and “OFF” positions. Rotation is clockwise for “OFF” and counterclockwise for “ON”.

MAINTENANCE

Normal stem packing wear can be compensated for by tightening the packing gland screw clockwise. If all of the adjustment to the packing gland screw has been made, remove the lever and packing gland nut and add one or two replacement bearings on top of the old packing. Reassemble the lever and packing gland nut.
CAUTION: Do not disassemble Valve while under pressure nor with entrapped hazardous fluids therein.

General repair of the valve can be made by:

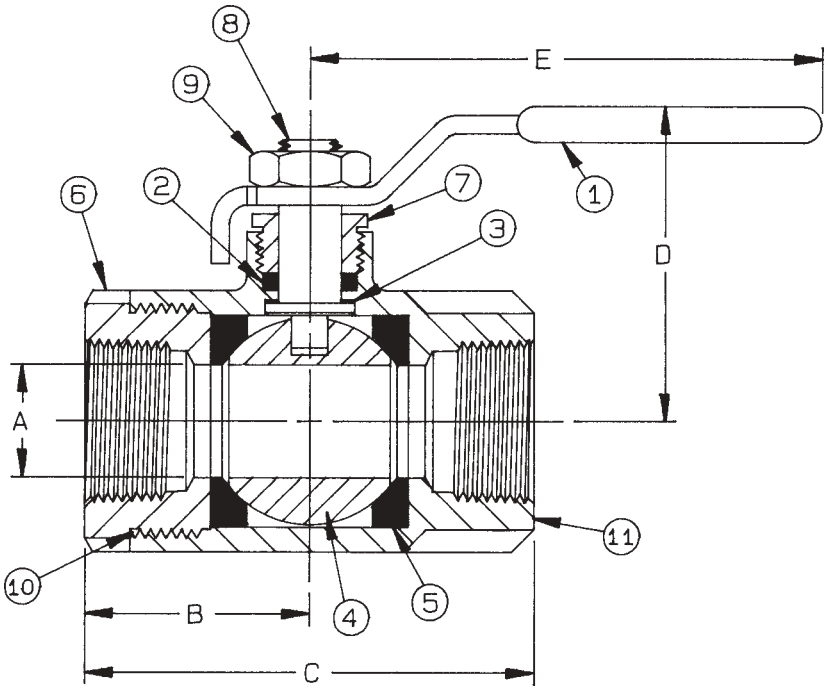
1. Close valve.
2. Remove retainer from body center section by turning counterclockwise
3. 1/4" thru 1" valves only; pry out the top seat being careful not to damage the ball. 1-1/4" thru 3" valves; the top seat will come out with the retainer.
4. Push ball out of body with finger.
5. Remove packing gland nut by turning counterclockwise and push stem down into body to remove.
6. Remove all seats and seals. To facilitate removal of the stem packing, cut with knife.
7. Replace all seats and seals as furnished in the Service Kit. Inspect the ball and stem for excessive wear or damage and replace if necessary.
8. Reverse the above procedure to reassemble using a sealant on the retainer threads equivalent to Loctite Hydraulic Sealant. **NOTE: VALVES IN OXYGEN SERVICE CAN ONLY BE SEALED WITH AN OXYGEN COMPATIBLE THREAD SEALANT.**

Union End Valves cannot be easily field repaired, therefore it is recommended that the main valve section be replaced.

NOTE: ALWAYS TEST VALVE AND SYSTEM BEFORE PUTTING THE SYSTEM INTO SERVICE.

Bronze Valves: **WARNING**: This product is made from Bronze Alloys which contain lead; a chemical known to the State of California to cause cancer and birth defects and other reproductive harm.

General 2-PC. BALL VALVE
Identification



1. Lever and grip
2. Stem packing
3. Stem bearing
4. Ball
5. Seat (2)
6. Retainer
8. Stem
9. Lever nut
10. Body seal
11. Body

94A SERIES
Full-Port Brass Ball Valve

Job Name:	**Contractor:**
Job Location:	**P.O. Number:**
Engineer:	**Representative:**
Tag:	**Wholesale Distributor:**

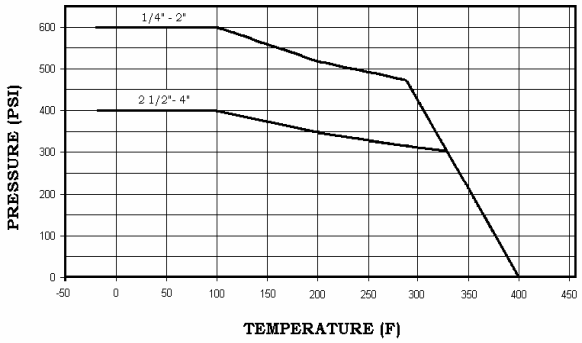
DESCRIPTION
The 94A full port ball valves are designed for reliable yet economic applications using corrosion resistant brass with all pertinent agency approvals.

FEATURES
- Full-Port
- Blow-out Proof Stem Design
- Adjustable Stem Packing Nut
- Silicone Free

MATERIALS

Body	Forged Brass (Cu >57%)
Retainer	Forged Brass (Cu >57%)
Ball	Brass, Cr plated
Stem	Brass, Cr plated
Seat Ring	PTFE
Stem Seal	NBR
Packing Nut	Steel w/corrosion resistant plating
Packing Gland	Brass
Friction Washer	PTFE
Handle	Steel w/corrosion resistant plating
Handle Cover	PVC
Handle Nut	Steel w/corrosion resistant plating

PERFORMANCE RATING



APPROVALS
CSA: ¼”-4” NPT per ANSI Z21.15/CGA 9.1 (1/2 psi)
¼”-4” NPT per ASME B16.44 (5 psi)
½”-2” NPT per ASME B16.33 (125 psi)
2 ½’-4” NPT per ASME B16.38 (125 psi)

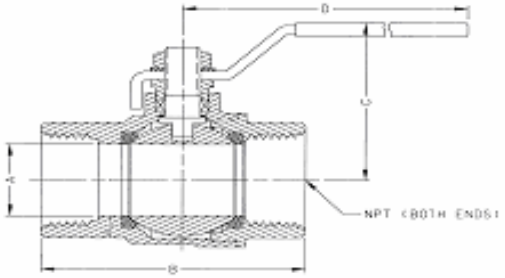
UL: Guides YQNZ, YRBX, YRPV, and YSDT (NPT only)

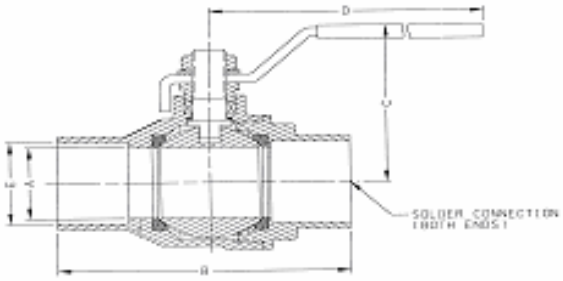
FM: ¼”-2” per FM1140 (<175 psi)

NSF: ¼”-4” meets ANSI/NSF 61 Section 8 (61<5)

DIMENSIONS

Part No.	Size	A	B	C	D	E	Wt. (lbs.)
NPT							
94A-101	1/4"	0.395	1.746	1.278	3.543	-	0.33
94A-102	3/8"	0.407	1.756	1.278	3.543	-	0.30
94A-103	1/2"	0.583	2.047	1.921	3.543	-	0.44
94A-104	3/4"	0.748	2.362	2.087	3.780	-	0.66
94A-105	1"	0.945	2.756	2.559	4.528	-	1.10
94A-106	1 1/4"	1.260	3.307	2.953	4.528	-	1.57
94A-107	1 1/2"	1.575	3.661	3.346	5.512	-	2.40
94A-108	2"	1.969	4.181	3.681	5.512	-	3.37
94A-109	2 1/2"	2.520	5.378	4.764	8.661	-	7.60
94A-100	3"	2.953	6.039	5.079	8.661	-	9.36
94A-10A	4"	3.898	7.386	5.866	9.606	-	16.85
SWEAT							
94A-203	1/2"	0.583	2.047	1.839	3.543	0.630	0.38
94A-204	3/4"	0.748	2.748	1.996	3.780	0.878	0.64
94A-205	1"	0.945	3.228	2.441	4.528	1.130	0.99
94A-206	1 1/4"	1.260	3.819	2.854	4.528	1.378	1.40
94A-207	1 1/2"	1.575	4.425	3.169	5.512	1.630	2.17
94A-208	2"	1.969	5.315	3.449	5.512	2.130	2.97
94A-209	2 1/2"	2.520	6.283	4.764	8.661	2.630	6.36
94A-200	3"	2.953	7.150	5.079	8.661	3.130	8.32





This specification is provided for reference only. Conbraco reserves the right to change any portion of this specification without notice and without incurring obligation to make such changes to Conbraco products previously or subsequently sold.

Technical Data and Standards

Physical Properties of Thermoplastics Used In Asahi Valves*

Properties	Unit	PVC	HI-PVC	CPVC	PP	PVDF	Test Method
Specific Gravity	-	1.43	1.40	1.54	0.92	1.76	ASTM D792
Tensile Strength	psi	7690 - 8700	7110 - 7540	8410 - 9280	4210 - 4930	7980 - 8700	ASTM D638
Elongation	%	60 - 120	60 - 180	30 - 80	200 - 400	30 - 60	ASTM D638
Tensile Modulus	10^3 psi	421 - 479	392 - 421	479 - 508	116 - 174	174 - 203	ASTM D638
Flexural Strength	psi	11310 - 15660	11310 - 12760	14210 - 15660	7830 - 9280	13490 - 14940	ASTM D790
Flexural Modulus	10^3 psi	377 - 406	290 - 334	421 - 450	203 - 232	218 - 261	ASTM D790
Compressive Strength	psi	12760 - 14210	8410 - 11310	14210 - 15660	8410 - 10010	12760 - 14210	ASTM D695
Compressive Modulus	10^3 psi	232 - 261	189 - 218	247 - 290	131 - 160	145 - 203	ASTM D695
Poisson's Ratio	-	0.37	NA	0.35	0.44	0.28	ASTM D638/D790
Hardness (Rockwell R)	degrees	114 - 116	112 - 116	117	95	110	ASTM D785
Impact Strength (Izod) with V-Notch	kJ/m^2	3 - 5	10 - 15	4 - 6	4 - 7	8 - 10	ASTM D256
Heat resistance	° F	32 ~ 140	23 ~ 140	32 ~ 194	- 4 ~ 194	- 40 ~ 248	-
Deflection Temperature (at 66 psi)	° F	163 - 167	162 - 165	250	230 - 244	302	ASTM D648
Thermal Expansion	10^{-5}mm/ mm/℃	6 - 8	7 - 8	6 - 8	11 - 12	11 - 12	ASTM D696
Thermal Conductivity	Kcal/mh℉	0.15	0.11	0.14	0.09	0.11	ASTM C177
Dielectric Strength	kV/inch	0.90	NA	0.90	1.02	1.18	ASTM D149
Volume Resistivity	ohm-inch	2.17×10^{15}	NA	2.28×10^{16}	1.93×10^{16}	1.97×10^{15}	ASTM D257
Dielectric Constant							ASTM D150
10 Hz	-	2.8 - 3.0	NA	NA	NA	NA	
60 Hz	-	3.15	NA	2.93	2.42	9.8	
10^3 Hz	-	3.14	NA	2.92	2.41	9.5	
10^6 Hz	-	2.85	NA	2.69	2.41	7.5	
Dissipation Factor							ASTM D150
60 Hz	10^{-2}	1.18	NA	1.09	NA	0.05	
10^3 Hz	10^{-2}	1.91	NA	1.10	0.044	0.048	
10^6 Hz	10^{-2}	1.72	NA	0.92	0.063	0.160	
Water absorption 24 hr. 1/8 inch thickness	%	0.07	NA	0.15	0.01	0.03	ASTM D570

* This data for reference only.

Standards

ANSI B1.20.1 (Was B2.1)
(American National Standards Institute)

This specification details the dimensions and tolerance for tapered pipe threads. This standard is referenced in the ASTM standard for threaded fittings mentioned above.

ASTM STANDARD D-1784 A
(American Society for Testing and Materials)

This standard covers PVC and CPVC compounds used in the manufacture of plastic pipe, valves, and fittings. It provides a means for selecting and identifying compounds on the basis of a number of physical and chemical criteria. Conformance to a particular material classification in this standard requires meeting a number of minimum physical and chemical properties.

ANSI B16.5

This specification sets forth standards for bolt holes, bolt circles, and overall dimensions for steel 150 lbs flanges.

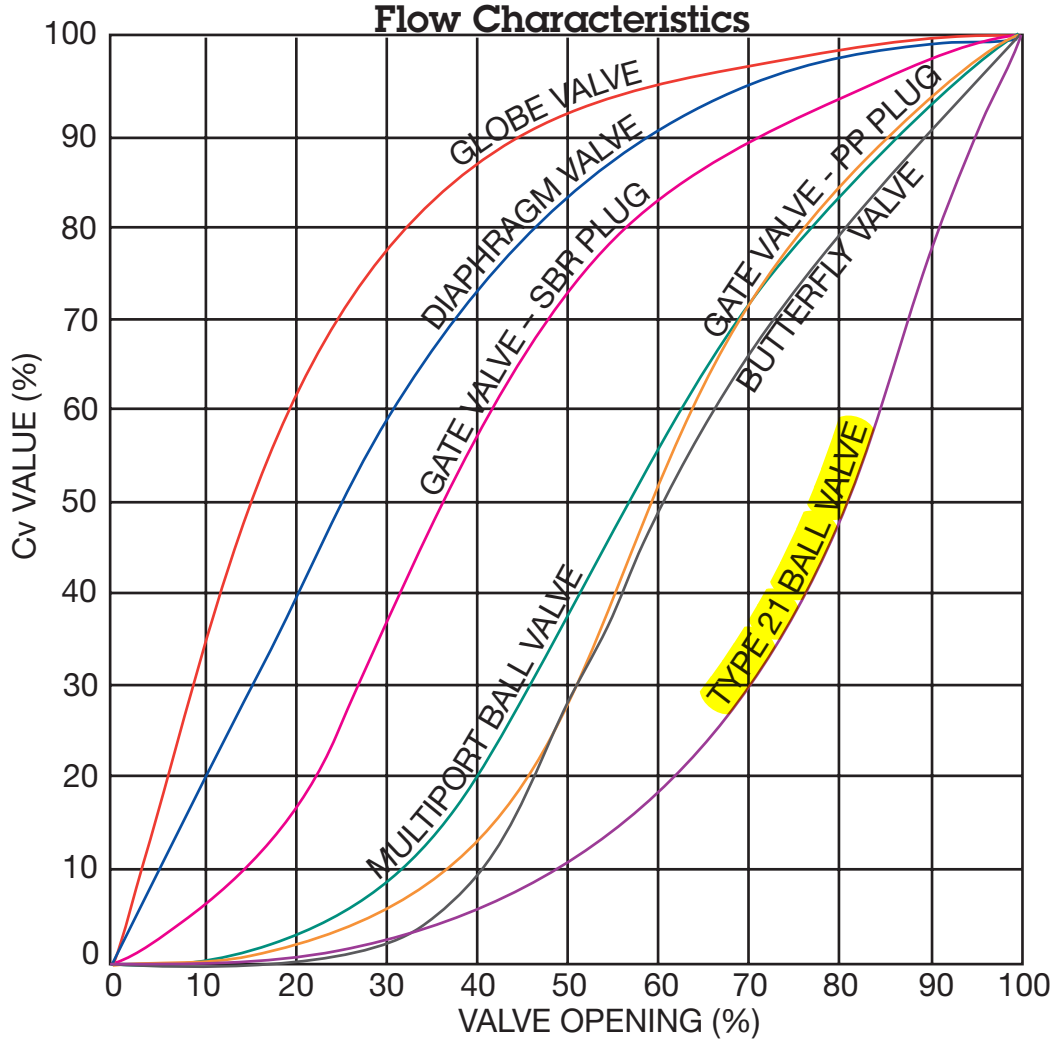
ASTM STANDARD D-3222

This standard covers the polymerization method and physical properties of PVDF (polyvinylidene fluoride) fluoroplastic materials for molding and extrusion. Organizations other than ASTM issue standards that are commonly encountered in industrial thermoplastic piping design. The most important of these are described here.

ASTM STANDARD D-4101 (FORMERLY D-2146)

This standard covers the polymeric content and physical characteristics of PP (polypropylene) plastic materials for injection molding and extrusion.

Flow Characteristics



This table shows the relationship between valve opening and Cv values. Each curve is the representative average of all sizes for a particular type of valve. Cv value is the percentage of the full open Cv. The Cv value can be found in the appropriate section of this catalog.

Using the Cv value to calculate the differential pressure or flow rate through a valve:

Whenever a fluid passes through a valve, there will be a drop in pressure. The upstream pressure less the downstream pressure is know as the differential pressure, or:

$$P_1 - P_2 = P$$

where,

P_1 = upstream pressure
P_2 = downstream pressure
P = dif ferential pressure

Cv is the flow rate through a valve which will produce a differential pressure of 1 psi.

$$P = (Q/Cv)^2 \text{ s.g.}$$
$$Q = Cv\ (P/\text{s.g.})$$
$$Cv = Q\ (\text{s.g.}/P)$$

where,

P = dif ferential pressure (psi)
s.g.= specific gravity
Q = flow rate (gpm)

For further technical information consult factory.

