SVE SYSTEM OPERATION & MAINTENANCE MANUAL

FARMINGDALE PLAZA CLEANERS

450-480 MAIN STREET

FARMINGDALE, NEW YORK 11735

SITE#: 1-30-107

Prepared For:

New York State - Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233

Prepared By:

ENVIRONMENTAL
ASSESSMENT &
REMEDIATIONS

Environmental Assessment & Remediations
225 Atlantic Avenue
Patchogue, NY 11772

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1.0 INTRODUCTION

This document represents the Operation & Maintenance (O&M) Manual for the soil vapor extraction (SVE) system at the Farmingdale Plaza Cleaners Site (Site No. 130107) at 450-480 Main Street, Farmingdale, NY.

The site is a former dry cleaner located in the Farmingdale Plaza shopping center, listed by the New York State Department of Environmental Conservation as a Class 2 Inactive Hazardous Waste Site in December 2002. Surrounding the shopping center is a mixed neighborhood of residential apartments, restaurants, and other retail businesses. Depth to water at this site is approximately 20 feet below grade surface. Site investigations have revealed the presence of tetrachloroethylene (PCE) and related degradation products (trichloroethene and 1,2-dichloroethene) in the site soil, groundwater, and soil vapors.

2.0 PROJECT CONTACT DIRECTORY

2.1 NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NYSDEC
Remedial Bureau E, Section A
Division of Environmental Remediation
625 Broadway, 12th floor
Albany, NY 12233-7017

Project Manager:
Brian Jankauskas
Ph: 518.402.9620

2.2 O&M CONTRACTOR

Environmental Assessment & Remediations
225 Atlantic Avenue
Patchogue, NY 11772
Ph: 631.447.6400
Fax: 631.447.6497

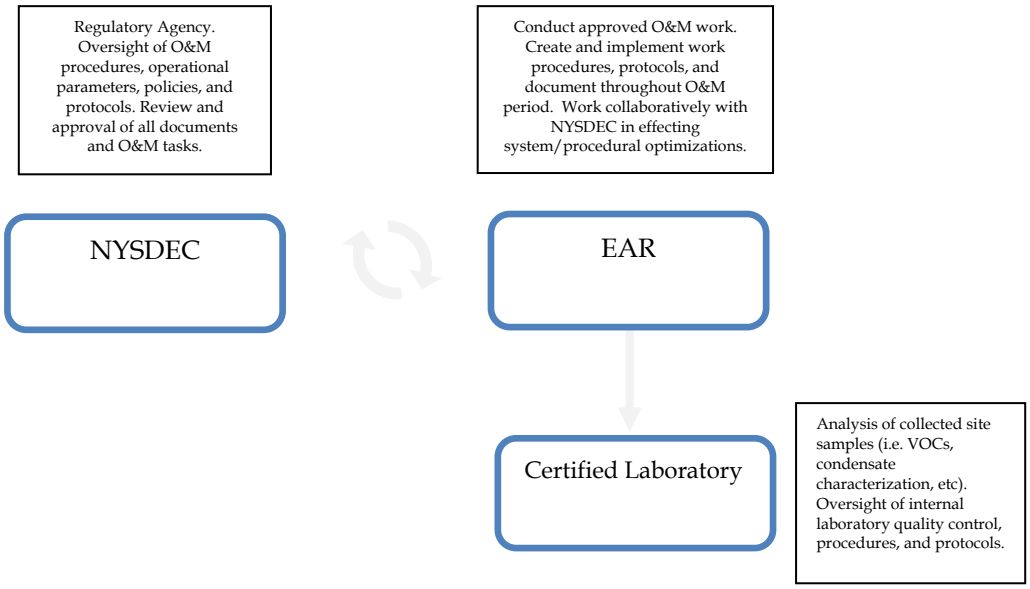
Project Manager:
Ian Hofmann
Cell: 631.241.8741

2.3 SVE SYSTEM MANUFACTURER

NES, Inc.
84 Dunham Street
Attleboro, MA 02703
Ph: 508.226.1100
Fax: 508.226.1180

3.0 O&M ORGANIZATION STRUCTURE

Environmental Assessment & Remediations (EAR) will be handling the operation and maintenance of the SVE System under the direction and guidance of the NYSDEC. The following figure provides the organizational structure and collaboration for this project:



4.0 HEALTH & SAFETY

EAR personnel are required to follow guidance set forth in the Health & Safety Plan, Traffic Safety Plan, Materials Handling Plan, Quality Assurance Project Plan (QAPP), and Contingency Plan submittals. Any additional, task-specific safety guidelines, as put forth in this document, are to be followed as well.

Please note that hearing protection and protective eyewear is to be worn at all times when working inside the system container when system is operating.

The system is equipped with two emergency stop buttons. One emergency stop is located on the rear, exterior of the system container (near fused disconnect box). The other emergency stop is located inside the system container, below the light switch. All project field personnel shall note the locations of both emergency stop buttons prior to beginning any work.

4.1 INJURY OR MEDICAL EMERGENCY

In the event of injury or medical emergency the following procedures will be implemented immediately:

- The local Emergency Medical Response Team (EMRT) and police will be notified of the situation via the 911 system.
- Personnel will render first aid within the limits of their training. One person will remain with the injured party at all times unless required to call the EMRT.
- After the EMRT arrives they will be notified of all pertinent site information, including nature of contaminants known or suspected to be on site and all information relating to the nature of the injury.

The Environmental Assessment & Remediations (EAR) office and the New York State Department of Environmental Conservation (NYSDEC) will be notified immediately in the event of an emergency/accident. Within two working days of any reportable accident, EAR will prepare and submit an Accident/Incident Report (see Health & Safety Plan submittal) to NYSDEC.

4.2 EMERGENCY CONTACTS

GENERAL

- Fire Department: **911**
- Police Department: **911**
- Ambulance: **911**
- Poison Control Center: **(212) 340-4494**
- Chemtrec: **800-424-9300**
- New York City and Long Island One Call System: **1-800-272-4480 (or 811)**

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

24-Hour Contact: ***1-888-EAR-6789 (option-2 for emergency)***

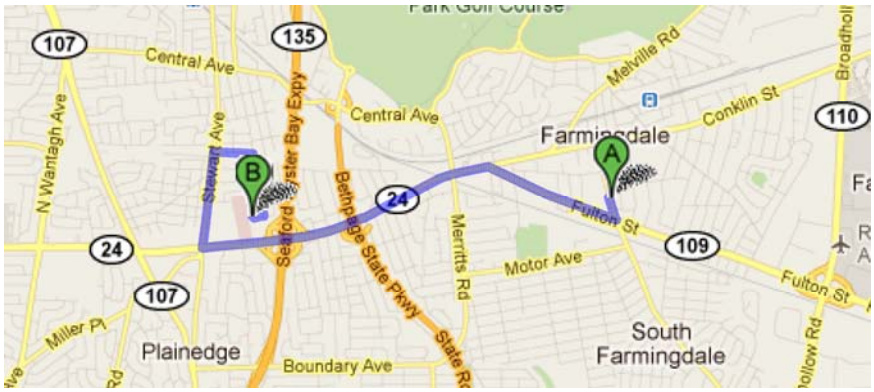
- David Vigliotta (Owner, President) (24 hour on-call for emergencies via above number)
  Work: **(631) 447-6400**
  Home: **(631) 363-0732**
  Cell: **(632) 872-2824**
- John Hofmann (Health & Safety Officer) (24 hour on-call for emergencies via above number)
  Work: **(631) 447-6400 x113**
  Home: **(631) 475-7206**
  Cell: **(516) 924-1382**
- Ian Hofmann (Project Manager)
  Work: **(631) 241.8741**
  Home: **(504) 858-2481 (no land based home line available)**
  Cell: **(504) 858-2481**

NYSDEC

- Brian Jankauskas (Project Manager)
  Work: **(518) 402-9620**

4.3 HOSPITAL INFORMATION

The nearest hospital from the Farmingdale Plaza Cleaners site is the St. Joseph Hospital at 4295 Hempstead Turnpike. The phone number for the hospital is (516) 579-6000. A map and directions to the hospital from the site location are provided below.



A 450 Main St, Farmingdale, NY 11735

1.	Head **south** on **Main St** toward **Richard St**	go 0.1 mi total 0.1 mi
2.	Take the 1st right onto **Fulton St** About 2 mins	go 0.9 mi total 1.0 mi
3.	**Fulton St** turns slightly left and becomes **Hempstead Turnpike** About 2 mins	go 1.3 mi total 2.3 mi
4.	Turn right onto **Stewart Ave** About 1 min	go 0.5 mi total 2.7 mi
5.	Take the 2nd right onto **Arthur Ave**	go 0.2 mi total 2.9 mi
6.	Turn right onto **Broadway** About 1 min	go 0.3 mi total 3.2 mi
7.	Turn right onto **Windhorst Ave** Destination will be on the left	go 295 ft total 3.3 mi

B **St. Joseph Hospital**
4295 Hempstead Turnpike, Bethpage, NY 11714 - (516) 520-5507

5.0 SYSTEM DESCRIPTION

The SVE system at this site is comprised of a "packaged" system, manufactured by National Environmental Systems, Inc. (NES), wherein all equipment, hardware, and controls have been mounted and plumbed inside a cargo container. A layout of the system equipment is provided as Figure 1. The purpose of the SVE system at this site is to prevent exposure to contaminated soil vapors and treat residual soil contamination.

The system is plumbed via subsurface piping to three SVE wells, SVE-1, SVE-3, and SVE-5. A site map showing the locations of the SVE wells and other pertinent site features is provided as Figure 2. A fourth, auxiliary, subsurface header piping run was installed from the SVE system compound enclosure, to just outside of the SVE-5 manhole where it terminates.

The system operates by inducing a vacuum at extraction wells SVE-1, SVE-3, or SVE-5 (or any combination thereof) utilizing a 10 horsepower (hp) regenerative blower. Captured soil vapors are transported, via subsurface piping, to the system compound. Moisture is removed from the airstream at a 60-gallon moisture separator tank prior to reaching the blower. Two 140 lb granular activated carbon vessels are piped in series such that exhaust can be treated prior to discharge to the atmosphere. These vessels are currently bypassed.

A process and instrumentation diagram (P&ID) is included as Figure 3. A summary of the major system components is provided as Appendix A.

The system is equipped with two emergency stop buttons. One emergency stop is located on the rear, exterior wall of the system container (near fused disconnect box). The other emergency stop is located inside the system container, below the light switch. All project field personnel shall note the locations of both emergency stop buttons prior to beginning any work.

5.1 SYSTEM ENCLOSURE

The system is enclosed in a 20′ x 8′ x 8′ steel cargo container. The container is equipped with interior lighting, heating, and ventilation. Product data for the system enclosure components is provided as Appendix B.

5.2 ELECTRICAL

Electrical power to the SVE system consists of a three-phase 208 volt, 100 amp overhead service. Control panel drawings and electrical line diagrams are provided as Figures 4 through 6. Product data for the system electrical components is provided as Appendix C.

5.2.1 COMMUNICATIONS AND CONTROL SYSTEMS

This system features an EOS Procontrol (EOS) programmable logic control system and Sensaphone autodialer. The EOS system allows users to access and view system status as well as select operational data, in addition to alerting designated parties of alarm conditions, and managing alarm response/sequencing. An input/output list for the EOS system is also provided as Appendix D. The EOS ProControl manual is included in Appendix C.

Separate "land-based" phone lines provide access to/from the EOS system and autodialer:

Phone number: **516.249.2740** - EOS system modem access (for remote access/connection)[1]
Phone number: **516.249.2650** - dedicated autodialer line

Service for both lines is provided by Verizon.

Remote users must have a dial-up modem, ProView software (available for download from the EOS website at http://www.eosresearch.com/Site/ProView.html), and the ProView site file (available from NES, Inc., and EAR).

5.3 SVE

Product data for the SVE components, including blower, level switches and vacuum/flow/temperature transmitters, is provided as Appendix E.

5.4 GRANULAR ACTIVATED CARBON SYSTEM[2]

The blower effluent airstream is treated at two 140 lb granular activated carbon (GAC) vessels (TetraSolv VR-140 w/ 4x10 mesh GAC) prior to discharge to the atmosphere. Product data is provided as Appendix F.

5.5 PERFORMANCE OBJECTIVES

The system performance objectives are as follows:

- The system is currently operated with vapor extraction at SVE-3 and SVE-5. SVE-1 is currently offline.
- Maintain an air flow rate of approximately 215-250 cubic feet per minute (CFM) at an approximate vacuum of -30 inches of water column ("WC).
- Maintain a minimum airflow of 100 CFM at SVE-3 and 115 CFM at SVE-5.
- Carbon treatment of the system exhaust is currently bypassed.

[1] This line is currently disconnected.

[2] Based on the results of DAR-1 emissions compliance and air quality impact analyses conducted by EAR in 2013, it was determined that the combined potential emissions from SVE-1, SVE-3, and SVE-5 would not require treatment. As such, the carbon vessels are currently bypassed.

6.0 SYSTEM TESTING & ACTIVATION

Prior to system activation, all process, mechanical, and electrical components and instruments should be individually visually inspected and tested to ensure proper installation, functionality, and proper operation. Equipment and system testing is to be conducted using non-impacted, ambient air. As such, the flex hose connecting the SVE header pipes to the equipment container should be disconnected. Valve positions for equipment and system testing are illustrated in Figure 7.

Except where indicated otherwise, the below testing procedures should be repeated whenever the system has remained off in excess of 5 days, or whenever the system has been moved or re-wired.

6.1 VISUAL INSPECTION

Prior to beginning the visual inspection activities, check that the system is NOT energized. The main power should be in the "off" position and locked & tagged. A qualified electrician will check that all electrical circuit breakers for the process equipment are locked and tagged.

Utilize the process and instrumentation diagram provided as Figure 3 to verify that all components are present, configured properly, and securely piped. In doing so, begin inspection at the SVE piping manifold, continuing along the treatment process. Check all instrumentation, equipment, and process piping connections. Check that all equipment and instrumentation components are properly labeled/identified. Check that all process piping and piping connections are true and free of cracks or other visible damage/defects. An inspection checklist is provided as Appendix G.

Should any damaged or out of place items be found, notify the project manager (PM) immediately. In addition, all defects and/or damages are to be individually logged on a deficiency report form. A sample deficiency report form is provided as Appendix H.

In the event damages and/or defects are observed, they will be reported to NYSDEC, and a proper corrective action(s) will be determined and implemented.

6.2 ELECTRICAL INSPECTION

Prior to beginning visual inspection of electrical components, check that the system is NOT energized. The main power should be in the "off" position and locked & tagged. A qualified electrician shall be onsite to check that all electrical circuit breakers for the process equipment are locked and tagged prior to conducting the inspection activities described in this section. All electrical inspections will be conducted by a qualified electrician.

Visually inspect control panel interior and all other electrical cabinets to ensure proper connections. Check that all cabinets are free of dirt, debris, or water.

Visually inspect all wiring for insulation flaws or defects. This includes visual inspection of all conduit, junction boxes, telephone conduits, and equipment connections.

Should any damaged or out of place items be found, notify the PM immediately. In addition, all defects and/or damages are to be individually logged. A sample deficiency report form is provided as Appendix H.

In the event damages and/or defects are observed, they will be reported to NYSDEC, and a proper corrective action(s) will be determined and implemented.

6.3 EQUIPMENT TEST

This section details the procedures for testing the individual equipment components to ensure proper installation and satisfactory performance.

Before energizing the system, ensure all components are set to "off" at the control panel. These components are:

- Control Power
- SVE Blower
- Moisture Separator Transfer Pump

After a qualified electrician energizes the system, turn the Control Power switch to "on" at the control panel.

6.3.1 SVE BLOWER

Operate the SVE blower (B-101) in "hand" for approx. 5-10 minutes. While operating check and record the vacuum, pressure, and airflow rates at instruments VI-102, VI-104, VI-106, PI-101, FI-101, and FI-102. Check that the direction of rotation is as indicated on the blower motor fan cowling, and that a positive pressure is indicated on effluent pressure gauges.

In the event any equipment is found not operational, notify the PM immediately. Defects are to be logged accordingly on a deficiency report form (Appendix H). Should an incorrect rotational direction be observed at the SVE blower, the power supply leads will need to be re-wired accordingly by a qualified electrician.

6.3.2 MOISTURE SEPARATOR PUMP

Operate the moisture separator transfer pump (TP-101) in "hand" to ensure operation. As the moisture separator tank will be dry, do not operate the pump in excess of 1 minute. Check that the motor starts and pump turns. Check rotational direction (should be clockwise when viewed from motor end).

In the event any equipment is found not operational, notify the PM immediately. Defects are to be logged accordingly on a deficiency report form (Appendix H). Should an incorrect rotational direction be observed at the transfer pump, the power supply leads will need to be re-wired accordingly by a qualified electrician.

6.4 SYSTEM TESTING

Prior to connection to the SVE well(s) and system activation, the system shall be operated in order to demonstrate that all equipment, sensors, controls, and programming are properly installed and coordinated to perform satisfactorily as a complete system. Testing will be conducted using non-impacted, ambient air.

During system testing, valving should be configured as illustrated in Figure 7.

6.5 CONTROL TESTING

In order to ensure proper installation and operation of the EOS system controls and programming, alarm conditions are to be manually triggered/activated with the system operating. Following each alarm condition simulation and confirmation of the proper response, the system is to be reset and

restarted prior to the next alarm condition simulation. System alarms should also be tested regularly during normal operation, at a quarterly frequency, to ensure proper operation. The alarm conditions and their respective responses are provided in the following table:

Instrument/Sensor	Alarm Condition	System Response	Panel Indicator Light?	Autodialer Call?	Autodialer Fax Report?
LSHH-101	Moisture separator high-level	Shutdown	Yes	Yes (alarm condition 1)	Yes
VT-101	Low vacuum level	Shutdown	Yes	Yes (alarm condition 4)	Yes
TIT-101	High discharge temp	Shutdown	Yes	Yes (alarm condition 2)	Yes
N/A	VFD fault	Shutdown	Yes	Yes (alarm condition 3)	Yes
N/A	Emergency stop active	Shutdown	Yes	Yes (alarm condition 4)	Yes

The system operator is to coordinate each alarm condition simulation with the PM so that autodialer function can be testing. Operator is to wait until PM confirms autodialer response (call & fax) for each alarm condition prior to proceeding further.

Should any of the above listed alarm conditions fail to result in the proper response (as listed above), or if any shutdown notifications are not transmitted by the autodialer, EAR will troubleshoot the errors as necessary. Defects are to be logged accordingly on a deficiency report form (Appendix H). Any necessary corrective actions are to be implemented, and the alarm retested and deemed satisfactory prior to continuing further.

6.6 ACTIVATING THE SYSTEM

Prior activating the system, the operator shall check that all valves are positioned as shown in Figure 8 for normal system operation, and that SVE header pipes are reconnected to the manifold.

1. Ensure the above listed inspection & testing procedures have been implemented and that any defects have been corrected.
2. Check that the control panel has power.
3. Turn the SVE Blower control (at control Panel) to the "AUTO" position.
4. Check and record the system influent vacuum and air flow. Slowly adjust the blower operation to the desired vacuum/airflow by increasing or decreasing the operating frequency (Hz) at the VFD.

7.0 SYSTEM MONITORING

During each site visit, monitoring data (collected both before and after any system adjustments) should be recorded on a site data information sheet (SDI). A site specific SDI sheet is provided as Appendix I.

Where gauges or other indicating instruments are not present/applicable, system data should be measured using the following instruments (or equivalents):

Parameter	Instrument	Model
Air flow	Air Velocity Meter	VelociCalc® 8345 or equivalent
Vacuum	Digital Manometer	Digimano® 2000 or equivalent
Volatile Organic Compounds (VOC)	Photo-Ionization Detector	PhotoVac® 2220 Pro / Pro Plus or Minirae® 2000 or equivalent
Temperature	Air Velocity Meter	VelociCalc® 8345 or equivalent

Site checks are currently conducted on a bi-weekly basis (once every other week). Additional visits may be warranted based on changing system operational/maintenance demands and as requested by NYSDEC.

7.1 AIR SAMPLES FOR LABORATORY ANALYSIS

In order to identify and quantify contaminant concentrations and recovery rates, air samples are be collected periodically from the system influent air stream(s) and submitted for laboratory analysis. Air samples collected for laboratory analysis shall be collected in 6-liter, passivated Summa® canisters, and submitted to a certified lab for analysis via EPA method TO-15. Samples will be analyzed for parameters as listed in the QAPP.

Typical sample locations and frequencies (unless noted otherwise by NYSDEC) are as follows:

Sample Location	Initial Collection Frequency	Collection Frequency as of 10/2014
SVE-1 Influent	Monthly	-
SVE-3 Influent	Monthly	-
SVE-5 Influent	Monthly	-
System Influent (or Pre-Carbon as applicable)	Monthly	-
System Effluent (or Post-Carbon as applicable)	Monthly	Quarterly

Sampling frequencies should be re-evaluated following significant system adjustments.

8.0 EMISSIONS COMPLIANCE

Although an air permit is not required for this site, air emissions from the SVE system are subject to regulations as set forth by DAR-1[3]. Should emissions exceed the Annual Guidance Concentration (AGC) or Short-term Guidance Concentration (SGC) for any given contaminant, actions will be taken immediately to reduce emissions contaminant concentrations to below their respective AGC/SGC. These actions may include, but are not limited to: carbon vessel changeout, adjustment of system operating parameters, implementation of additional remedial controls, system shutdown, or a combination of these actions.

Based upon a nominal system airflow rate of 300 CFM, an actual exhaust stack height of 18-feet, and an actual exhaust stack inner diameter of 3.826-inches, the **maximum** allowable emission rates per contaminant are as follows:

Contaminant	AGC (ug/M^3)	SGC (ug/M^3)	Maximum Allowable Emission Rate (lbs/hr)
Tetrachloroethylene	1.0	1,000	0.01269
Trichloroethylene	0.45	54,000	0.00444
1,2-Dichloroethylene	1,900	n/a	24.13593

The above listed maximum allowable emission rates will be considered action levels. NYSDEC and AECOM will be notified immediately should lab analytical results suggest that the above values are being exceeded. The required corrective action(s) will be implemented following discussion and approval from AECOM and/or NYSDEC.

Any additional contaminants reported in the discharge airstream are to be evaluated as they are encountered.

8.1 AIR SAMPLING

In order to ensure compliance with the above listed emissions rates, air samples should be collected from the system effluent at a frequency of once per quarter (as noted in Section 7.1).

Air samples shall be collected in 6-liter, passivated Summa® canisters, and submitted to a certified lab for analysis via EPA method TO-15. Samples will be analyzed for parameters as listed in the QAPP.

8.2 PID MONITORING

A comparison of laboratory reported contaminant concentrations against total VOC concentrations as reported in the field using a PID revealed a poor correlation between the two. However, should field screening of the effluent (post-carbon) airstream yield a PID reading of 10ppm or greater, NYSDEC should be notified immediately such that a determination to shut down the system pending further evaluation can be made.

[3] NYSDEC Division of Air Resources, DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants

9.0 INSPECTION & MAINTENANCE

Regular inspection and maintenance items, with their respective, suggested frequencies, are provided in the inspection, maintenance, and lubrication schedule (IMLS), provided here as Appendix J. Maintenance activities should be conducted following guidance provided in the manufacturer's product data sheets (Appendices B through F), implementing any additional safety precautions set forth therein.

IMLS sheets shall be completed in the field by the system operators, and denote the date, if the inspection/maintenance item was conducted, and date when the inspection/maintenance item was last conducted.

Site visits are currently conducted on a bi-weekly basis (once every other week). Additional visits may be warranted based on changing system operational/maintenance demands and as requested by NYSDEC.

9.1 SYSTEM ALARMS

9.1.1 ALARM RESPONSE

In the event an alarm notification has been received, EAR will dispatch a technician to the site in order to investigate the cause and restart the system within 24 hours of receiving the notification.

NYSDEC is to be notified of any instance where the system will not be operating for a period of 72 hours or greater. The notification shall be transmitted via email and include the date/time of shutdown, reason for shutdown, corrective action(s), and anticipated duration of shutdown.

9.1.2 ALARM TESTING

During system operation, the alarms should be tested quarterly to ensure functionality. Alarm testing should be conducted following the guidance provided in Section 6.5.

9.2 CONDENSATE MANAGEMENT

9.2.1 DRAINING THE MOISTURE SEPARATOR

Depending on site conditions, the moisture separator tank will require periodic draining to prevent a system shutdown caused by high liquid levels in the separator. Draining the separator tank should be conducted whenever the liquid level in the sight tube is greater than 50% of the length of the sight tube.

The moisture separator is equipped with a 1.5-inch diameter drainage line connected to a 0.5 hp transfer pump. In order to drain the moisture separator, follow these steps:

1. Ensure transfer pump outlet hose is positioned to empty to a 55-gallon drum.
2. Open valve at transfer pump outlet.
3. At the control panel, turn the M/S Effluent switch to the "hand" position. This will operate the pump. Hold the switch in "hand" until liquid levels in the separator are below the sight tube. DO NOT run the transfer pump dry. Return the switch to the "off" position.
4. Close valve at the transfer pump outlet.

5. Seal and label the 55-gallon condensate storage drum. If the drum is not full, the drum can be used again for moisture separator drainage as necessary. Notify the project manager when any storage drums are nearing capacity so that disposal can be arranged accordingly.

9.2.2 CLEARING HEADER PIPING OF MOISTURE

Depending on site conditions, moisture may accumulate in the header piping and/or system manifold, resulting in decreased system performance. This system has been configured such that the SVE blower, drawing ambient air, can induce positive pressure at the header piping and SVE wells, thus clearing the lines of moisture by "blowing" moisture back to the SVE wells where it can drain back into the unsaturated zone.

This procedure is to be conducted as necessary, following these steps:

1. Shut down blower by turning the SVE Blower switch at the control panel to the "off" position.
2. Reconfigure valves as indicated in Figure 9. ***It is imperative that the valves are positioned correctly in order to avoid damaging the instrumentation.***
3. Double check that valves are correctly positioned and that the dilution valve is open 100%.
4. If only one SVE header line is affected, close the valve at the manifold to the unaffected line(s).
5. Operate the blower in "hand" for no more than 10 minutes, then return the blower switch to the "off" position
6. Return valves to normal operating positions (see Figure 8).
7. Keep system off for approximately 30 minutes to allow moisture to drain back to the vadose zone.
8. Restart system following guidelines provided in Section 6.6.

9.2.3 CONDENSATE DISPOSAL

Condensate is to be disposed of offsite. Transportation and disposal of condensate is to be conducted by **Island Pump & Tank (40 Doyle Court, East Northport, NY 11731. Phone: 631.462.2226).** Island Pump & Tank has already been provided with analytical results from a condensate sample collected at this site. The laboratory analytical report is also provided here as Appendix K.

9.3 CARBON CHANGEOUTS[4]

As necessary, spent carbon media will need to be replaced. The frequency of carbon changeouts will be dependent on contaminant loading/humidity/air temperature. Changeouts will be conducted as deemed necessary when monitoring indicates that system effluent air is not meeting emissions requirements.

Carbon changeouts are to be conducted by a subcontractor, **General Carbon Corp. (33 Paterson Street, Paterson, NJ, 07501. Phone: 973.523.2223)**. General Carbon Corp will be responsible for the removal of spent carbon (via vacuum), transport & reactivation or disposal of spent carbon, and the installation of replacement carbon.

[4] Based on the results of DAR-1 emissions compliance and air quality impact analyses conducted by EAR in 2013, it was determined that the combined potential emissions from SVE-1, SVE-3, and SVE-5 would not require treatment. As such, the carbon vessels are currently bypassed.

Replacement carbon shall be a virgin, 4x10 mesh activated media specifically for removal of volatile organic compounds. During changeouts, the carbon vessel interiors are to be visually inspected by EAR personnel for any rusting or other fouling prior to installation of the replacement carbon. Dust masks are to be worn by all personnel conducting carbon changeouts.

Prior to the *first* carbon changeout, a sample of the spent media must be collected for profiling as follows:

ANALYSES	SAMPLE CONTAINER
TCLP Volatiles	1x 2oz glass jar w/ septa (unpreserved)
TCLP Metals & Flashpoint	1x 8oz glass jar (unpreserved)

Carbon samples are to be submitted to a certified laboratory for the above listed analyses.

9.4 EXTENDED SYSTEM SHUTDOWNS

This system should not be stored for longer than 1 month without operating, as blowers and pumps may rust and seize if not run once per month.

Should the system be idle for longer than 1 month with no means of intermittent operation, follow the manufacturers' guidelines for extended storage (Appendices B through F).

10.0 DOCUMENTATION & REPORTING

10.1 DOCUMENTATION

A "project folder" (three-ring binder) is to be kept onsite, within the system container, at all times. The project folder shall include:

- Testing logs
- Inspection, maintenance, and lubrication logs
- Copies of any permits
- Documentation of carbon change-outs and pickup/disposal of any condensate
- Boring logs

A separate log book will be kept onsite which will contain all system data as observed during each site visit, as well as details of any system adjustments made. The log book will be updated during each site visit, prior to departure from the site.