Part Numbers

All part numbers for Asahi/America products are seven digits long. In general, the first four digits specify the product and the last three digits specify the size. In this catalog, part numbers will be referenced with the first four digits followed by "****", signifying that the size code should follow. The Part Numbers Table, below, defines the three digit code for various valve sizes.

Nominal Size (inches)	Asahi/America Part Number	Nominal Size (inches)	Asahi/America Part Number
3/8	****003	5	****050
1/2	****005	6	****060
3/4	****007	8	****080
1	****010	10	****100
1 1/4	****012	12	****120
1 1/2	****015	14	****140
2	****020	16	****160
2 1/2	****025	18	****180
3	****030	20	****200
4	****040	24	****240

Type 21 Ball Valves

Body	Elastomer	Connection	1/2" - 2"	2 1/2" - 6"
PVC	EPDM	Soc	1601***	1602***
PVC	EPDM	Thd	1601***	1603***
PVC	EPDM	Flg	1604***	1604***
PVC	FKM	Soc	1605***	1606***
PVC	FKM	Thd	1605***	1607***
PVC	FKM	Flg	1608***	1608***
CPVC	EPDM	Soc	1609***	1610***
CPVC	EPDM	Thd	1609***	1611***
CPVC	EPDM	Flg	1612***	1612***
CPVC	FKM	Soc	1613***	1614***
CPVC	FKM	Thd	1613***	1615***
CPVC	FKM	Flg	1616***	1616***
PP	EPDM	DIN Soc	1638***	1638***
PP	EPDM	IPS Soc	1618***	1618***
PP	EPDM	Thd	1619***	1619***
PP	EPDM	Butt	1620***	1620***
PP	EPDM	Flg	1621***	1621***
PP	FKM	DIN Soc	1652***	1652***
PP	FKM	IPS Soc	1622***	1622***
PP	FKM	Thd	1623***	1623***
PP	FKM	Butt	1624***	1624***
PP	FKM	Flg	1625***	1625***
PVDF	FKM	DIN Soc	1666***	1666***
PVDF	FKM	IPS Soc	1626***	1626***
PVDF	FKM	Thd	1627***	1627***
PVDF	FKM	Butt	1628***	1628***
PVDF	FKM	Flg	1629***	1629***

Type 23 Multiport Ball Valves

Body	Elastomer	Connection	1/2" - 4"
PVC	EPDM	Soc	2510***
PVC	EPDM	Thd	2511***
PVC	EPDM	Flg	2512***
PVC	FKM	Soc	2513***
PVC	FKM	Thd	2514***
PVC	FKM	Flg	2515***
CPVC	EPDM	Soc	2516***
CPVC	EPDM	Thd	2517***
CPVC	EPDM	Flg	2518***
CPVC	FKM	Soc	2519***
CPVC	FKM	Thd	2520***
CPVC	FKM	Flg	2521***
PP	EPDM	DIN Soc	2522***
PP	EPDM	IPS Soc	2523***
PP	EPDM	Thd	2524***
PP	EPDM	Butt	2525***
PP	EPDM	Flg	2526***
PP	FKM	DIN Soc	2527***
PP	FKM	IPS Soc	2528***
PP	FKM	Thd	2529***
PP	FKM	Butt	2530***
PP	FKM	Flg	2531***
PVDF	FKM	DIN Soc	2532***
PVDF	FKM	IPS Soc	2533***
PVDF	FKM	Thd	2534***
PVDF	FKM	Butt	2535***
PVDF	FKM	Flg	2536***

Quarter-Bloc Ball Valves

Body	Elastomer	Connection	1/2"-2"
PVC	EPDM	SOC	1640***

Gate Valves

Body	Gate	Elastomer	Connection	1 1/2"-14"
PVC	PP	EPDM	Flg	1251***
PVC	SBR	EPDM	Flg	1252***

Constant Flow Valves

Body	Elastomer	Connection	1" - 4"
PVC	EPDM	Flg	1307***

Trademarks

Air-Pro, Duo-Pro, Electromni, FloSonex, Fluid-Lok, Labcock, Multiport, Omni, Poly-Flo, Poly-Pure, Purad, Proline, Pro-Tek, Pro-Vent, Proweld, and UltraPro are registered trademarks of Asahi/America, Inc.

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AFLAS is a registered trademark of Asahi Glass Co., Ltd.

Halar is a registered trademark of Ausimont.

Serial No.	H – V027 E – 4

Ball Valve Type 21

User's Manual

Contents

ASAHI AV VALVES

(1) General operating instructions

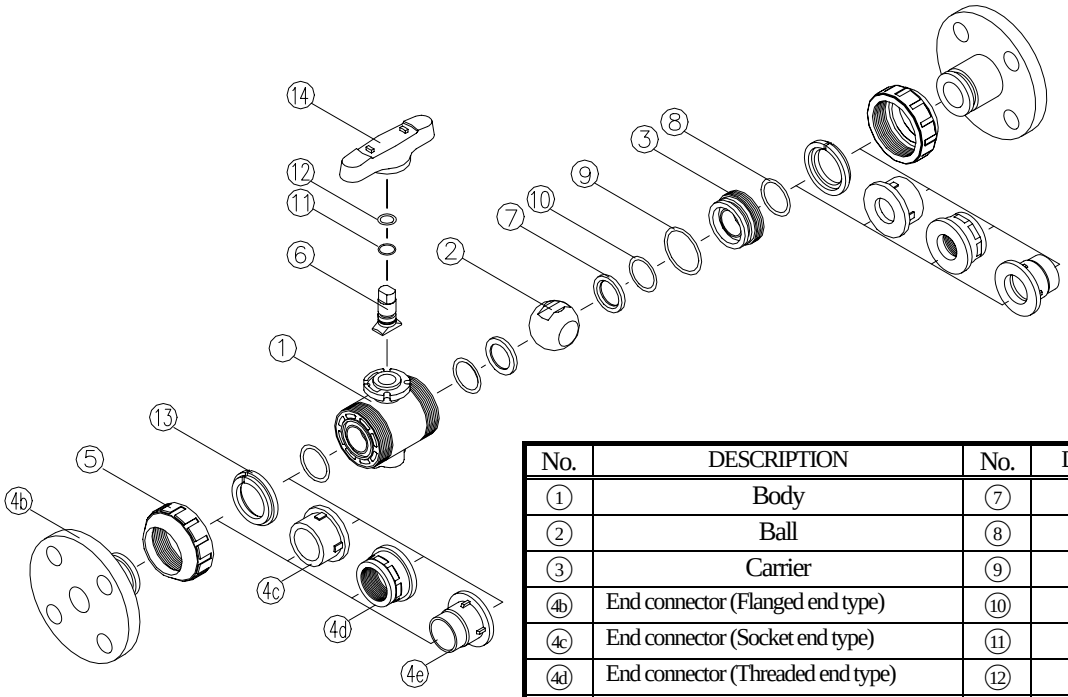
- Operate the valve within the pressure Vs temperature range.
  （The valve can be damaged by operating beyond the allowable range.）
- Select a valve material that is compatible with the media, refer to “CHEMICAL RESISTANCE ON ASAHI AV VALVE”.
  （Some chemicals may damage incompatible valve materials.）
- Do not use the valve to fluid containing slurry. (The valve will not operate properly.)
- Do not use the valve on condition that fluid has crystallized.
  (The valve will not operate properly.)
- Do not step on the valve or apply excessive weight on valve. (It can be damaged.)
- Do not exert excessive force in closing the valve.
- Make sure to consult a waste treatment dealer to dispose of the valves.
  (Poisonous gas is generated when the valve is burned improperly.)
- Allow sufficient space for maintenance and inspection.
- Keep the valve away from excessive heat or fire. (It can be deformed, or destroyed.)
- The valve is not designed to bear any kind of external load. Never stand on or place anything heavy on the valve at anytime.
- Certain liquid such as H2O2, NaClO, etc may be prone to vaporization which may cause irregular pressure increases, which may destroy the valve.

(2) General instructions for transportation, unpacking and storage

- Keep the valve packed in the carton or box as delivered until installation.
- Keep the valve away from any coal tar, creosote (antiseptic for wood), termite insecticide, vermicides, and paint.
  （This could cause swelling damage the valve.）
- Do not impact or drop the valve. (It can be damaged.)
- Avoid scratching the valve with any sharp object.

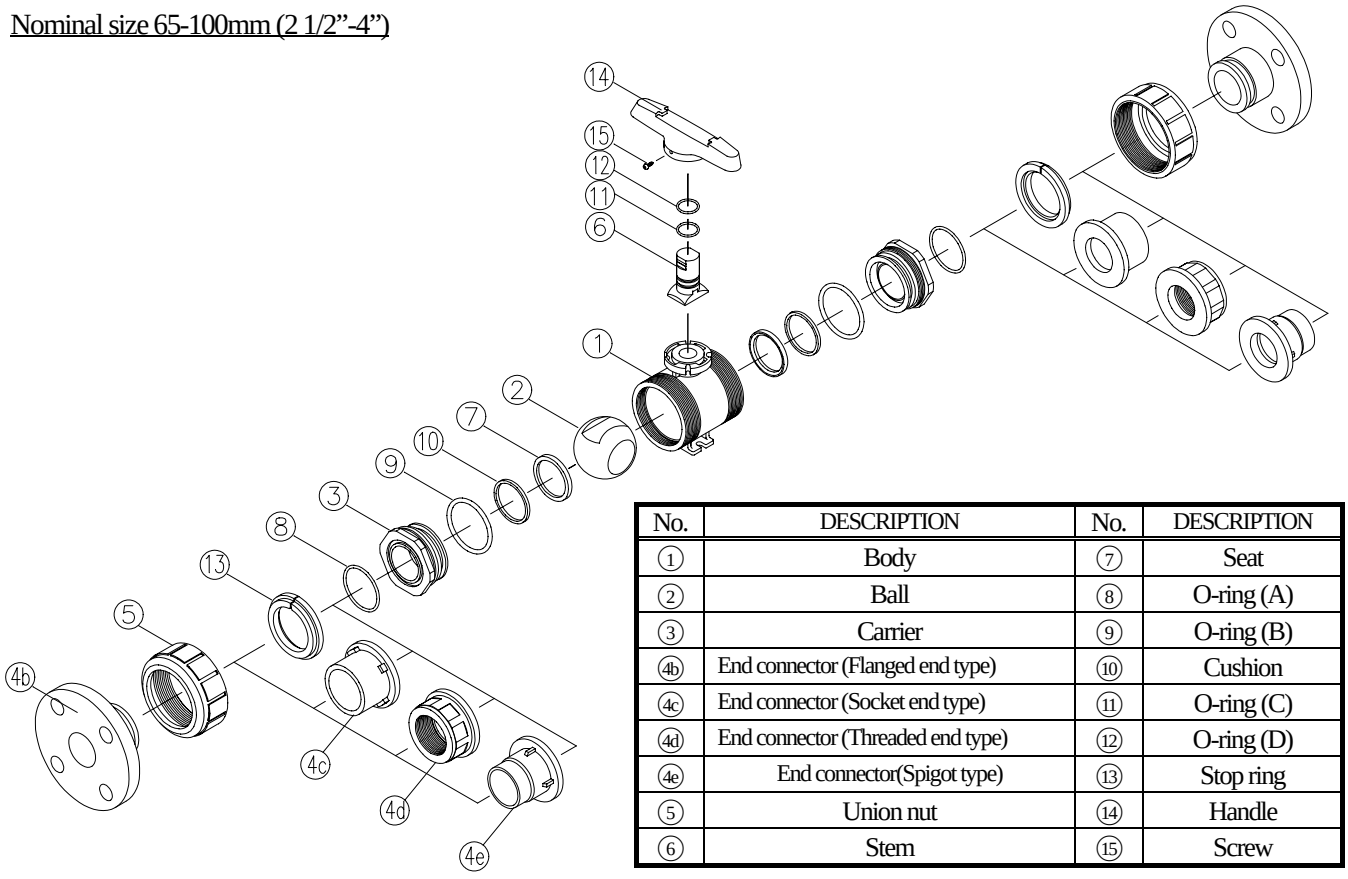
(3) Name of parts

Nominal size 15-50mm (1/2”-2”)



No.	DESCRIPTION	No.	DESCRIPTION
①	Body	⑦	Seat
②	Ball	⑧	O-ring (A)
③	Carrier	⑨	O-ring (B)
④b	End connector (Flanged end type)	⑩	O-ring (C)
④c	End connector (Socket end type)	⑪	O-ring (D)
④d	End connector (Threaded end type)	⑫	O-ring (E)
④e	End connector(Spigot type)	⑬	Stop ring
⑤	Union nut	⑭	Handle
⑥	Stem		

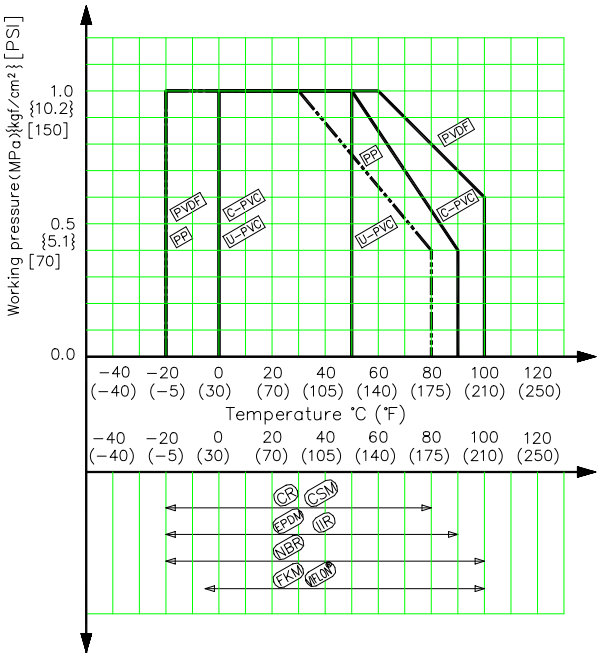
Nominal size 65-100mm (2 1/2”-4”)



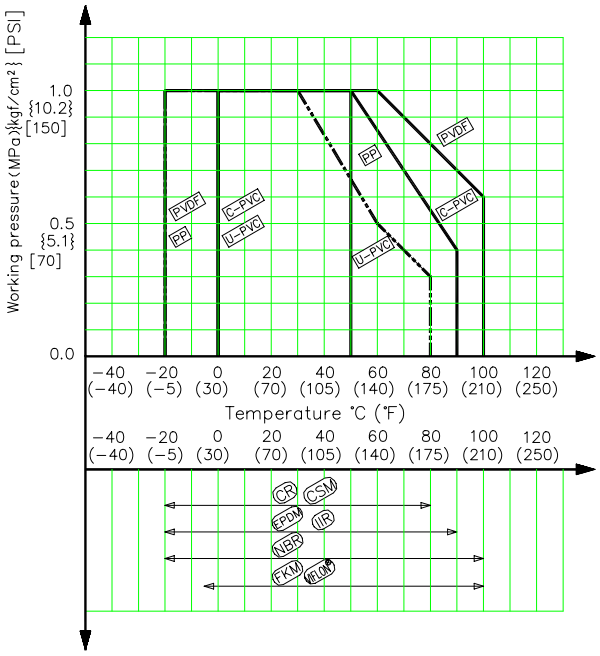
No.	DESCRIPTION	No.	DESCRIPTION
①	Body	⑦	Seat
②	Ball	⑧	O-ring (A)
③	Carrier	⑨	O-ring (B)
④b	End connector (Flanged end type)	⑩	Cushion
④c	End connector (Socket end type)	⑪	O-ring (C)
④d	End connector (Threaded end type)	⑫	O-ring (D)
④e	End connector(Spigot type)	⑬	Stop ring
⑤	Union nut	⑭	Handle
⑥	Stem	⑮	Screw

(4) Comparison between working temperature and pressure

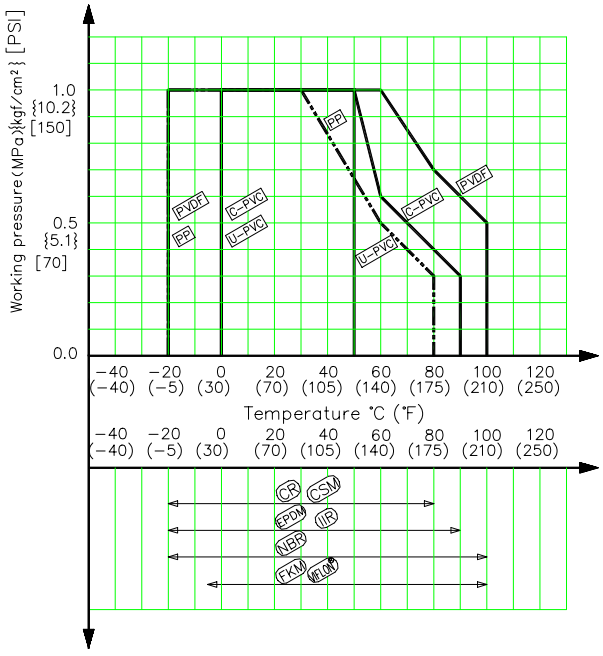
Nominal size: 15mm-50mm (1/2”-2”)



Nominal size: 65mm (2 1/2”)



Nominal size: 80mm, 100mm (3”, 4”)



Caution

Do not operate the valve beyond the range of working temperature and pressure.
(The valve can be damaged.)