10.2 MONTHLY REPORTS

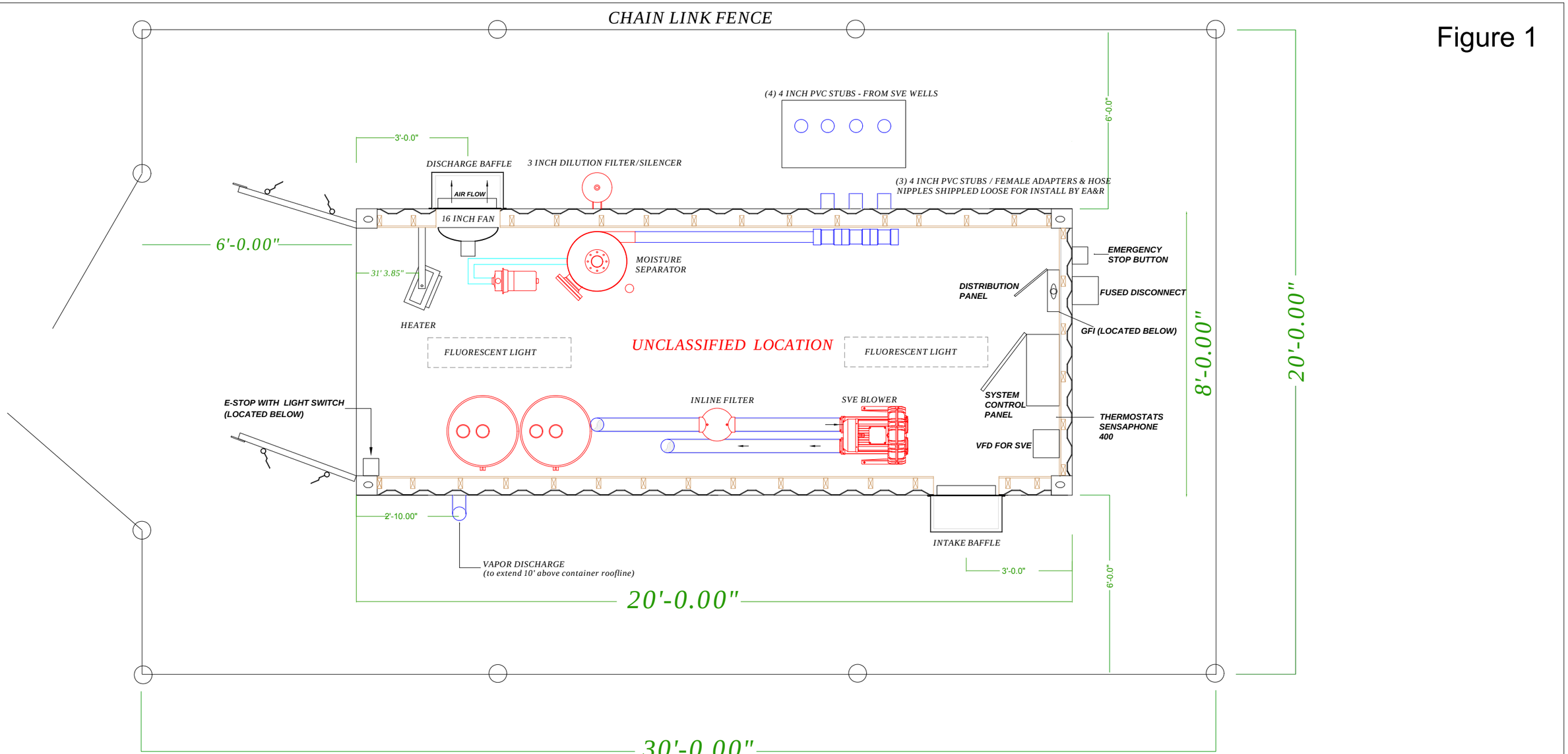
Monthly reports will be submitted to NYSDEC in both a *.pdf and tabular format (*.xls) within three weeks of the end of the reporting month. The monthly reports will provide the observed system data, detail any system adjustments and maintenance activities, and provide estimated vapor recovery and emissions rates.

11.0 WARRANTY

The packaged SVE system carries a manufacturer's (NES, Inc.) warranty of up to 12 months from the date of manufacture and invoice (9/22/11). A copy of the manufacturer's warranty is provided as Appendix L.

FIGURES

Figure 1



REVISION:	DESCRIPTION:	DATE:	APPROVED:

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

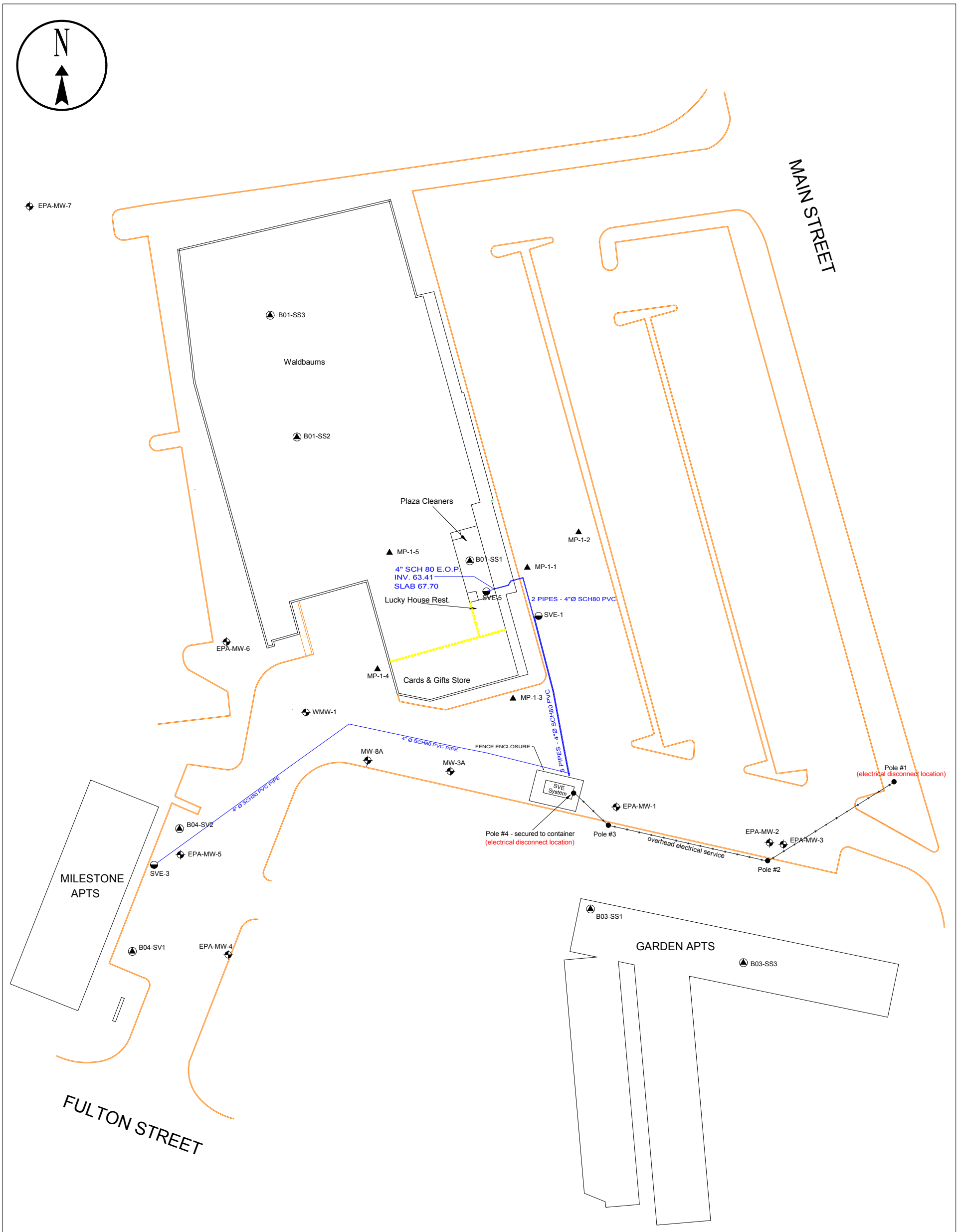
JOB SITE IDENTIFICATION:

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
Site No. 130107

DRAWING IDENTIFICATION:

SVE SYSTEM LAYOUT

DESIGNED BY:		DATE:	
DRAWN BY:		DRAWING NO:	
CHECKED BY:			
APPROVED BY:		REVISION: 3/25/15	



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 2

Site Map

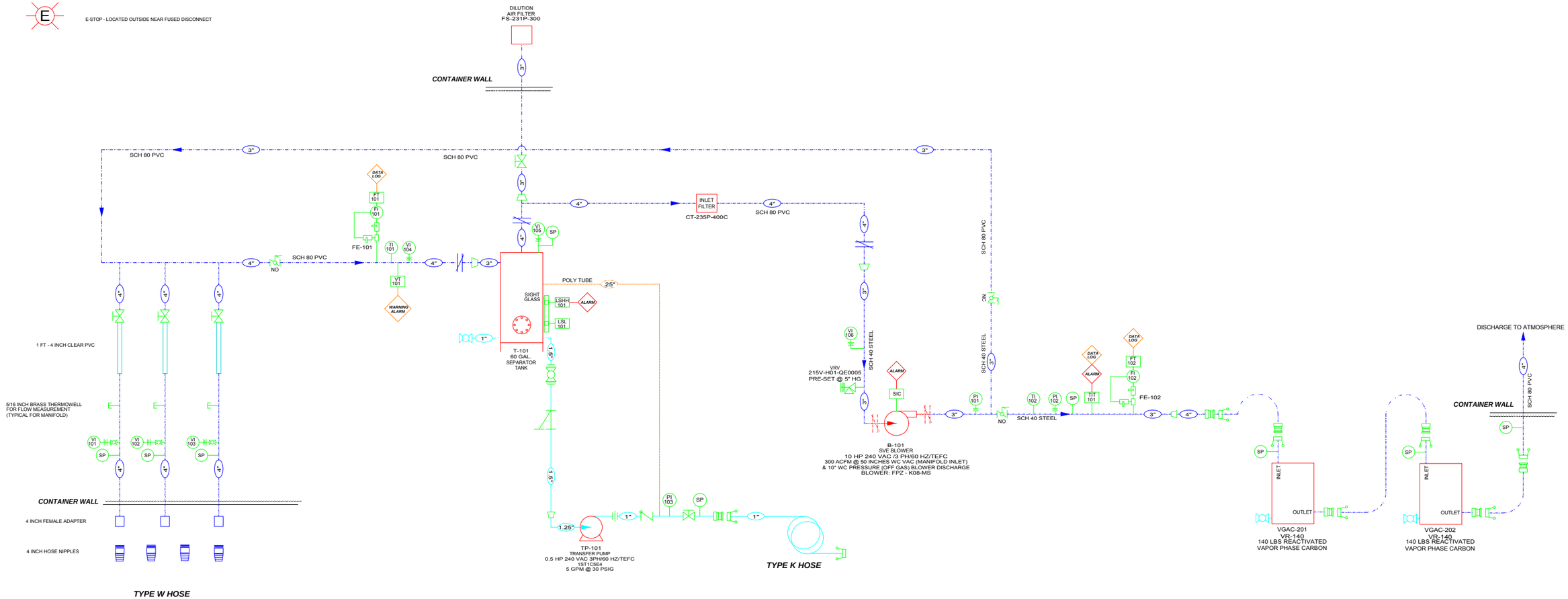
Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
Site No. 130107

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	*(LSHH-101)*	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	*(TIT-101)*	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	*(VT-101)*	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN

E E-STOP - LOCATED INSIDE NEAR LIGHT SWITCH

E E-STOP - LOCATED OUTSIDE NEAR FUSED DISCONNECT



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 3

SVE Process & Instrumentation Diagram

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

INSTRUMENTATION ABBREVIATIONS

CC	CYCLE COUNTER
CF	COALESCING FILTER
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIT	FLOW INDICATING TRANSMITTER
FM	FLOW METER
PF	PARTICULATE FILTER
PI	PRESSURE INDICATOR
PS	PRESSURE SWITCH
SP	SAMPLE PORT
SV	SOLENOID VALVE
TI	TEMPERATURE INDICATOR
VI	VACUUM INDICATOR
DPG	DIFFERENTIAL PRESSURE GAUGE
FS	FLOW SWITCH OR SENSOR
VSH	VACUUM SWITCH HIGH
VSL	VACUUM SWITCH LOW
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
LSHH	LEVEL SWITCH HIGH HIGH
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW LOW
PS	PRESSURE SWITCH
TIT	TEMPERATURE INDICATING TRANSMITTER
TE	TEMPERATURE ELEMENT
HOL	HIGH OIL LEVEL
LOL	LOW OIL LEVEL

INSTRUMENTATION LABELING

INSTRUMENT TYPE / INSTURMENT DESIGNATION — PI 101 — REMOTE DISPLAY

INSTRUMENT TYPE / INSTURMENT DESIGNATION — PI 101 — LOCAL DISPLAY

INSTRUMENT TYPE — LSH 101 — SWITCH

PIPE DESIGNATION

- AIR LINE
- WATER LINE
- CONTROL LINE
- INTRINSICALLY SAFE LINE
- ANALOG LINE
- BREAK
- FLOW DIRECTION
- X" — PIPE SIZE

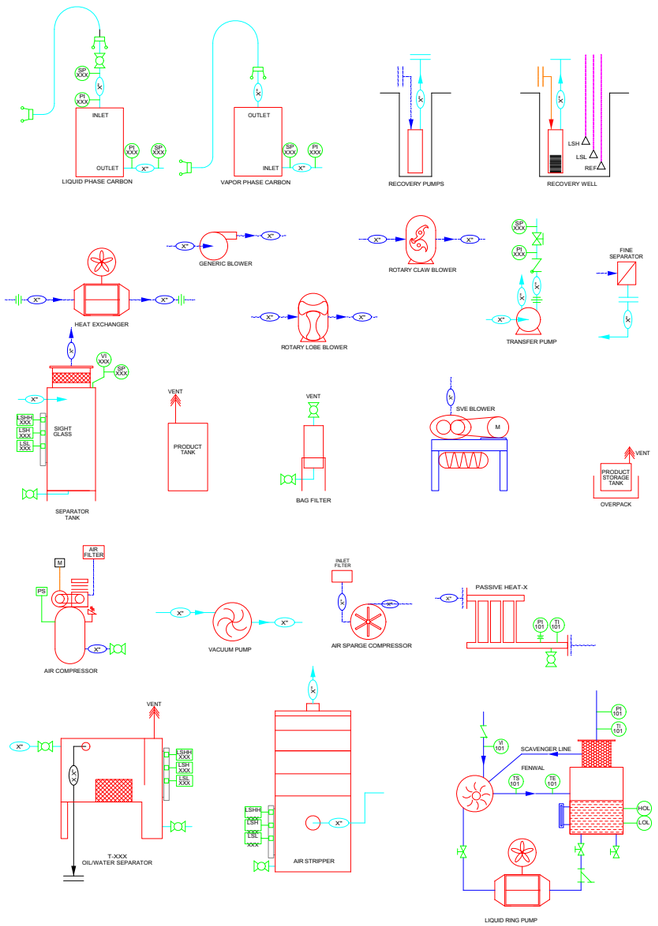
SYMBOLS

- ROTAMETER
- FM XXX — FLOW METER
- ETM — ELAPSED TIME METER
- AD — AUTO DIALER
- T — TIMER
- M — MOTOR
- A — AMP METER
- RTS — REMOTE TELEMETRY SYSTEM
- SIC — VARIABLE FREQUENCY DRIVE
- STATIC MIXER
- DISCHARGE SILENCER
- DILUTION AIR FILTER
- INLET/INLINE FILTER
- CF — COALESCING FILTER
- PF — PARTICULATE FILTER

SYMBOLS CONTINUED

- FR — FILTER REGULATOR
- MP — METERING PUMP
- GLOBE VALVE
- GATE VALVE
- BALL VALVE/DRAIN VALVE
- CHECK VALVE
- RAIN CAP
- BUTTERFLY VALVE
- WYE STRAINER
- RELIEF VALVE
- M&F CAMLOCK
- S — SOLENOID VALVE
- PRESSURE REGULATOR
- SIPHON BREAK
- UNION
- CLEAR PVC
- MECHANICAL FLOAT
- PULSE-DAMPING SNUBBER
- PITOT TUBE
- SIGHT GLASS
- X AL — ALARM LIGHT
- R — RUN LIGHT
- E — E-STOP
- NEEDLE VALVE

SYMBOLS CONTINUED



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 3a

SVE Process & Instrumentation Diagram

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

FIGURE 4

PANEL EXTERIOR

ENCLOSURE EXTERNAL DIMENSIONS: 30"L X 24"W X 12 D"

PROCONTROL
ACCESS/VIEW PORT

CONTROL POWER APPLIED (TIME) — HM2

SVE BLOWER RUN TIME — HM1

SVE BLOWER TIMER — T1
884.1K
(1CH)

RESET — PB

MOISTURE SEPARATOR HIGH LEVEL — R

LOW VACUUM LEVEL — Y

HIGH DISCHARGE TEMPERATURE — R

VFD FAULT — R

EMERGENCY STOP ACTIVE — R

CONTROL POWER OFF ON

SVE BLOWER HAND OFF AUTO

M/S EFFLUENT PUMP HAND OFF AUTO

DATA CONNECTOR

ESTOP1 (INTERNAL)
EMERGENCY STOP
PUSH TO STOP
TWIST TO START

ESTOP2 (EXTERNAL)
EMERGENCY STOP
PUSH TO STOP
TWIST TO START

VFD

WALL MOUNTED

ESV752N02TXB
SN:

NOTE: (2) SEPARATE PHONE LINES ARE TO BE PROVIDED (1 FOR EOS, 1 FOR DIALER).

AUTODIALER
(SENSAPHONE 400)

WALL MOUNTED

FGD-400
SN:

PANEL INTERIOR

2" WIREWAY

PROCONTROL
TYPE B1
(BY EOS RESEARCH)

TF
FOR EOS

SN: 9594

2" WIREWAY

GFI RECEPT.
FOR PROCONTROL
PROTECTION ONLY.

2" WIREWAY

6A
CB

PS
PS5RA24

ESTOP — CR1 RH3B
VFD STRT — CR2 RH1B
VFD RUN — CR3 RH2B
120VAC | 24VDC

14 TERMINAL BLOCKS
SPLICE POINTS

N2(2), EOS(2), 1,4, CM1, 33-39

2" WIREWAY

M1

D09

LRD07
1.6-2.5A

42TERMINAL BLOCKS

L1, N, G(3), 2, 3, 5-11, C(5), 24V(5), 12-30

2" WIREWAY

GROUNDBAR

REV	DATE	DESCRIPTION	BY
1	7/25/11	ADDED HM2, LOW VAC. LIGHT DELETED CELL I/F UNIT.	RJD

DRAWN BY RJD DATE 7/12/11
CHK BY DATE
APPR BY DATE

NES NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

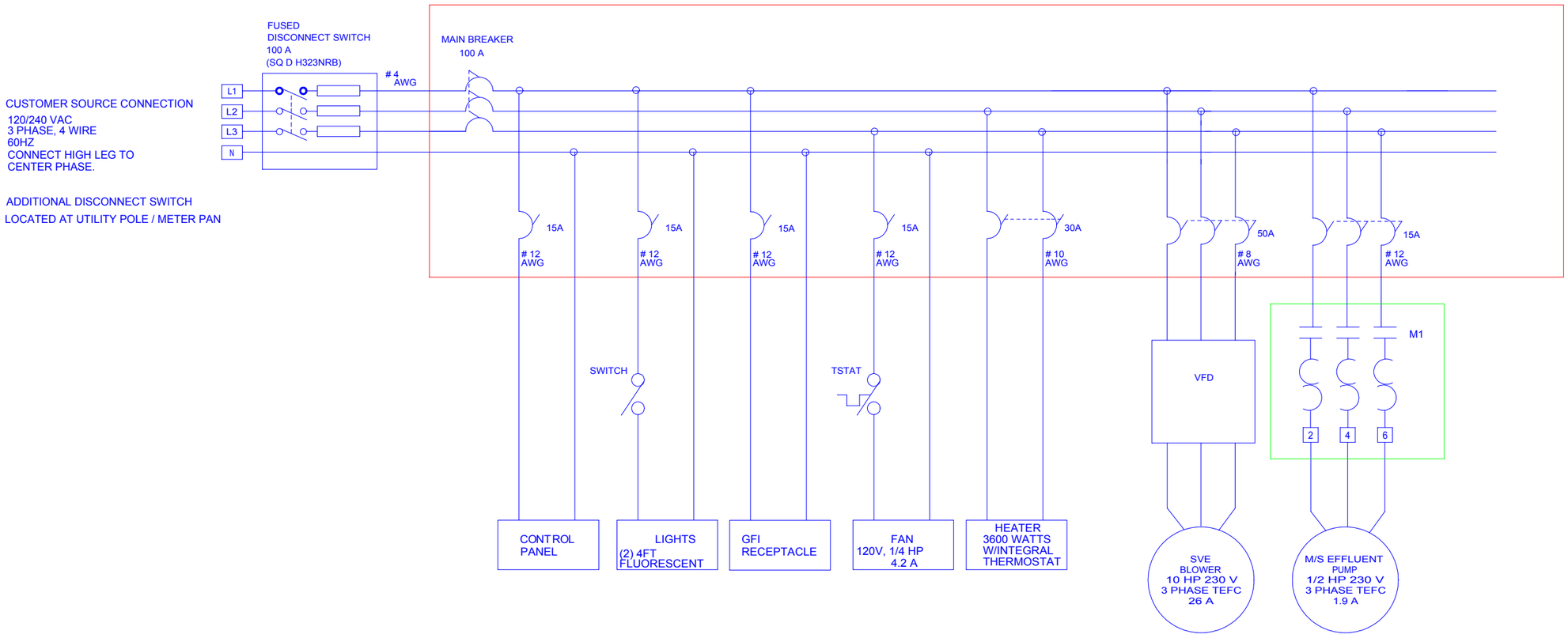
TITLE
CONTROL PANEL EXTERIOR/INTERIOR LAYOUT

Environmental Assessment & Remediations
NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners

JOB NO. 11-177

SCALE	SIZE	DWG NO.	SHEET	REV
N/A	B	E1 PNL_IX	E-1	1

FIGURE 5



NOTES: 1. CONTROL PANEL UL 508 LISTED

LEGEND	
ABBREV.	DESCRIPTION
M	MOTOR STARTER
MDS	MAIN DISCONNECT SWITCH
CB	CIRCUIT BREAKER
TSTAT	THERMOSTAT
OL	OVER LOAD
AWG	AMERICAN WIRE GAGE
———	DISTRIBUTION PANEL LIMIT
———	CONTROL PANEL LIMIT

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508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

REV	DESCRIPTION	DATE	INIT
A	AS BUILT	9/8/11	EMB

DRWN BY RJD — DATE 07/12/11
CHK BY — DATE
APPR BY — DATE

TITLE: LINE DIAGRAM

Environmental Assessment & Remediations
NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners

JOB NO. 11-177

SCALE N/A | SIZE B | DWG NO. E2 LINE | SHEET E-2 | REV A

THREE PHASE DISTRIBUTION PANEL

120/208 VAC, 100 AMP, 4-WIRE

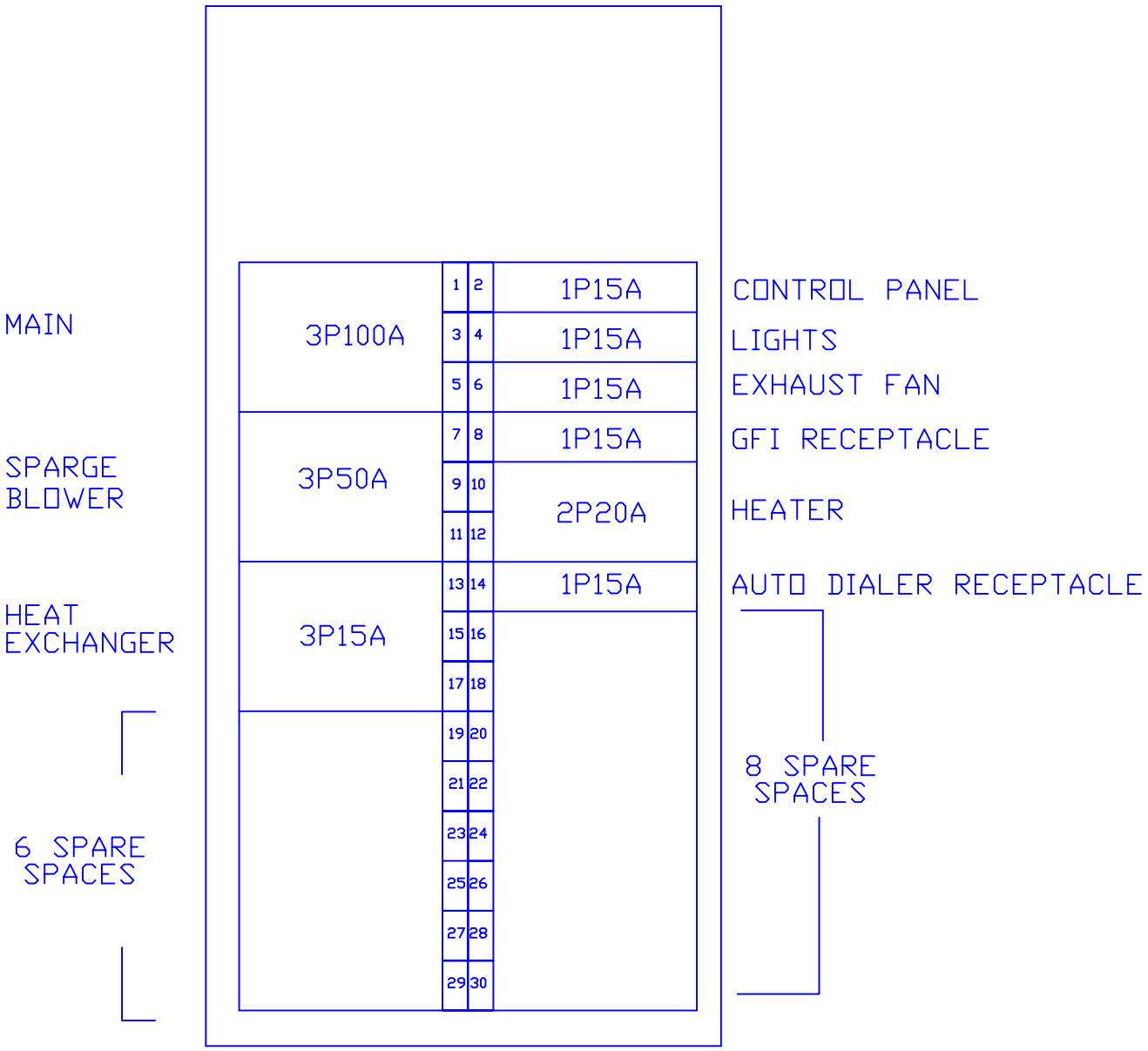


FIGURE 6

NOTES:

1.) BREAKERS INDICATED BY POLE AND AMPERAGE.
(I.E. 3P20A INDICATES A 3 POLE 20 AMP BREAKER)

2.) ONLY PANEL INTERIOR SHOWN. EXTERIOR IS BLANK.

JOB SPECIFIC INFORMATION:

EXTERNAL DIMENSIONS: 30"L X 15"W X 5"D

MANUFACTURER: SQUARE D PHASE: 3

PART NUMBER: QO327M100RB MAX AMPS: 100

OF BUS SECTION

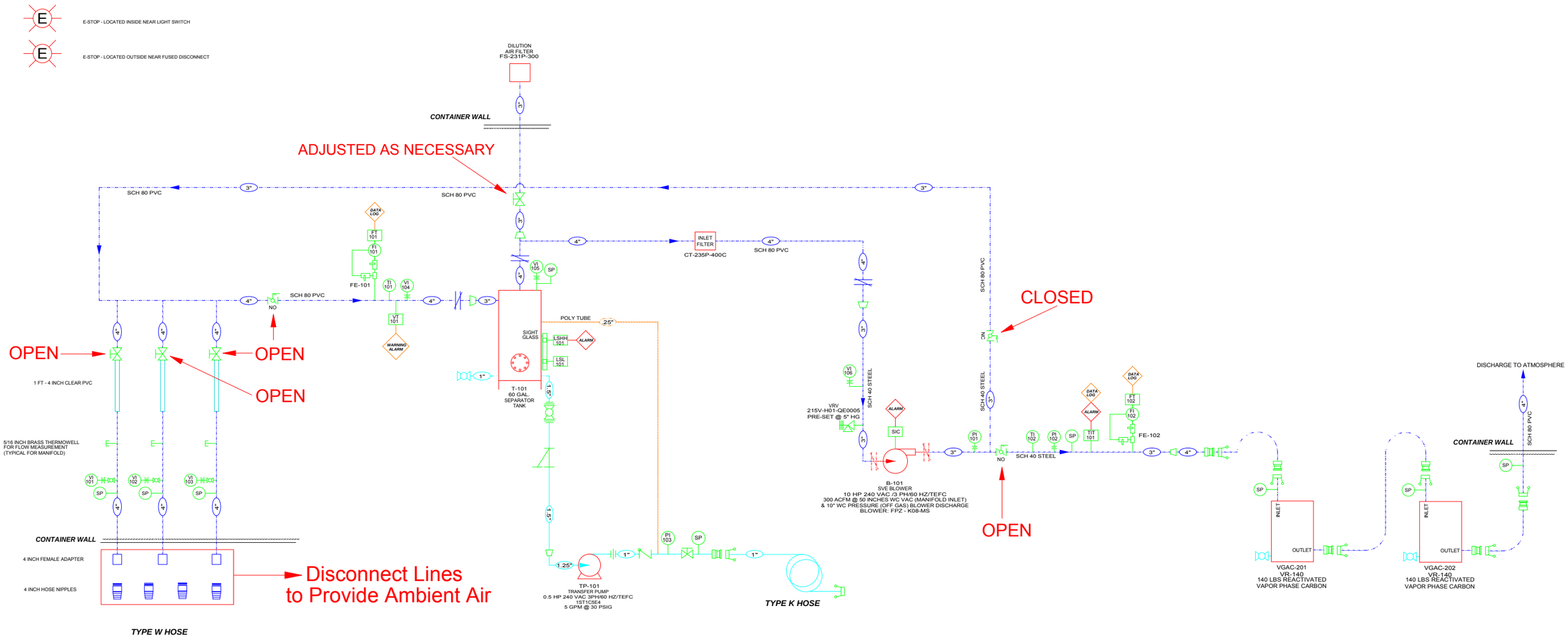
REV	DESCRIPTION	DATE	APPR
A	AS BUILT	7/8/11	EMB

NES™ NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

DRWN BY RJD	DATE 5/16/11	TITLE: DISTRIBITION PANEL LAYOUT	
CHK BY	DATE	CAMERON BAYONNE URBAN RENEWAL BAYONNE, NJ	JOB NO. 11-136
APPR BY	DATE	SCALE N/A / SIZE A / DWG NO. E5 DIST-A	SHEET E-5 / REV A

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	***(LSHH-101)***	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	***(TIT-101)***	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	***(VT-101)***	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

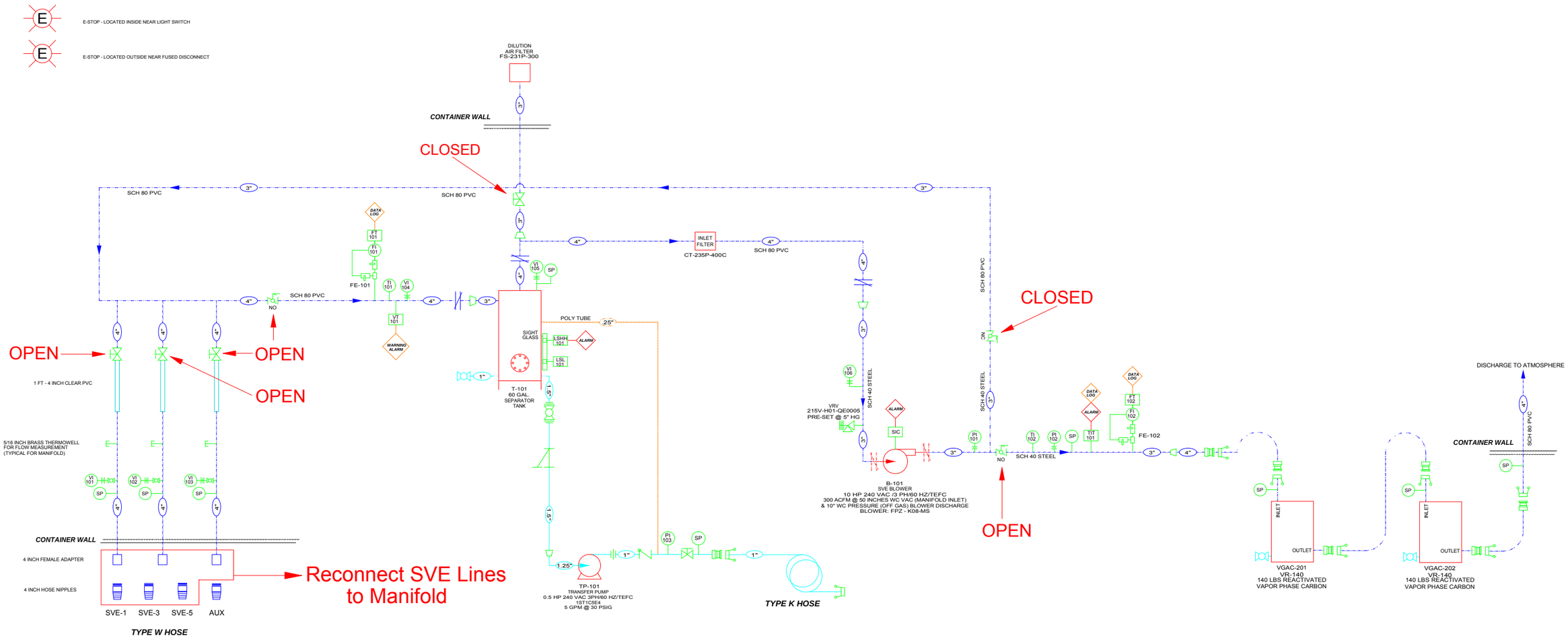
Figure 7

Valve Positions for Equip/System Testing

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	***(LSHH-101)***	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	***(TIT-101)***	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	***(VT-101)***	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 8

Valve Positions for Normal Operation

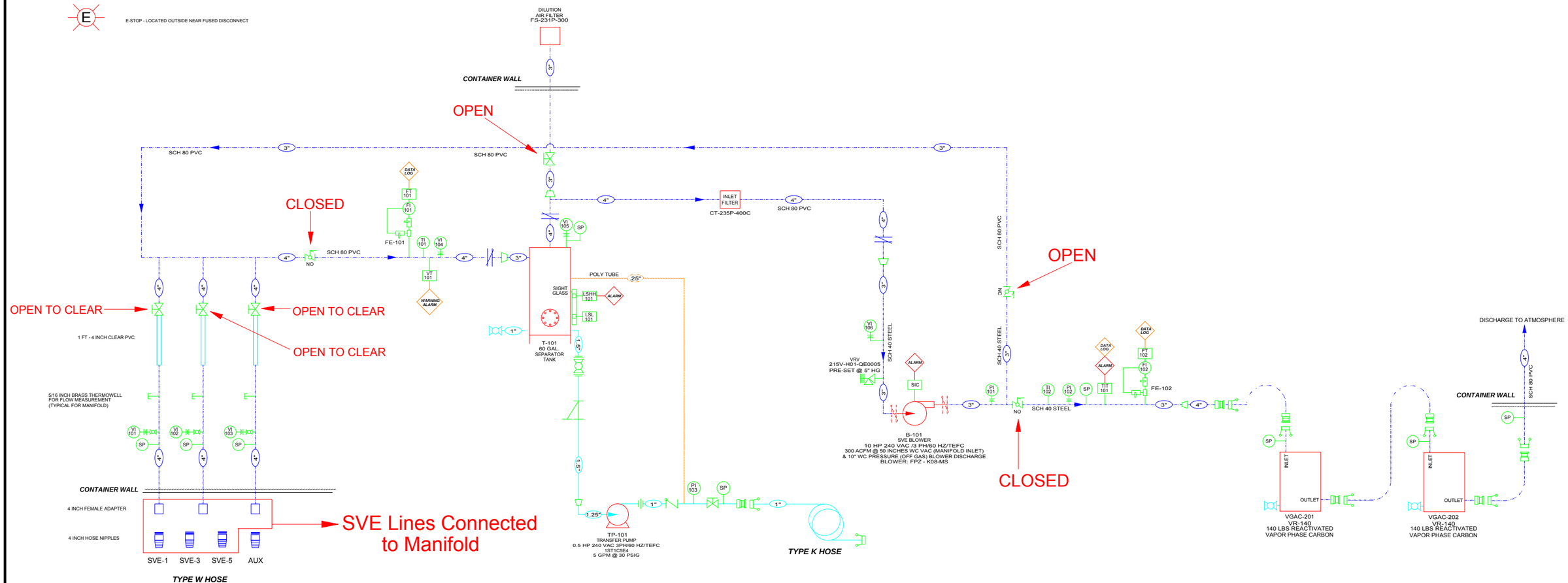
Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	(LSHH-101)	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	(TIT-101)	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	(VT-101)	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN

E E-STOP - LOCATED INSIDE NEAR LIGHT SWITCH

E E-STOP - LOCATED OUTSIDE NEAR FUSED DISCONNECT



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 9

Valve Positions for Reverse Airflow - Header Pipe Clearing

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

APPENDIX A: SUMMARY OF MAJOR COMPONENTS

National Environmental Systems
84 Dunham Street
Attleboro, MA 02703

MAJOR COMPONENT SUMMARY

Project No.: 11-177 (September 2011)

Project: EA&R - SVE Integrated Cargo Box System - NYSDEC Site No.: 1-30-107 Farmingdale, NY Cleaners

Component	Qty.	Manufacturer	Model	Serial Number(s) if Applicable
Control Panel	1	NES		UL:
Panel Enclosure	1	Hoffman	C-SD302412	
Programmable Logic Controller (PLC)	1	EOS	B1 Series 2+	
Telemetry System	1	Sensaphone	FGD-400	
SVE Blower Motor Hour Meter	2	ENM	T-50	
SVE Blower Timer	1	Diehl	TA4353	
Power Distribution Panel	1	Square D	QO327M100RB	
Fused Disconnect	1	Square D	H323NRB	
Variable Frequency Drive (VFD)	1	AC Tech	ESV752N02TXB	
SVE Components				
Moisture Separator, Tank Style	1	NES	60gal	
MS Level Switch	1	NES	P500	
MS Centrifugal Transfer Pump, 0.5hp	1	Goulds	1ST1C5E4	
SVE Blower, 10hp - Specifications	1	FPZ	Model K08-MS-10	
Inline Filter	1	Solberg	CT-235P-400C	
Dilution Filter/Silencer	1	Solberg	FS-231P-300	
Vacuum Relief Valve	1	Tyco-Kunkle	215V-H01-QE0005	
Influent 4in Pitot Tube	1	Dwyer	DS-300-4	
Discharge 3in Pitot Tube	1	Dwyer	DS-300-3	
Pitot Tube Magnehelic Gauges	2	Dwyer	2010	
Flow Transmitters	2	Dwyer	616-3C	
Influent Vacuum Transmitter	2	Dwyer	626-00-GH-P1-E2-S1	
Discharge Temperature Transmitter	1	Pyromation	R1T185L483-004-SL-6HN31T-440	
Vapor Phase Carbon Vessels	2	Tetrasolv	VR 140	
Carbon Media		Tetrasolv	4x10 Re-activated	
Enclosure Components				
Enclosure Exhaust Fan, 16in	1	Dayton	4C163	
Fan Thermostat - Honeywell Model T6031A	1	White Rodgers	2E834/T6031A	
Interior Lights	1	New England Lighting	VT240EBO-UV	
Enclosure Heater	1	Dayton	3UF62	

APPENDIX B: SYSTEM ENCLOSURE COMPONENTS - PRODUCT DATA

Exhaust Fan, 16 In.

Exhaust Fan, Heavy Duty Direct Drive, Propeller Dia 16 In, CFM @ 0.000-In SP 2657, @ 0.125-In SP 2430, @ 0.250-In SP 1960, Sones @ 0.000-In SP @ 5 Ft 17.4, 115 Volts, 60 Hz, 1 Phase, Operating Amps 4.4, Motor RPM 1725, 1/4 HP, Motor Type Split Phase, Height 20 In, Width 20 In, Max Depth 10 1/4 In, Vertical Mounting Position, Frame Material Steel, Propeller Material Fabricated Aluminum, Number of Blades 4, Guard Material Steel Wire, For Use With General Ventilation Applications

Grainger Item #	4C163
Your Price (ea.)	
Brand	DAYTON
Mfr. Model #	4C163
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	26.0
Usually Ships	Today
Catalog Page No.	4210

Additional Info

Direct-Drive Venturi Exhaust Fans

Fans are UL and C-UL Listed.

- Mount: vertical or horizontal, except vertical only Nos. 4C361 and 4C007 (with sleeve bearings)
- Motors: totally enclosed
- Ball bearings
- Max. inlet/ambient temp.: 104°F
- Aluminum blades
- Optional speed controls sold separately

Industrial Units

Welded blades exhaust larger volumes of air at higher static pressures. For use in factories, foundries, and other industrial environments.

Tech Specs

Item: Exhaust Fan
Type: Heavy Duty Direct Drive
Propeller Dia. (In.): 16
CFM @ 0.000-In. SP: 2657
CFM @ 0.125-In. SP: 2430
CFM @ 0.250-In. SP: 1960
CFM @ 0.375-In. SP: 1400
CFM @ 0.500-In. SP: 1150
Sones @ 0.000-In. SP @ 5 Ft.: 17.4
Sones @ 0.125-In. SP @ 5 Ft.: 16.5
Voltage: 115
Hz: 60
Phase: 1
Full Load Amps: 4.4
Motor HP: 1/4
Motor Type: Split Phase
Motor Enclosure: Totally Enclosed Air-Over
Motor Insulation: Class A
Motor RPM: 1725
Watts: 365
Max. Ambient Temp. (F): 104
Height (In.): 20
Width (In.): 20
Max. Depth (In.): 10 1/4

Outside Dia. (In.): 20
Inside Dia. (In.): 16 7/16
Flange Width (In.): 1
Venturi Depth (In.): 1 3/4
Venturi Clearance Dia. (In.): 16 7/16
Mounting Position: Vertical
Frame Material: Steel
Frame Finish: Baked On Gray Polyester
Guard Material: Steel Wire
Wire Guard Finish: Baked On Polyester Finish
Propeller Material: Fabricated Aluminum
Number of Blades: 4
Agency Compliance: UL Listed, CUL Listed, AMCA
Speed Control: No
Aluminum Wall Shutter No.: 4C557
Fiberglass Wall Shutter No.: 5C212
Galvanized Wall Shutter No.: 1C743
Dimension A (In.): 20
Dimension B (In.): 10-1/4
Dimension C (In.): 3-5/8
Dimension D (In.): 16-7/16
For Use With: General Ventilation Applications

Notes & Restrictions

Note: Automatic shutters recommended; see Index under "Shutters". On Grainger.com®, search by Grainger Item Number and click the Optional Accessories tab. Note: OSHA complying guards (included with select models) are required when a fan is installed within 8 ft. of floor, working level, or within reach of personnel. Review OSHA codes and UL standards. See Index under "Guards, Fan".

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Repair Parts

Repair Parts Information is available for this item.

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Heavy-Duty Direct Drive Exhaust Fans

Description

NOTE: Manufacturer assumes no obligation or liability on account of any unauthorized recommendations, opinions, or advice as to the choice, installation or use of products.

Dayton 12" to 24" heavy duty direct drive exhaust fans have wire intake guards that comply with OSHA 1/2" max. opening requirements and baked-on charcoal grey metallic polyester finish to resist corrosion. All units are supplied with aluminum propeller with a corrosion resistant spider. Fans are powered by a 115V, 60 Hz., totally enclosed motor. Shipped completely assembled.

c UL us U.L. Listed

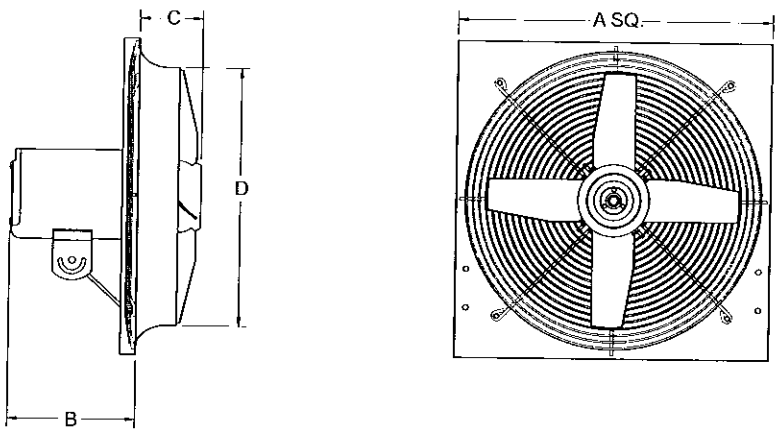


Figure 1 - Dimensions

Model	Propeller Dia.	A. Sq.	B	C	D
4YC81F	12"	16"	7 3/4"	1 1/2"	12 3/8"
4C163F	16	20	7 3/4	1 3/4	16 1/16
4C164F	18	22	7 3/4	1 15/16	18 1/16
4C367F	20	24	7 3/4	2 3/16	20 1/2
4C127F	20	24	7 3/4	2 3/16	20 1/2
4C165F	20	24	7 3/4	2 3/16	20 1/2
4C059F	24	28	7 3/4	2 5/8	24 3/8
4C167F	24	28	7 3/4	2 5/8	24 3/8

Unpacking

Receiving and Inspection. Immediately upon receipt of shipment, carefully inspect for damage and/or shortage. Turn the impeller by hand to see that it turns freely and does not bind. If any damage and/or shortage is detected or suspected, the carrier must be notified to conduct an inspection. The customer should not accept shipment without a notation on the delivery receipt indicating items not delivered or the apparent extent of damage.

When shipment is opened and damage is found which was not evident externally (concealed damage), it is mandatory that the customer request an immediate inspection by the carrier. Report any damage to the carrier within 15 days. Failure to report damage within the above time limit could result in rejection of claim.

Handling. When handling fans and their accessories, always use equipment and methods that will not cause damage. To avoid damage fans should be lifted using slings and padding or spreaders.

⚠ CAUTION ***Always make sure that all lifting and handling equipment and techniques conform to current safety standards.***

Avoid lifting fans in a way that will bend or distort fan parts. Never pass slings or timbers through the fan orifice.

⚠ CAUTION ***Do not lift by the fan hood. Fans with special coatings or paints must be protected in handling to prevent damage.***

Form 5S5230

Printed in U.S.A.
01120
0109/024/VCPVP

610909
January 2009

Dayton®

Dayton® Heavy-Duty Direct Drive Exhaust Fans

Performance

Model	Propeller Dia. (in.)	CFM Air Delivery @ Static Pressure Shown*					Sones**	Motor RPM	Operating Amps	Watts	HP
		0.0" S.P.	0.125 S.P.	0.250" S.P.	0.375" S.P.	0.500" S.P.	5' @ 0.0				
4YC81	12	1275	1160	1000	755	460	13.3	1725	3.4	210	1/4
4C163	16	2657	2430	1960	1400	1150	17.4	1725	4.4	365	1/4
4C164	18	2792	2495	2110	1725	1320	17.9	1725	4.3	330	1/4
4C367	20	2935	2640	2340	1990	1580	23	1725	4.3	366	1/4
4C127	20	3558	3290	2905	2520	2050	22	1725	4.5	410	1/3
4C165	20	4169	3860	3570	3130	2620	21	1725	5.9	540	1/2
4C059	24	3710	3255	2750	2240	1655	28	1725	4.3	370	1/3
4C167	24	5180	4700	4150	3610	2920	26	1725	6.6	600	1/2

(*) Performance certified is for installation type A: free inlet, free outlet. Speed (RPM) shown is nominal. Performance is based on actual speed of test. Performance ratings include the effects of a guard.
(**) The sound ratings shown are loudness values in fan sones at 5 ft. (1.5m) in a hemispherical free field calculated per AMCA standard 301. Values shown are for installation type A: free inlet fan sone levels.

Unpacking (Continued)

Storage. Fans are protected against damage during shipment. If they cannot be installed and put into operation immediately upon receipt, certain precautions are necessary to prevent deterioration during storage. Responsibility for integrity of fans and accessories during storage must be assumed by the user. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user, who shall make his own decision as to whether to use any or all of them.

Indoor Storage. The ideal storage environment for fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained at between 70°F and 105°F (wide temperature swings may cause condensation and "sweating" of metal parts). Windows should be covered to prevent temperature variations caused by sunlight. Provide thermometers and humidity indicators at several points and maintain the atmosphere at 40% relative humidity, or lower.

It may be necessary to use desiccant or a portable dehumidifier to remove moisture from the air in the storage enclosure.

Thermostatically controlled portable heaters (vented to outdoors) may be required to maintain even temperatures inside the enclosure.

⚠ CAUTION ***Provide fire extinguishers, fire alarms, or emergency response communication to protect building and equipment against fire damage. Be sure that building and storage practices meet all local, state and federal fire and safety codes.***

The following fans or accessories must be stored indoors, in a clean dry atmosphere:

a. Propeller wall fans not in wall housings.

b. Any fan protected by a cardboard carton.

c. Motors dismounted from fans.

d. Spare wheels or propellers.

e. Belts, sheaves, bushings and other parts when not mounted on fan.

f. Boxes, bags or cartons of hardware.

g. Curbs

h. Shutters

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. Allow cold parts to reach room temperature to avoid "sweating" of metal parts. Open boxes or cartons. Remove any accumulated moisture; if necessary use portable electric heaters to dry parts and packages. Leave coverings loose to permit air circulation and to permit periodic inspection.

Rotate impeller by hand to distribute bearing grease over the entire bearing surfaces.

Store at least 3 ½" above the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Provide aisles between parts and along all walls to permit air circulation and space for inspection.

Outdoor Storage. Fans designed for outdoor use may be stored outdoors, if absolutely necessary. The storage area should be reasonably level and drained or ditched to prevent accumulation of water. Fencing and lighting for security are desirable. Roads or aisles for portable cranes and hauling equipment are needed. Consider the use of drift fencing to minimize accumulation of blowing snow or dirt.

Models Heavy-Duty Direct Drive Exhaust Fans

Unpacking (Continued)

The following fans may be stored outdoors, if dry indoor storage space is not available:

a. Fans intended for outdoor use that are crated in wood.

b. Wall fans installed in wall housings.

All fans must be supported on wooden blocks or timbers above water or normal snow levels. Provide enough blocking to prevent settling into soft ground. Fans should be set in place using the directional arrow markings on the crate as a guide.

Locate pieces far enough apart to permit air circulation, sunlight, and space for periodic inspection. Place all parts on their supports so that rain water will run off, or to minimize water accumulation.
IMPORTANT: Do not cover parts with plastic film or tarps — these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan impellers should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage. Inspect fans and accessories at least once per month, while in storage. Log results of inspection and maintenance performed. A typical log entry should include the following:

a. Date

b. Inspector's Name

c. Name of Fan

d. Location

e. Condition of Paint or Coating

f. Is moisture present?

g. Is dirt accumulated?

h. Corrective steps taken?

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. Fan impellers should be rotated at each inspection by hand ten to fifteen revolutions to redistribute the motor and bearing lubricant.

If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. The most critical items are pulleys, shafts and bearing locking collars. At the first sign of rusting on any of the above parts, remove the original rust preventive coating with petroleum solvent and clean lint-free cloths. Polish any remaining rust from surfaces with crocus cloth or fine emery paper and oil. **IMPORTANT:** Do not destroy the continuity of the surfaces. Wipe clean with lint-free cloths and recoat surfaces evenly and thoroughly with Tectly 506 (Ashland Oil Company) or equal. For hard to reach internal surfaces or for occasional use, consider using Tectly 511M Rust Preventive or WD40 or equal.

Removing from Storage. As fans are removed from storage to be installed in their final location, they should be protected and maintained in similar fashion, until the fan equipment goes into operation.

General Safety Information

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA) in the United States.
2. Motor must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system by using a separate ground wire connected to the bare metal of the motor frame, or other suitable means.
3. Always disconnect power source before working on or near a motor or its connected load. If the power disconnect point is out-of-sight, lock it in the open position and tag to prevent unexpected application of power.
4. All moving parts should be guarded.
5. Be careful when touching the exterior of an operating motor - it may be hot enough to be painful or cause injury. With modern motors this condition is normal if rated at normal load and voltage - modern motors are built to operate at higher temperatures.
6. Make certain that the power source conforms to the requirements of your equipment.
7. Wiping or cleaning rags and other flammable waste materials must be placed in a tightly closed metal container and disposed of later in the proper fashion.
8. When cleaning electrical or electronic equipment, always use an approved cleaning agent such as dry cleaning solvent.

Installation

1. The unit should be securely mounted in a rigid framework.
2. Connect power to motor, using an approved wiring method.
3. Install any auxiliary components.
4. Before activating the fan, double-check to ensure that there are no obstructions (framing, stud, shutter, etc.) which would interfere with proper fan operation.

⚠ CAUTION ***This fan has rotating parts. Exercise applicable safety precautions during its handling, assembly, operation and maintenance. Disconnect power before handling, assembling, operating or maintaining. If disconnect means is out of sight, lock it in the open position to prevent unexpected starts.***

Dayton®

Dayton® Heavy-Duty Direct Drive Exhaust Fans

Installation (Continued)

⚠WARNING **Do not use in hazardous environments where the fan's electrical system could provide ignition to combustible or flammable materials, unless the unit is specifically built for hazardous environments.**

⚠ CAUTION ***Guards must be installed when the fan is within reach of personnel or within eight (8) feet (2.5 m) of working level or when deemed advisable for safety.***

⚠ CAUTION ***Before proceeding, make sure electrical service to the fan is locked in the "OFF" position.***

⚠WARNING ***Check the voltage at the fan to see if it corresponds with the motor nameplate. High or low voltage can seriously damage the motor. Extra care should be taken when wiring two speed motors since improper connections will damage the motor and void the motor warranty.***

Apply power momentarily and compare the rotation of the impeller with the directional arrow on fan.

⚠WARNING ***Operation in the wrong direction will deliver air but will overload the motor to the extent of blowing fuses and seriously damaging the motor. In the case of three phase motors, the direction can be changed by interchanging any two of the three motor leads. In the case of single phase motors, the reversing instructions will appear on the wiring diagram in the motor wiring compartment.***

Maintenance

1. Periodically clean the propeller and motor of any excessive accumulation of dirt.
2. Under normal usage, no spare parts are recommended for one year of operation. Motor bearings are prelubricated. Consult information printed on motor for lubrication instructions.

⚠ CAUTION ***Before proceeding, make sure electrical service to the fan is locked in the "OFF" position.***

⚠WARNING ***Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.***

Set Screw Tightening Schedule

1. Before initial operation of the fan, tighten set screws according to the procedure outlined below.
2. After 500 operating hours or three months, whichever comes first, tighten set screws to the full recommended torque.
3. At least once a year, tighten set screws to the full recommended torque.

Procedure for Tightening Set Screws in Bearings and Hubs

<u>One Set Screw Application</u>

Using a torque wrench, tighten the set screw to the torque recommended in Table 1.

<u>Two Set Screw Application</u>

1. Using a torque wrench, tighten one set screw to half of the torque recommended in Table 1.
2. Tighten the second set screw to the full recommended torque.
3. Tighten the first set screw to the full recommended torque.

Table 1. Recommended Tightening Torque for Set Screws

Set Screw Diameter	Torque (in-lbs)
#10	35
1/4	80
5/16	126
3/8	240
7/16	384
1/2	744
9/16	1080
5/8	1500
3/4	2580
7/8	3600
1	5400

Variable Frequency Drives and Motors

There are occasions when a Variable Frequency Drive (VFD) will cause poor motor performance and possible damage. To avoid these problems, the manufacturer recommends the following:

1. Select compatible motor and VFD converter; if possible, the motor and the converter should be from the same manufacturer or at least the converter selected should be recommended by the motor manufacturer.
2. A motor shaft grounding system should be used to prevent motor bearing damage from eddy currents.

NOTE: The manufacturer will not honor motor warranty claims if the customer fails to follow these recommendations.