(5) Installation procedure

Flanged type (Material: PVC,C-PVC,PP,PVDF)

Necessary items

- Torque wrench
- Spanner wrench
- AV gasket
- Bolt, Nut, Washer (For many flanges specification)

（When a non-AV gasket is used, a different tightening torque specification should be followed.)

Procedure

1) When the union nut ⑤ flange assembly set was removed or loosen from body ①, O-ring (A) ⑧ should be installed into carrier and body groove. (In either horizontal or vertical installation, if necessary apply a small amount of lubricant to O-ring to hold in place.) Align union nut and end connector with the body. Insure end connector mates with body and O-ring. Make certain union nut threads onto body smoothly. Tighten union nuts on each side valve until hand tight. Then using a strap wrench tighten union nuts uniformly on each side approx 90° -180° turns, 1/4 to 1/2 turns.

2) Set the AV gasket between the flanges.

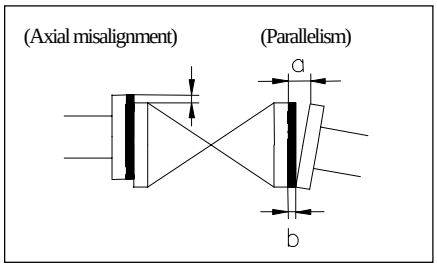
3) Insert washers and bolts from the pipe side, insert washers and nuts from the valve side, then temporarily tighten them by hand.

⚠ Caution

The parallelism and axial misalignment of the flange surface should be under the values shown in the following table to prevent damage the valve.
（A failure to observe them can cause destruction due to stress application to the pipe）

Unit : mm (inch)

Nom. Size	Axial Misalignment	Parallelism (a-b)
15-32mm (1/2”-1 1/4”)	1.0mm (0.04”)	0.5mm (0.02”)
40-80mm (1 1/2”-3”)	1.0mm (0.04”)	0.8mm (0.03”)
100mm (4”)	1.0mm (0.04”)	1.0mm (0.04”)



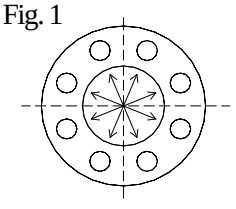
4) Tighten the bolts and nuts gradually with a torque wrench to the specified torque level in a diagonal manner. (Refer to fig.1.)

Recommended torque value

Unit: N-m{kgf-cm}[lb-inch]

Nom. Size	15-20mm (1/2”-3/4”)	25-40mm (1”-1 1/2”)	50, 65 mm (2”, 2 1/2”)	80, 100 mm (3”, 4”)
Torque value	17.5 {179} [155]	20.0 {204} [177]	22.5 {230} [230]	30.0 {306} [266]

Fig. 1



⚠ Caution

Avoid excessive tightening. (The valve can be damaged.)

Threaded type (Material : PVC,C-PVC,PP,PVDF)

Necessary items

- Sealing tape（A non-sealing tape can cause leakage.）
- Strap wrench（Do not use Pipe wrench.）
- Spanner wrench

⚠ Caution

Make sure that the threaded connections are plastic x plastic.
（Metallic thread can cause damage.）

Procedure

1) Wind a sealing tape around the external thread of joint, leaving the end (about 3mm) free.
2) Loosen the union nut ⑤ with a strap wrench..
3) Remove the union nut ⑤ and the end connector ④d.
4) Lead the union nut ⑤ through the pipe.
5) Tighten the external thread of the joint and the end connector ④d hardly with hand.
6) Using a spanner wrench, screw in the end connector ④d by turning 180° -360° carefully without damaging it.

⚠ Caution

Avoid excessive tightening. (The valve can be damaged.)

7) Make sure that the O-ring (A) ⑧ is mounted.
8) Set the end connector ④d and union nut ⑤ directly on the body without allowing the O-ring (A) ⑧ to come off.
9) Tighten union nuts ⑤ on each valve until hand tight.
10) Using a strap wrench tighten union nuts uniformly on each on each side approx 90° -180° turns, 1/4 to 1/2 turns.

⚠ Caution

Avoid excessive tightening.（The valve can be damaged.）

Socket type (Material : PVC, C-PVC)

Necessary items

- Adhesive for hard vinyl chloride pipes
- Strap wrench (Do not use the pipe wrench)

⚠ Caution

Do not install a socket type valve where the atmospheric temperature is 5℃ or lower.
（The valve can be damaged.）

Procedure

1) Loosen the union nut ⑤ with a strap wrench.

2) Remove the union nut ⑤ and end connector ④c .

3) Lead the union nut through the pipe.

4) Clean the hub part of the end connector ④c by wiping the waste cloth.

5) Apply adhesive evenly to the hub part of the end connector ④c and the pipe spigot.

⚠ Caution

Do not apply more adhesives than necessary.
（The valve can be damaged due to solvent cracking.）

Adhesive quantity（guideline）

Nom. Size	15mm (1/2")	20mm (3/4")	25mm (1")	32mm (1 1/4")	40mm (1 1/2")	50mm (2")	65mm (2 1/2")	80mm (3")	100mm (4")
Quantity（g）	1.0	1.3	2.0	2.4	3.5	4.8	6.9	9.0	13.0

6) After applying adhesive, insert the pipe quickly to the end connector ④c and leave it alone for at least 60 seconds.

7) Wipe away overflowing adhesive.

8) Make sure that O-ring(A) ⑧ is mounted

9) Set the end connector ④c and union nut ⑤ directly on the body without allowing the O-ring (A) ⑧ to come off.

10) Tighten union nut ⑤ hardly with hand.

11) Using a strap wrench tighten union nuts uniformly on each side approx 90° -180° turns, 1/4 to 1/2 turns.

⚠ Caution

Avoid excessive tightening. (The valve can be damaged.)

Socket type (Material : PP, PVDF)

Necessary items

- Strap wrench（Do not use the pipe wrench.）
- Sleeve welder or automatic welding machine
- User's manual for sleeve welder or automatic welding machine

Procedure

1) Loosen the union nut with a strap wrench.
2) Remove the union nut ⑤ and the end connector.
3) Lead the union nut ⑤ through the pipe.
4) For the next step, refer to the user's manual for the sleeve welder or the automatic welding machine.
5) After welding, make sure that the O-ring (A) ⑧ is mounted.
6) Set the end connector ④c and the union nut ⑤ directly without allowing the O-ring (A) ⑧ to come off.
7) Tighten union nut ⑤ hardly with hand.
8) Using a strap wrench tighten union nuts uniformly on each side approx 90° -180° turns, 1/4 to 1/2 turns.

⚠ Caution

Avoid excessive tightening. (The valve can be damaged.)

Spigot type (Material : PVDF)

Necessary items

- Strap wrench（Do not use the pipe wrench.）
- Automatic welding machine
- User's manual for automatic welding machine

Procedure

1) Loosen the union nut with a strap wrench.
2) Remove the union nut ⑤ and the end connector.
3) Lead the union nut ⑤ through the pipe.
4) For the next step, refer to the user's manual for the sleeve welder or the automatic welding machine.
5) After welding, make sure that the O-ring (A) ⑧ is mounted.
6) Set the end connector ④e and the union nut ⑤ directly without allowing the O-ring (A) ⑧ to come off.
7) Tighten union nut ⑤ hardly with hand.
8) Using a strap wrench tighten union nuts uniformly on each side approx 90° -180° turns, 1/4 to 1/2 turns.

⚠ Caution

Avoid excessive tightening. (The valve can be damaged.)

Caution

{15mm-50mm(1/2”-2”)}

It is recommended to install the valve with the threaded carrier to the upstream side of the system.

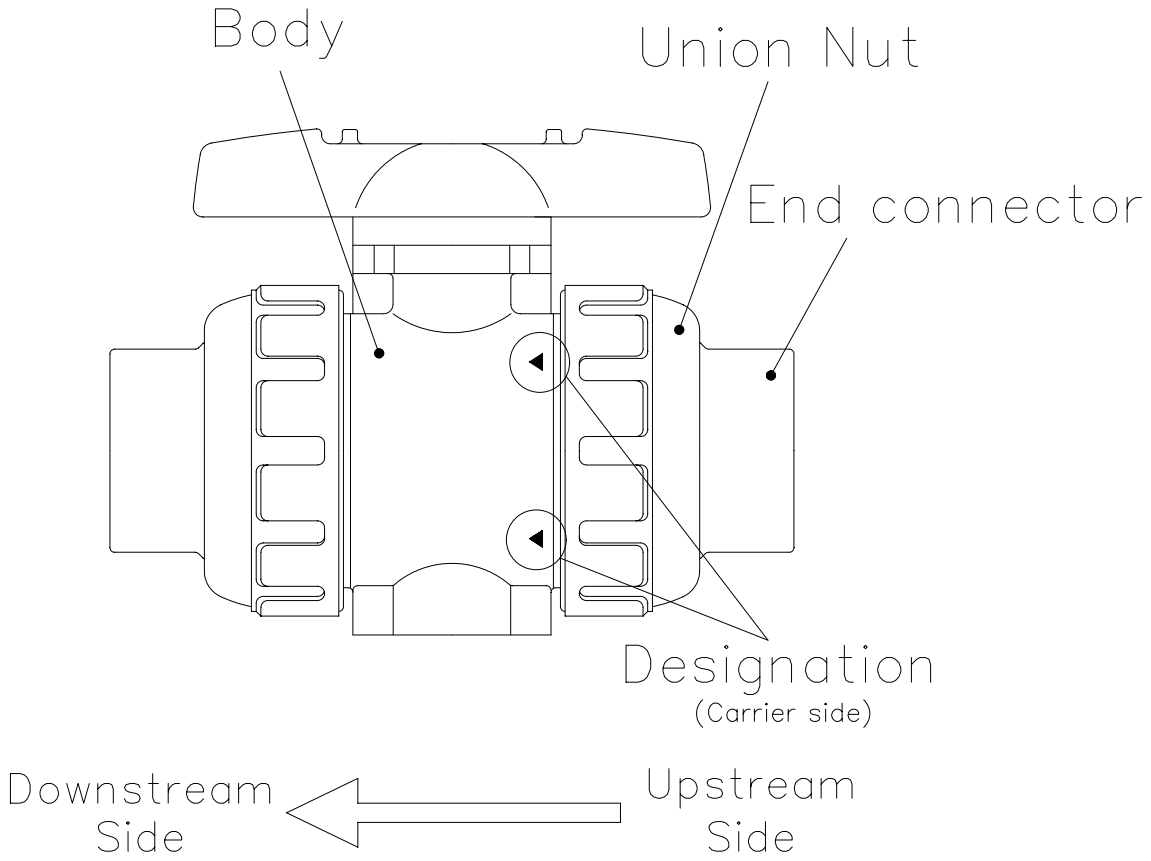
This allows for an increase safety factor and eliminating a threaded connection when used as a blocking valve.

This also allows the down stream union nut and end connector to be removed safely under pressure.

It increases the safety where there is no chance of thread leakage or accidentally removing the carrier.

The designation of the up stream side (non threaded carrier is marked as shown) on the body.

Nominal size 15mm - 50mm (1/2” – 2”)



(6) Operating Procedure

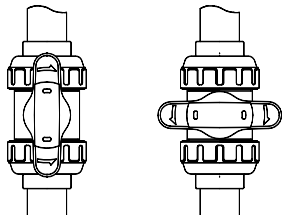
Caution

Avoid excessive tightening. (The valve can be damaged.)

○ Turn the handle gently to open or close.
(Turn the handle clockwise to close and counter clockwise to open.)

Fully closed ····· The position of the handle should be perpendicular to the pipe.

Fully opened ····· The position of the handle should be parallel to the pipe.



Fully opened Fully closed

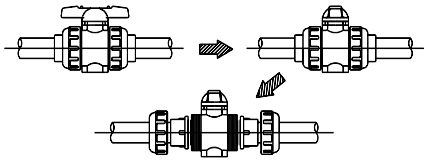
(7) Method of Adjusting Face Pressure between Ball and Seat

Necessary items

- Strap wrench
- Protective gloves
- Safety goggles
- Screwdriver (+) (only with nominal size 65～100mm)

Procedure

1) Completely discharge fluid from pipes.
2) Turn the handle to full close.
3) Loosen the right union nut and the left one ⑤ with a strap wrench.
4) Remove the body part from piping system.



Caution

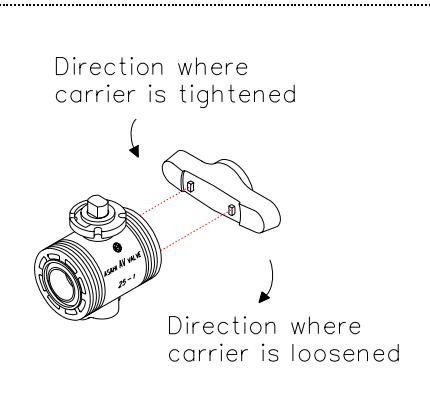
Wear protective gloves and safety goggles as some fluid remains in the valve. (You may be injured.)

5) Pull the handle off the body part.

Caution

As for nominal size 65-100mm (2 1/2”-4”), loosen the screw ⑮ properly with a screwdriver before pulling it off..

6) Engage the upper convex part of the handle with the concave part of the union ③.



Caution

As for nominal size 15-50mm
Only the union ③ on the right side when viewed from the trademark (AV mark) can be adjusted.
As for nominal size 65-100mm
adjust the unions on both sides.

7) Make an adjustment by turning the union clockwise (to tighten it) or counter clockwise (to loosen it).
8) Make sure that the handle can be operated smoothly.
9) Assemble the valve by following the above procedure in the reverse order, starting at 6)

(8) Disassembling Method for Replacing Parts

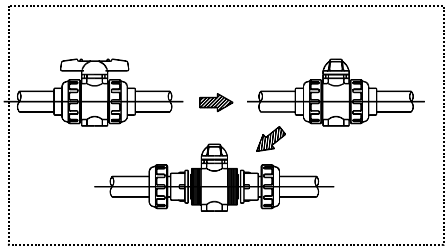
Necessary items

- Strap wrench
- Safety goggles
- Protective gloves

⚠ Caution

Wear protective gloves and safety goggles as some fluid remains in the valve.
(You may be injured.)

<Disassembly>

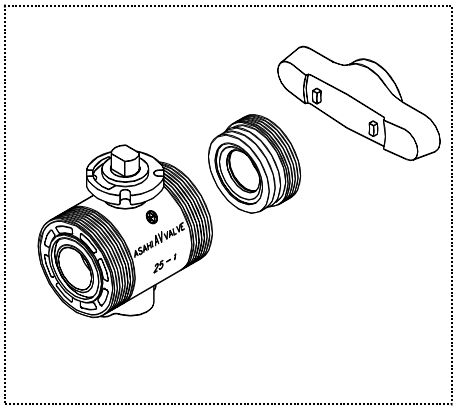


Procedure

1) Completely discharge fluid from pipes.
2) Turn the handle to full close.
3) Loosen the right union nut and the left one ⑤ with a strap wrench.
4) Remove the body part from piping system.
5) Pull the handle off the body part.

⚠ Caution

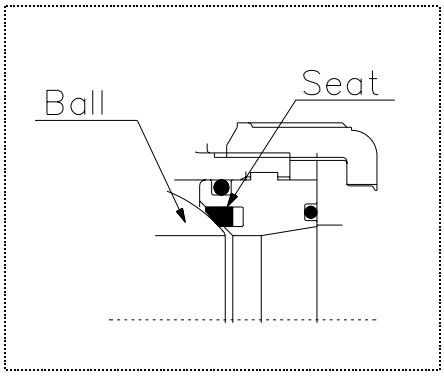
As for nominal size 65-100mm (2 1/2”-4”), loosen the screw ⑮ properly with a screwdriver before pulling it off..



6) Engage the upper convex part of the handle with the concave part of the union.

⚠ Caution

As for nominal size 15-50mm
Only the union ③ on the right side when viewed
from the trademark (AV mark) can be adjusted.
As for nominal size 65-100mm, adjust the unions on both sides.



7) In the engaged state, turn the handle ⑭ counter clockwise to loosen it and remove the union ③.
8) Remove the seat ⑦ carefully by hand without damaging it.
9) Push out the ball ② by hand.
10) Push out the stem ⑥ from the top flange side to the body side.

<Assembly>

Procedure

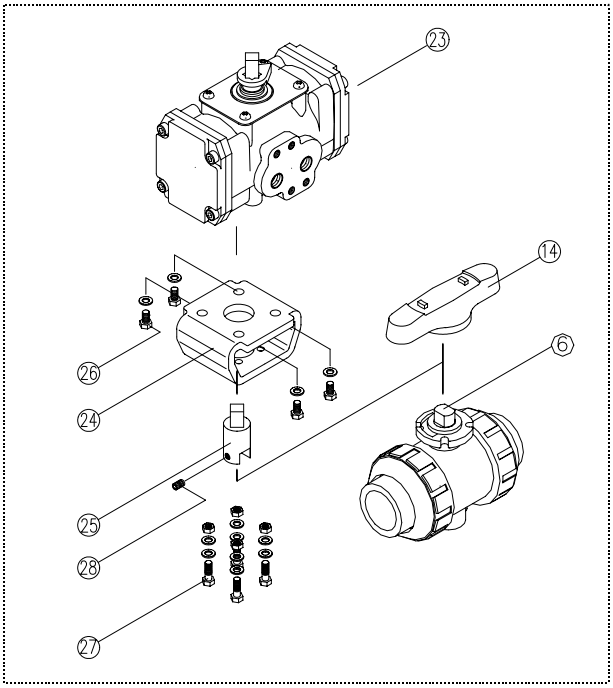
Carry out the assembly work in the reverse procedure from item 10)

⚠ Caution

With regard to item 8), before installing seat ⑦ on the valve, check the seat for its face and back.

(9) Mounting actuator, Ensat and base (panel)

○ Attach actuator to the top flange



Procedure

1) Remove the handle ⑭.

> ⚠ Caution
> As for nominal 65mm-100mm, tighten the screw ⑮ properly before removing it.

2) Fix the stand ㉔ to actuator ㉓ with bolt (A).

3) Fix the stem ⑥ to the joint ㉕ with screw (B) ㉘.

4) Engage the joint ㉕ with actuator ㉓.

5) Fix the stand ㉔ to the top flange with bolt-nut (B) ㉗.

6) Make sure that the valve works smoothly, by operating actuator ㉓ by hand.

○ Attach Inserted metal to the bottom stand.

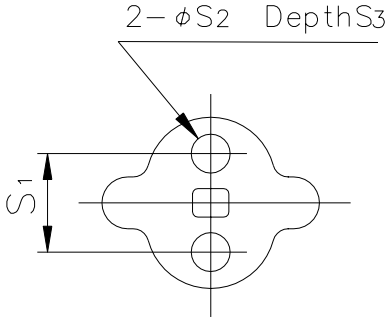
Procedure

Refer to the user's manual for the Inserted metal (Commercially available.)

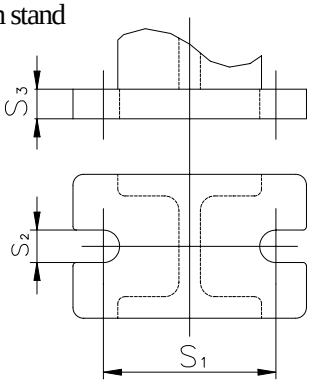
Bottom stand dimension Unit; mm

Nom.Size	S1	S2	S3
15mm (1/2")	19	7.3	11
20mm (3/4")	19	7.3	11
25mm (1")	19	7.3	11
32mm (1 1/4")	30	9	15
40mm (1 1/2")	30	9	15
50mm (2")	30	9	15
65mm (2 1/2")	48	9	6
80mm (3")	55	11	7
100mm (4")	65	11	8

Nominal 15-50mm(1/2"-2")
Bottom stand



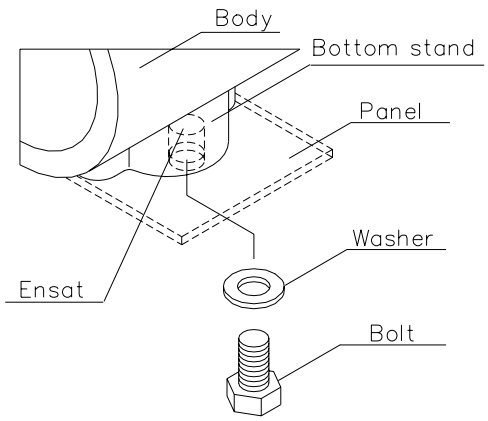
Nominal 65-100mm (2 1/2"- 4")
Bottom stand



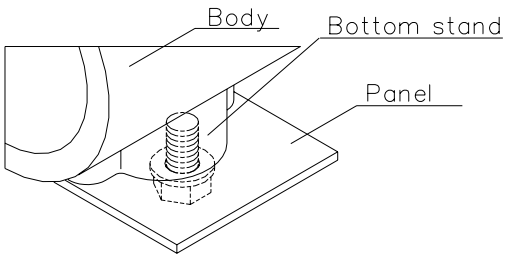
○Fixation of bottom stand with panel

Nominal size: 15mm-50mm (1/2”-2”)

Before the fixation

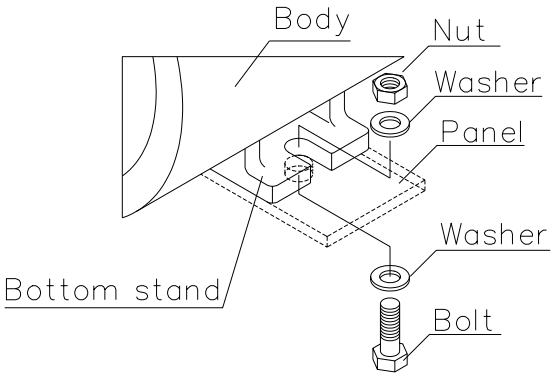


After the fixation

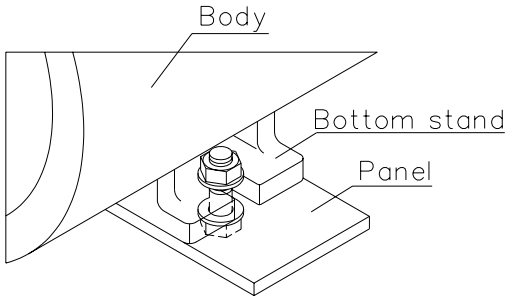


Nominal size: 65mm-100mm (2 1/2”-4”)

Before the fixation



After the fixation



(10) Inspection items

○Inspect the following items.

(1)	Existence of scratches, cracks, deformation, and discoloring.
(2)	Existence of leakage from the valve to the outside.
(3)	Existence of leakage when the valve is opened fully at right or left.

(11) Troubleshooting

Problem	Cause	Treatment
Fluid leaks from the valve even when the valve is closed fully.	The carrier is loosened.	Adjust the face pressure between the ball and the seat. (Refer to page 9)
	The seat is scratched or worn.	Replace the seat with a new one.
	Foreign matter is in the valve.	Clean up.
	The ball is scratched or worn.	Replace the scratched ball with a new one.
Fluid leaks from the valve.	The union nut is loosened.	Tighten up the union nut.
	The carrier is loosened.	Adjust the face pressure between the ball and the seat. (Refer to page 9)
	The O-ring is scratched or worn.	Replace the O-ring with a new one.
The handle can not be turned smoothly.	Foreign matter is in the valve.	Clean up.
	Deformation. (By heat etc.)	Replace the parts.
The handle fails to engage.	The stem is broken.	Replace the stem with a new one.
	The engagement between the stem and the ball is broken.	Replace the stem and ball with new ones.

(12) Handling of residual and waste materials

⚠ Caution

In discarding remaining or waste materials, be sure to ask waste service company.
（Poisonous gas is generated.）

(13) Inquiries

ASAHI ORGANIC CHEMICALS INDUSTRY CO., LTD.

Nobeoka Head Office : 2-5955, Nakanose- Cho, Nobeoka –City, Miyazaki- Pref. , Japan.
Tel : (81) 982-35-0880 Fax : (81) 982-35-9350

Tokyo Head Office : (Furukawachiyoda Bldg.) 15-9, Uchikanda 2- Chome, Chiyoda-Ku, Tokyo, Japan.
Tel : (81) 3-3254-8177 Fax : (81) 3-3254-3474

Singapore Branch Office : 16 Raffles Quay, #40-03 Hong Leong Building, Singapore 048581.
Tel : (65) 220-4022 Fax : (65) 324-6151

Europe Representative Office : Kaiser-Friedrich-Promenade 61 D-61348 Bad Homburg v. d. H. Germany.
Tel : (49) 6172-9175-0 Fax : (49) 6172-9175-25

Shanghai Branch Office : Room 1301-P Shanghai Kerry Center, 1515 Nanjing Xi Road, Shanghai China
Tel : (21) 5298-6900 Fax : (21) 5298-6556

ASAHI /AMERICA Inc. :35 Green Street P.O.Box 653 , Malden, Massachusetts 02148 U.S.A.
Tel : (1) 781-321-5409 Fax : (1) 781-321-4421

Distributor

Ball Valves Type 21

ASAHI *AV* VALVES

Class 125 Bronze Check Valves

Horizontal Swing • Regrinding Type • Y-Pattern • Renewable Seat and Disc

Dezincification Resistant

125 PSI/8.6 Bar Saturated Steam to 353° F/178° C
200 PSI/13.8 Bar Non-Shock Cold Working Pressure

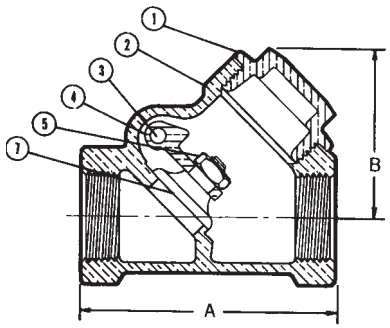
T-413
Threaded

CONFORMS TO MSS SP-80

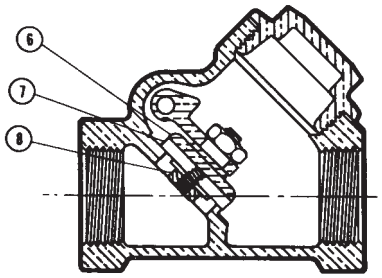
MATERIAL LIST

PART	SPECIFICATION
1. Bonnet	Bronze ASTM B 62
2. Body	Bronze ASTM B 62
3. Hinge Pin	Bronze ASTM B 140 Alloy C31400 or B 134 Alloy C23000
4. Disc Hanger	Bronze ASTM B 62 or 304 Stainless Steel ¼" thru ¾" sizes
5. Hanger Nut	Bronze ASTM B 16
6. Disc Holder	Bronze ASTM B 62
7. Seat Disc	Water, Oil or Gas (Buna-N) (W) Steam (PTFE) (Y) Bronze ASTM B 62 (B) Viton (V)
8. Seat Disc Nut	Bronze ASTM B 16 or B 62
9. Hinge Pin Plug	Bronze ASTM B 140 Alloy C32000 (not shown)
*10. Seat Disc Washer	ASTM B 98 Alloy C65500 or ASTM B 103 (not shown)

***Sizes ¾", 1", 1¼", and 1½" only.**



T-413-B
NPT x NPT



T-413-Y
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		Dimensions B		Master		
In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Ctn. Qty.
¼	8	2.13	54	1.63	41	0.50	0.23	50
⅜	10	2.13	54	1.63	41	0.47	0.22	50
½	15	2.44	62	1.69	43	0.55	0.25	50
¾	20	2.94	75	1.88	48	0.90	0.41	50
1	25	3.56	90	2.31	59	1.46	0.66	30
1¼	32	4.19	106	2.69	68	2.17	0.99	20
1½	40	4.50	114	2.94	75	2.95	1.34	10
2	50	5.25	133	3.94	100	4.79	2.17	10
2½*	65	8.00	203	5.06	129	11.48	5.21	5
3*	80	9.25	235	6.25	159	17.53	7.96	4

Ordering: T-413 normally furnished with Bronze Disc (T-413-B).
Available with PTFE Steam Disc (T-413-Y) or CWP Disc (T-413-W) or 300° F 67 PSI steam Viton Disc (T-413-V).

***– Class 150 (433) furnished for these sizes.**

NIBCO check valves may be installed in both horizontal and vertical lines with upward flow or in any intermediate position. They will operate satisfactorily in a declining plane (no more than 15°).

Warning – Do Not Use For Reciprocating Air Compressor Service.

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Calibrated Pressure and Vacuum Relief Valve
Part Number: Watts N36 (Grainger 6A772)

Vacuum Relief Valve,1/2 In,Brass

Vacuum Relief Valve, Inlet/Outlet 1/2 In, MNPT Connection, Material of Construction Brass, Pressure Range 15 To 200 PSI, Standards ANSI Z21.22, CSA Certified

Prevents vacuum conditions that could siphon water from the system and burn out a heater or collapse a tank. Automatically vents closed system to atmosphere when a vacuum is created. Opens at less than 1/2" vacuum. Also suitable for steam service.

Item Vacuum Relief Valve
Inlet/Outlet (In.) 1/2
Connection MNPT
Material of Construction Brass
Pressure Range 15 To 200 PSI

Liquid Level Switches and Sensors

Madison Company's comprehensive line of level sensors includes single- and multi-point level switches, continuous level and conductivity sensors and more. The wide selection of materials offers reliable and durable level sensors for all liquid environments, as well as a full range of other application conditions. Madison engineers can incorporate temperature sensors into level sensor designs, offering combination sensing and cost savings for many applications.

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Madison® *M Series* Stainless Steel *Liquid Level Switches*

Full-size Switches

MODEL NO.	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M5600	MS5600	1	316SS	316SS	200˚	200	0.55	60	22 ga. Teflon 24"	1/4" NPT	A,B,C,D,E
M5600-SPDT	MS5600-SPDT	1	316SS	316SS	200˚	200	0.55	25*	22 ga. Teflon 24"	1/4" NPT	A,B,C,D
M5601	MS5601	1	316SS	316SS	200˚	200	0.55	100	22 ga. Teflon 24"	1/4" NPT	A,B,C,D
M5917	MS5917	1	316SS	316SS	250˚	200	0.55	60	18 ga. UL/CSA appr.	1/4" NPT	A,B,C,D
M4600	MS4600	2	Buna-N	316SS	105˚	150	0.45	60	22 ga. Teflon 24"	1/4" NPT	A,B,C
M4600-SPDT	MS4600-SPDT	2	Buna-N	316SS	105˚	150	0.45	25*	22 ga. Teflon 24"	1/4" NPT	A,B,C
M4601	MS4601	2	Buna-N	316SS	105˚	150	0.45	100	22 ga. Teflon 24"	1/4" NPT	A,B,C
M8600	MS8600	2	PP	316SS	105˚	100	0.75	60	22 ga. Teflon 24"	1/4" NPT	A,B,C,D
M8600-SPDT	MS8600-SPDT	2	PP	316SS	105˚	100	0.75	25*	22 ga. Teflon 24"	1/4" NPT	A,B,C,D
M8601	MS8601	2	PP	316SS	105˚	100	0.75	100	22 ga. Teflon 24"	1/4" NPT	A,B,C,D
M5600-PR	MS5600-PR	3	316SS	316SS	200˚	500	0.70	100	22 ga. Teflon 24"	1/4" NPT	C,D
MSB5600	–	4	316SS	316SS	110˚	85	0.55	60	Teflon Cable 6 ft.	–	–
M3842	–	4	316SS	316SS	100˚	30	0.64	25*	18 AWG Neoprene Cable 10 ft.	–	–

** SPDT switch operation* *PP= Polypropylene*

Miniature Switches

MODEL	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M5000	MS5000	5	316SS	316SS	200˚	300	0.70	30	22 ga. Teflon 24"	1/8" NPT	A,B,C,D
M4400	MS4400	6	Buna-N	316SS	105˚	150	0.45	30	22 ga. Teflon 24"	1/8" NPT	A,B,C
M8020	MS8020	6	PP	316SS	105˚	100	0.80	30	22 ga. Teflon 24"	1/8" NPT	A,B,C,D

PP= Polypropylene

Side-Mounted Switches

MODEL	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	** APPROVALS
M5900*	–	11	316SS	316SS	200˚	300	0.60	30	22 ga. Teflon 24"	A,B,C,D,E
M5910*	–	13	316SS	316SS	200˚	300	0.60	30	22 ga. Teflon 24"	A,B,C,D,E
M5920*	–	12	316SS	316SS	200˚	300	0.60	30	22 ga. Teflon 24"	A,B,C,D,E
M5970	–	14	316SS	316SS	200˚	100	0.70	30	22 ga. Teflon 24"	A,B,C,D
M5010	MS5010	15	316SS	316SS	200˚	300	0.70	30	22 ga. Teflon 24"	A,B,C,D

** Available with extended stem length, see drawing No. 19. Consult factory for appropriate model number.*

MODEL	SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	OUTER THREAD
M3827-1	–	16	316SS	316SS	200˚	50	0.60	30	22 ga. Teflon 24"	1/2-13 Bulkhead
M3827-2	–	17	316SS	316SS	200˚	50	0.60	30	22 ga. Teflon 24"	1/2 NPT
M3827-3	–	18	316SS	316SS	200˚	50	0.60	30	22 ga. Teflon 24"	1/8 NPT
M3827-1NO	–	–	316SS	316SS	200˚	50	0.60	30	22 ga. Teflon 24"	1/2-13 Bulkhead
M3827-2NO	–	–	316SS	316SS	200˚	50	0.60	30	22 ga. Teflon 24"	1/2 NPT
M3827-3NO	–	–	316SS	316SS	200˚	50	0.60	30	22 ga. Teflon 24"	1/8 NPT