For Repair Parts, call 1-800-323-0620

24 hours a day - 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part descriptions and number as shown in parts list

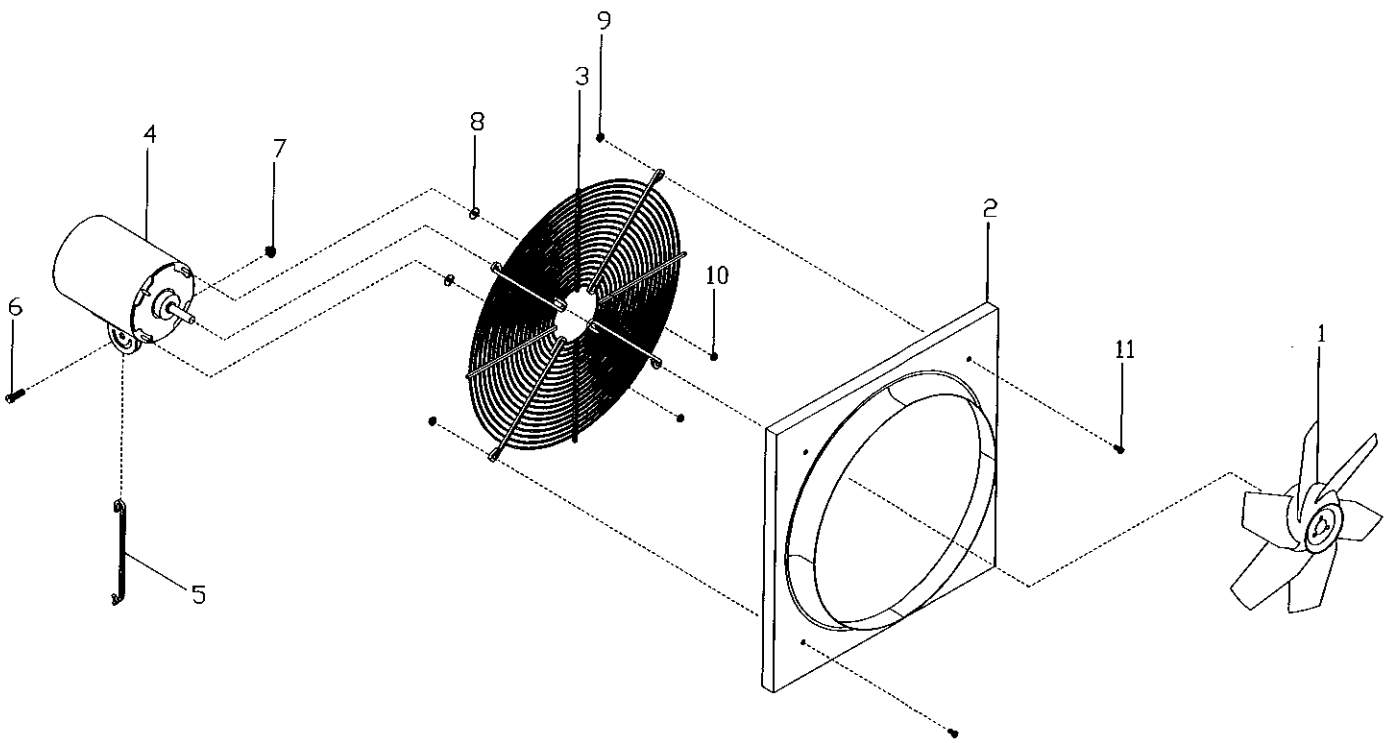


Figure 2 - Repair Parts Illustration

Ref. No.	Description	Part Numbers for Models								Qty.
		4YC81F	4C163F	4C164F	4C367F	4C127F	4C165F	4C059F	4C167F	
1	Prop	506524	506525	506526	506527	506528	506529	506530	506531	1
2	Orifice	506000	506001	506002	506003	506003	506003	506004	506004	1
3	Guard	993814	993815	993818	993819	993819	993819	993821	993821	1
4	Motor	994208G	994207G	994207G	994207G	994209G	994223G	994209G	994223G	1
5	Motor Support Strut	993813	993810	993810	993810	993810	993810	993811	993811	1
6	Hex Bolt	*	*	*	*	*	*	*	*	1
7	Washered Nut	*	*	*	*	*	*	*	*	1
8	Washer	*	*	*	*	*	*	*	*	4
9	Washered Nut	*	*	*	*	*	*	*	*	4
10	Washered Nut	*	*	*	*	*	*	*	*	4
11	Hex Bolt	*	*	*	*	*	*	*	*	4

(*)Standard hardware item available locally.

Dayton®

Dayton® Heavy-Duty Direct Drive Exhaust Fans

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *DAYTON® HEAVY-DUTY DIRECT DRIVE EXHAUST FAN MODELS COVERED IN THIS MANUAL, ARE WARRANTED BY DAYTON ELECTRIC MFG. CO. (DAYTON) TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE YEAR AFTER DATE OF PURCHASE. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.*

LIMITATION OF LIABILITY. *TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, DAYTON'S LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES IS EXPRESSLY DISCLAIMED. DAYTON'S LIABILITY IN ALL EVENTS IS LIMITED TO AND SHALL NOT EXCEED THE PURCHASE PRICE PAID.*

WARRANTY DISCLAIMER. *A DILIGENT EFFORT HAS BEEN MADE TO PROVIDE PRODUCT INFORMATION AND ILLUSTRATE THE PRODUCTS IN THIS LITERATURE ACCURATELY; HOWEVER, SUCH INFORMATION AND ILLUSTRATIONS ARE FOR THE SOLE PURPOSE OF IDENTIFICATION, AND DO NOT EXPRESS OR IMPLY A WARRANTY THAT THE PRODUCTS ARE MERCHANTABLE, OR FIT FOR A PARTICULAR PURPOSE, OR THAT THE PRODUCTS WILL NECESSARILY CONFORM TO THE ILLUSTRATIONS OR DESCRIPTIONS. EXCEPT AS PROVIDED BELOW, NO WARRANTY OR AFFIRMATION OF FACT, EXPRESSED OR IMPLIED, OTHER THAN AS STATED IN THE "LIMITED WARRANTY" ABOVE IS MADE OR AUTHORIZED BY DAYTON.*

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Product Suitability. *Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While attempts are made to assure that Dayton products comply with such codes, Dayton cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.*

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. *A good faith effort will be made for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.*

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 U.S.A.

T6031A1136

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

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

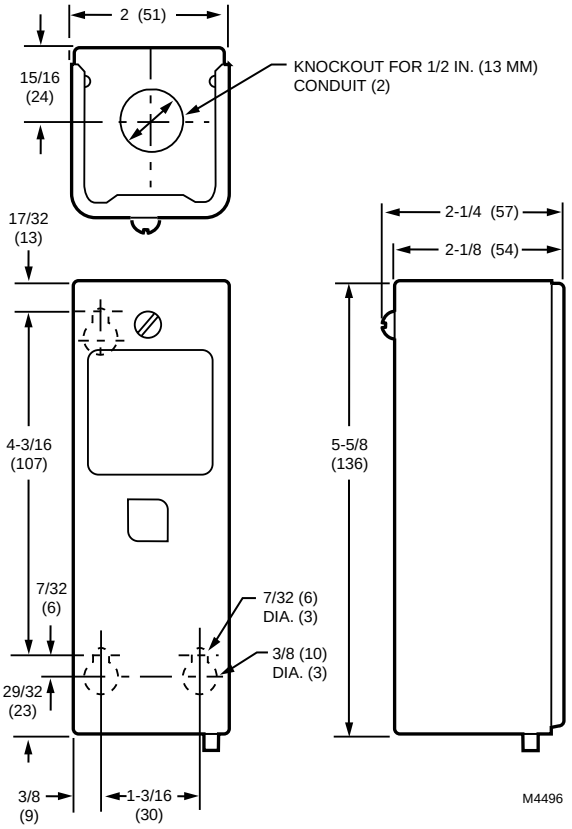


Fig. 1. Dimensions of T4031, T6031 in. (mm).

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. De-formed 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.

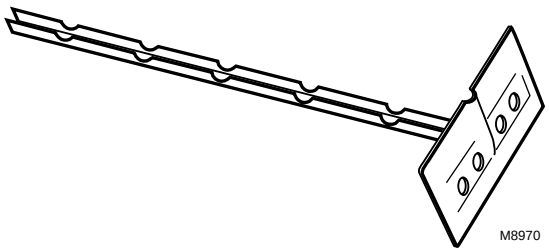


Fig. 2. 107324A bulb holder.

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.

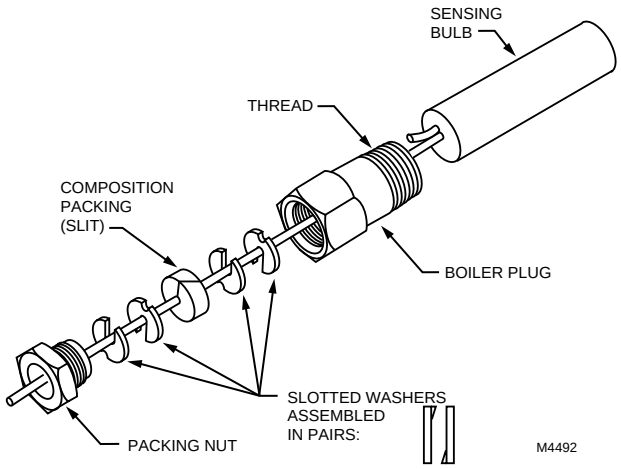


Fig. 3. Compression fitting installation.

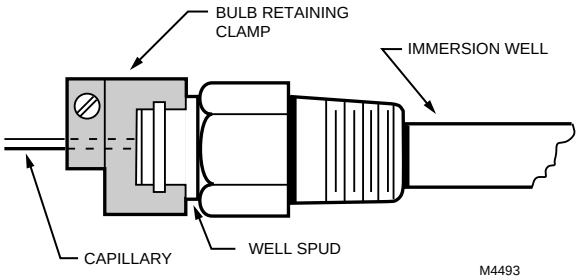


Fig. 4. Immersion well installation.

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.

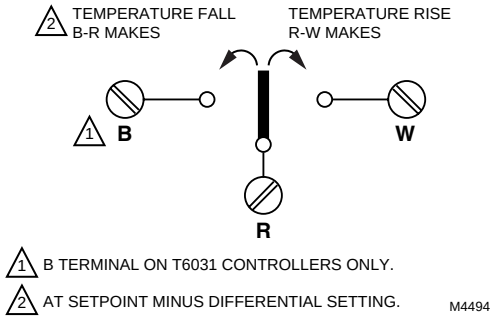


Fig. 5. Wiring terminals on T4031 and T6031 temperature controllers.

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.

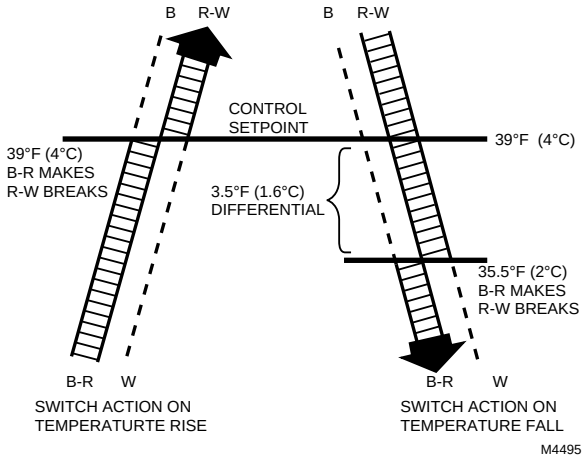


Fig. 6. Operation of switch on temperature rise and fall.

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.

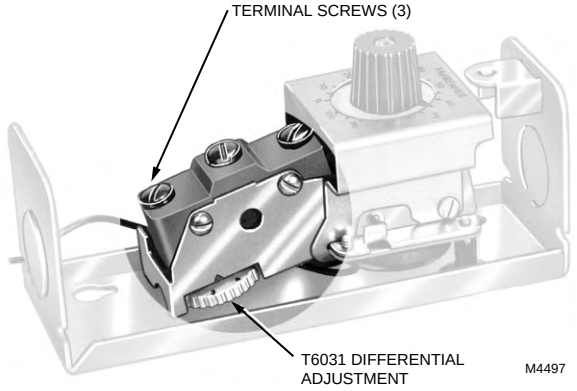


Fig. 7. Internal view showing differential adjustment wheel (applicable models).

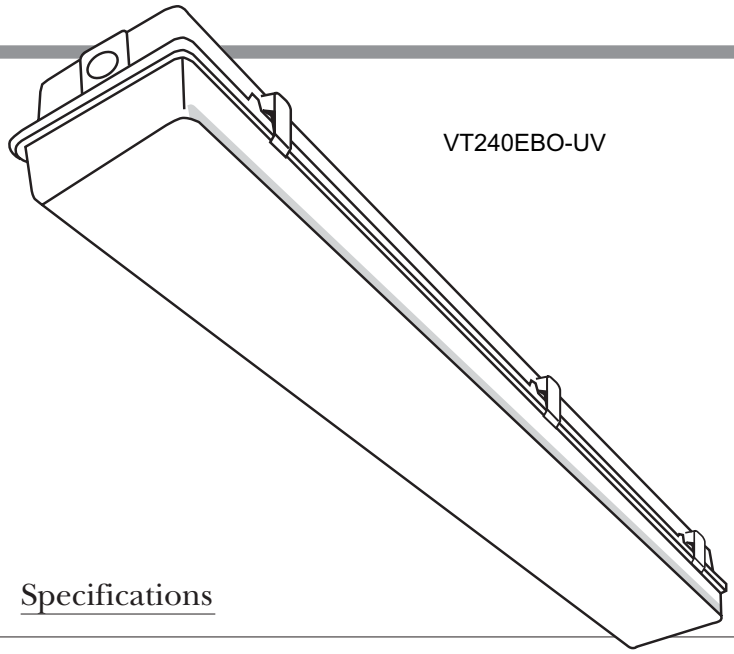
For calibration, take an accurate temperature reading of the controlled medium. Place an accurate thermometer near the bulb of the controller, or refer to a thermometer installed as part of the system. If the bulb of the controller is installed in an inaccessible area, or if the controlled medium is 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.

VT SERIES

VT Series is designed for heavy duty service in areas subjected to moisture and chemicals. Ideally suited for food processing areas also.



VT240EBO-UV

Ordering Information

Magnetic

CATALOG#	LAMP	NOMINAL LENGTH
	430 MA	
VT120	1-F20T12	2'
VT220	2-F20T12	2'
VT140ES	1-F40	4'
VT240ES	2-F40	4'
VT240TES	4-F40	8'
VT196	1-F96T12	8'
VT296ES	2-F96T12	8'
	800 MA	
VT124HO	1-F24T12HO	2'
VT224HO	2-F24T12HO	2'
VT148HO	1-F48T12HO	4'
VT248HO	2-F48T12HO	4'
VT196HO	1-F96T12HO	8'
VT296HO	2-F96T12HO	8'

All Ballast Standard Low Temperature (-20 F)

Electronic Octron

CATALOG#	LAMP	NOMINAL LENGTH
VT120EBO	1-FO17T8	2'
VT220EBO	2-FO17T8	2'
VT140EBO	1-FO32T8	4'
VT240EBO	2-FO32T8	4'
VT240TEBO	4-FO32T8	8'
VT196EBO	1-FO96T8	8'
VT296EBO	2-FO96T8	8'

Consult Factory for other options

Specifications

Mounting: Units may be either surface or pendant mounted. Housing provided with adequate amount of knockouts which must be drilled on job site to insure proper sealing.

Construction: A one piece housing molded from ABS material with a smooth white exterior. ABS cam-lock latches provide both a positive lock between lens and housing and self hinging for lamp replacement. A self-adhesive, closed-cell polyethylene gasket on housing forms a continuous seal with diffuser. Internal metal is die-formed from heavy gauge cold-rolled steel.

Finish: External housing to be smooth white. All internal metal parts are cleaned and treated to prevent rust with a phosphate coating applied automatically in a five-stage process. Surfaces are then sprayed with high quality baked white enamel to provide a minimum reflectance of 87%.

Diffuser: Lens is crepe acrylic.

Wiring: Standard ballast are ETL-CBM, Class "P" 120 volt. All 800 MA and 1500 ballast are low temperature (-20°F).

Approval: All units are Underwriter's Laboratories (UL) approved.

NEW ENGLAND LIGHTING INCORPORATED

311 Eastern Ave. Chelsea, MA 02150 Phone 617-887-1515 Fax 617-889-6529 www.newenglandlighting.com (Eastern, MA) 800-698-3737 (New England) 800-247-3230

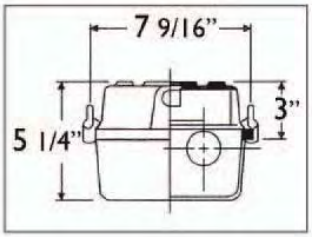
VT SERIES

Options and Accessories

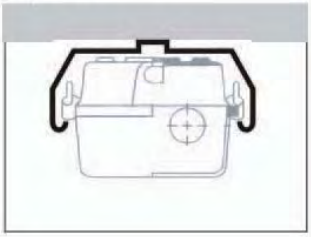
EB	Electronic T12	**PA**	Prismatic Lens
***CW**	Low Temperature (0) Ballast	**RFI**	Radio Interference Filter
***DIM**	Dimming Ballast	**FS**	External Fuse and Holder
EM	Emergency Ballast (1 lamp)	**REF**	Internal Polished Aluminum Reflector
•**EM/2**	Emergency Ballast (2 lamp)	**REFS**	Internal Specular Silver Reflector
HOEBO	800MA Electronic T8	**SSL**	Stainless Steel Latches
HUBS	Fitting Assembly for 1/2" Rigid Contour	**SSLTP**	Stainless Steel Latches Tamper Proof
LEX	Polycarbonite lens	**WL**	Wet Location Rating
		BRK	Mounting Bracket

*Available Magnetic T12 or Electronic T8
•Note: Consult Factory on Compatibility EM/2 Option

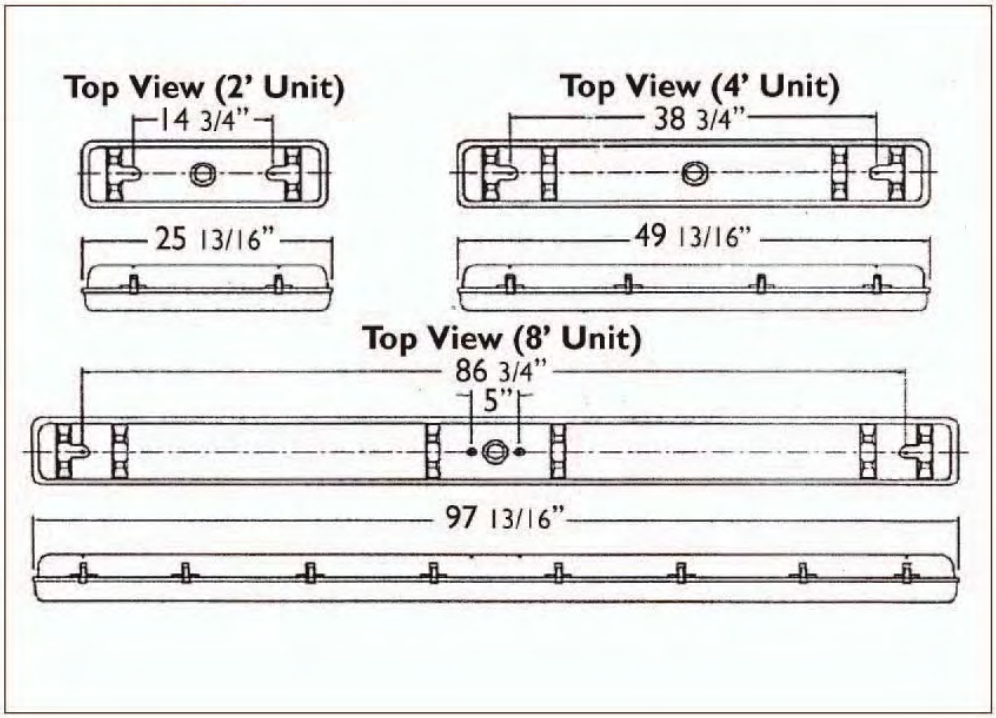
Dimensional Data



Mounting Bracket- Optional



Installation Data



Photometrics

Photometric Information available upon request.

NEW ENGLAND LIGHTING INCORPORATED
311 Eastern Ave. Chelsea, MA 02150 Phone 617-887-1515 Fax 617-889-6529 www.newenglandlighting.com (Eastern, MA) 800-698-3737 (New England) 800-247-3230

Heater, Wall, with Built in Thermostat

Wall Heater, Current Rating 17.3/20.0 Amps, Power Rating 3600/4800 Watts, BtuH 10287/16382, Voltage @ 60 Hz 208/240 Volts, Enamel Finish White, Architectural and Commercial Grade, With Built In Thermostat

Grainger Item #	3UF62
Your Price (ea.)	
Brand	DAYTON
Mfr. Model #	3UF62
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	22.0
Usually Ships	Today
Catalog Page No.	4385

Additional Info

Electric Wall Heaters

Provide fast space heating. Units use 1-phase power except where noted, and have a built-in thermostat except where noted. Mounting frames sold separately. UL and C-UL Listed, except shallow-wall models are ETL Listed.

Commercial

Aesthetically designed to suit public areas or residential settings. Small models are good for locations with limited wall space.

Tech Specs

Item: Electric Wall Heater
Type: Residental, Light Commercial
Voltage: 208/240
Hz: 60
Phase: 1
Amps AC: 17.2/20.0
Watts: 3600/4800
BtuH: 10,287/16,382
Wall Opening Height (In.): 18-1/4
Wall Opening Width (In.): 14-3/8
Wall Opening Depth (In.): 3-3/4
Grille Height (In.): 19-1/4
Grille Width (In.): 15-3/4
Grille Depth (In.): 1-1/2
Housing Height (In.): 18-1/4
Housing Width (In.): 14-5/16
Housing Depth (In.): 3-3/4
Grille Material: Heavy Gauge Steel
Finish: Powder Paint
Color: Northern White
Mounting Location: Wall
Mount Type: Recessed or Surface
Built-In Features: Double Pole Single Throw Disconnect Switch, Impedance Protected, Permanently Lubricated Totally Enclosed Motor, Thermostat with 40 to 90 Range, Thermal Overheat Protector
Requires: Proper Gauge Wire for Distance From Heater to Breaker Panel for Load
Warranty (Years): 5 On Element, 1 All ther parts
Agency Compliance: UL

Optional Accessories

Frame, Semi Recessed

Item #: 3UF64
Brand: DAYTON
Usually Ships: 1-3 Days
Your Price (ea): $71.87

Frame, Semi Recessed

Item #: 3UF65
Brand: DAYTON
Usually Ships: Today
Your Price (ea): $71.87

Frame, Surface Mount

Item #: 3UF66
Brand: DAYTON
Usually Ships: Today
Your Price (ea): $69.53

Security Front Cover

Item #: 3UG58
Brand: DAYTON
Usually Ships: Today
Your Price (ea): $92.88

Alternate Products

Heater, Tamper Proof

Item #: 5E183
Brand: DAYTON
Usually Ships: Today

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Fan Forced Wall Heaters

Description

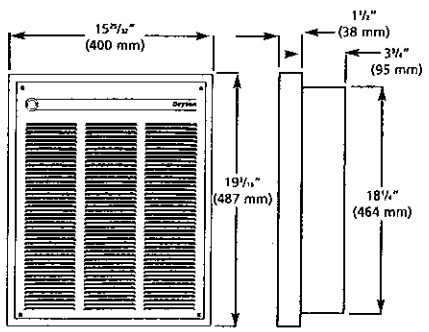
Dayton fan-forced large wall heaters provide electric heat for offices, reception rooms, game rooms, family rooms and similar light-duty commercial and residential applications. These heaters have an integral thermostat so a separate thermostat is not necessary. Heaters include a built-in power disconnect switch for added safety during maintenance and can be surface mounted using optional surface frame.

Specifications

Model Number	Volts	Phase	Watts	Amps	Wire Gauge
2HAD7	120	1	1500	12.5	12
2HAD8	120	1	1800	15.0	12
3UF59D*	277	1	3000/1500	10.8/5.4	14
3UF60D*	240/208	1	4000/3000	16.7/14.5	10
			2000/1500	8.3/7.2	12
3UF61D*	277/240	1	4000/3000	14.5/12.5	12
			2000/1500	7.2/6.3	12
3UF62D	208/240	1	3600/4800	17.3/20.0	10
3UF63D	240/277	1	3600/4800	15.0/17.3	10
3END1	208	1	4000/2000	19.3/9.7	10

(*) Factory wired for higher wattage. Field convertible to half wattage.

Dimensions



General Safety Information

⚠WARNING ***Read Carefully - These instructions are written to help you prevent difficulties that might arise during installation of heaters. Studying the instructions first may save you considerable time and money later. Observe the following procedures and cut your installation time to a minimum. TO REDUCE RISK OF FIRE OR ELECTRIC SHOCK:***

1. Disconnect all power coming to heater at main service panel before wiring or servicing.
2. All wiring must be in accordance with the National and Local Electrical Codes and the heater must be grounded.
3. Verify the power supply voltage coming to heater matches the ratings printed on the heater nameplate before energizing.
4. This heater is hot when in use. To avoid burns, do not let bare skin touch hot surfaces.
5. Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock, fire, or damage to the heater.
6. Do not block air intakes or exhaust in any manner. Keep combustible materials, such as crates, drapes, etc., away from heater. Do not install behind doors, furniture, towels, or boxes.
7. A heater has hot and arcing (sparking) parts inside. Do not use it in areas where gasoline, paint, or flammable liquids are used or stored.
8. Use this heater only as described in this manual. Any other use not recommended by the manufacturer may cause fire, electric shock, or injury to persons.

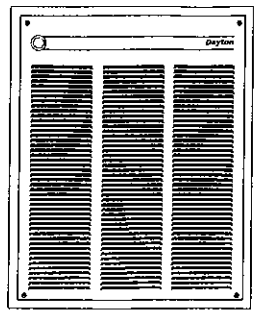


Figure 1

c UL us
File #E154218

9. This heater is not approved for use in corrosive atmospheres, such as marine, green house, or chemical storage areas.
10. Do not install heater upside down or sideways. Do not use heater without grille.
11. For wall mounting only. Do not install heater closer than 8" (203 mm) to the floor or any adjacent wall surface. Do not install closer than 36" (915 mm) to the ceiling.

SAVE THESE INSTRUCTIONS

NOTE: This heater has a continuous fan-only feature. See page 4 for details.

Installation

RECESSED BACK BOX IN NEW CONSTRUCTION

1. Mounting Back Box (See Figure 2, page 2).
   a. Place the back box between two 16" (406 mm) center-to-center wall studs at the desired mounting height but no closer than 8" (203 mm) to adjacent wall or floor.
   b. Align back box such that the bottom and sides will be flush with finished wall surface (top flange of back box should protrude approximately 1/2" [12.7 mm] from finished wall surface).

Form 5S5987 Printed in China 09663 0508/127/VCPVP MEP100 07/09 Form #89

Dayton® Fan Forced Wall Heaters

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Installation (Continued)

c. Secure the back box in position with wood screws or nails as shown in Figure 2.

2. Power Supply Wiring (See Figure 2).

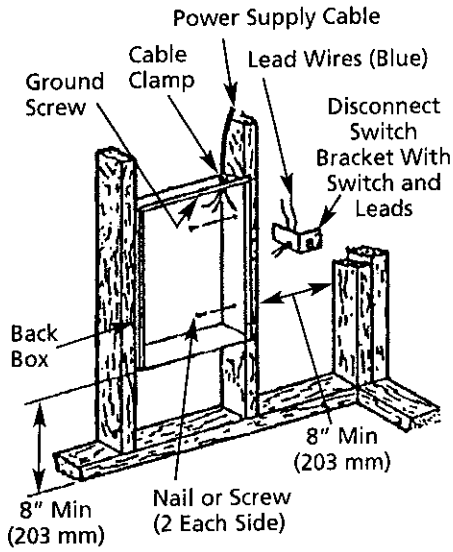

Figure 2 – Locating Recessed Back Box in New Construction

NOTE: Wire compartment volume – 119 in.³ (1950 cm³).

a. Run a power supply cable into the knockout area in the upper right hand corner of the back box. All wiring must be in accordance with National and Local Electrical Codes. Refer to Specifications for correct wire size.

b. Remove disconnect switch bracket by loosening two screws on the right side.

c. Install a cable clamp in the "knockout" in the top of the back box.

d. Insert power supply cable through cable clamp, allowing at least 6" (152 mm) of leads to extend inside the back box. Connect the blue lead wires of disconnect switch to the supply wire leads using wire connectors (See Wiring Diagram, page 4).

e. Ground the back box by connecting the supply ground lead wire to the green ground screw located in the inside top of the back box.

f. Secure disconnect switch bracket in place by tightening screws.

RECESSED BACK BOX IN EXISTING CONSTRUCTION

1. Provide a wall opening 14½" (362 mm) wide by 18½" (470 mm) high at the desired mounting height, but no closer than 8" (203 mm) (See Figure 3).

2. Power Supply Wiring

NOTE: Wiring Compartment Volume – 119 in.³ (1950 cm³).

a. Run a power supply cable into the area above the top of the wall opening. All wiring must be in accordance with National and Local electrical codes. Refer to Specifications for correct wire size.

b. Remove disconnect switch bracket by loosening the two screws on the right side.

c. Install a cable clamp in the "knockout" in the top of wall back box.

d. Insert power supply cable through cable clamp, allowing approximately 6" (152 mm) of cable length to remain inside the back box to facilitate connections.