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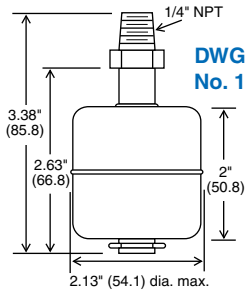
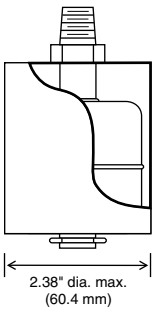
Madison® *M Series* Stainless Steel *Liquid Level Switches*

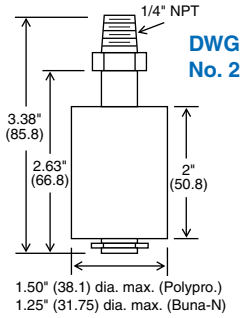
Vertical Switches



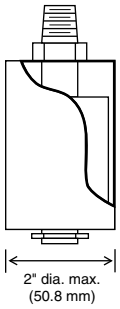
DWG No. 1



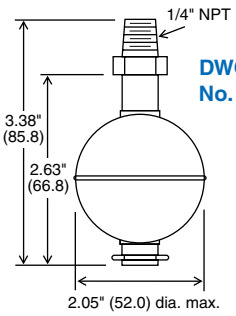
Cutaway Showing Slosh Shield Operation



DWG No. 2



Cutaway Showing Slosh Shield Operation



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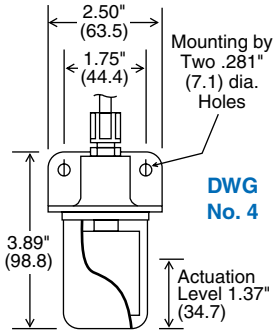

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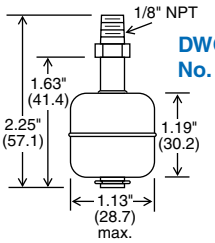

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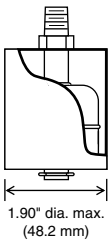
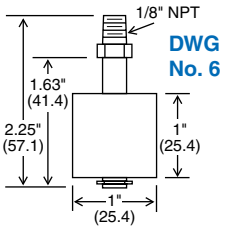
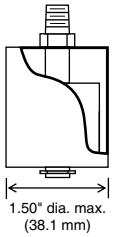


Cutaway Showing Slosh Shield Operation

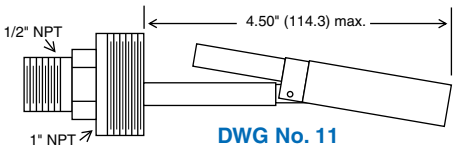


DWG No. 6

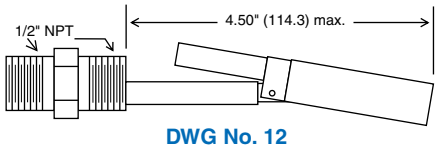


Cutaway Showing Slosh Shield Operation

Side-Mounted Switches



DWG No. 11



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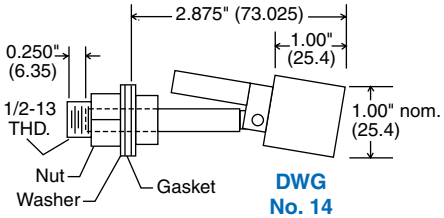

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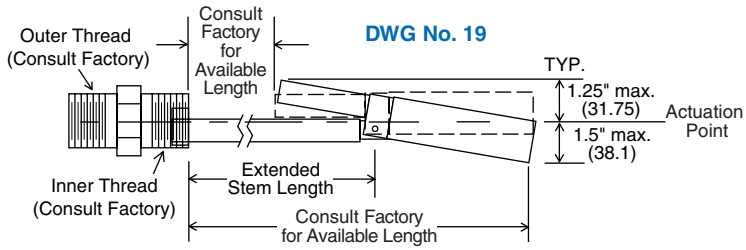
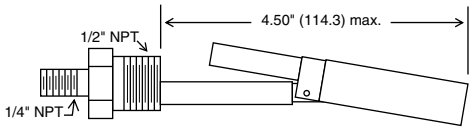


DWG No. 19



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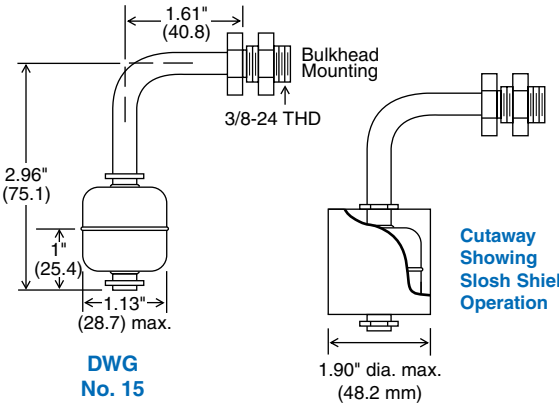
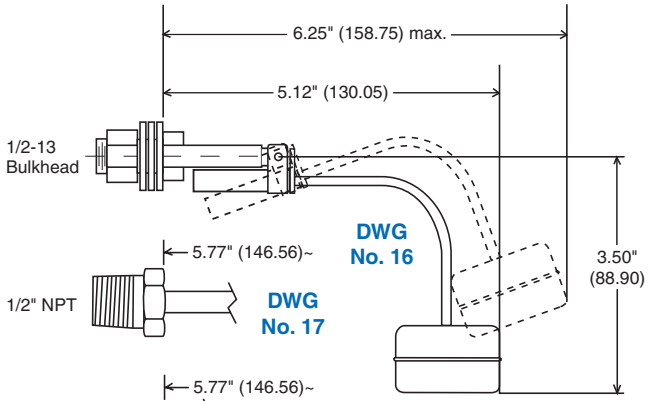


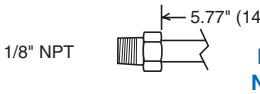
DWG No. 15

Cutaway Showing Slosh Shield Operation



DWG No. 16

DWG No. 17



DWG No. 18

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Madison® *M Series* **Plastic** *Liquid Level Switches*

Full-size Switches

MODEL NO.	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M8800	MS8800	28	PP	PP	105˚	100	0.75	60	22 ga. MTW 24"	1/4" NPT	A,B,C,D
M8800-SPDT	MS8800-SPDT	28	PP	PP	105˚	100	0.75	25**	22 ga. Teflon 24"	1/4" NPT	A,B,C,D
M8801	MS8801	28	PP	PP	105˚	100	0.75	100	22 ga. MTW 24"	1/4" NPT	A,B,C,D
M8800-PR	MS8800-PR	28	PP	PP	105˚	100	0.75	360	22 ga. MTW 24"	1/4" NPT	C,D
M7800*	MS7800*	28	Buna-N	PBT	105˚	150	0.45	60	22 ga. Teflon 24"	1/4" NPT	A,B,C
M7800-SPDT*	MS7800-SPDT*	28	Buna-N	PBT	105˚	150	0.45	25**	22 ga. Teflon 24"	1/4" NPT	A,B,C
M7801*	MS7801*	28	Buna-N	PBT	105˚	150	0.45	100	22 ga. Teflon 24"	1/4" NPT	A,B,C
M8060-PR	MS8060-PR	28	PP	CPVC	105˚	100	0.75	360	22 ga. MTW 24"	1/4" NPT	C
M9800	MS9800	28	Kynar	Kynar	105˚	15	0.75	60	22 ga. Teflon 24"	1/4" NPT	B,C,D
MSB7800*	–	29	Buna-N	PBT	105˚	150	0.45	60	Nylon Cable 6 ft.	–	–
MSB8800	–	29	PP	PP	105˚	100	0.75	60	PP Cable 6 ft.	–	–

** Not for use in hot water at temperatures above 65ºC ** SPDT switch operation PP=Polypropylene*

Miniature Switches

MODEL	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M8000	MS8000	30	PP	PP	105˚	100	0.80	30	22 ga. MTW 24"	1/8" NPT	A,B,C,D
M4008	MS4008	30	Buna-N	PP	105˚	150	0.45	30	22 ga. MTW 24"	1/8" NPT	A,B,C
M7000*	MS7000*	30	Buna-N	PBT	105˚	150	0.45	30	22 ga. Teflon 24"	1/8" NPT	A,B,C
M9000	MS9000	30	Kynar	Kynar	105˚	15	0.85	30	22 ga. Teflon 24"	1/8" NPT	A,B,C,D

** Not for use in hot water at temperatures above 65ºC PP=Polypropylene*

Side-Mounted Switches

MODEL NO.	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	** APPROVALS
M8700	M8705	32	PP	PP	105˚	100	0.60	30	22 ga. MTW 24"	A,B,C,D
M8725	MS8725	33	PP	PP	105˚	100	0.60	30	22 ga. MTW 24"	A,B,C,D
M8740	–	34	PP	PP	105˚	100	0.60	30	22 ga. Teflon 24"	A,B,C,D
M8750	M8755	35	PP	PP	105˚	100	0.60	30	22 ga. MTW 24"	A,B,C,D
M8790	–	36	PP	PP	105˚	100	0.60	30	22 ga. MTW 24"	A,B,C,D
M7700*	M7705*	32	PBT	PBT	150˚	100	0.70	30	22 ga. Teflon 24"	A,B,C
M7725*	MS7725*	33	PBT	PBT	150˚	100	0.70	30	22 ga. Teflon 24"	A,B,C
M7740*	–	34	PBT	PBT	150˚	100	0.70	30	22 ga. Teflon 24"	A,B,C
M7750*	M7755*	35	PBT	PBT	150˚	100	0.70	30	22 ga. Teflon 24"	A,B,C
M7790*	–	36	PBT	PBT	150˚	100	0.70	30	22 ga. Teflon 24"	A,B,C
M9700	M9705	32	Kynar	Kynar	105˚	100	0.93	30	22 ga. Teflon 24"	A,B,C,D

** Not for use in hot water at temperatures above 65ºC PP=Polypropylene*

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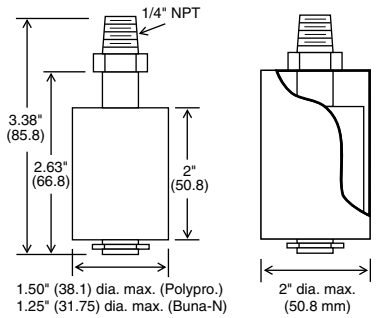
Madison® *M Series* **Plastic** *Liquid Level Switches*

Subminiature Switches

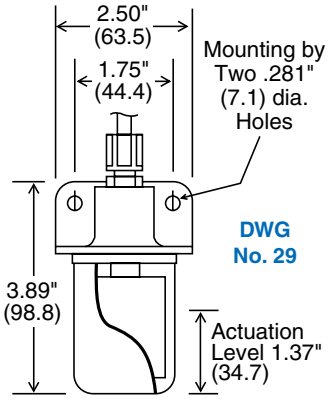
MODEL	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M3326	–	31	PP	PP	105˚	50	0.85	15	22 ga. Teflon 24"	3/8-16	A,B,C
M3326-NO	–	31	PP	PP	105˚	50	0.85	15	22 ga. Teflon 24"	3/8-16	A,B,C

PP= Polypropylene

DWG No. 28

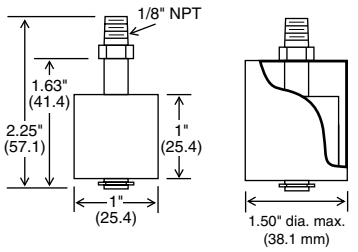


Cutaway Showing Slosh Shield Operation



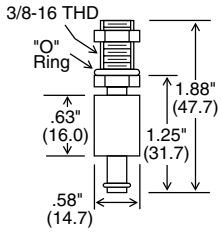
DWG No. 29

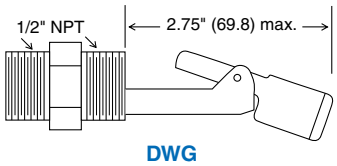
DWG No. 30



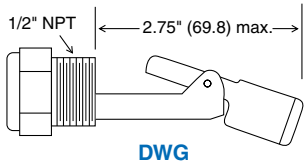
Cutaway Showing Slosh Shield Operation

DWG No. 31





DWG No. 32



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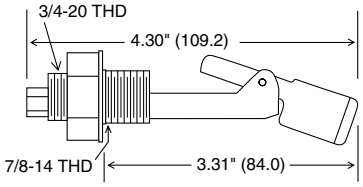
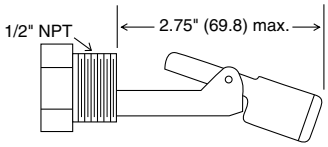


DWG No. 34



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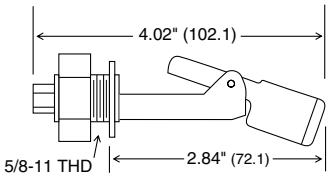
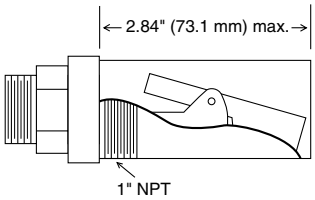


DWG No. 36



Cutaway Showing Slosh Shield Operation

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Madison® M Series Brass Liquid Level Switches

Full-size Switches

MODEL NO.	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M4300	MS4300	21	Buna-N	Brass	105˚	150	0.45	60	22 ga. MTW 24"	1/4" NPT	A,B,C
M4300-SPDT	MS4300-SPDT	21	Buna-N	Brass	105˚	150	0.45	25*	22 ga. Teflon 24"	1/4" NPT	A,B,C
M4301	MS4301	21	Buna-N	Brass	105˚	150	0.45	100	22 ga. MTW 24"	1/4" NPT	A,B,C
M5400	MS5400	21	316SS	Brass	200˚	200	0.55	60	22 ga. Teflon 24"	1/4" NPT	A,B,C
M5400-SPDT	MS5400-SPDT	21	316SS	Brass	200˚	200	0.55	25*	22 ga. Teflon 24"	1/4" NPT	A,B,C
M5401	MS5401	21	316SS	Brass	200˚	200	0.55	100	22 ga. Teflon 24"	1/4" NPT	A,B,C
M8400	MS8400	21	PP	Brass	105˚	100	0.75	60	22 ga. MTW 24"	1/4" NPT	A,B,C
M8400-SPDT	MS8400-SPDT	21	PP	Brass	105˚	100	0.75	25*	22 ga. Teflon 24"	1/4" NPT	A,B,C
M8401	MS8401	21	PP	Brass	105˚	100	0.75	100	22 ga. MTW 24"	1/4" NPT	A,B,C

** SPDT switch operation PP=Polypropylene*

Miniature Switches

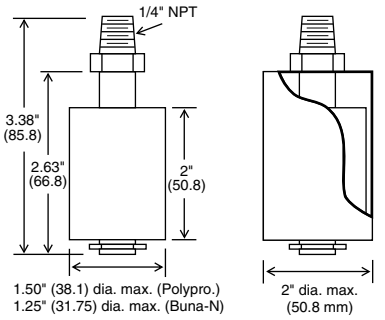
MODEL	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	FITTING	** APPROVALS
M4500	MS4500	22	Buna-N	Brass	200˚	300	0.70	30	22 ga. Teflon 24"	1/8" NPT	A,B,C
M5040	MS5040	22	316SS	Brass	105˚	150	0.45	30	22 ga. Teflon 24"	1/8" NPT	A,B,C
M8040	MS8040	22	PP	Brass	105˚	100	0.80	30	22 ga. Teflon 24"	1/8" NPT	A,B,C

PP=Polypropylene

Side-Mounted Switches

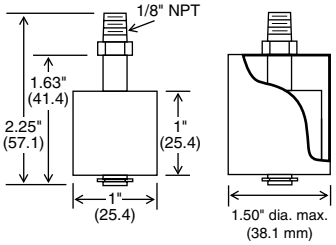
MODEL	With SLOSH SHIELD	DWG NO.	FLOAT MATL	STEM MATL	MAX TEMP (CELSIUS)	MAX PSIG	FLOAT SG	NOMINAL VA	LEAD WIRES	** APPROVALS
M4010	MS4010	23	Buna-N	Brass	105˚	100	0.45	30	22 ga. Teflon 24"	A,B,C

DWG No. 21



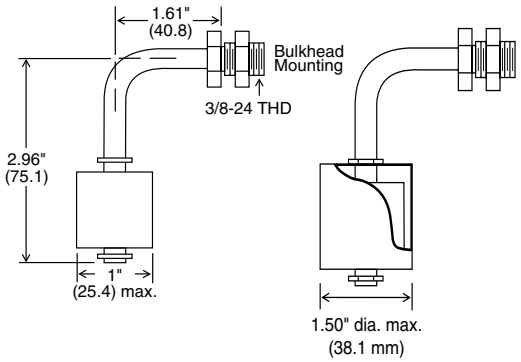
Cutaway Showing Slosh Shield Operation

DWG No. 22



Cutaway Showing Slosh Shield Operation

DWG No. 23



Cutaway Showing Slosh Shield Operation

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M Series

Single-Level Liquid Level Switches

A selection of engineered single-level switches

Madison Company offers a complete line of Standard and Configured (slightly modified Standard designs) models. These products continue to meet the needs of applications in many markets, at competitive prices. In addition, Madison Company offers the capability to design specific liquid level switches for OEM applications that require unique considerations in materials, configurations and system interfacing.