3. Mounting Back Box

a. Place the back box into wall opening flush with finished wall surface on bottom and sides of box. (Top flange of backbox should protrude approximately 1/2" [12.7 mm] from finished wall surface.)

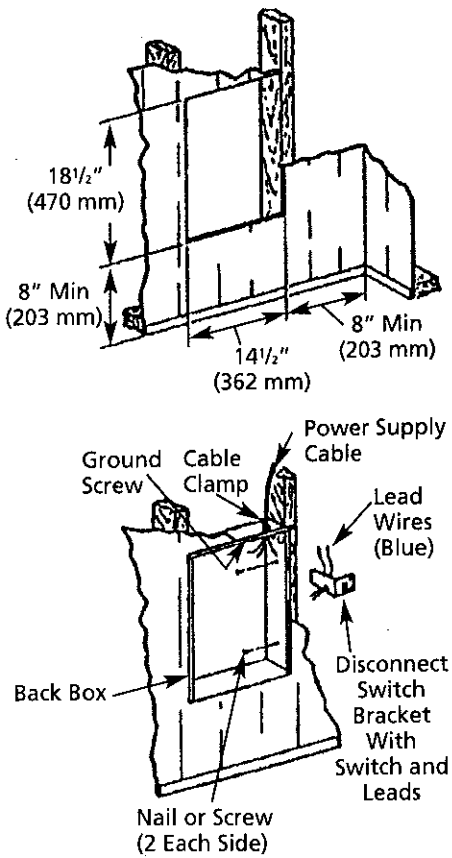

Figure 3 – Locating Recessed Back Box in Existing Construction

b. Secure the back box in place with wood screws or nails.

4. Wiring Disconnect Switch

a. Connect the power supply wires to the blue wires of the disconnect switch using wire connectors (See Wiring Diagram, page 4).

b. Ground the back box connecting the supply ground lead wire to the green ground screw located in the inside top of the back box.

c. Secure disconnect switch bracket in place by tightening screws.

Models 2HAD7, 2HAD8, 3UF59D thru 3UF63D and 3END1

Installation (Continued)

BACK BOX WITH SURFACE-MOUNTING FRAME 3UF66D

(See Figure 4)

1. Secure back box to wall with knock-outs in upper right hand corner using screws and anchors.
2. Hang the surface-mounting frame on the back box. Ensure that the back edge of the surface-mounting frame is flush against the wall.

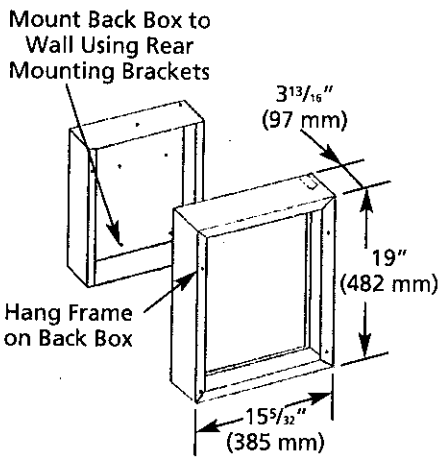

Figure 4 – Surface Mounting Installation

NOTE: If heater is located in a high traffic area where it may be subjected to vandalism or abuse, take extreme care to see that the box is firmly attached to the wall.

3. Power Supply Wiring

NOTE: Wiring Compartment Volume – 119 in.³ (1950 cm³).

a. Run a power supply cable into the area of the upper right corner of the mounting frame. Arrangement of wiring to this point must be in accordance with National and Local codes. Refer to Specifications for proper wire size.

NOTE: If the wiring is to run through the wall, cut a hole in the area of the top of the wall box. Run the supply wire through this hole. Then remove the "knockout" from the top of the box and proceed to step C.

b. Remove the "knockout" on the top side of the frame.

c. Remove disconnect switch bracket by loosening the two screws on the right side.

d. Feed the power supply cable through the frame allowing 6" (152 mm) of lead to remain inside the back box.

e. Secure the power supply cable to the back box (using cable clamp, connector, or other suitable strain relief) allowing 6" (152 mm) of lead to remain inside the back box.

f. Connect supply wires to blue wires of disconnect switch using wiring connectors (See Wiring Diagram, page 4).

g. Ground the back box by connecting the supply ground leadwire to the green ground screw located in the inside top of the back box.

h. Secure disconnect switch bracket in place.

HEATER ASSEMBLY AND GRILLE

After back box is completely installed and no further construction dirt is expected, clean debris from back box, remove heater assembly from its carton, then refer to Figure 5 and proceed as follows:

1. Insert the heater assembly into back box, placing the four mounting holes (with key-hole slots) over the screws in the back box. Tighten all screws securely.
2. If surface-mounting frame is used, ensure that the frame is even with all four heater assembly tabs before tightening screws.

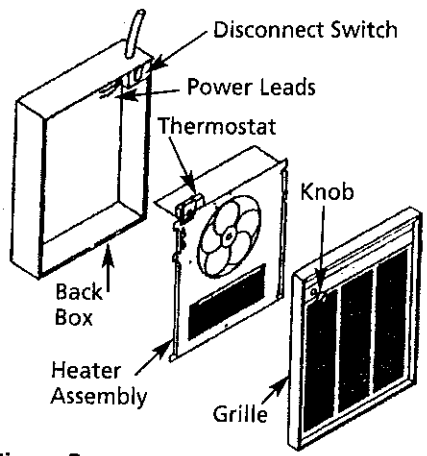

Figure 5

3. Connect the two disconnected switch wires to the heater control switch (thermostat) leads using wire nuts. After connection, push wires back into the opening.
4. Turn thermostat to the extreme counterclockwise position.
5. Push disconnect switch into ON position.
6. Mount the grille using the four (4) long screws provided. The screws thread into holes located in the side flanges of the back box.
7. Push thermostat knob onto thermostat shaft.

NOTE TO INSTALLER: Converting heater to half wattage

The 3UF59D thru 3UF63D wall heaters are manufactured and shipped at the higher rated wattage (See Specifications, page1). Full wattage heaters can be converted to half wattage by doing the following steps:

1. Remove the red jumper wire as shown in Figure 6, page 4 and discard.
2. To permanently make the heater half wattage, cut the male terminal spade, carefully not to damage the cold pin and discard.
3. Mark the wattage of the heater on the white label inside the backbox.

Dayton® Fan Forced Wall Heaters

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Installation (Continued)

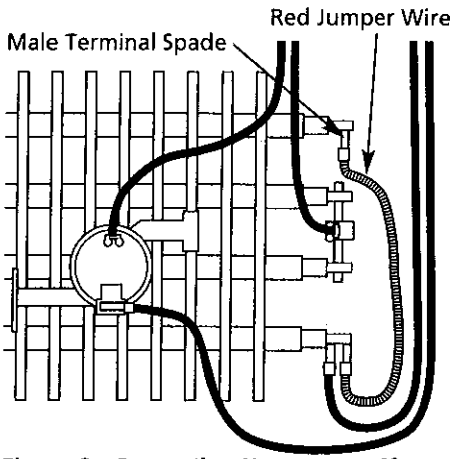


Figure 6 – Converting Heater to Half Wattage

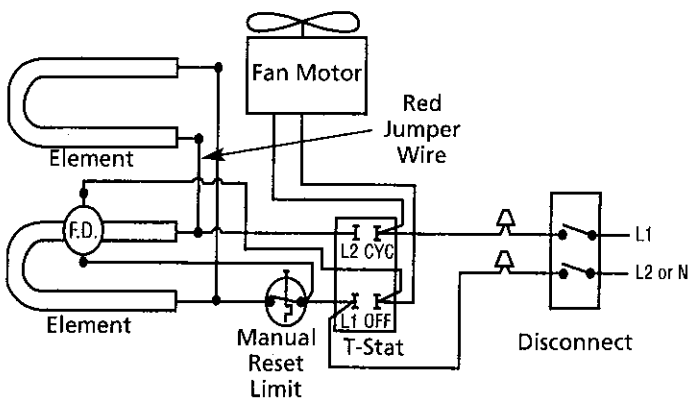
Operation

1. Rotate the thermostat knob fully clockwise. This should energize the heating elements and fan causing warm air to flow from the hot air discharge at the openings in the bottom of the grille.
2. After the operation check, rotate the thermostat knob to the desired position to obtain room comfort.
3. For continuous fan-only operation (elements will not be energized) rotate thermostat knob where indicator dot on knob is aligned with FAN.
4. There will be a short delay from the time the unit is turned on until the fan engages. This is to allow the elements time to warm up. The fan will also continue to run once the unit is turned off to allow the elements time to cool.

NOTE: For best results, the heater should be left "ON" constantly during the heating season because the thermostat, when properly set, will maintain the desired temperature.

⚠CAUTION ***Operation of the manual reset safety thermal limit control is an indication that the heater has been subjected to some abnormal condition. It is recommended that the heater be checked by a reputable electrician or repair service to ensure the heater has not been damaged.***

Wiring Diagram



208V, 240V, or 277V (Full wattage heaters can be converted to half wattage by removing the red jumper wire connecting the top and bottom element terminals.)

Diagram 1 – 1500, 1800, 4800, 4000 & 3000 Watt Heaters

Maintenance

TO RESET MANUAL RESET LIMIT

Your heater is equipped with a manual reset safety thermal limit control that will automatically turn the heater off to prevent a fire if the heater overheats. This control is located on the fan panel assembly between the element and fan blade and marked "reset". The red reset button can be seen through the front grille when the heater is installed. To reset, allow the heater to cool, then push the red button that is visible through the hole in the fan panel. The heater should immediately return to normal operation.

Once each year the heater should be cleaned to remove dust and other foreign material which has collected during the heating season. This is a simple operation when performed as follows:

1. Turn off the electric power at main line switch (or remove all fuses) to disconnect electric power from the heater. THIS IS IMPORTANT.
2. Remove the grille (Figure 5, page 3) and turn the disconnect switch to the OFF position.

⚠CAUTION ***DO NOT use water or damp cloth for cleaning and DO NOT disturb the heating element.***

3. With a vacuum cleaner nozzle or dust cloth, remove dust and other foreign material.
4. After cleaning, turn disconnect switch to ON position and reinstall the grille.
5. Turn on the main line switch (or replace fuses) to restore power to the heater. The heater is now ready for another season of operation.

For Repair Parts, call 1-800-323-0620

24 hours a day – 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

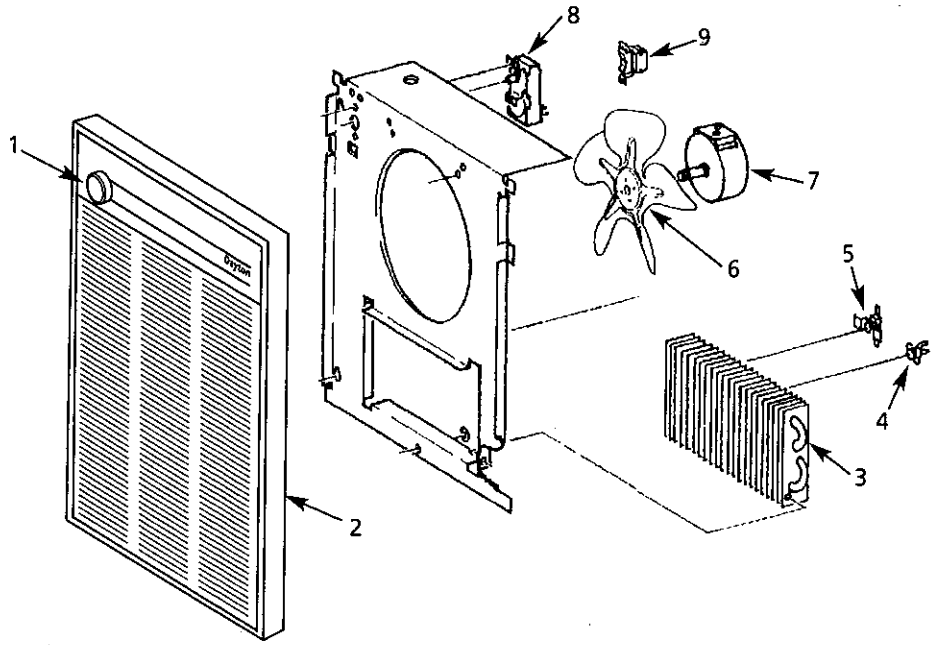


Figure 7 – Repair Parts Illustration for Fan Forced Wall Heaters

Reference Data

Catalog Number	Volts	Ph.	Watts
2HAD7	120	1	1500
2HAD8	120	1	1800
3UF59D	277	1	3000
3UF60D	208/240	1	3000/4000
3UF61D	240/277	1	3000/4000
3UF62D	208/240	1	3600/4800
3UF63D	240/277	1	3600/4800
3END1	208	1	4000/2000

Repair Parts List for Fan Forced Wall Heaters

Reference Number	Description	Part Number for Models: 2HAD7	2HAD8	3UF59D	3UF60D	Quantity
1	Knob	HV33012016001G	HV33012016001G	HV33012016001G	HV33012016001G	1
2	Grille	HV25012068000G	HV25012068000G	HV25012068000G	HV25012068000G	1
3	Element	302012827	302012828	302012806	302012808	1
4	High Limit	—	—	—	—	1
	Manual Limit	4520-2027-000	4520-2027-000	4520-2027-000	4520-2027-000	1
5	Fan Delay	410074000	410074000	410074000	410074000	1
6	Fan Blade	490030103	490030103	490030103	490030103	1
7	Motor	3900-2010-003	3900-2010-003	3900-2010-001	3900-2010-000	1
8	Thermostat	5813-2059-000	5813-2059-000	5813-2059-000	5813-2059-000	1
9	Disconnect	410170001	410170001	410170001	410170001	1

Reference Number	Description	Part Number for Models: 3UF61D	3UF62D	3UF63D	3END1	Quantity
1	Knob	HV33012016001G	HV33012016001G	HV33012016001G	HV33012016001G	1
2	Grille	HV25012068000G	HV25012068000G	HV25012068000G	HV25012068000G	1
3	Element	302012809	302012810	302012811	302012807	1
4	High Limit	—	—	—	—	1
	Manual Limit	4520-2027-000	4520-2027-000	4520-2027-000	4520-2027-000	1
5	Fan Delay	410074000	410074000	410074000	410074000	1
6	Fan Blade	490030103	490030103	490030103	490030103	1
7	Motor	3900-2010-001	3900-2010-000	3900-2010-001	3900-2010-000	1
8	Thermostat	5813-2059-000	5813-2059-000	5813-2059-000	5813-2059-000	1
9	Disconnect	410170001	410170001	410170001	410170001	1

Dayton® Fan Forced Wall Heaters

ENGLISH

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *DAYTON® FAN FORCED WALL HEATERS, MODELS COVERED IN THIS MANUAL, ARE WARRANTED BY DAYTON ELECTRIC MFG. CO. (DAYTON) TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE YEAR AFTER DATE OF PURCHASE. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.*

LIMITATION OF LIABILITY. *TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, DAYTON'S LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES IS EXPRESSLY DISCLAIMED. DAYTON'S LIABILITY IN ALL EVENTS IS LIMITED TO AND SHALL NOT EXCEED THE PURCHASE PRICE PAID.*

WARRANTY DISCLAIMER. *A DILIGENT EFFORT HAS BEEN MADE TO PROVIDE PRODUCT INFORMATION AND ILLUSTRATE THE PRODUCTS IN THIS LITERATURE ACCURATELY; HOWEVER, SUCH INFORMATION AND ILLUSTRATIONS ARE FOR THE SOLE PURPOSE OF IDENTIFICATION, AND DO NOT EXPRESS OR IMPLY A WARRANTY THAT THE PRODUCTS ARE MERCHANTABLE, OR FIT FOR A PARTICULAR PURPOSE, OR THAT THE PRODUCTS WILL NECESSARILY CONFORM TO THE ILLUSTRATIONS OR DESCRIPTIONS. EXCEPT AS PROVIDED BELOW, NO WARRANTY OR AFFIRMATION OF FACT, EXPRESSED OR IMPLIED, OTHER THAN AS STATED IN THE "LIMITED WARRANTY" ABOVE IS MADE OR AUTHORIZED BY DAYTON.*

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Product Suitability. *Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While attempts are made to assure that Dayton products comply with such codes, Dayton cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.*

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. *A good faith effort will be made for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.*

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 U.S.A.

Manufactured for Dayton Electric Mfg. Co.
Niles, Illinois 60714 U.S.A.

Dayton®

APPENDIX C: SYSTEM ELECTRICAL COMPONENTS – PRODUCT DATA

CONCEPT® Wall-Mount Enclosures

CONCEPT®, Type 4 and 12

Industry Standards

Wall-mounting brackets required to maintain UL/CSA external mounting requirement.

CONCEPT solid single-door, door with window and flush-mount models

UL 508A Listed; Type 4, 12; File No. E61997
cUL Listed per CSA C22.2 No. 94; Type 4, 12; File No. E61997

NEMA/EEMAC Type 4, 12, 13
CSA, File No. 42186: Type 4, 12
VDE IP66
IEC 60529, IP66

CONCEPT two-door models

UL 508A Listed; Type 12; File No. E61997
cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997

NEMA/EEMAC Type 12
CSA, File No. 42186, Type 12
VDE IP 55
IEC 60529, IP55

Application

CONCEPT® Enclosures are ideal for machine control applications. With streamlined styling, flush quarter-turn latches and an attractive, durable finish. Available in solid or window single-door and two-door landscape, flush-mount and sloped-top versions for application and mounting flexibility. Two-door landscape models provide full-width access and easy panel installation.

Specifications

- 14, 16 or 18 gauge steel (see table)
- Seams continuously welded and ground smooth
- Corner-formed doors
- Simple easy-to-remove and install hinge pins with built-in captivation clip
- High-torque threadless studs and fasteners on door
- Minimum-width body flange provides maximum door opening (210 degrees)
- External formed body flange
- Panel mounting studs fit optional CONCEPT panels and other accessories
- Mounting holes in back of body for optional external wall-mount brackets
- Hidden hinges
- Doors are interchangeable and easily removed by pulling clip-style hinge pins
- Seamless foam-in-place gasket
- Quarter-turn slotted latch(es)
- Door alignment device on doors wider than 30 in.
- Four hinges on 60-in.-high enclosures
- Grounding stud on body; bonding provision on door (except window-door models)
- Provisions for thermoplastic data pocket (right-hand hinged door on two-door models)
- Hardware kit with panel mounting nuts, panel grounding hardware and sealing washers
- Single-door enclosures have a three-point latch system on enclosures where A is equal to or greater than 42-in. with quarter-turn, slotted latch
- Window-door enclosures have a clear polycarbonate window flush with door surface
- Mounting frame on flush-mount enclosures extends completely around enclosure
- Two-door enclosures have a overlapping door design which provides full-width access
- Two door enclosures have a three-point latch system on right-hand hinged door furnished with flush slotted insert
- Illustrated instruction sheet

Finish

Two standard finishes are available: ANSI 61 gray or RAL 7035 textured light-gray polyester powder paint inside and out.

Accessories

Door Stop Kit
Handles
Lock Inserts
CONCEPT® Panels
Mounting-Bracket Kits

Modification and Customization

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

Bulletin: CW1

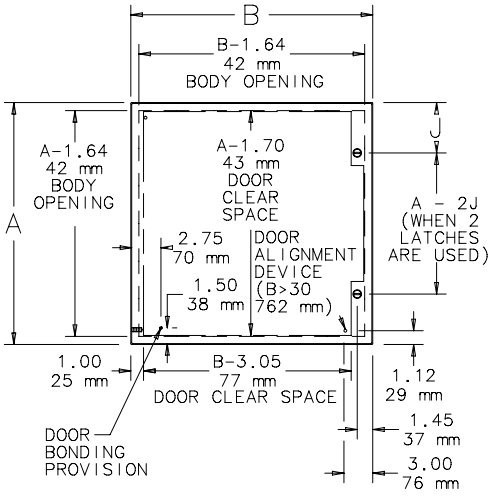
CONCEPT® Wall-Mount Enclosures

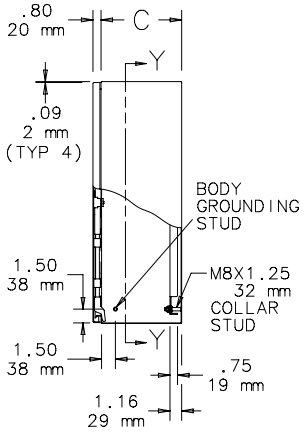
Catalog Number	AxBxC in./mm	Finish	Door Ga.	Body Ga.	CONCEPT Panel	Conductive CONCEPT Panel	Panel Size D x E in./mm	Mounting G x H in./mm	Latches qty.	Latches style	J in./mm
CSD24308LG	24.00 x 30.00 x 8.00 610 x 762 x 203	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127
CSD30208	30.00 x 20.00 x 8.00 762 x 508 x 203	ANSI 61 Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD30208LG	30.00 x 20.00 x 8.00 762 x 508 x 203	RAL 7035 Lt. Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD30248	30.00 x 24.00 x 8.00 762 x 610 x 203	ANSI 61 Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD30248LG	30.00 x 24.00 x 8.00 762 x 610 x 203	RAL 7035 Lt. Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD30308	30.00 x 30.00 x 8.00 762 x 762 x 203	ANSI 61 Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127
CSD30308LG	30.00 x 30.00 x 8.00 762 x 762 x 203	RAL 7035 Lt. Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127
CSD36248	36.00 x 24.00 x 8.00 914 x 610 x 203	ANSI 61 Gray	14	16	CP3624	CP3624G	34.20 x 22.20 869 x 564	34.50 x 22.50 876 x 572	2	Quarter-turn	5.00 127
CSD36248LG	36.00 x 24.00 x 8.00 914 x 610 x 203	RAL 7035 Lt. Gray	14	16	CP3624	CP3624G	34.20 x 22.20 869 x 564	34.50 x 22.50 876 x 572	2	Quarter-turn	5.00 127
CSD36308	36.00 x 30.00 x 8.00 914 x 762 x 203	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD36308LG	36.00 x 30.00 x 8.00 914 x 762 x 203	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD36368	36.00 x 36.00 x 8.00 914 x 914 x 203	ANSI 61 Gray	14	14	CP3636	CP3636G	34.20 x 34.20 869 x 869	34.50 x 34.50 876 x 876	2	Quarter-turn	5.00 127
CSD36368LG	36.00 x 36.00 x 8.00 914 x 914 x 203	RAL 7035 Lt. Gray	14	14	CP3636	CP3636G	34.20 x 34.20 869 x 869	34.50 x 34.50 876 x 876	2	Quarter-turn	5.00 127
CSD161210	16.00 x 12.00 x 10.00 406 x 305 x 254	ANSI 61 Gray	16	18	CP1612	CP1612G	14.20 x 10.20 361 x 259	14.50 x 10.50 368 x 267	1	Quarter-turn	8.00 203
CSD161210LG	16.00 x 12.00 x 10.00 406 x 305 x 254	ANSI 61 Gray	16	18	CP1612	CP1612G	14.20 x 10.20 361 x 259	14.50 x 10.50 368 x 267	1	Quarter-turn	8.00 203
CSD161610	16.00 x 16.00 x 10.00 406 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP1616	CP1616G	14.20 x 14.20 361 x 361	14.50 x 14.50 368 x 368	1	Quarter-turn	8.00 203
CSD161610LG	16.00 x 16.00 x 10.00 406 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP1616	CP1616G	14.20 x 14.20 361 x 361	14.50 x 14.50 368 x 368	1	Quarter-turn	8.00 203
CSD162010	16.00 x 20.00 x 10.00 406 x 508 x 254	ANSI 61 Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	14.50 x 18.50 368 x 470	1	Quarter-turn	8.00 203
CSD162010LG	16.00 x 20.00 x 10.00 406 x 508 x 254	RAL 7035 Lt. Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	14.50 x 18.50 368 x 470	1	Quarter-turn	8.00 203
CSD201610	20.00 x 16.00 x 10.00 508 x 406 x 254	ANSI 61 Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	18.50 x 14.50 470 x 368	1	Quarter-turn	10.00 254
CSD201610LG	20.00 x 16.00 x 10.00 508 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	18.50 x 14.50 470 x 368	1	Quarter-turn	10.00 254
CSD202010	20.00 x 20.00 x 10.00 508 x 508 x 254	ANSI 61 Gray	16	18	CP2020	CP2020G	18.20 x 18.20 462 x 462	18.50 x 18.50 470 x 470	1	Quarter-turn	10.00 254
CSD202010LG	20.00 x 20.00 x 10.00 508 x 508 x 254	RAL 7035 Lt. Gray	16	18	CP2020	CP2020G	18.20 x 18.20 462 x 462	18.50 x 18.50 470 x 470	1	Quarter-turn	10.00 254
CSD202410	20.00 x 24.00 x 10.00 508 x 610 x 254	ANSI 61 Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	18.50 x 22.50 470 x 572	1	Quarter-turn	10.00 254
CSD202410LG	20.00 x 24.00 x 10.00 508 x 610 x 254	RAL 7035 Lt. Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	18.50 x 22.50 470 x 572	1	Quarter-turn	10.00 254
CSD241610	24.00 x 16.00 x 10.00 610 x 406 x 254	ANSI 61 Gray	16	18	CP2416	CP2416G	22.20 x 14.20 564 x 361	22.50 x 14.50 572 x 368	1	Quarter-turn	12.00 305
CSD241610LG	24.00 x 16.00 x 10.00 610 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP2416	CP2416G	22.20 x 14.20 564 x 361	22.50 x 14.50 572 x 368	1	Quarter-turn	12.00 305
CSD242010	24.00 x 20.00 x 10.00 610 x 508 x 254	ANSI 61 Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	22.50 x 18.50 572 x 470	1	Quarter-turn	12.00 305
CSD242010LG	24.00 x 20.00 x 10.00 610 x 508 x 254	RAL 7035 Lt. Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	22.50 x 18.50 572 x 470	1	Quarter-turn	12.00 305
CSD242410	24.00 x 24.00 x 10.00 610 x 610 x 254	ANSI 61 Gray	14	16	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD242410LG	24.00 x 24.00 x 10.00 610 x 610 x 254	RAL 7035 Lt. Gray	14	16	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD243010	24.00 x 30.00 x 10.00 610 x 762 x 254	ANSI 61 Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127
CSD243010LG	24.00 x 30.00 x 10.00 610 x 762 x 254	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127
CSD302010	30.00 x 20.00 x 10.00 762 x 508 x 254	ANSI 61 Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD302010LG	30.00 x 20.00 x 10.00 762 x 508 x 254	RAL 7035 Lt. Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD302410	30.00 x 24.00 x 10.00 762 x 610 x 254	ANSI 61 Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD302410LG	30.00 x 24.00 x 10.00 762 x 610 x 254	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD303010	30.00 x 30.00 x 10.00 762 x 762 x 254	ANSI 61 Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127

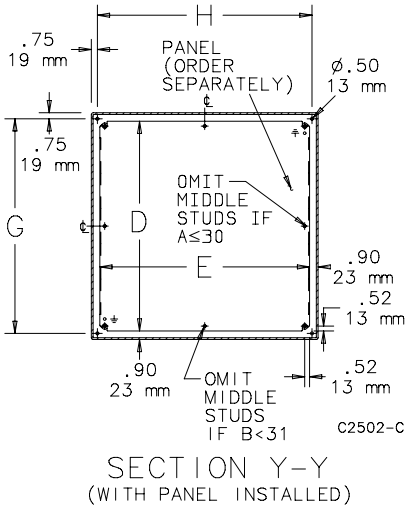
CONCEPT® Wall-Mount Enclosures

Catalog Number	AxBxC in./mm	Finish	Door Ga.	Body Ga.	CONCEPT Panel	Conductive CONCEPT Panel	Panel Size D x E in./mm	Mounting G x H in./mm	Latches qty.	Latches style	J in./mm
CSD603612LG	60.00 x 36.00 x 12.00 1524 x 914 x 305	RAL 7035 Lt. Gray	14	14	CP6036	CP6036G	58.20 x 34.20 1478 x 869	58.50 x 34.50 1486 x 876	1	3-point	30.00 762
CSD242416	24.00 x 24.00 x 16.00 610 x 610 x 406	ANSI 61 Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD242416LG	24.00 x 24.00 x 16.00 610 x 610 x 406	RAL 7035 Lt. Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD363016	36.00 x 30.00 x 16.00 914 x 762 x 406	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD363016LG	36.00 x 30.00 x 16.00 914 x 762 x 406	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD483616	48.00 x 36.00 x 16.00 1219 x 914 x 406	ANSI 61 Gray	14	14	CP4836	CP4836G	46.20 x 34.20 1173 x 869	46.50 x 34.50 1181 x 876	1	3-point	24.00 610
CSD483616LG	48.00 x 36.00 x 16.00 1219 x 914 x 406	RAL 7035 Lt. Gray	14	14	CP4836	CP4836G	46.20 x 34.20 1173 x 869	46.50 x 34.50 1181 x 876	1	3-point	24.00 610
CSD242420	24.00 x 24.00 x 20.00 610 x 610 x 508	ANSI 61 Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD242420LG	24.00 x 24.00 x 20.00 610 x 610 x 508	RAL 7035 Lt. Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD302420	30.00 x 24.00 x 20.00 762 x 610 x 508	ANSI 61 Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD302420LG	30.00 x 24.00 x 20.00 762 x 610 x 508	RAL 7035 Lt. Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD363020	36.00 x 30.00 x 20.00 914 x 762 x 508	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD363020LG	36.00 x 30.00 x 20.00 914 x 762 x 508	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127

Purchase panels separately.
Optional NEMA-size panels require conversion kit Catalog Number CCPM4.





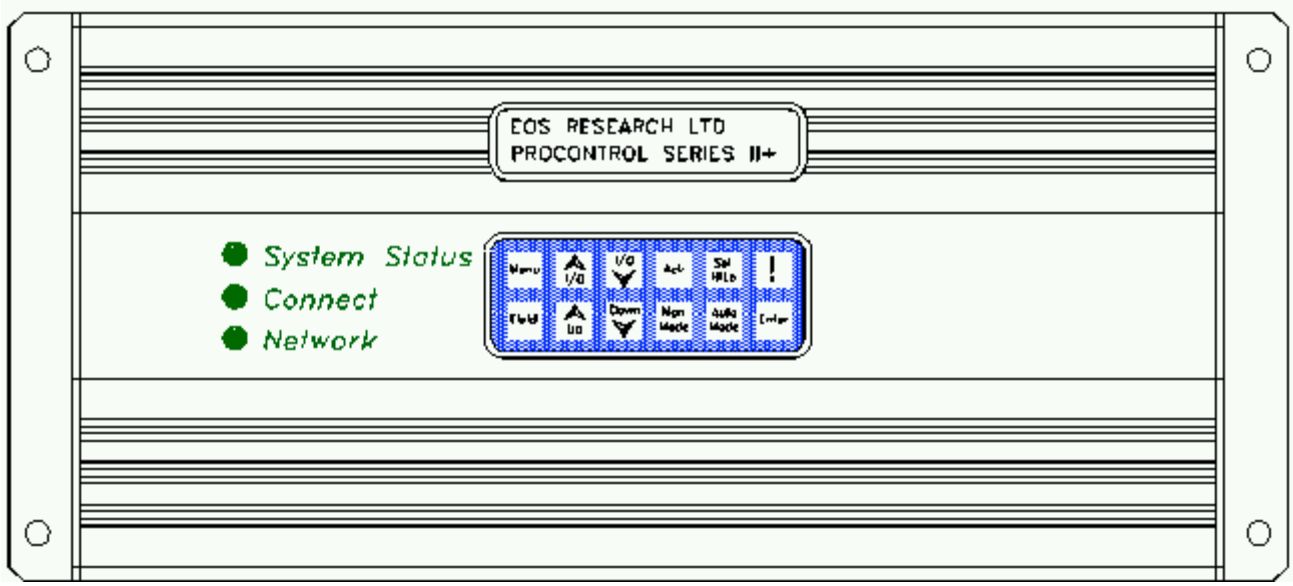


SECTION Y-Y
(WITH PANEL INSTALLED)

PROCONTROL SERIES 2*plus*

Type B

Product Specification



The next generation **Type B** ProControl features a capacity of up to 51 industrially-hardened inputs and outputs in a small and easy-to-use package. The **Series 2*plus*** contains everything you need for the core of your control/telemetry system, including the ability to connect directly to 120V inputs, and to drive motor starters, solenoids and other devices directly from built-in relay outputs. The **Type B** includes expanded datalogging and reporting capability, a built-in power supply for your instruments and transducers, as well as pluggable connectors for all I/O. It's a truly capable SCADA system for your operation.

	Model B1	Model B2
Inputs		
Discrete	Twelve (12) protected discrete inputs. Support for 4 flowmeters or pulse accumulators with rates to 200Hz.	Fourteen (14) protected discrete inputs. Eight (8) optically isolated inputs. Support for 6 flowmeters or pulse accumulators with rates to 200Hz.
Analog	Eight (8) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected and may also be used as discrete inputs	Ten (10) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected and may also be used as discrete inputs
Outputs		
Discrete	Fourteen (14) relay outputs rated at 1/2A, 120VAC	Fourteen (14) relay outputs rated at 1/2A, 120VAC
Analog		Five (5) 4-20ma outputs. PID loop control.

	Model B1	Model B2
Datalogging		
Discrete	2,000 points standard. 30,000 points optional. All logging occurs on change of state.	2,000 points standard. 30,000 points optional. All logging occurs on change of state.
Analog	16,000 points standard (2000 per channel). 40,000 points optional.	20,000 points standard (2000 per channel). 50,000 points optional.
Event	2,000 points standard. 10,000 points optional.	2,000 points standard. 10,000 points optional.
Totalizers	50 points per channel.	50 points per channel.
Communications		
Modem	ProView Software, PC to ProControl Interface - 9600 baud.	
FAX	Alarm and Status Reports. Group 3, Class 2 FAX reporting at 9600 baud	
Pager	TAP standard numeric and alphanumeric paging at 300 to 2400 baud.	
Local	Direct RS-232 Serial interface with automatic local/remote switching.	
e-mail	Via third-party service, alarm and status reports	
Network	Optional - Types B1 and B2 can be linked via RS-485 for distributed control or higher I/O counts	
User Interface		
LCD	2 x 20 character display	
Keypad	2 x 6 membrane keypad	
LEDs	LEDs: System Status, Communications Link, Networking	
Process Control		
System	Up to 32 regular system processes total with 8 startup and 8 shutdown processes. Processes run every 0.35 seconds.	
Alarms	Generate shutdowns, two FAX reports and/or two Pager messages.	
Loops	PID loop control with user control of setpoint, proportional, integral and differential gains and max change per calculation. Also open loop proportional algorithm.	
Power		
System	10VAC, 30VA, external transformer provided	
I/O Supply	24 VDC, 15V and 9V available for powering sensors/instruments.	
Environmental		
Dimensions	13.5” long x 6” wide x 3.5” high.	
Weight	6 lbs.	
Power Dissipation	25W	
Operating Temp.	-20C to +50C	
Humidity	95% R.H. non-condensing	

EOS research

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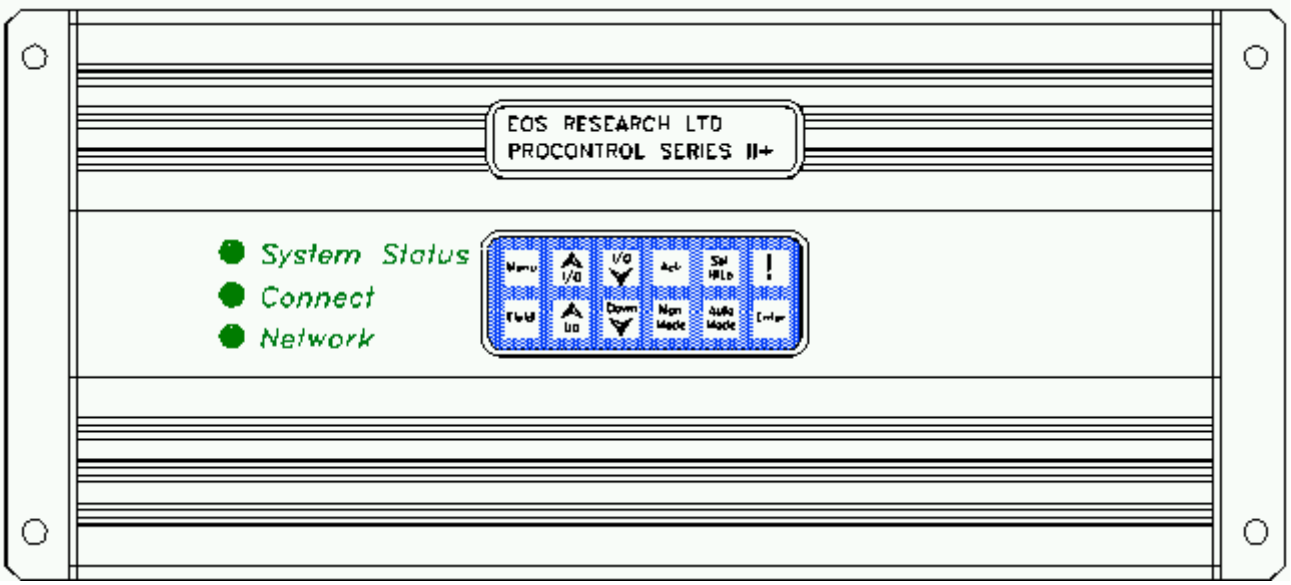
PROCONTROL

SERIES 2*plus* USER MANUAL



Version 2.X

LIMITED WARRANTY

EOS Research Ltd. (EOS) warrants its products to be free from defects in materials and workmanship for a period of one year from the date of purchase. Its obligation under this warranty is limited to repairing or replacing, at its sole option, any such defective products. This warranty includes parts and labor. This warranty does not apply to equipment which has been damaged by accident, negligence or misapplication or has been altered or modified in any way.

EXCEPT AS PROVIDED HEREIN, EOS RESEARCH LTD. MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MECHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties, therefore the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

IMPORTANT SAFETY PRECAUTIONS

Any complex hardware or software may be difficult to document, explain or understand. It is important to consider the consequences or unexpected or abnormal behavior which may be caused by a defect or human failure to comprehend. In order to protect people and property from damage, a thorough safety analysis should always be performed. When the consequences of a failure are serious, it is essential to protect life and property against such a failure with redundant backup systems or safety devices. It is agreed between the purchaser and EOS Research Ltd. that protection against and the consequences of any such failure are entirely the purchaser's responsibility.

This device is not approved for use in life support or medical systems.

As installed, this product may be part of a system which is required to meet various electrical, fire, safety or other codes and regulations. Compliance with these code is the purchaser's responsibility.

Specifications subject to change without notice.

EOS Research Ltd.
210 West Road
Portsmouth, NH 03801
603.431.2371
Fax: 603.431.2562

TABLE OF CONTENTS

Please see the ProView manual for operation of the remote access software which is supplied with the ProControl Series **2*plus***.

1.0 SYSTEM OVERVIEW

1.1 General

The *ProControl Series* **2**^{plus} is a small but powerful microprocessor based control/ telemonitoring system. By combining a control panel and remote monitor in one unit, the Series **2**^{plus} can act as a central supervisory and data management tool for any stand-alone operation. The *ProControl Series* **2**^{plus} can perform multiple tasks:

- **Stand-Alone Control:** The *ProControl Series* **2**^{plus} is a sophisticated programmable logic controller that will efficiently supervise and control your operation. It can interface with up to 70 electrical devices (float switches, pressure transducers, pH transmitters, flow meters, pumps, blowers, etc.), and execute numerous control functions simultaneously. Automatic shutdown routines can be programmed in to protect you operation during alarm conditions. It is extremely versatile in terms of the control algorithms it can execute.

- **Remote Control and Monitoring:** The *ProControl Series* **2**^{plus} gives you a window into your operation from any remote location, using the easy-to-use Windows-based software supplied with the system. You communicate with the ProControl over a modem link, which allows you to view all of your system's operating conditions, while also providing the same access to control functions that you would have if you were at the site (e.g., turning pumps on and off, adjusting alarm setpoints, etc.). No other telemonitoring device gives you the ProControl's level of remote control capability.

- **Reporting:** The *ProControl Series* **2**^{plus} will keep you informed. It will send you periodic fax status reports of your project operations on a schedule specified by you, and will alert you immediately either by fax or by numeric or alpha-numeric pager if an alarm condition warrants attention. No longer do you have to assume what's happening at your remote operation.....the ProControl will tell you exactly.

- **Datalogging:** The *ProControl Series* **2**^{plus} is your information manager. It is a powerful datalogger that automatically records all operating conditions in its battery-backed memory. You can access your logged data remotely at any time, and download it to your office computer for further processing. The datalogging capability is an invaluable tool for reporting purposes, troubleshooting, and trend graphing.

One or more of these features can be used in your installation; they are standard in every ProControl unit.

1.2 Key Concepts

The following are the building blocks of any Series **2*plus*** monitoring and control system.

Inputs and Outputs (I/O's)

No system can be effective in the real world without communication and one of the principal ways the ProControl communicates is by responding to information collected by sensors and by issuing "commands" to other electronic or electrical devices. Sensor information constitutes an *Input* while a "command" to another device constitutes an *Output*. The Series **2*plus*** works with all of the more important types of I/O devices in general use. Appendix A demonstrates how a variety of I/O devices are connected to the ProControl.

Digital Inputs

These inputs are designed to detect the closure of switch contacts such as those found on float switches or overpressure sensors. They can respond to any normally open or normally closed dry contact. The Series **2*plus*** provides its own wetting (supply) voltage of 5 volts DC for each digital input circuit. The Series **2*plus*** can respond to changes in state as fast as 4 Hz or 3 Hz (cycles per second) depending on the model purchased. Digital inputs are "debounced" for 125 or 150 milliseconds, respectively. This means that a switch or other input that changes state (becomes open or closed) must stay in that state for 125 or 150 milliseconds before the Series **2*plus*** will respond to the change.

Eight high-speed digital inputs can also be used for traditional digital (pulse-output) flow meters. These inputs can detect signal changes at up to a 200/500 Hz rate. All high-speed digital inputs are "debounced" for 1250/500 microseconds. The faster rate applies only to those systems containing the 18.432 MHz processor.

Analog Inputs

These inputs are compatible with sensors which send out a 4 - 20 milliamp (mA) signal. Most analog sensors are available with this type of signal, examples being pressure transducers, pH transmitters, and many flow meters. These inputs allow the operator to read the actual "value" of a parameter, such as pressure, instead of an on/off signal.

Digital Outputs

Digital outputs turn things like pumps, solenoid valves, and alarm lights on and off. The Series **2*plus*** digital outputs are relay outputs designed to switch small loads directly, such as motor starters, lamps, and solenoid valves.

Analog Outputs

Analog outputs are typically used in process control schemes where a controlled piece of equipment can accept a signal which is variable over a range. This output is expressed as a percentage (0 - 100%) and is used to control pump speeds, chemical dosing rates, etc., instead of conventional on/off operation. The equipment that the ProControl sends the analog output to must accept a 4 - 20 mA signal. Often, an analog output is used in conjunction with an analog input such as a pH transmitter to form a control scheme known as *feedback control*. In essence, the input and output will work together to maintain a user set input level. This concept is described further in the next section under *Analog Output Processes*.

Tagnames

Each input and output is given a descriptive *Tagname* by the user that uniquely identifies it to the system operator. For instance, a digital input could be called "TANKHI", an analog input could be called "AIRFLO" and a digital output could be called "PUMP_1". This tagname is used by the local LCD display, the FAX report and by the ProView software. The analog inputs are also given a *Units Tagname* which identifies the unit of measure associated with the input sensor. Each tagname can be up to six characters long and each units tagname can be up to three characters long ("PSI", for instance). The tagnames can include the uppercase letters A-Z, the numbers 0-9, a blank space, and the underscore (_) character.

1.3 Control Basics

The status of all inputs or outputs can easily be monitored both locally and remotely. What gives the Series **2*plus*** its real power, however, is the ability to automatically initiate actions based on the status of the inputs and your pre-programmed instructions (this is often called *Process Control*). These actions can include switching certain outputs, faxing back a report, sending an alphanumeric or numeric page, shutting down the entire system or sounding the local alarm. Process control functions are programmed into your ProControl by EOS Research or one of our technology partners according to your specifications.

Active State

Central to the use of control on the Series **2*plus*** is the concept of *Active State*. Each input on the ProControl receives certain signals from a sensor which constitute "normal" operation and other signals which constitute an exception to normal operation.

A digital input can monitor only two states, ON or OFF (alternatively, CLOSED or OPEN). The *Active State* would be the state in which the controller would respond to the digital input, and perform certain actions or generate an alarm. For example, if a high level float switch in a tank is tripped (turned ON) by rising fluid level, we can say that its *Active State* correlates to a situation in which the fluid level is high. The active state of the float switch could cause the Series **2*plus*** to trigger an alarm, turn off a pump, or initiate some other action. The Series **2*plus*** can be set up so that either ON or OFF is the active state.

An analog input sensor can take on many states (or values) between the minimum and maximum of its measurement range. The ProControl operator, however, can set two threshold values which divide the total input span into two functional regions. These threshold values are more commonly called the *Low Alarm Limit* and the *High Alarm Limit*, although on the Series **2*plus*** these thresholds are somewhat more flexible in use than those names imply. An analog input which has transcended either its Low Alarm Limit or High Alarm Limit is said to be in its active state.

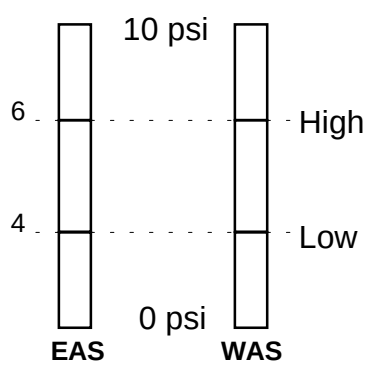


Figure 1. Active State

For instance, consider an analog input sensor which measures pressure from 0 to 10 PSI. The system operator could set the low limit to 4 PSI and the high limit to 6 PSI. In this case the *Active State* would usually be considered as the input state greater than 6 PSI or less than 4 PSI. This interpretation is called *Endpoint Active State* (EAS) on the Series **2*plus*** because the endpoints of the range are the areas which need to trigger action or generate alarms. The opposite interpretation is also possible and is called *Window Active State* (WAS). Any input values between 4 PSI and 6 PSI would trigger action or generate alarms.

If the ProControl has *Alarms Set*, when any input enters its active state, a local beeper will sound on the ProControl. The word *Alarm* here applies only to the sounding of a local beeper and is not associated with any process control. The active state condition is indicated on the LCD display and can be acknowledged by the operator. The beeper is silenced when it has been acknowledged or after 30 seconds have elapsed. The beeper only operates when the system is operating in Manual mode.

Startup Sequence

The *Startup Sequence* is a series of control algorithms or steps which run in succession and which are designed to place the system in its normal operating mode. It can be as simple as turning all the outputs on simultaneously, or as complex as a multi-stage delay with many conditions. Up to 8 or 16 individual startup steps can be declared depending on the model of the controller. The ProControl can be configured to automatically run this sequence when the unit is powered up.

Process Tasks

A *Process Task* is an ongoing control algorithm which runs continuously. Think of each process task as an IF-THEN statement, in which an action is initiated if a certain condition or combination of conditions exists. Some examples are:

- IF Tank Level Sensor 2 is on, THEN turn Pump 2 off
- IF Air Flow Rate < 10 cfm AND Reactor Temperature > 250^{O}, THEN open Bleed Valve 2

Up to 16 or 64 separate process tasks can be run simultaneously depending on the model of the controller. Process tasks can trigger FAX reports, pager alerts, and system shutdowns.

Shutdown Sequence

The *Shutdown Sequence* is a series of control steps which run in succession and which are designed to shut your system down in a manner which is best for the equipment or treatment processes involved. The shutdown sequence can be activated manually or automatically due to an alarm condition. Here is a typical shutdown sequence:

- Turn off Well Pumps 1 and 2
- Wait 5 minutes, then turn off Stripper Blower
- Open Bleed Valve 2
- When Oxidizer Temperature < 150^{O}, turn off SVE Blower

Automatic Operation

The use of the startup sequence, process tasks, and the shutdown sequence constitutes *Automatic Operation* of your system with the ProControl Series **2*plus*** (otherwise known as *Auto Mode*). The Series **2*plus*** will be placed into auto mode (automatically) when your system has been started up using the programmed startup sequence. If one condition of the programmed startup sequence is not met during the startup process, your system will be completely shut down by the ProControl as a safety measure. Once the startup sequence has been successfully completed, the ProControl begins running the process tasks continuously. **PROCESS TASKS WILL RUN ONLY WHEN IN AUTO MODE**. Please note that the audible beeper will not sound even if the ProControl has *Alarms Set* when it is in Auto Mode, since the process tasks will control these situations as the user has specified.

Manual Operation

You can override the Series **2**^{plus} programmed control functions by operating in *Manual Mode*. In manual mode, your process will respond only to operator input from the keypad of the ProControl, or to commands issued from the ProView software. **PLEASE NOTE THAT PROCESS TASKS AND THEIR ERROR-CHECKING MECHANISMS DO NOT RUN DURING MANUAL MODE!** Manual mode is useful when you wish to troubleshoot your system, but none of the system safeguards built into auto mode are available. You can place your operation into auto mode any time by issuing the command from the keypad.

Analog Output Processes

In some cases, you may want to use an analog output to control equipment that maintains an analog input at a certain constant level. For example, you may wish to automatically maintain a pH of 8.5 in a reaction tank by varying the dosing rate of a chemical feed pump. The pH you wish to maintain (8.5) is called the *SetPoint* of the analog output process. An analog input to the ProControl (in this case, a pH transmitter) is said to provide *feedback* to the unit, and combined with an analog output, constitute *feedback control*.

PID Loops

A reliable type of feedback control can be obtained through a *PID Loop*. PID stands for *Proportional-Integral-Derivative*, and is a commonly-used process control technique. We'll skip the details of the mathematics involved, but suffice it to say that a PID loop is the favored control technique for most analog output processes. With only a *Proportional* term applied in the equation, the analog output is controlled based on an error signal generated from the difference between the SetPoint and the actual analog input. The PID loop can also improve its performance as it continues to run if an *Integral* term is used and can respond to quick changes in the controlling analog input if a *Derivative* term is used. EOS Research will configure your PID loops for you and can provide further information if necessary.

Proportional Outputs

In some cases, it may be desirable to base an analog output signal on an analog input value. In this situation, no specific SetPoint is used because there is a direct relationship between the output and input values. For example, if you wanted to base the output of a metering pump on some flow rate, you might use a proportional output to relate the amount of chemical metered to the flow rate.

2.0 ON-SITE OPERATION

2.1 LCD Display

If your unit did not come with an LCD display, the following sections *do not* apply.

The 2 line x 20 character LCD display is used to display and control system operations. The display is divided into separate areas or fields, as outlined below.

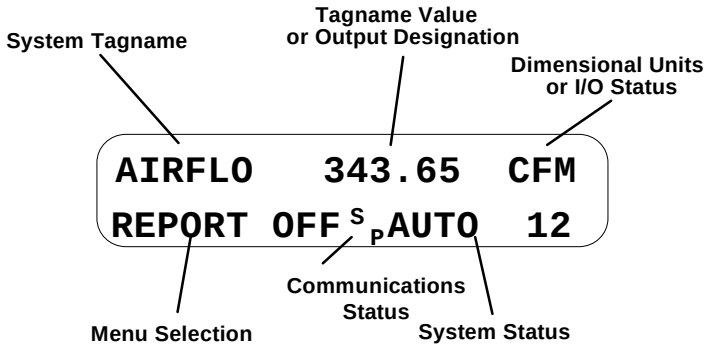


Figure 2. Display Fields

System Tagname This six-character field is used to identify the I/O point displayed. Descriptive names such as WELL1 or BLOWER are used.

Tagname Value For analog inputs, this field displays the value of the input, the high alarm limit, or the low alarm limit. For digital outputs, OUTPUT is displayed. For digital inputs, this field is unused. For analog outputs, this field displays the output percentage, the output level, or the associated input setpoint.

Dimensional Units or I/O Status For analog inputs, this three-character field displays the dimensional units associated with the input sensor, such as GPM or PSI. For digital inputs and outputs, this field displays either ON or OFF. For analog outputs, this field abbreviates percent with PCT. In the case of digital outputs, if the particular output displayed has been designated a lamp output (*see ProView manual*), and a lamp test is currently running, an asterisk (*) will appear before ON or OFF to indicate the lamp is illuminated despite the indicated output status (the output will return to this indicated status once the lamp test has been completed).

Menu Selection This field displays the current menu selection.

Communications Status This field displays one of five different descriptors which indicate any of several special functions of the ProControl. If no communications action is being taken, ">" will appear. Communications messages include: **SP** (Sending Page) - indicates that the unit is attempting to send either an alphanumeric or numeric page; **EF** (Encoding Fax) - indicates that the unit is presently encoding a facsimile report as a result of a request by either the operator or the unit itself; **SF** (Sending Fax) - indicates that the unit is attempting to send a fax report; and **DC** (Data Communications) - indicates that the unit is presently interfaced with ProView.

System Status This area displays the current system status: AUTO, MANUAL, START, or SHUTD and an associated process task number indicating the last successfully completed Auto process, current Startup process, or current Shutdown process.

2.2 Keypad

The Series **2**^{plus} keypad contains 12 buttons which are used along with the LCD Display to control the operations of the system.

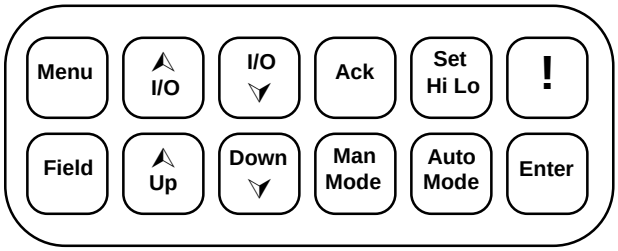
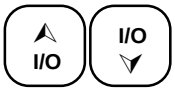


Figure 3. Series 2^{plus} Keypad

This key is used to scroll through a series of options which are displayed on the LCD screen, and which allow the user to configure various aspects of system behavior.



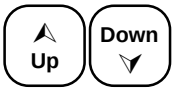
These keys are used to display information about particular I/O points on the LCD Screen. The keys allow the user to scroll through all of the system I/O points either forward or backward.

The Acknowledge key is used to silence the audible beeper or to acknowledge a memo sent from a remote ProView user.

The Set Hi Lo key allows the user to change the high and low alarm limits for analog inputs or to toggle the display in the I/O Summary.

The Emergency Shutdown key is used to turn off all outputs and return the system to manual mode. The programmed shutdown sequence is <u>not</u> executed using this key.

The Field key is used to select a character position to be edited. It is used in conjunction with any direct alphanumeric entry.



These keys are used to toggle system variables from one state to the next or to scroll through possible character entries when used in conjunction with the Field key.

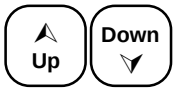
This key is used to place the system in manual mode.

This key is used to place the system in auto mode.

The Enter key is used to initiate certain actions selected by other keys or to confirm alphanumeric editing done using other keys.

2.3 Password

When the system is first turned on the password screen is displayed and the user is prompted to enter the password to gain access to the system. "EOS" is the default password. The password on the Series **2**^{plus} was designed as a *low-level* security feature. It is not sufficient in and of itself to withstand a determined effort at system entry. The ProControl unit can be configured to bypass the password screen when the unit is powered up.




```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

Use the Up and Down keys to change the character displayed above the cursor.


```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

The Field key is used to move the cursor to the next character to be edited.


```
CUSTOMER ID TAGNAME
ENTER PASSWORD: EOS
```

The enter key submits the password for approval.

If the password was entered correctly, the following screen will be displayed for about a second before the operations screen is displayed:

```
Password Accepted
VER 2.XXX   : 1
```

ROM Version # — User Setup Version #

Otherwise, the following message will be displayed for a second and the user will be returned to the password menu:

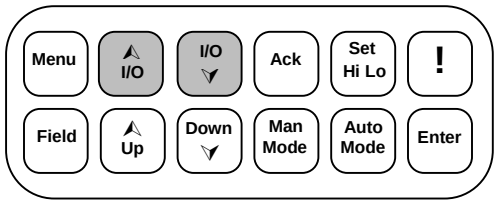
```
Incorrect Password
```

2.4 Operations Screen

After the password has been entered correctly, the operations screen is displayed. The operations screen allows the user to set system parameters and to review the status of all system inputs and outputs.

```
WELL1              OFF
ALARMS SET >MANUAL
```

2.5 I/O Keys



Pressing the I/O Up or I/O Down keys will scroll through the operational I/O points in the system. Data relevant to a particular I/O point will be displayed to right of the point's Tagname.

I/O

```
WELL2                ON
ALARMS SET >MANUAL
```

Forward scroll through I/O points

I/O

```
WELL3                OFF
ALARMS SET >MANUAL
```

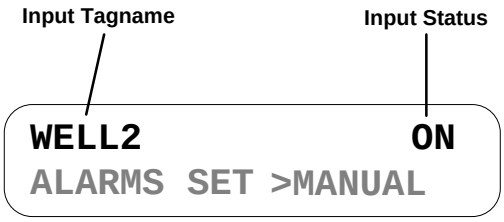
Forward scroll through I/O points

I/O

```
WELL2                ON
ALARMS SET >MANUAL
```

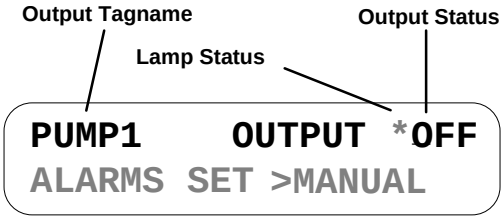
Backward scroll through I/O points

2.6 Digital Input Menu



A digital input displayed in the operations screen will be displayed as shown. When the input is in its Active State "ON" will be displayed in the Input Status area. Otherwise, "OFF" will be displayed.