Engineered designs incorporate over 45 years of experience in liquid level switch applications in a variety of environments and installation configurations. High reliability of the magnetic reed switch technology assures repeatability at an economical price. Our design experience and flexible manufacturing techniques also offer customers many value-added design and assembly options to reduce their product cost.

Features

- Single-point
- Magnetic reed switch technology
- High reliability
- Wide selection of available materials
- Three basic sizes: full, miniature and subminiature
- Direct interface to controllers available

Madison Company • (203) 488-4477 • Fax (203) 481-5036 • E-mail: info@madisonco.com • www.madisonco.com

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Product Selection Guide

The first consideration is the type of liquid, temperature and pressure to which the switch will be subjected. Madison manufactures liquid level switches in various styles, in a variety of materials, to cover a broad range of conditions. Following are some basic recommendations for selecting the proper liquid level switch material for your application.

► *See Approvals pages*

Material	Application
316 Stainless Steel	For high-temperature (to 200°C), high-pressure (to 300 PSIG) and corrosive conditions. Commonly used in food processing, medical, heating, and cooling equipment.
Polypropylene	For acidic conditions, such as found in electroplating and metal cleaning. Another choice for lower-temperature (to 105°C) food processing applications (Madison Company uses only polypropylene that is FDA-approved for food contact). Also a good choice for general-purpose applications in commercial or consumer appliances and equipment. Available in white and other colors.
Brass & Buna-N **PBT & Buna-N**	The selection for petroleum-based liquids, such as lubricating oils, gasoline and diesel fuels. Widely used in storage tanks of vehicles, generators, transmissions and hydraulic systems. Other uses are in lubrication, recovery, refining and fuel processing equipment. *Please note: PBT is not suitable for use in water above 65°C.*
Kynar	Chemical- and solvent-resistant properties make this material a problem solver for many applications. Its high-purity nature is ideal for food handling and sensitive laboratory or test equipment.

Once a suitable material has been selected, the type of switch and configuration are the next considerations. Madison Company stocks a full line of standard products that can meet the requirements of many applications. For specific designs, Madison can custom-build, to order, switches with an infinite number of variations and options. Please utilize our M & MT Series single-level specification sheet which, when completed, will allow our engineering department to better meet your needs.

Madison®

Sensor solutions for today and the future™

CERTIFIED ISO 9001

Madison Company 800-466-5383

27 Business Park Drive, Branford, CT 06405 • 203-488-4477 • Fax: 203-481-5036
www.madisonco.com • E-mail: info@madisonco.com

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Sediment Strainers

Standard Features

- True Union design facilitates installation or repair without expanding the pipeline
- Large filtration capacities and low pressure drops
- Transparent PVC strainer body permits easy evaluation of filter screen's condition
- Complete thermoplastic construction
- Pressure rating: 1/2" – 2", 150 psi; 3" and 4", 85 psi
- Sizes 1/2" – 2" supplied with two sets of end connectors (socket and threaded)

Options

- FKM seals for corrosive media
- Stainless Steel 316 screens available in 20, 40 and 60 mesh
- Inline cleaning (clean out valve)

Tips on Sediment Strainers

- Clean screen regularly.
- Union nut of screening section can be removed for quick and easy maintenance (no need to remove body from pipeline).
- Sediment strainers protect pipeline's important and costly components, such as pumps and meters, by removing suspended particles and impurities.
- Filtering section must face downward when installed.
- You must identify flow direction, shown by molded "Arrow" on the body, before installation.

Sediment Strainers

Specifications

Sizes:	1/2" – 4"
Models:	Socket, Threaded, Flanged (ANSI)
Body:	PVC
Screens:	Standard: 20 mesh PVC Optional: PVC - 30 and 40 mesh Stainless Steel - 20, 40 and 60 mesh
Seals:	EPDM, FKM

Sizes 1/2" - 4" PVC/EPDM/FKM
Models available with NSF-61 Certification

Parts (Sizes 1/2" – 4")

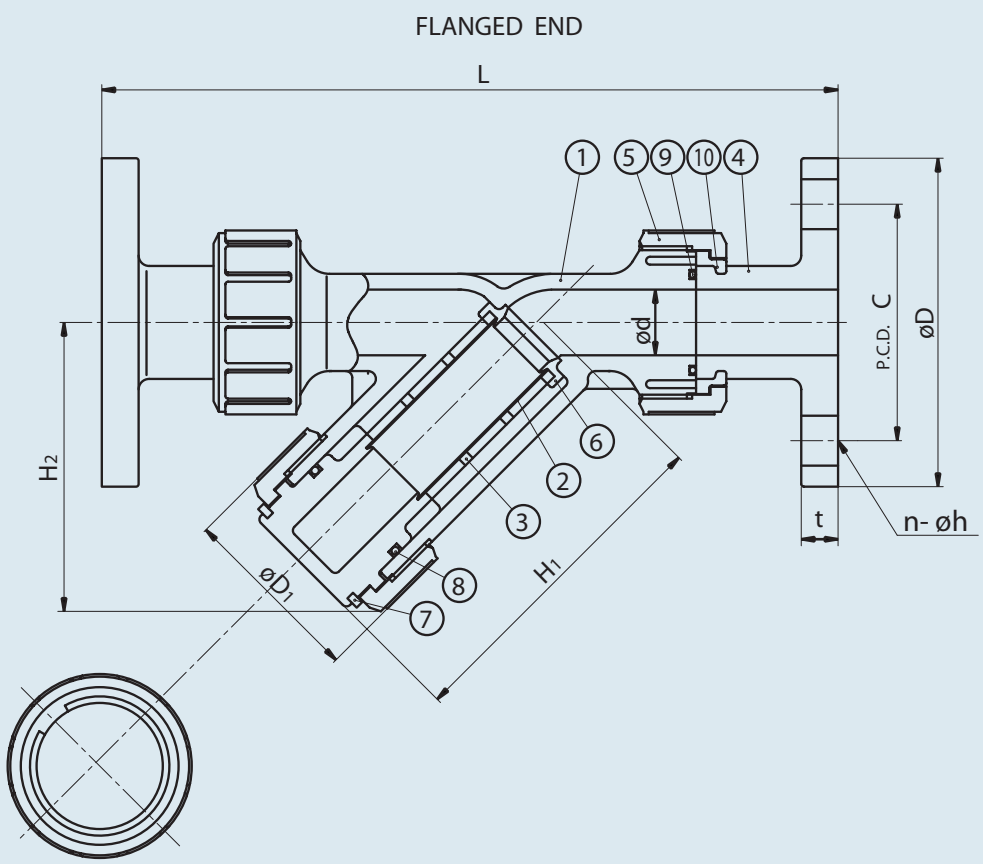
PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC
2	Filter Screen	1	PVC, Stainless Steel 316
3	Screen Support	1	PVC
4	End Connector	2	PVC
5	Union Nut	3	PVC
6	Retaining Ring	1	PVC
7	Split Ring	1	PVC
8	O-Ring (A)	1	EPDM, FKM, Others
9	O-Ring (B)	2	EPDM, FKM, Others
10	Stop Ring	2	PVDF**

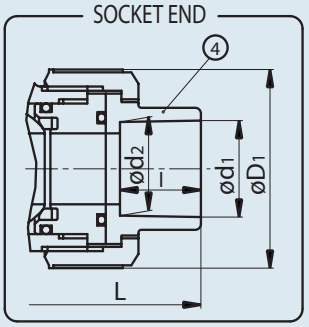
** Used for flanged end

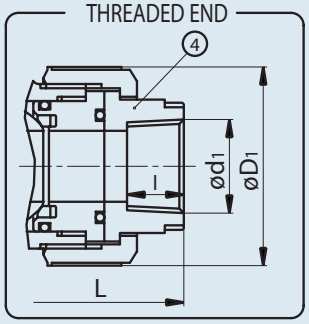
Sample Specification

All True Union Sediment Strainers, Sizes 1/2"– 4", shall be of true union design and shall be constructed of transparent PVC. All O-rings shall be EPDM or FKM. Screens shall be 20, 30 and 40 mesh PVC or 20, 40 and 60 mesh 316 SS. Filter maintenance is achieved without removing strainer from the pipeline. PVC shall conform to ASTM D1784 Cell Classification 12454-A. Valves shall be rated to 150 psi sizes 1/2" thru 2" and 85 psi sizes 3" and 4" at 70 degrees F, as manufactured by Asahi/America, Inc.

Sediment Strainers







Dimensions (Sizes 1/2" – 4")

NOMINAL SIZE		FLANGED						SOCKET				THREADED						
		ANSI CLASS 150						ASTM CLASS 40										
INCHES	mm	D	C	n	h	L	t	d_1	d_2	l	L	d_1	l	L	d	D_1	H_1	H_2
1/2	15	3.50	2.38	4	0.62	8.11	0.47	0.848	0.836	0.688	6.93	1/2-14 NPT	0.59	6.50	0.59	1.89	3.74	3.19
3/4	20	3.88	2.75	4	0.62	10.00	0.55	1.058	1.046	0.719	8.31	3/4-14 NPT	0.67	7.91	0.79	2.36	4.49	3.74
1	25	4.25	3.12	4	0.62	11.02	0.55	1.325	1.310	0.875	9.37	1-111/2 NPT	0.79	8.82	0.98	2.76	5.12	4.33
1 1/4	30	-	-	-	-	-	-	1.670	1.655	0.938	12.13	11/4-111/2 NPT	0.87	11.34	1.57	3.78	6.85	5.79
1 1/2	40	5.00	3.88	4	0.62	13.23	0.63	1.912	1.894	1.094	12.13	11/2-111/2 NPT	0.98	11.34	1.57	3.78	6.85	5.79
2	50	6.00	4.75	4	0.75	14.20	0.63	2.387	2.369	1.156	12.55	2-111/2 NPT	1.10	13.27	2.01	4.17	7.48	6.57
3	80	7.50	6.00	4	0.75	18.78	0.71	3.516	3.492	1.875	17.84	3 – 8 NPT	1.38	17.17	3.07	5.98	10.67	9.21
4	100	9.00	7.50	8	0.75	23.94	0.71	4.518	4.491	2.000	23.06	4 – 8 NPT	1.77	23.47	3.94	8.27	14.21	12.44

Weight (POUNDS)

NOMINAL SIZE		SOCKET THREADED	FLANGED
INCHES	mm		
1/2	15	0.66	1.10
3/4	20	1.32	2.20
1	25	1.76	3.31
1 1/2	40	4.41	5.51
2	50	5.51	8.82
3	80	15.43	18.74
4	100	40.78	45.19

Cv Values

NOMINAL SIZE		Cv
INCHES	mm	
1/2	15	5.2
3/4	20	7.5
1	25	14
1 1/2	40	34
2	50	50
3	80	110
4	100	165

Filter Screen Sizes*

MESH (HOLES PER LINEAR INCH)	20	30	40
MAXIMUM PARTICLE SIZE (INCH)	.033	.023	.011
MICRON PARTICLE SIZE (10-30 µ)	840	595	420

* For 60 mesh consult factory

Caution

- Never remove strainer from pipeline under pressure.
- Always wear protective gloves and goggles.

Serial No.	H – V034E – 2

Sediment strainer

(Type Y)

User's Manual

Contents

ASAHI AV VALVES

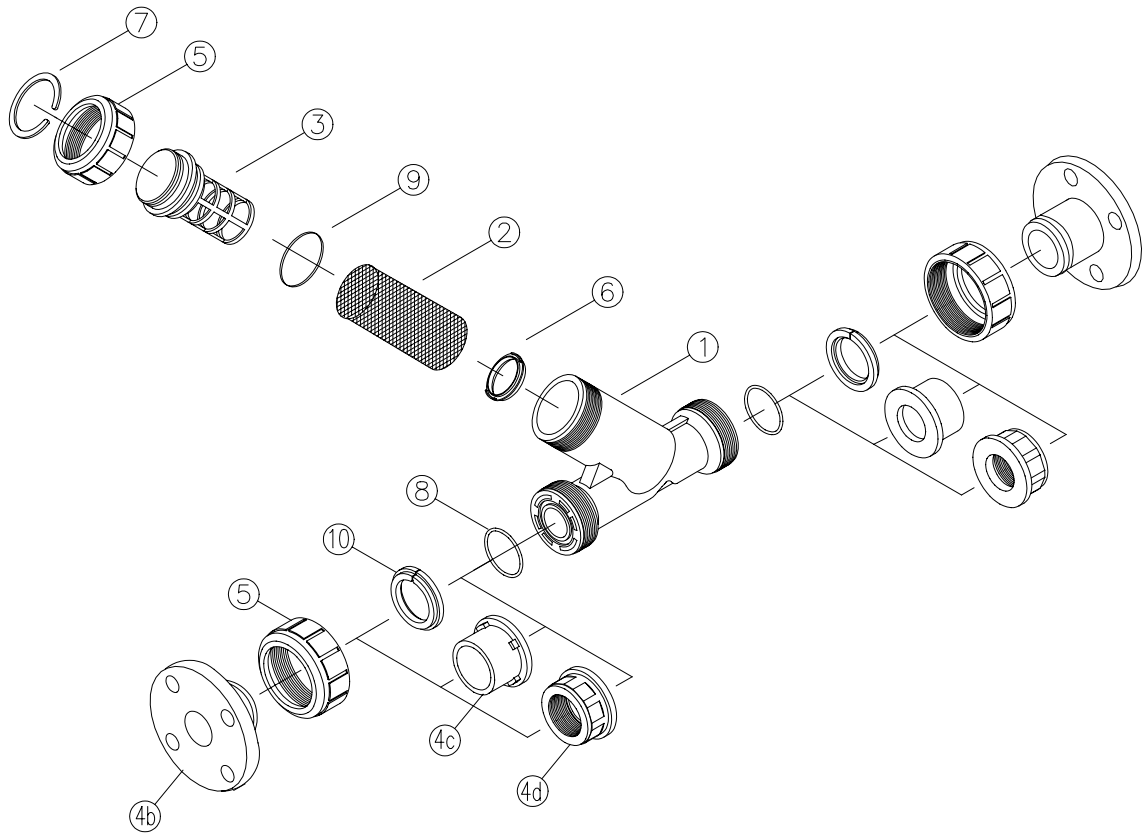
(1) General operating instruction

- Operate the valve within the range of the published working temperature and pressure.
  （The valve can be damaged by operation beyond the maximum allowable range of temperature vs pressure.）
- To select a valve in appropriate materials, refer to “CHEMICAL RESISTANCE ON ASAHI AV VALVE”.
  （Some chemicals give heavy damage to valve materials.）
- The valve is not designed to bear any kind of external load. Never stand on or place anything heavy on the valve at anytime.
- When the valve is disposed of, contact waste disposal specialist.
- The valve should be installed at place where space for periodic inspection & maintenance is sufficient.
- Do not store or install the valve near any heat source or hot surface.
  (The valve may cause deformation, destruction, and fire.)
- Volatile liquids such as a hydrogen peroxide (H2O2) and sodium hypochlorite (NaC1O) may vaporize, thus causing an abnormal pressure increase in the valve.
  (If the pressure rises abnormally, gas may break a valve into pieces.)
- Plumb in the strainer considering the fluid direction (the arrow is shown on the body) so that the screen points downward.
- Avoid excessive force on the strainer when plumbed in.
- As for the flanged end type, tighten bolts in turn diagonally not to tighten unevenly. Avoid excessive tightening the union nut ⑤ of the screen. There is no influence on sealing.

(2) General instructions for transportation, unpacking and storage

- Keep the valve in its original packaging until needed for installation.
- Avoid contact with any coal tar creosote, insecticides, vermicides or paint.
  (The force of swelling may damage the valve.）
- The valve is not designed to handle any kind of impact. Avoid throwing or dropping the valve.
- Avoid scratching the valve with any sharp object.