2.7 Digital Output Menu



A digital output displayed in the operations screen will appear as shown. When the output has been turned on, "ON" will be displayed in the Output Status area. Otherwise, "OFF" will be displayed. The cursor is displayed under the first character in the status field to indicate that it can be changed. The Lamp Status character (*) will be shown for a lamp output if a *lamp test* is running regardless of the output's true state.

Up Down

```
PUMP1     OUTPUT  ON
ALARMS SET >MANUAL
```

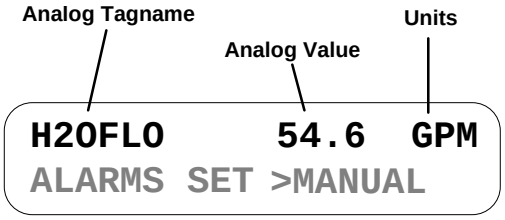
Pressing the Up or Down key will toggle the digital output state and turn the corresponding relay OFF or ON.

Field

```
PUMP1     OUTPUT  ON
ALARMS SET >MANUAL
```

Pressing the Field key will move the cursor to the Menu selection field.

2.8 Analog Input Menu



An analog input displayed in the operations screen will be displayed as shown to the left. The value of the analog input will be shown along with the dimensional units. In the case of a pulse accumulator (totalizer only), you will see only TOT where units is normally displayed.

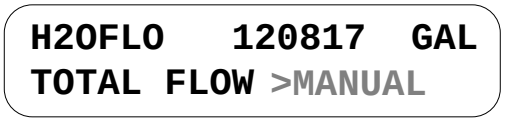
Set Hi Lo

Use the Set Hi Lo key to set the low alarm limit.

Set Hi Lo

Press the Set Hi Lo key again to set the high alarm limit.

Set Hi Lo



Press the Set Hi Lo key again to see the total flow on a flow type input, and once more to return.

Up Down

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

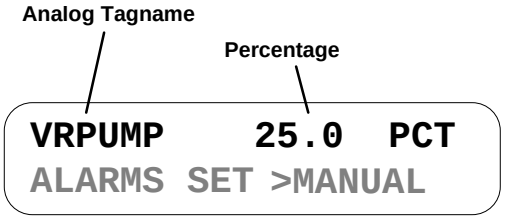
Field

The Field key is used to move to the next character to be edited.

Enter

To save the low alarm limit changes, press the enter key.

2.9 Analog Output Menu



An analog output displayed in the operations screen will be displayed as shown to the left. The percentage of full scale output will be displayed as well.

Set Hi Lo

The Set Hi Lo key can be used to set the output percentage.

Set Hi Lo

Press the Set Hi Lo key again to declare the SetPoint of an associated analog input. The SetPoint is used only if a PID control loop is in use as an analog output process.

Pressing Set Hi Lo again returns to the original menu.

Up Down

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

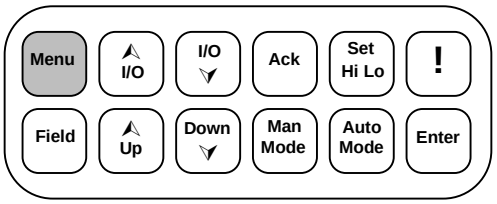
Field

The Field key is used to move to the next character to be edited.

Enter

To save the output level changes, press the enter key.

2.10 Menu Key



When pressed, the Menu key will scroll through a series of items which allow the user to configure various aspects of system behavior. A description of these items appear in a 10 character field at the bottom left of the display. Either the Up and Down keys or the Enter key is used to change the item.

ALARMS Use the Up and Down keys to enable or disable Alarms.

Menu

```
TAGNAM          DIM
ALARMS OFF >MANUAL
```

```
TAGNAM          DIM
ALARMS SET >MANUAL
```

Up Down

REPORT Use the Up and Down keys to enable or disable the unit's reporting capabilities (fax or page).

Menu

```
TAGNAM          DIM
REPORT OFF >MANUAL
```

```
TAGNAM          DIM
REPORT ON  >MANUAL
```

Up Down

FAX NOW Use the Enter key to send a FAX report immediately.

Menu

```
TAGNAM          DIM
FAX NOW    >MANUAL
```

Enter

STARTUP Use the Enter key to run the Startup Sequence.

Menu

```
TAGNAM          DIM
STARTUP    >MANUAL
```

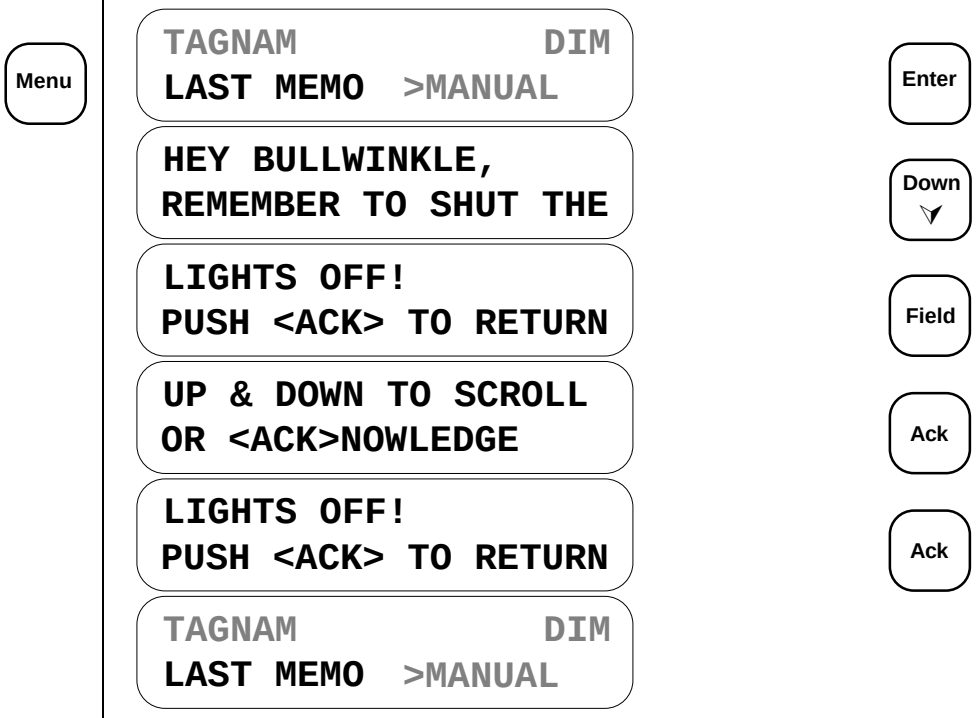
Enter

SHUTDOWN Use the Enter key to run the Shutdown Sequence.

LAST SHUTDOWN This display item shows what input or output caused the last shutdown.

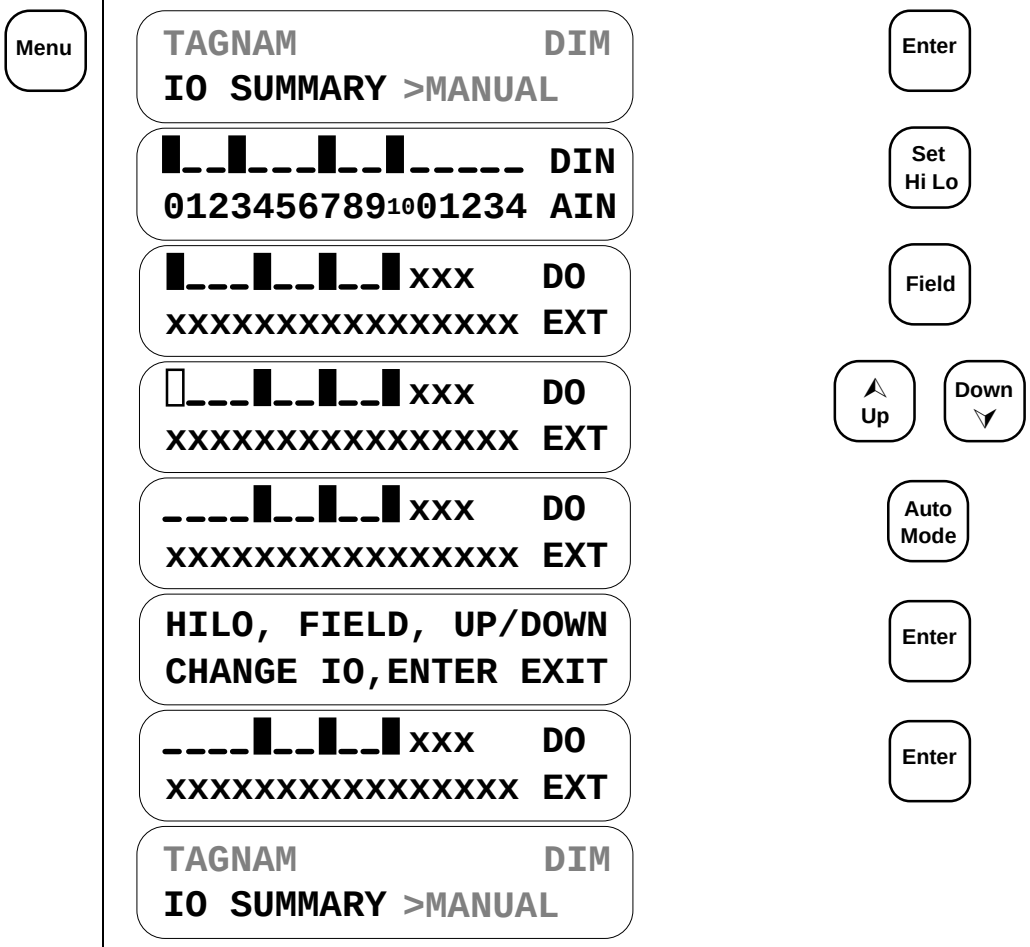
LOG OFF Use the Enter key to Log Off the system and return to the password menu.

LAST MEMO Use the Enter key to see the last memo sent from the remote ProView user. Up and Down are used to scroll through the message, and Ack is used to return to the ProControl menus. If you hit any other key you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be acknowledged before the 3-second period by pressing either the Ack or Enter keys.

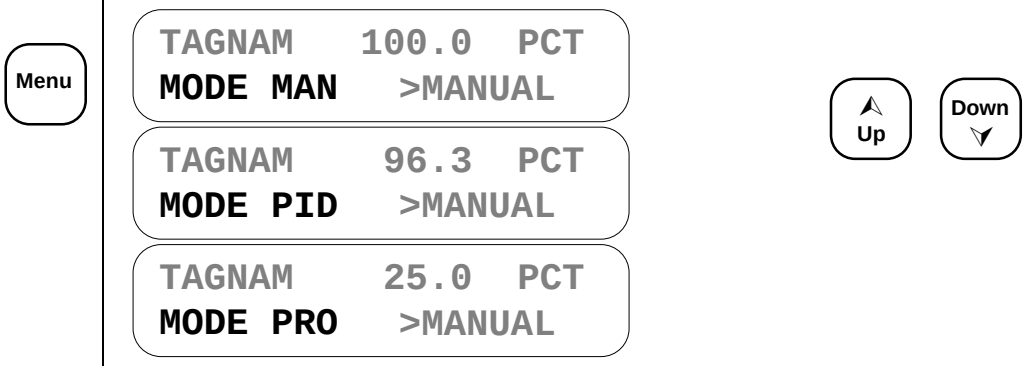


IO SUMMARY

Use the Enter key to enter the I/O summary. The analog input values 0-10 represent a percentage of full scale (i.e. 0 ≅ 4 mA, 5 ≅ 12 mA). Set HiLo is used to toggle between input/output summaries. An underscore represents an open input or an unswitched output. A block indicates a closed input or a switched output. An **x** or **X** is displayed when an output is not enabled and is unswitched or switched, respectively. An asterisk (*****) will be displayed if an output is declared as a lamp and a lamp test is currently being performed. The Field key can be used to move the blinking cursor through the outputs. The Up/Down keys can be used to toggle the state of the output whose position is covered by the blinking cursor. The Enter key will return the ProControl back to its standard menus. If you press any other keys you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be interrupted before the 3-second period by pressing the Enter key.

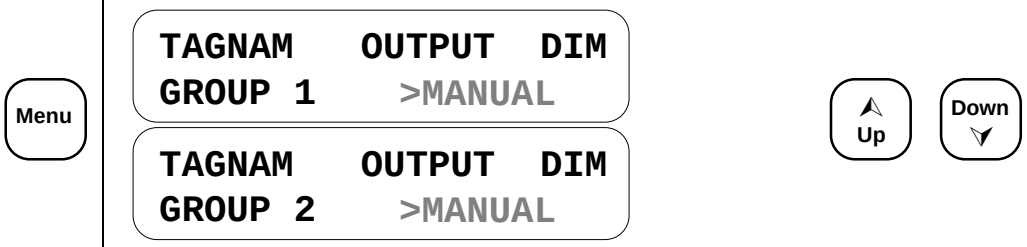


MODES Use the Up and Down keys to toggle an Analog Output from Manual control to PID control or Proportional control, depending on which analog output process is being used. This selection will only appear if an analog output tagname is displayed and the analog output is part of an analog output process.



GROUP The ProControl allows outputs to be assigned to different *Groups* to allow greater process control flexibility. In some cases, you may wish to be able to specify alternate process tasks for a given output. For instance, you can have the operation of a pump be controlled by a series of level switches in a tank, or alternately, the pump can be run on a timed cycle. By selecting the appropriate process Group, you can change the control strategy for that piece of equipment. EOS Research will configure the groups for you according to your specifications

Use the Up and Down keys to select a Group for the displayed output. This menu item is displayed only for outputs that have been configured by EOS to have alternate process Groups.



2.11 LED Indicators

Your ProControl unit has three status LEDs to the left of the keypad, which are used to indicate the following:

System Status:	Normally ON when unit is powered. One blink - The system has internally reset. Two blinks - An internal error has occurred.
Connect:	ON if user is remotely or locally connected. ON if system is faxing or paging. Slow blink - last fax or page failed, press ACK to clear. Fast blink - local connect cable inadvertantly left plugged in, press ACK to clear.
Network:	Rapid blinking indicates an active network connection.

3.0 REPORTING FEATURES

3.1 Fax Report

The ProControl unit will keep you informed of your system's operations with facsimile status reports. With the supplied ProView software you can configure the unit to send fax reports to up to two different numbers. You can also have these reports sent on a daily basis, at regular intervals during the day, or when triggered by specific process tasks. You can send one at any time by using the *Fax Now* option either from the menu on the ProControl's display, or through the ProView software.

The fax report you receive will contain several fields, each denoted by a shadow box. The number of fields will depend on the configuration of your system. For instance, you would not see a field indicating *Analog Outputs* if your system does not contain any of these.

The fields as you will see them are shown below. All information enclosed in brackets is variable and depends on your particular system configuration.


```
<FAX RECIPIENT>
```

will indicate the intended fax recipient's name.


```
THE <SYSTEM NAME>          SYSTEM IN <SITE LOCATION>    AT <TIME> ON <DATE>
SETUP VERSION X       :    ROM VERSION 2.x          :   MODEL B1
```

will indicate the name and location of your system, the date and time at which the fax report was initiated, your current ProView setup version, and the current on-board software version 2.X.


```
<MODE><PXX>  :   LAST SHUTDOWN AT <TIME> ON <DATE> BY <SHUTDOWN CAUSE>
                 FAX REPORT INITIATED BY <FAX CAUSE>
```

will indicate the current <MODE> of the controller and associated process. For example, if the controller is running the startup or shutdown sequence, you would see either START or SHUTD followed by the current algorithm. Similarly, in auto mode, you would see AUTO followed by the last successfully completed process task.

The LAST SHUTDOWN indicates when the system last initiated the shutdown sequence and what caused it to happen. For example, if the shutdown sequence were initiated by a key press, the cause you would see would be KEYPAD. Similarly, if the shutdown sequence were caused by a process task such as a high pressure sensor whose tagname was HIPRES, you would see HIPRES as the <SHUTDOWN CAUSE>. If multiple inputs or outputs caused the shutdown (i.e. a process task was dependent on more than one input being in the active state and/or multiple outputs being ON), the most recent one which changed will appear as the cause.

Similarly, the FAX REPORT INITIATED BY line will indicate the tagname of the I/O point which caused the fax to be sent, provided there was only one I/O point responsible. If multiple I/O points were responsible, the process itself will be indicated. Consider, for example, a process task where a shutdown was caused by HIPRES and BLOWER, and a fax was also generated. The <FAX CAUSE> would be PROCESS XX, where *XX* is the number from 1 - 64 of this process task. In the case where *Fax Now* was selected from the menu option on the LCD, the <FAX CAUSE> would be KEYPAD. The <FAX CAUSE> from a ProView generated *Fax Now* command would be REMOTE. This line will <u>not</u> appear on daily or interval scheduled fax reports.

Discrete Inputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital inputs in four columns. Inputs which are in the active state will appear as ON and those which are in their normal state will appear as OFF.

Discrete Outputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital outputs in four columns.

Analog Inputs:

```
<TAGNAME> is <VALUE> <DIM> LIMITS are L: <LO-LIM> <DIM> H: <HI-LIM> <DIM>
<TAGNAME> is <VALUE> <DIM> TOTAL FLOW is <FLOW>   <DIM>
<TAGNAME>                  TOTAL FLOW is <FLOW>   <DIM>
...
```

will indicate the current value, dimensional units, low alarm limit, and high alarm limit for all analog inputs which are not flow-type inputs. The precision of the values displayed can be selected through ProView. Any flow-type analog input which is responsible for maintaining a total flow will display that flow in place of the alarm limits. Any pulse-type digital input used for a digital flow meter will appear here since the information being obtained by that type of flow meter is analog in nature. In addition, pulse accumulators (volume totalizers) will appear here.

Analog Outputs:

```
<TAGNAME>   <PCT>  PCT  <MODE>      <TAGNAME>   <PCT>  PCT  <MODE>
...
```

will indicate the output percentage and mode of operation of all analog outputs. The precision is fixed to one decimal place and will range from 0.0 to 100.0, expressed as a percentage. The <MODE> of operation will be PID if the analog output is currently being used in a PID loop, or PRO if the analog output is currently being used in a Proportional scheme, otherwise it will be MAN indicating that the analog output is under manual control.

The next two pages contain examples of scheduled and alarm fax reports.

3.2 Page Alerts

The ProControl unit can alert you to important conditions at your site via a page alert. Any system that is not in manual mode, that is, executing process tasks or the startup or shutdown sequences, can send a message up to eighty characters in length to an alphanumeric pager or up to nineteen digits in length to a numeric pager. If you are out of the office and away from a fax machine, you will still be alerted to any trouble at your site. With ProView you can select up to two pager numbers to be called. Each process task or startup/shutdown algorithm is capable of sending a message to either or both of these pagers. The pager messages are configured by EOS Research according to your specifications.

An example message for an alphanumeric pager would be:

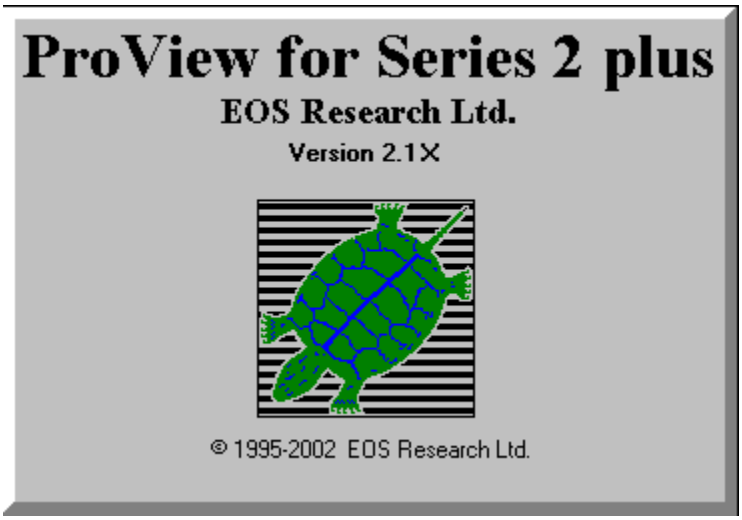
```
ANYTOWN SITE
High water level EQ Tank
System shut down!
Call Fred to fix: 555-6789
```

APPENDIX A

ProView™

for ProControl Series 2plus

USER'S GUIDE



Version 2.1x

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND INSTALLATION

This chapter provides a brief introduction to ProView features, system requirements for running the program, and instructions for installing it.

Introduction to PROVIEW

ProView is a powerful but straightforward software package used in conjunction with the ProControl system to provide integrated stand-alone control and remote telemetry for your operation. ProView versions 2.1 and higher can serve as an on-site or remote human-machine interface (HMI) for both the Series II and Series **2**^{plus} ProControls. With ProView you can:

- Monitor system sensors
- Control equipment that are outputs on the ProControl
- Change the way the system operates
- View and change system setpoints, alarm levels, etc.
- Extract datalogged system information

In short, ProView can be used to remotely gain the same level of control over your operation as if you were at the site. Although many system parameters can be set with the ProControl's display and keypad (if included), ProView allows a more comprehensive, easy-to-access view into system operations.

In order for ProView to function, your PC must be connected to the ProControl unit. It can be connected in one of two ways. The first way is with a cable (provided with your ProControl system) that connects your PC's serial port with the ProControl unit. This method of connection is most often used at the system site using a laptop PC. The second method is via dial-up modem from your office or from anywhere that a connection to the telephone system can be established.

You should be familiar with the operation of the ProControl unit and have read the ProControl User Manual before using ProView.

System Requirements

COMPUTER: You will need an PC or compatible with a 486 (minimum) or greater microprocessor with 4MB RAM and Microsoft Windows version 3.1 or later. A minimum of 4MB of Hard Disk space needs to be available. A mouse or similar pointing device is also required.

Several functions in ProView require the use of the right mouse button. Make sure the right mouse button is not assigned to some other function such as double-click. See your mouse driver software for details.

MODEM: You need a Hayes compatible (AT) Modem that supports a data rate of 9600 baud (this means almost any commonly-available modem). The modem can be external or internal. It must be connected to COM Port 1, 2, 3 or 4.

*Some PCs are now being supplied with so-called "WinModems", which are not true hardware modems and will **not** work with ProView for communication with a ProControl system. A true Hayes-compatible hardware modem is an inexpensive investment in reliable communications.*

How to Install ProView from Windows Explorer

1. Close **all** open programs before beginning the ProView installation procedure. Close any task bars for software packages like Microsoft Office that may be lurking at the edge of your screen. *If a ProView installation fails, it is almost always the result of having other programs open at the time of installation. Certain programs, when included in the Windows Startup group, may cause the ProView installation to fail, and must be removed temporarily from the Startup group prior to installing ProView.*

2. Open the Windows Explorer and insert Disk 1 of the ProView diskettes in your **a:** drive.

3. Click on the **a:** drive, then double-click on the **setup.exe** file *Or* click on the Windows **Start** button, choose **Run…** and type in **a:setup.exe**.

4. The ProView installation program will begin and will guide you through the rest of the installation process.

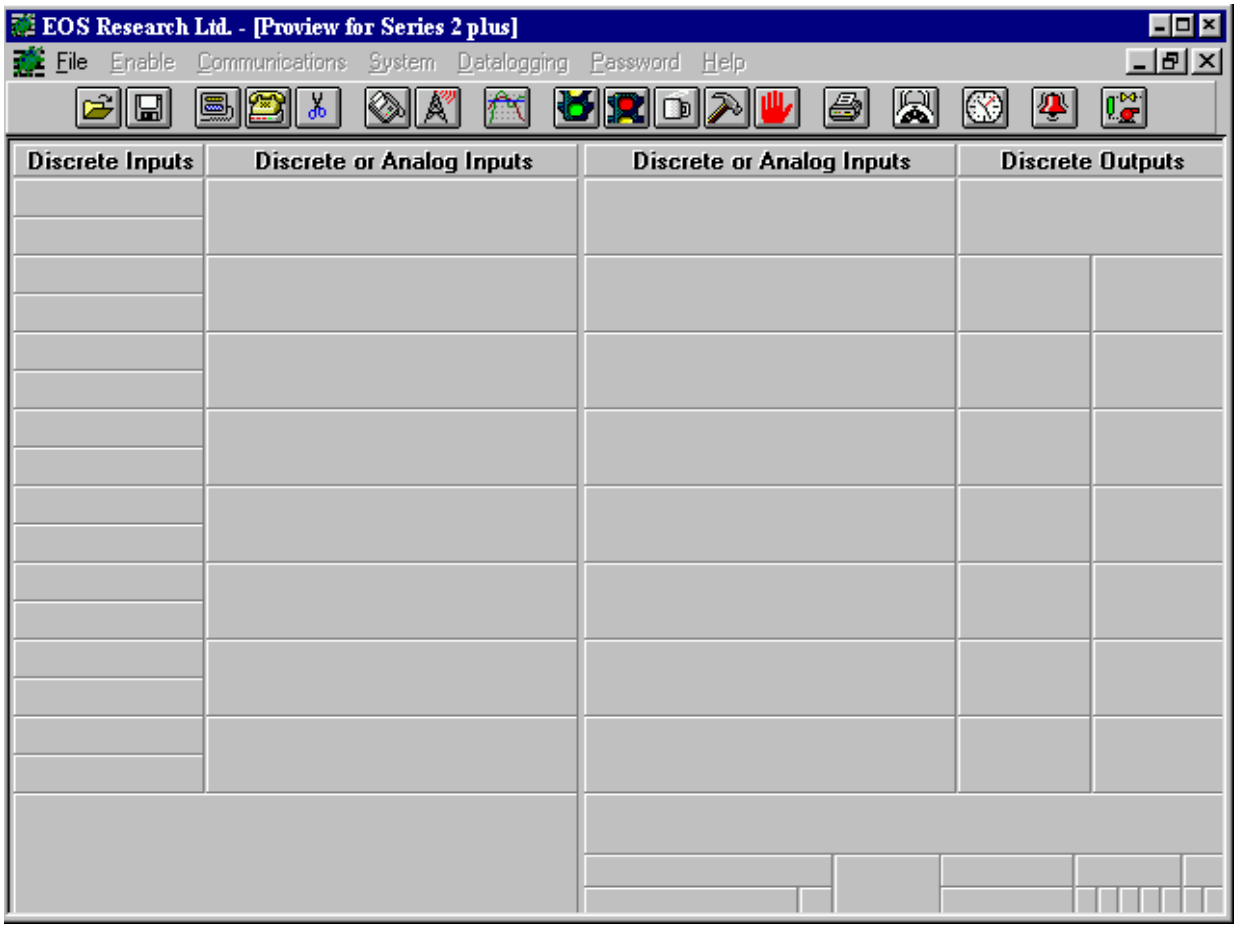
After the appropriate files from Disk #1 have been installed, you will be asked to insert Disk #2, and then Disk #3. ProView uses a default folder of C:\ProView for the program installation, but you can specify a different one if you'd like.

You will also be provided with configuration files (or ***site files***) for every ProControl unit you need to access. At a minimum, you will have a configuration file with a ".pvs" extension and one with a ".not" extension (these are normally supplied pre-configured for you on a separate diskette). Using Windows Explorer, copy these site files to the folder in which your ProView software was installed. Depending on your site configuration, you may have other files included along with the two standard site files. The files will have the extensions of .pid or .pvg. You must copy these files to the ProView folder as well.

When the installation is complete, you will see the ProView program group and icon. We recommend making a shortcut to ProView that you can then move to your main Windows screen. *Right*-click on the ProView turtle icon in the program group, then click on **Create Shortcut**. Drag your new shortcut to a prominent position on your Windows main screen.

Running ProView

After installing ProView as described above, double-click on the ProView icon. After an introduction screen, you will see the ProView Main screen.



The main screen contains a series of pull-down menus and a ***Toolbar*** that provides shortcut buttons for commonly-used commands. Placing the cursor over a Toolbar button and leaving it there for a short while produces a "balloon". A ***balloon*** is a small pop-up message that describes the action to be taken if the Toolbar button is "pushed".

Right now, since no site file has been loaded, the main screen is blank, and the toolbar is disabled. All menus except the **File** menu have been "ghosted". A selection is ghosted when the operation represented by the selection is unavailable.