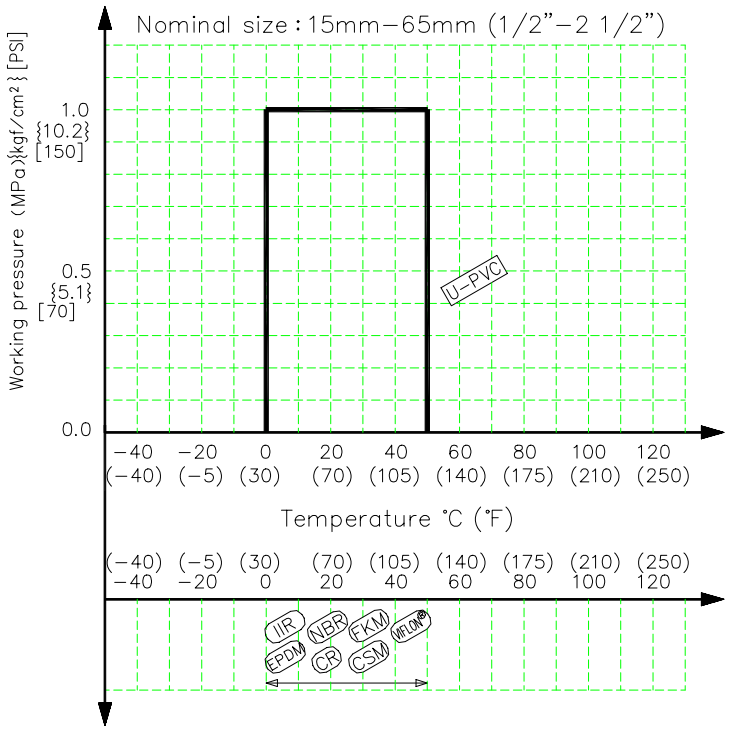
(3) Name of parts



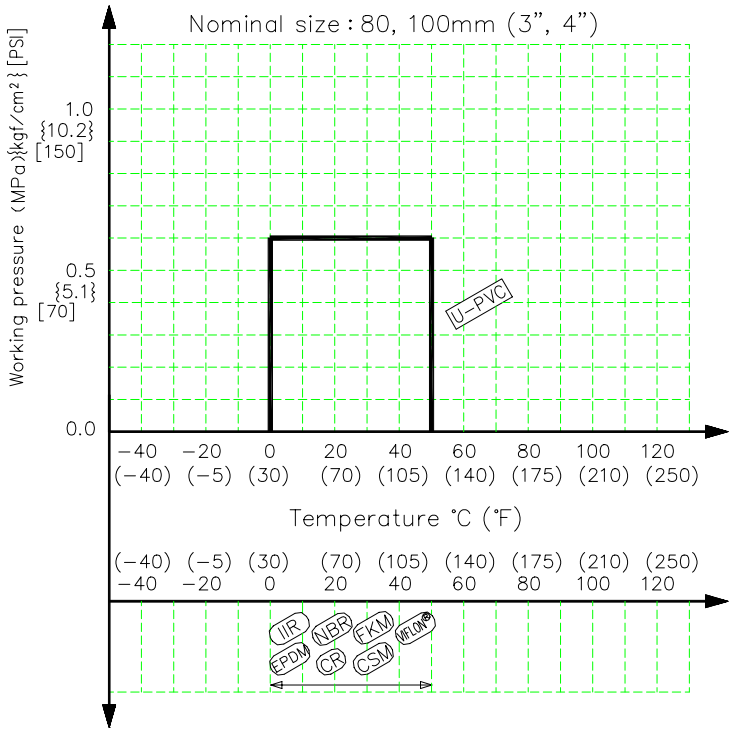
No.	DESCRIPTION	No.	DESCRIPTION
①	Body	⑤	Union nut
②	Filter screen	⑥	Retaining ring
③	Screen support	⑦	Split ring
④b	End connector (Flanged end type)	⑧	O-ring(A)
④c	End connector (Socket end type)	⑨	O-ring(B)
④d	End connector (Threaded end type)	⑩	Stop ring

(4) Comparison between operating temperature and pressure

Nominal size; 15mm-65mm (1/2”-2”)



Nominal size; 80mm, 100mm (3”, 4”)



Caution

Do not operate the valve beyond the range of working temperature and pressure.
(The valve can be damaged.)

(5) Installation procedure

Flanged type (Material; PVC, CPVC, PVDF)

Necessary items

- Torque wrench
- Spanner wrench
- Bolt, Nut, Washer (For many flanges specification)
- AV gasket （When a non-AV gasket is used, a different tightening torque specification should be followed.)

Procedure

1) Set the AV gasket between the flanges.

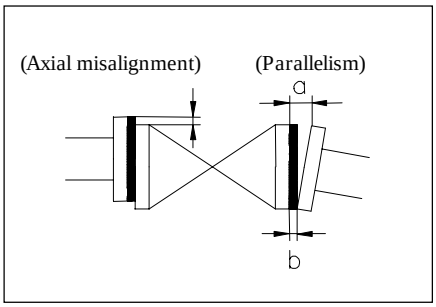
2) Insert washers and bolts from the pipe side, insert washers and nuts from the valve side, then temporarily tighten them by hand.

Caution

The parallelism and axial misalignment of the flange surface should be under the values shown in the following table to prevent damage the valve.
(A failure to observe them can cause destruction due to stress application to the pipe)

Unit: mm (inch)

Nom. Size	Axial Misalignment	Parallelism (a-b)
15-25mm (1/2"-1")	1.0 (0.04)	0.5 (0.02)
40-80mm (1 1/2"-3")	1.0 (0.04)	0.8 (0.03)
100mm (4")	1.0 (0.04)	1.0 (0.04)

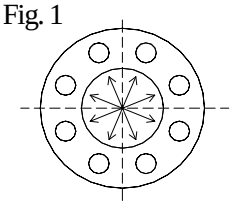


3) Using a torque wrench, tighten the bolts and nuts gradually to the specified torque in a diagonal manner (Refer to fig.1.)

Caution

Avoid excessive tightening. (The valve can be damaged.)

Fig. 1



Recommended torque value

Unit: N-m{kgf-cm}[lb-inch]

Nom. Size	15mm (1/2")	20mm (3/4")	25mm (1")	40mm (1 1/2")	50mm (2")	80mm (3")	100mm (4")
Torque value	17.5 {179} [155]	17.5 {179} [155]	20.0 {204} [200]	20.0 {204} [200]	22.5 {230} [200]	30.0 {306} [266]	30.0 {306} [266]

*Be sure to set the union nut ⑤ when it was removed or loosen from body ①.

1) The o-ring(A) ⑧ should be set on surface of the end connector ④b.
2) The end connector ④b must be put onto the carrier , then ensure that the o-ring(A) ⑧ is being between the end connector ④b and the carrier.
3) Tighten the union nut ⑤ hardly with hand.
4) Screw the union nut ⑤ on the body ① by quarter or half turn using a strap wrench without damaging it.

Caution

Avoid excessive tightening. (The valve can be damaged.)

Threaded type

Necessary items

- Sealing tape（A non-sealing tape can cause leakage.）
- Strap wrench（Do not use Pipe wrench.）
- Spanner wrench

⚠ Caution

Make sure that the threaded connections are plastic x plastic.
（Metallic thread might damage the body cap.）

Procedure

1) Wind a sealing tape around the external thread of joint, leaving the end (about 3mm) free.
2) Loosen the union nut ⑤ with a strap wrench..
3) Remove the union nut ⑤ and the end connector ④d.
4) Lead the union nut ⑤ through the pipe.
5) Tighten the external thread of the joint and the end connector ④d hardly with hand.
6) Using a spanner wrench, screw the end connector ④d by turning 180° ～360° carefully without damaging it.

⚠ Caution

Avoid excessive tightening. (The valve can be damaged.)

7) Make sure that the O-ring(A) ⑧ is mounted.
8) Set the end connector ④d and union nut ⑤ directly on the body without allowing the O-ring (A) ⑧ to come off.
9) Tighten the union nut ⑤ hardly with hand.
10) Using a strap wrench, screw it in by turning 90° -180° carefully without damaging it.

⚠ Caution

Avoid excessive tightening.（The valve can be damaged.）

Socket type

Necessary items

- Adhesive for hard vinyl chloride pipes
- Spanner wrench (Do not use a piping wrench.)

Caution

Do not install a socket type valve where the atmospheric temperature is 5℃ or lower. （The valve can be damaged.）

Procedure

1) Loosen the union nut ⑤ with a spanner wrench.

2) Remove the union nut ⑤ and end connector ④c .

3) Lead the union nut ⑤ through the pipe.

4) Clean the hub part of the end connector ④c by wiping with waste cloth.

5) Apply adhesive evenly to the hub part of the end connector ④c and the pipe spigot.

Caution

Do not apply more adhesive than necessary.
（The valve can be damaged due to solvent cracking.）

Adhesive quantity（guideline）

Nom. Size	15mm (1/2")	20mm (3/4")	25mm (1")	40mm (1 1/2")	50mm (2")	80mm (3")	100mm (4")
Quantity（g）	1.0	1.3	2.0	3.5	4.8	9.0	13.0

6) After applying adhesive, insert the pipe quickly to the end connector ④c and leave it alone for at least 60 seconds.

7) Wipe away overflowing adhesive.

8) Make sure that O-ring(A) ⑧ is mounted

9) Set the end connector ④c and union nut ⑤ directly on the body without allowing the O-ring (A) ⑧ to come off.

10) Tighten the union nut ⑤ hardly with hand.

11) Using a strap wrench, screw it in by turning 90° -180° carefully without damaging it.

Caution

Avoid excessive tightening. (The valve can be damaged.)

(6) Cleaning and Replacing Method for Screen

Necessary items

- Strap wrench
- Protective gloves
- Safety goggles

Caution

Wear protective gloves and safety goggles as some fluid remains in the valve.
(You may be injured.)

1) Loosen the union nut ⑤, and remove the screen part (the numbers or the part are ②, ③, ⑤, ⑥, and ⑦) from the body ①.
2) Remove the retaining ring ⑥, and pull the filter screen ② out then wash it to remove the dust or foreign matter.
3) If the filter screen ② or the O-ring (B) ⑨ is damaged, replace with a new one.
   (Replace the O-ring (B) ⑨ removing the split ring ⑦ from the screen support ③.)
4) Carry out the assembly work in the reverse procedure from 3).

(7) Inspection items

- Periodically clean the screen in accordance with the use.
- Inspect the following items.

(1)	Check for any flaw, crack, or deformation on the outside.
(2)	Check whether fluid leaks to the outside.
(3)	Check the tightness of union nuts (loose or not).

(8) Troubleshooting

Problem	Cause	Treatment
Fluid leaks to the outside.	The union nut is loose.	Retighten.
	The O-ring is scratched or worn.	Replace the O-ring.

(9) Handling of residual and waste materials

Caution

In discarding remaining or waste materials, be sure to ask waste service company.

(10) Inquiries

ASAHI ORGANIC CHEMICALS INDUSTRY CO., LTD.

Nobeoka Head Office : 2-5955, Nakanose- Cho, Nobeoka –City, Miyazaki- Pref. , Japan.
Tel : (81) 982-35-0880 Fax : (81) 982-35-9350

Tokyo Head Office : (Furukawachiyoda Bldg.) 15-9, Uchikanda 2- Chome, Chiyoda-Ku, Tokyo, Japan.
Tel : (81) 3-3254-8177 Fax : (81) 3-3254-3474

Singapore Branch Office : 16 Raffles Quay, #40-03 Hong Leong Building, Singapore 048581.
Tel : (65) 220-4022 Fax : (65) 324-6151

Europe Representative Office : Kaiser-Friedrich-Promenade 61 D-61348 Bad Homburg v. d. H. Germany.
Tel : (49) 6172-9175-0 Fax : (49) 6172-9175-25

Shanghai Branch Office : Room 1301-P Shanghai Kerry Center, 1515 Nanjing Xi Road, Shanghai China
Tel : (21) 5298-6900 Fax : (21) 5298-6556

ASAHI /AMERICA Inc. :35 Green Street P.O.Box 653 , Malden, Massachusetts 02148 U.S.A.
Tel : (1) 781-321-5409 Fax : (1) 781-321-4421

Distributor

Sediment strainer (Type Y)

ASAHI AVVALVES

Plicord® Flexwing® Petroleum

APPLICATION:

For use in tank truck and in-plant operations to transfer gasoline, oil, and other petroleum base products up to 50% aromatic content. It is designed for pressure, gravity flow, or full-suction service.

CONSTRUCTION:

TUBE: Nitrile synthetic rubber RMA Class A (High Oil Resistance)

COVER: Black (red spiral stripe) or Red Chemivic (white spiral stripe) synthetic rubber (oil resistant); smooth cover; wrapped finish

REINFORCEMENT: Spiral-plied synthetic fabric with wire helix

TEMPERATURE: -35°F to 200°F (-37°C to 93°C)

PACKAGING: 100' lengths, coiled and polywrapped

BRANDING: Continuous spiral brand example “Goodyear™ Flexwing Petroleum 150 psi WP.”

COUPLINGS: Use Goodyear’s Insta-Lock Cam & Groove Fittings with this product. See page 221 for available Insta-Lock products.

NON-STOCK/SIZES: Refer to page 300 for special production run minimum requirements.

ORDER CODES: 543-109 (black) / 543-110 (red)

NOM. ID		NOM. OD		MAX. WP		BEND RADIUS		VACUUM HG		WEIGHT	
in.	mm.	in.	mm.	psi	Mpa	in.	mm.	in.	mm.	lb./ft.	kg./m.
3/4	19.1	1.22	31.0	150	1.03	2	51	29	737	0.47	0.70
1	25.4	1.50	38.1	150	1.03	2	51	29	737	0.63	0.94
1 1/4	31.8	1.76	44.7	150	1.03	3	76	29	737	0.79	1.18
1 1/2	38.1	2.03	51.6	150	1.03	4	102	29	737	0.99	1.47
1 3/4	44.5	2.28	57.9	150	1.03	4	102	29	737	1.07	1.59
2	50.8	2.55	64.8	150	1.03	5	114	29	737	1.30	1.93
2 1/2	63.5	3.07	78.0	150	1.03	6	146	29	737	1.66	2.47
3	76.2	3.57	90.7	150	1.03	7	178	29	737	2.03	3.02
3 1/2	88.9	4.13	104.9	150	1.03	8	203	29	737	2.39	3.56
4	101.6	4.60	116.8	150	1.03	10	254	29	737	2.68	3.99
6	152.7	6.78	171.9	150	1.03	30	762	29	737	5.61	8.36

The GOODYEAR (and Winged Foot Design) trademark is used by Veyance Technologies, Inc. under license from The Goodyear Tire & Rubber Company.

Goodyear Engineered Products are manufactured and sourced exclusively by Veyance Technologies, Inc. or its affiliates.

Temperature range: -40°F to +180°F(-40°C to +82°C). **NOTE:** Fuels are normally conveyed below 120°F (+49°C).

Tube: Type C (Nitrile) hose. Black.

Reinforcement: Synthetic, high tensile textile with steel wire helix.

Cover: Type A (Neoprene). Black with red spiral stripe. Smooth or corrugated.

Branding: Continuous transfer label.

Example: Gates ***Longhorn***® *Petroleum Transfer hose 150 PSI (1.03MPa) WP Made In U.S.A.*

Packaging: Coiled and wrapped in polyethylene.

Nom. I.D. (In.)	(mm)	Nom. O.D. (In.)	(mm)	Max. W.P. (psi)	Suction (In. Hg)	Min. Bend Radius (In.)	Wt. Per Ft. (Lbs.)	Standard Pack	Stock (X) or Min. Order Qty.	Gates Product No.
Smooth Cover										
1	25.4	1.50	38.1	150	30	3.0	0.59	100 ft.	X	4688-1305
1 1/4	31.8	1.75	44.5	150	30	4.0	0.71	100 ft.	X	4688-1306
1 1/2	38.1	2.02	51.3	150	30	4.0	0.87	100 ft.	X	4688-1307
2	50.8	2.52	64.0	150	30	6.0	1.12	100 ft.	X	4688-1308
2 1/2	63.5	3.05	77.5	150	30	8.0	1.48	100 ft.	X	4688-1309
3	76.2	3.58	90.9	150	30	9.0	1.87	100 ft.	X	4688-1310
4	101.6	4.60	116.8	150	30	12.0	2.72	100 ft.	X	4688-1311
6	152.4	6.88	174.8	150	30	18.0	6.28	50 ft.	X	4688-1312
Corrugated Cover										
2	50.8	2.52	64.0	150	30	5.0	1.08	100 ft.	X	4688-1351
3	76.2	3.58	90.9	150	30	8.0	1.70	100 ft.	X	4688-1352
4	101.6	4.64	117.9	150	30	11.0	2.50	100 ft.	X	4688-1353

WEST MICHIGAN RUBBER & SUPPLY
1.800.533.9677
sales@westmichiganrubber.com

RFH DUCTING HOSE

Temperature Range: -60°F to 275°F (intermittent to 300°F)
Construction: Thermoplastic rubber reinforced with a wire helix
Standard Colors: Black
Standard Lengths: 25', 50' (available up to 100')
Size Range: 1-1/4" to 24"
Description:

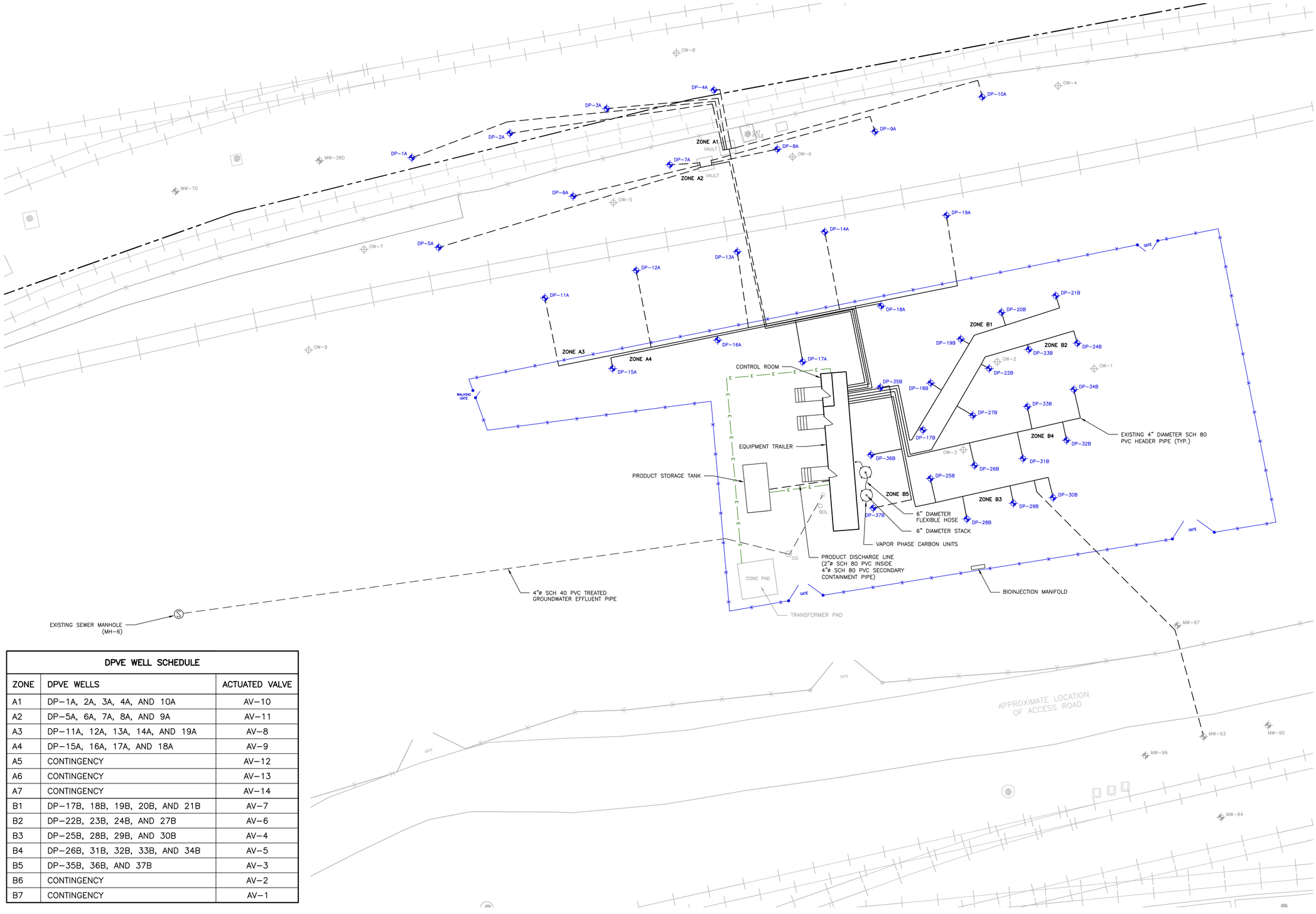
- Most versatile general purpose hose available today
- No cements, glues or adhesives are used in the manufacturing process
- Can handle applications with a wide temperature range
- Superior chemical resistance
- RFH-FR (flame retardant) version available
- Good abrasion resistance
- UV/ozone resistant
- Available in metric diameter, other colors and with cuffed ends

I.D. (in)	Working Pressure (PSI)	Vacuum (inHg)	CL Bend Radius (in)	Compression Ratio	O.D. Nominal (in)	Wall Thickness (in)	Wt (lbs/ ft)	Part #
1.25	28	>29	1.50	1 ft/6 in	1.49	.026	.11	RFH0125
1.50	24	>29	1.75	1 ft/6 in	1.75	.026	.22	RFH0150
1.75	22	>29	2.00	1 ft/9 in	2.00	.026	.23	RFH0175
2.00	17	>29	3.50	1 ft/6 in	2.27	.030	.24	RFH0200
2.50	13	28	4.00	1 ft/6 in	2.77	.030	.29	RFH0250
3.00	10	28	4.25	1 ft/5 in	3.27	.030	.32	RFH0300
3.50	10	20	5.25	1 ft/6 in	3.77	.030	.41	RFH0350
4.00	10	25	6.50	1 ft/6 in	4.29	.030	.50	RFH0400
5.00	9	15	8.00	1 ft/6 in	5.29	.030	.63	RFH0500
6.00	8	11.5	8.75	1 ft/6 in	6.29	.030	.85	RFH0600
7.00	7	10	10.50	1 ft/7 in	7.35	.030	.95	RFH0700
8.00	6	5.5	12.00	1 ft/7 in	8.35	.030	1.20	RFH0800
10.00	4	5	12.50	1 ft/4 in	10.38	.030	1.63	RFH1000
12.00	4	4	13.75	1 ft/4 in	12.38	.030	1.90	RFH1200
14.00	2	2	18.00	1 ft/4 in	14.48	.030	1.87	RFH1400
16.00	2	2	21.00	1 ft/4 in	16.48	.030	3.19	RFH1600
18.00	2	2	21.50	1 ft/4 in	18.48	.030	3.36	RFH1800
20.00	1	2	25.50	1 ft/4 in	20.50	.030	3.63	RFH2000
24.00	1	1	36.00	1 ft/4 in	24.50	.030	3.81	RFH2400

Pressure and vacuum data based on straight lengths of hose at ambient temperature 72°F.

PLATES

1. DPVE System Layout
2. DPVE Well Details
3. DPVE System Details



DPVE WELL SCHEDULE

ZONE	DPVE WELLS	ACTUATED VALVE
A1	DP-1A, 2A, 3A, 4A, AND 10A	AV-10
A2	DP-5A, 6A, 7A, 8A, AND 9A	AV-11
A3	DP-11A, 12A, 13A, 14A, AND 19A	AV-8
A4	DP-15A, 16A, 17A, AND 18A	AV-9
A5	CONTINGENCY	AV-12
A6	CONTINGENCY	AV-13
A7	CONTINGENCY	AV-14
B1	DP-17B, 18B, 19B, 20B, AND 21B	AV-7
B2	DP-22B, 23B, 24B, AND 27B	AV-6
B3	DP-25B, 28B, 29B, AND 30B	AV-4
B4	DP-26B, 31B, 32B, 33B, AND 34B	AV-5
B5	DP-35B, 36B, AND 37B	AV-3
B6	CONTINGENCY	AV-2
B7	CONTINGENCY	AV-1

NOTE

THIS DRAWING DOES NOT INCLUDE ALL SUBSURFACE STRUCTURES AND UTILITIES (I.E., FORMER FOUNDATIONS, PIPES, ETC.)

NO.	DATE	REVISION DESCRIPTION	INT.
5	11/6/13	REVISED TO SHOW AS-BUILT SYSTEM LOCATION	G.N.
4	1/10/13	REVISED TO SHOW NEW SYSTEM LOCATION	G.N.
3	8/8/12	REVISED TO SHOW NEW SYSTEM LOCATION	D.E.K.
2	2/8/12	REVISED TO SHOW NEW SYSTEM LOCATION	G.N.
1	7/11/11	REVISED TO SHOW NEW SYSTEM LOCATION	G.N.

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PROJECT NAME:
OPERATION, MAINTENANCE, AND MONITORING MANUAL OU-03

PROJECT FOR:
AMTRAK SUNNYSIDE YARD
QUEENS, NEW YORK

TITLE:
DPVE SYSTEM LAYOUT
AS-BUILT

DRAWING NO.
1

DRAWING 1 OF 3

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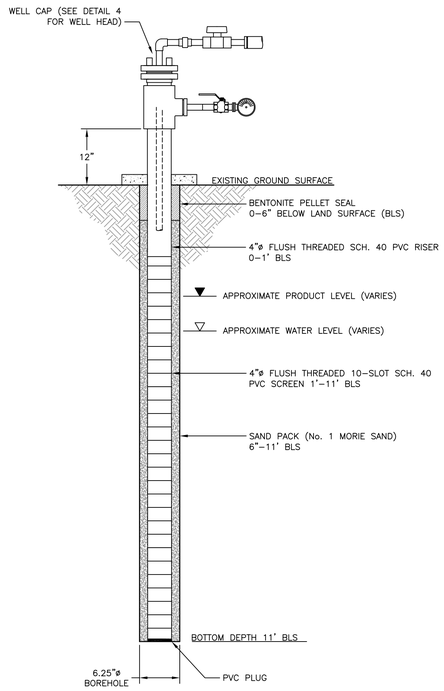
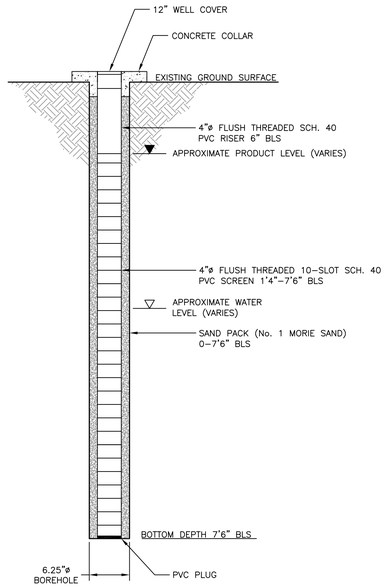


NOTE

FOR FLUSH–MOUNTED DPVE WELLS, DRILLER TO FINISH WELL WITH 12" WELL COVER AND CONCRETE COLLAR

1 TYPICAL ABOVEGROUND DPVE WELL CONSTRUCTION DETAIL

SCALE: NOT TO SCALE



2 TYPICAL OBSERVATION MONITORING WELL CONSTRUCTION DETAIL

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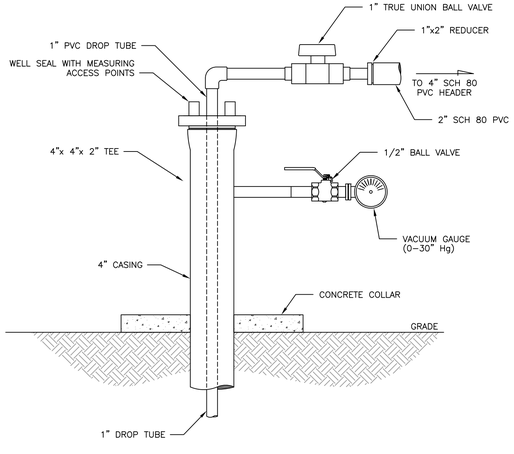

3 TYPICAL ABOVEGROUND DPVE WELL HEAD

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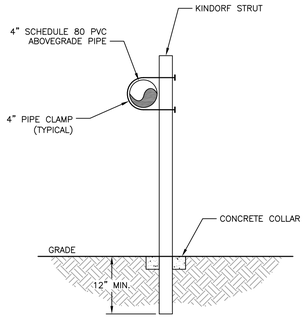
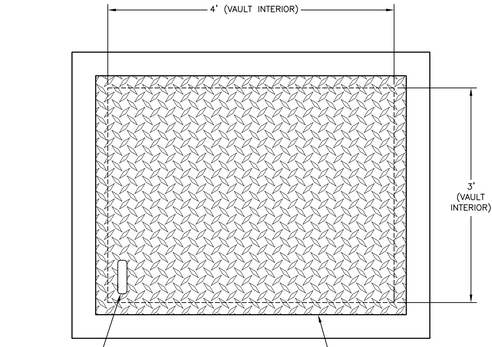


NOTE

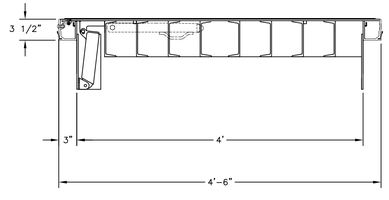
THE PIPING SUPPORTS ARE SPACED APPROX. 8 FT APART.

4 TYPICAL ABOVEGRADE PIPING SUPPORT DETAIL

SCALE: NOT TO SCALE



PLAN VIEW



SECTION VIEW

5 SINGLE LEAF DOOR HATCH DETAIL

SCALE: NOT TO SCALE

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PROJECT NAME:
OPERATION, MAINTENANCE, AND MONITORING MANUAL OU-3

PROJECT FOR:
AMTRAK SUNNYSIDE YARD
QUEENS, NEW YORK

TITLE:
DPVE WELL DETAILS
AS-BUILT

DRAWING NO.
2

DRAWING 2 OF 3

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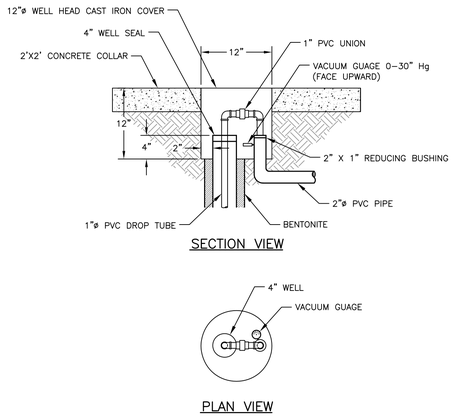

6 FLUSH-MOUNTED DPVE WELL HEAD

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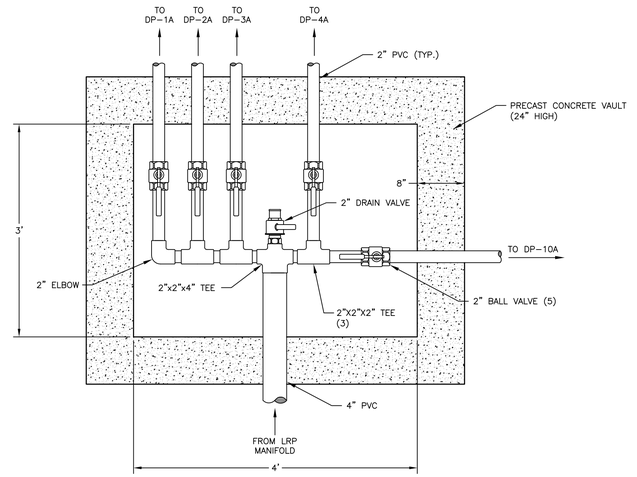

7 DPVE WELL VALVE VAULT FOR ZONE A1

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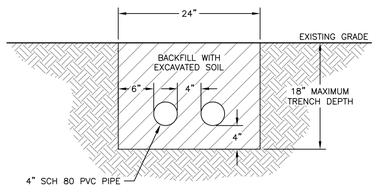

8 TYPICAL 4" DIAMETER PIPE TRENCH DETAIL

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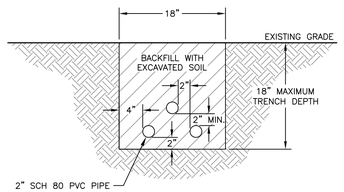

9 TYPICAL 2" DIAMETER PIPE TRENCH DETAIL

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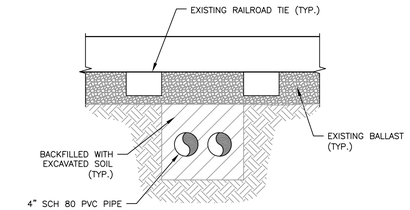

10 TYPICAL TRACK CROSSING DETAIL - 2 PIPES

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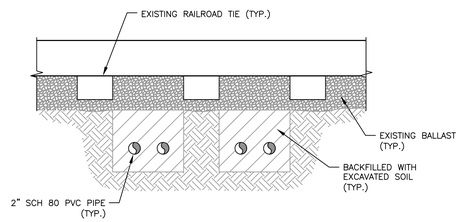
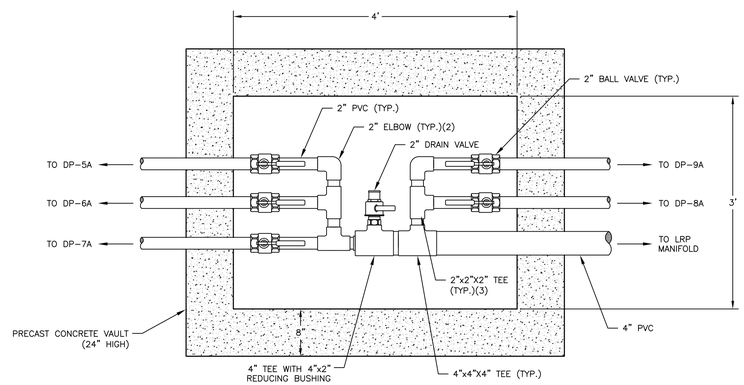


11 TYPICAL TRACK CROSSING DETAIL - 4 PIPES

SCALE: NOT TO SCALE



12 DPVE WELL VALVE VAULT FOR ZONE A2

SCALE: NOT TO SCALE

DPVE WELL VALVE VAULT NOTES

1. THE DPVE WELL VALVE VAULTS ARE PRE-CAST CONCRETE.
2. THE CONCRETE HAS A COMPRESSIVE STRENGTH OF 4,000 PSI.
3. THE PRE-CAST CONCRETE VAULTS HAVE NO.4 REBAR SPACED EVERY 6" ON CENTER, EACH WAY.
4. AN ALUMINUM SINGLE LEAF DOOR HATCH IS PROVIDED FOR EACH VAULT, RATED FOR H20 LOADING. THE DOOR FRAME IS CAST INTO DPVE WELL VALVE VAULT.
5. A DRAINAGE VALVE IS PROVIDED IN EACH VAULT.

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TITLE:
DPVE SYSTEM DETAILS
AS-BUILT

DRAWING NO.
3

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