Below the Toolbar are four columns of information arranged in a standard format. These columns are filled in based on the system setup and the current system status. The **Discrete Inputs** column contains information about the switches or sensors connected to inputs 1 through 16 on the ProControl unit. The two columns labeled **Discrete or Analog Inputs** contain information about the 4-20 milliamp (mA) sensors or discrete switches connected to ProControl inputs 17 through 32 (examples include analog instruments such as flow meters or pressure transducers and digital devices such as float switches). The **Analog Outputs** area

resides behind the third column, and is accessed by clicking on the **Discrete or Analog Inputs** label at the top of the column. The **Discrete Outputs** column contains information regarding the devices connected to the ProControl's output relays. The **Extended Outputs** area, behind the **Discrete Outputs** column, contains information regarding any outputs configured beyond the first 14, if available on the ProControl model you are using.

At the bottom of the screen are a series of information boxes. These show the status of certain important system parameters when ProView is connected to a ProControl unit.

A Word About Changing Settings

ProView has been designed to make it easy to view and change the settings that govern the way your system works. However, ProView must always be *connected* to the ProControl unit in order for these changes to take effect. It is important to remember that ProView itself is only a window into the operation of the ProControl unit. It does not provide any control functionality on its own. Chapter 3 discusses how to connect to the ProControl.

When a setting is changed in ProView (e.g., alarm level, password, datalog interval), a "?" is temporarily appended to the description or title of the information to indicate that the new value has been sent to the ProControl. When the "?" disappears, the data has been received by the ProControl and confirmed by ProView.

While many of the controls that change information in ProView are represented graphically, much of the information is displayed in text form. To edit text-based information, click on it and make your changes as you would in any Windows application. When you click on the text, it is highlighted to show that it has the current focus.

*After completing your text editing the changes must be saved by first pressing the **ENTER** key while the cursor is still within the text box being edited, and then clicking on the "OK" button for the current form.*

CHAPTER 2: GETTING STARTED

This chapter explains how to open a ProView site file, describes what's in all those little boxes on the screen, and shows you how to print the system configuration to a file.

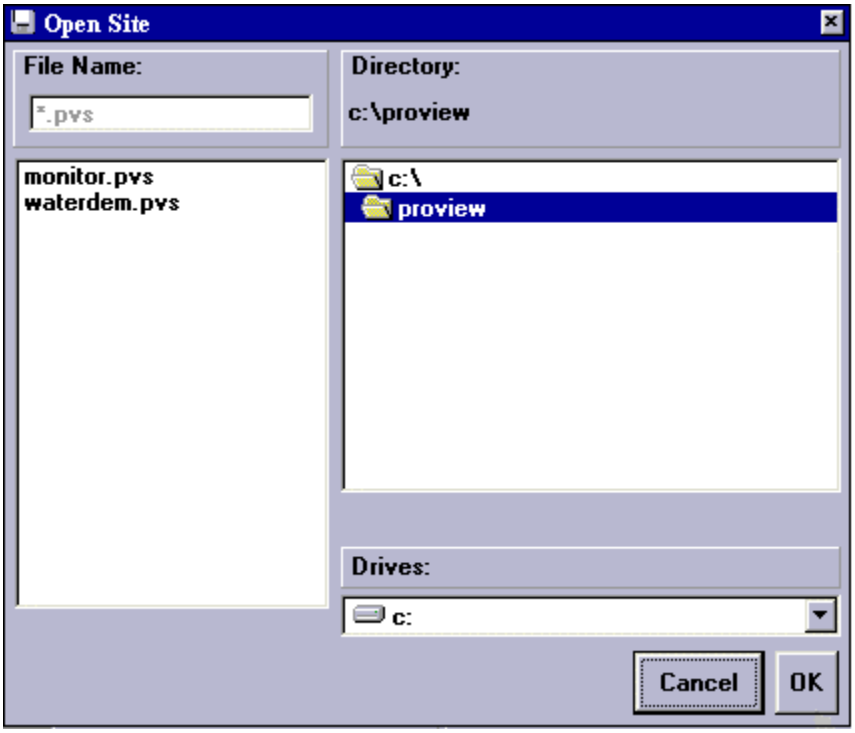
Opening a Site File

Every ProControl unit has a ***site file*** that tells the unit which inputs or outputs are enabled, what their descriptive ***Tagnames*** are and how they should respond to changes in input status. This same file is used by ProView to provide a window into what is going on within the remote ProControl unit and, by extension, with the site operation. To open a site file:

1. Click on the **File** menu, then click **Open Site**. You will see the **Open Site** dialog box. You can also use the ALT-Key combination represented by the first underlined character in the menu name. In this case, use ALT-F.

   *For opening subsequent site files, you can use the **Open Site** Toolbar button at the top of the main screen. ProView will also list the last four site files that you accessed at the bottom of the **File** menu. If you wish to open one of these, just click on the appropriate file name.*



2. In the **Drives** area of the dialog box click once on the down arrow to pull down the Drives list, then click on the drive that contains the file you wish to open.

3. In the **Directory** area of the dialog box, click on the folder that contains the file. To move "up" in the directory tree, double-click on the level to which you want to move. To move "down" in the directory structure, double-click on the appropriate folder.

4. In the **File** area you will see all files in the selected drive and folder that have the extension **.pvs** or **.pvg**. Only files with these extensions can be opened. Select the file you wish to open by clicking on the file name in the file list box, then click the **OK** button to open the selected file.

The title bar of the main screen will change to include the file name and version number. The file name and version number are enclosed within brackets.

5. In the **Security** dialog box, enter the password for your site file, and click on the **OK** button or hit Enter.

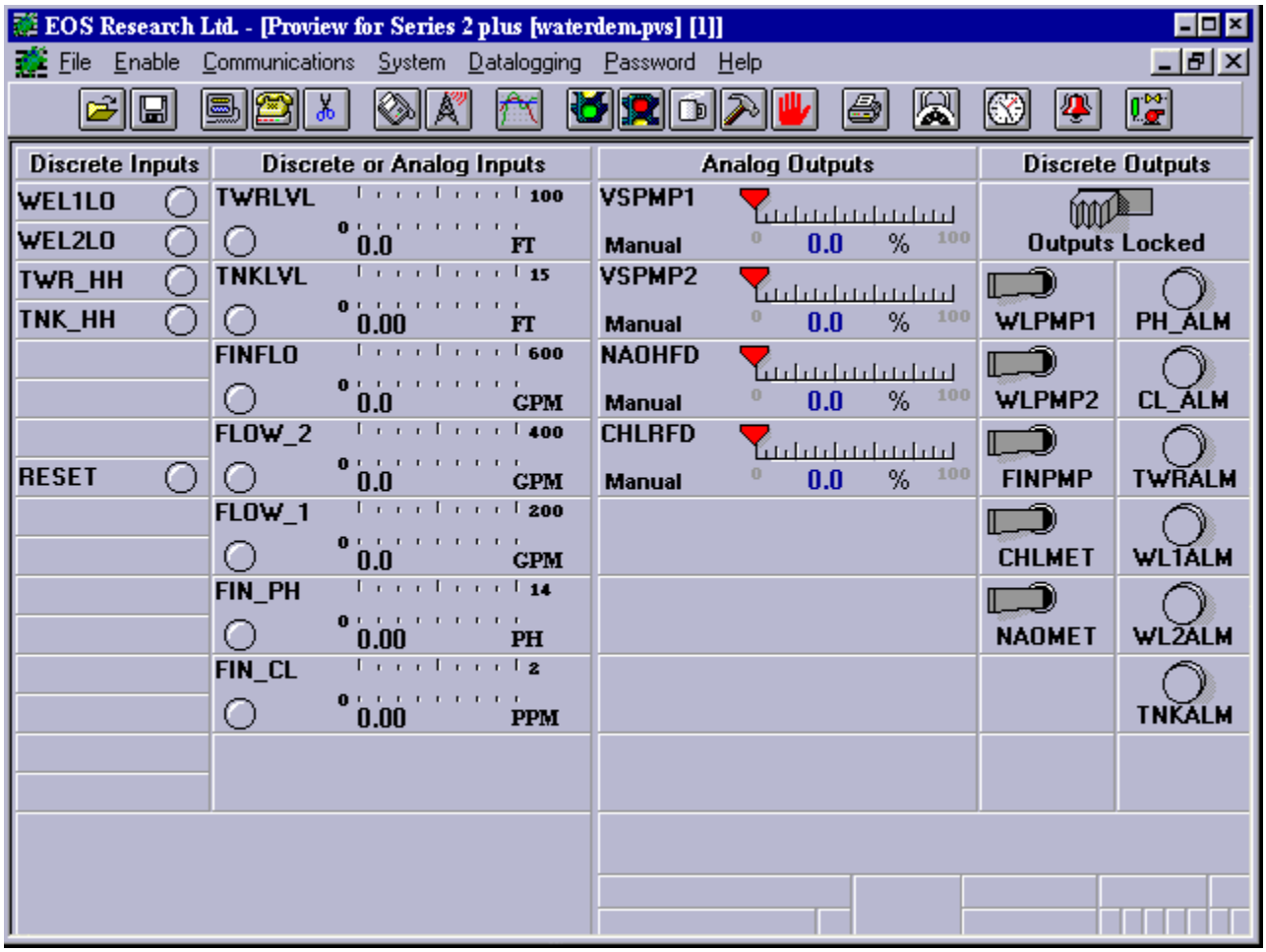
A word about passwords: *The password used in ProView can be different than the one used to access the ProControl unit through its on-board display. In either case the valid characters are 0-9 and A-Z, upper case only. Up to three characters are permitted. The password was designed as a low-level security feature sufficient to prevent inadvertent operation and to deter tampering. It is* ***NOT*** *sufficient in and of itself to withstand a* ***determined*** *effort at system entry. The default password is supplied to you with your ProControl unit by your system integrator.*

6. If the password is incorrect, the dialog box will disappear and a beep will sound. No system configuration information will be shown. You will need to select the **Password** menu and re-enter it.

7. If the password is correct, the **Security** dialog box will disappear and the system configuration information will be shown on the main screen.

FYI

ProView is supplied with a View-Only Mode password, "VOM", which may be used to connect to the ProControl to observe the system status and obtain logged data; however, no changes to any ProControl operating settings may be made when in this mode.



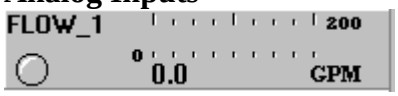
Examining the Main Screen

This particular site file shows five discrete inputs, seven analog inputs, eleven discrete outputs, and four analog outputs.

Discrete Inputs

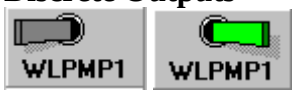
On the left side of the screen below the heading **Discrete Inputs** are shown the tagnames of enabled discrete (or digital) inputs. To the right of the tagname is a virtual "LED". This LED's color or shape will change based on the status of the input. If a discrete input is "OFF", the LED next to the tagname is gray in color. If a discrete input is "ON", then the LED is green. If the discrete input is "ON" and has been set up as an alarm input the LED becomes a red "Alarm Bell". Some panels are blank because those inputs have not been enabled in this particular site configuration.

Analog Inputs



In the second column below the heading **Analog or Discrete Inputs** are shown the enabled analog inputs. Analog inputs can also be configured as simple discrete inputs. Below the tagname is another LED. This LED behaves in a similar fashion to those for discrete inputs; it is gray when the input is not "active", and green or red when it is in the active state (see the definition for Active State in the ProControl User Manual). A small bar graph provides a visual indication of the value of the analog input. At the left and right ends of the bar graph are numbers that represent the lower and upper limits, respectively, of the analog input values (corresponding to 4 and 20 mA). In this case FLOW_1 has been set up with a range of 0 to 200 GPM. Below the bar graph is a numerical representation of the current value of FLOW_1.

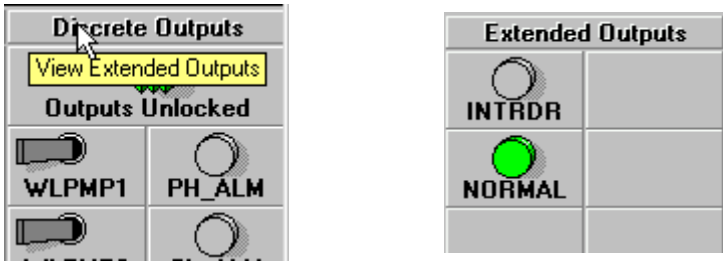
Discrete Outputs



On the right side of the screen below the heading **Discrete Outputs** are shown the enabled discrete outputs, corresponding to the relay outputs in the ProControl. In this site configuration there are 11 outputs. Above the tagname of the output is either a virtual "Toggle Switch" or lamp/button representation. By its position and/or its color it shows the state of discrete output: if the switch is left-leaning and gray the output is "OFF"; if the switch is right-leaning and green then the output is "ON".

Discrete outputs can be configured as an alarm lamp or button when this would be more appropriate. If the lamp/button appears gray then the output is "OFF". If the lamp/button appears red or green then the output is "ON".

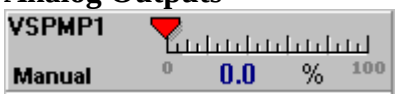
Your system may also have **Extended Outputs**, which are located on a panel behind the discrete outputs. To access these outputs, point your mouse at the words **Discrete Outputs** at the top of the column and click the left mouse button.



FYI

Regardless of what the discrete outputs look like in ProView, they all behave the same way on the ProControl itself – namely, the associated relay output is energized when the output is ON.

Analog Outputs



The third column contains the **Analog Outputs** area. It may be concealed by the second column of **Discrete or Analog Inputs**. To pull the analog outputs to the front, click on the title **Discrete or Analog Inputs** at the top of the third column of the ProView screen.

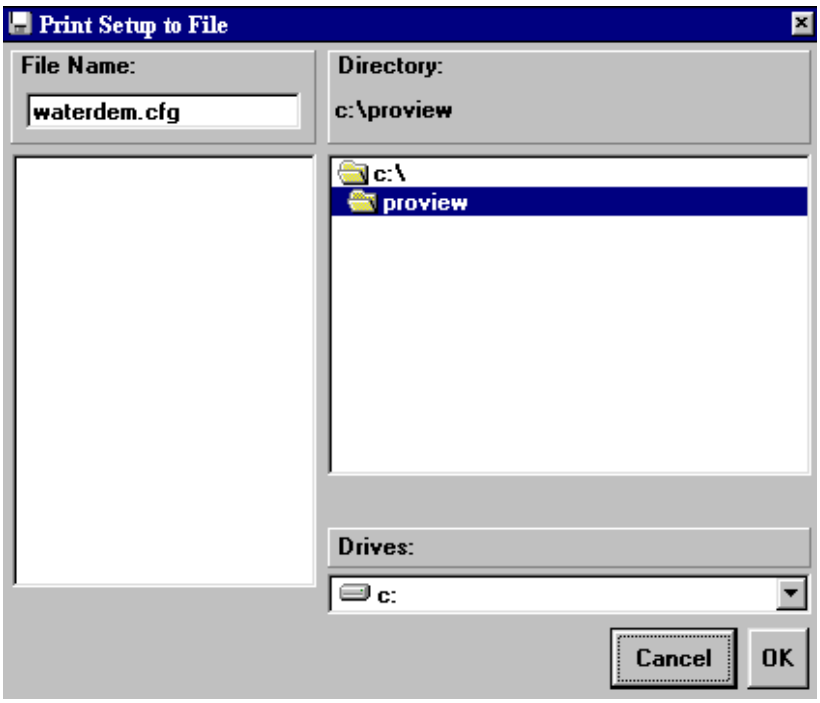
To the right of the tagname there is a slide-scale that indicates the current percentage of full-scale output (0% to 100%), displayed both graphically and with text. Below the tagname is the current mode of the output. This mode can be changed from **Manual**, which indicates the output is under user control, to **PID** or **PRO**, which would indicate that the output is involved in an output control scheme and is under automatic control. These output control schemes are described in Chapter 5 under Analog Output Options.

Printing the Setup to File

A more detailed listing of the site configuration can be made by printing the setup data to a text file. To print the setup, do the following:

1. Click on **Print Setup** in the **File** menu.
   Or
   Click on the Print Setup button. 

2. You will see the **Print Setup to File** dialog box.

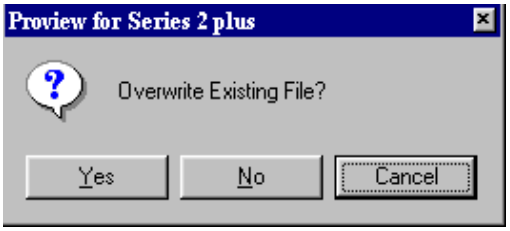


3. Specify the drive and folder in which the text file will be saved.

4. ProView will select a default file name for you, with the extension **.cfg**. However, you can give the file another name if you wish. You can also select an existing .cfg file name by clicking on the file name in the file list box.

5. Click on the OK button to print the setup to the selected file.

If you are overwriting an existing file, a message box pops up to make sure that you don't make a mistake.



A word about Files:
Do not confuse the site configuration file (.pvs), which is a binary file, with the printed setup file (.cfg), which is a text file. A text file can be viewed with a word processing program while a binary file typically cannot.

Examining the Setup File

To examine your site configuration file, use a text editor or word processor such as Notepad or Word to open the file you have just created.

The file produced by our sample site is shown below. The first section consists of identifying information about the ProControl unit and information about the inputs and outputs wired to it.

```
                    EOS RESEARCH LTD.
                 ProControl Series II+

           ProView Configuration File Information


*******************************************************
***** FAX Recipient:     BULLWINKLE MOOSE          *****
***** Customer:          MAYBERRY WATER DEPT       *****
***** Site Location:     MAYBERRY RFD              *****
*******************************************************
***** Setup:             1                         *****
***** Option:            B                         *****
***** Type:              102                       *****
***** Serial Number:     7421                      *****
***** Date:              09/06/2000                *****
***** Time:              10:17:01                  *****
***** ProView:           Version 2.153             *****
*******************************************************
```

THE INPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*	RANGE
1	WEL1LO	Well 1 Low Level	D,NO,AL	
2	WEL2LO	Well 2 Low Level	D,NO,AL	
3	TWR_HH	Water Tower High Alarm Level	D,NO,AL	
4	TNK_HH	Clearwell Tank High Alarm Level	D,NO,AL	
8	RESET	Reset Switch	D,NO,ST,SU	
17	TWRLVL	Water Tower Level	A,EP,ST	0-100 FT
18	TNKLVL	Clearwell Tank Water Level	A,EP,AL	0-15 FT
19	FINFLO	Finish Flow Rate	A,EP,ST	0-600 GPM
20	FLOW_2	Well 2 Flow Rate	A,EP,ST	0-400 GPM
21	FLOW_1	Well 1 Flow Rate	A,EP,ST	0-200 GPM
22	FIN_PH	Finish Water pH	A,EP,AL	0-14 PH
23	FIN_CL	Finish Water Chlorine Residual	A,EP,AL	0-2 PPM

*INPUT SETUP NOTES

D - This input is a (Discrete) or ON/OFF Input.
A - This input is a (Analog) or Variable Input.
C - This input is a Pulse Flowmeter Input.
P - This input is a Pulse Accumulator Input.
UPP - Units per Pulse. Number of units (i.e. Gallons) to record for each pulse
NO-This input is a (Normally Open) Discrete Input.
NC-This input is a (Normally Closed) Discrete Input.
EP-(Endpoint) This input is "Active" when its value is outside the low to high alarm levels.
WD-(Window) This input is "Active" when its value is between the low and high alarm levels.
ST-(Status) This input shows a green LED in ProView when it is in its Active State.
AL-(Alarm) This input shows a red alarm bell in ProView when it is in its Active State.
SU-(Startup) This is a menu function input. When activated it will run the startup routine.
SD-(Shutdown) This is a menu function input. When activated it will run an emergency shutdown.
MN-(Manual) This is a menu function input. When activated it place the unit in Manual Mode.
AU-(Auto) This is a menu function input. When activated it place the unit in Auto Mode.
SQ-(Square Root) This analog channel's reading is proportional to the square root of the input.
LT-(Lamp Test)This is a Lamp Test input. When activated it will turn on all Alarm Light outputs.

THE DISCRETE OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*
1	WLPMP1	Well 1 Pump	
2	WLPMP2	Well 2 Pump	
3	FINPMP	Finish Water Pump	
4	CHLMET	Chlorine Metering Pump	
5	NAOMET	Sodium Hydroxide Metering Pump	
8	PH_ALM	pH Alarm	AI
9	CL_ALM	Chlorine Alarm	AI
10	TWRALM	Water Tower High Alarm	AI
11	WL1ALM	Well 1 Low Level Alarm	AI
12	WL2ALM	Well 2 Low Level Alarm	AI
13	TNKALM	Clearwell Tank High Level Alarm	AI

*OUTPUT SETUP NOTES

G1-(Group 1)- This output will not respond to processes 17-32.
G2-(Group 2)- This output will not respond to processes 01-16.
LT-(Lamp Test) - This output has been declared as an alarm light.
AI-(Alternate Image) - This output is displayed as an icon other than the default switch.

```
THE ANALOG OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#  TAGNAME               TAGNAME DESCRIPTION                    SETUP*   INPUT
-- ------- ------------------------------------------------- ---------- ------
1  VSPMP1  Variable Speed Drive for Finish Water Pump         PID,FOR    TWRLVL
2  VSPMP2  Variable Speed Drive for Well 2 Pump               PID,FOR    TNKLVL
3  NAOHFD  Caustic Soda Feed Rate                             PID,FOR    FIN_PH
4  CHLRFD  Chlorine Feed Rate                                 PRO,FOR    FLOW_2

*ANALOG OUTPUT SETUP NOTES
--------------------------
PID  -This output is involved in a PID (Proportional,Integral,Derivative) control loop.
PRO  -This output is involved in an open (Proportional) control loop.
FOR  -The PID or PRO loop will run in the (Forward) direction.
REV  -The PID or PRO loop will run in the (Reverse) direction.
INPUT-This Tagname will serve as the input to the control loop.
```

Input and Output Configuration

The INPUTS section identifies all enabled system inputs from 1 to 32 and describes how they are configured. the input number is followed by its TAGNAME and the TAGNAME DESCRIPTION, which is taken from the Notes file (more on that in Chapter 5). In addition, a SETUP section further identifies each input in terms of its signal nature, analog (A) or discrete (D); its configuration if discrete as Normally Open (NO) or Normally Closed (NC); and its alarm display nature when active, Alarm (AL) or Status (ST). Discrete Inputs can also be configured as functions such as Startup (SU) or Emergency Shutdown (SD), and can be used as a lamp tester (LT) which will illuminate any Discrete Outputs that are configured as lamps. A RANGE is specified for all Analog Inputs as well as the Active State region, denoted Endpoint (EP) or Window (WD).

See the ProControl User Manual for a further explanation of Normally Open, Normally Closed, and related terminology and a description of Endpoint and Window Active States.

The DISCRETE OUTPUTS section is similar except that there are some different SETUP codes. Some outputs may be assigned to groups (G1,G2) that affect the way they are viewed by the process tasks. Outputs which display an Alternate Image (lamp image) than the standard switch image are designated AI.

The ANALOG OUTPUTS section details the setup of any enabled 4-20 mA output loops. The SETUP codes PID and PRO indicate whether or not the output is involved in one of two analog output control schemes known as PID loops or open loop Proportional control. The direction of the analog output control scheme is indicated by forward (FOR) or reverse (REV). The input that provides the reference signal upon which the analog output scheme is based is designated under the INPUT heading.

For a further explanation of PID or open loop Proportional control please see the Analog Output Options section in Chapter 5.

In this particular setup, TWRLVL is the input to the PID control loop that operates on the variable speed pump VSPMP1, with VSPMP1 maintaining a "setpoint" for the value of TWRLVL. The chlorine feed rate CHLRFD will be varied in proportion to the flow rate FLOW_2 under open loop proportional control.

Process Tasks

The next section of the setup file is a listing of PROCESS CONTROL TASKS. These determine how the ProControl unit responds to input changes while in Auto, Startup or Shutdown modes. It is important to note that the ProView software does not take any independent action itself. All automated control decisions are made by the ProControl unit, although you can change many operating parameters via ProView.

```
THE PROCESS CONTROL TASKS EXERCISED BY THIS SYSTEM ARE:

Process 01: If WEL1LO is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;Page #1],
            Switch WLPMP1 OFF
            Page Message: 'Well 1 Low Level Mayberry North '

Process 02: If WLPMP1 is OFF AND PH_ALM is OFF AND
               CL_ALM is OFF AND TWRALM is OFF AND TNKALM is OFF
            THEN Delay for 30 Seconds, Switch WLPMP1 ON

Process 03: If FIN_PH is High
            THEN Delay for 5 Seconds, Switch NAOMET OFF AND PH_ALM ON

Process 04: If FIN_CL is High
            THEN Delay for 5 Seconds, Switch CHLMET OFF AND CL_ALM ON

Process 05: If TWR_HH is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Initiate Shutdown, Switch TWRALM ON
            Page Message: 'Tower's about to overflow, Bullwinkle - COME OUT NOW! '

Process 06: If TNK_HH is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Switch TNKALM ON
            Page Message: 'Clearwell Tank High Mayberry North '

Process 07: If TWRLVL is High
            THEN Delay for 5 Seconds, Switch TWRALM ON

Process 08: If TWRLVL is NOT High or Low
            THEN Delay for 5 Seconds, Switch TWRALM OFF

Process 09: If TNKLVL is High
            THEN Delay for 5 Seconds, Switch TNKALM ON

Process 10: If TNKLVL is NOT High or Low
            THEN Delay for 5 Seconds, Switch TNKALM OFF

Process 11: If FIN_PH is High or Low
            THEN Delay for 5 Seconds, Send Report[FAX #1;Page #1],
            Switch PH_ALM ON
            Page Message: 'Finish Water pH Alarm Mayberry North '

Process 12: If FIN_PH is NOT High or Low
            THEN Delay for 5 Seconds, Switch NAOMET ON AND PH_ALM OFF

Process 13: If FIN_CL is High or Low
            THEN Delay for 5 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Switch CL_ALM ON
            Page Message: 'Finish Water Chlorine Alarm Mayberry North '

Process 14: If FIN_CL is NOT High or Low
            THEN Delay for 5 Seconds, Switch CHLMET ON AND CL_ALM OFF
```

```
Startup 01: Switch WLPMP1 ON AND PH_ALM OFF AND CL_ALM OFF AND TWRALM OFF AND WL1ALM OFF AND
WL2ALM OFF AND TNKALM OFF

Startup 02: Delay for 2 Seconds, Switch WLPMP2 ON

Startup 03: Delay for 2 Seconds, Switch FINPMP ON

Startup 04: Delay for 5 Seconds, Switch CHLMET ON AND NAOMET ON


Shutdown 01: Switch CHLMET OFF AND NAOMET OFF

Shutdown 02: Delay for 2 Seconds, Switch WLPMP1 OFF AND WLPMP2 OFF

Shutdown 03: Delay for 2 Seconds, Switch FINPMP OFF
```

This sample configuration has a fairly straightforward process flow. On startup, some of the system outputs are switched on sequentially and all alarm indicators are switched off. On shutdown, all pump outputs and chemical metering devices are turned off. The process tasks are mostly self-explanatory. Some process tasks include fax and pager reporting functions. It is important to remember how and when the process tasks are run:

- Process tasks are run continuously while the ProControl unit is in AUTO mode. Process control tasks are ***event-driven***, i.e., they occur once when the "IF…" conditions are true (subject to any delays). No automatic action is taken in MANUAL mode.

- Startup and Shutdown processes are run in sequence. When the Startup sequence is finished, the unit is placed in AUTO mode and the **Process Tasks** are run. If any Startup process in the sequence fails, then all the non-lamp outputs are turned "OFF" and the unit reverts to MANUAL mode. A Startup process fails when any IF condition is not satisfied for 60 seconds after the Startup process begins (there may not be any IF conditions in your Startup sequence). The Startup sequence begins when the ProControl or ProView operator initiates it. The Startup sequence can also begin when power is first applied to the ProControl unit if the "Auto Startup" option has been enabled.

- The Shutdown sequence works in a similar manner. When the Shutdown sequence is finished, the ProControl unit reverts to MANUAL mode. If any Shutdown process in the sequence fails (is not run after 60 seconds), then all the non-lamp outputs are immediately turned "OFF" and the unit reverts to MANUAL mode. The Shutdown sequence can be initiated either by the ProControl or ProView operator or by a process task (Process 5 does this in our example).

Process Capability

The ProControl runs process tasks which are based on Boolean IF ___ AND ___ THEN ___ logic. There are 64 available processes, 16 of which can be used as part of a startup sequence, and 16 of which can be used as part of a shutdown sequence. Each process can:

- be based on several, simultaneously existing I/O conditions
- include short or long delays for de-bouncing or simple time delay
- use memory variables (registers) for linking processes
- cycle outputs with timers or during certain times of the day
- perform system shutdowns

- send reports to fax and/or pagers

FYI

If you wish to modify the ProControl programming, please contact your Control System Integrator for assistance.

CHAPTER 3: ESTABLISHING COMMUNICATION

This chapter explains how to connect to the ProControl unit using ProView by local serial cable and by remote modem.

By itself, ProView does not reveal very much about your site's operation. It must be connected to the ProControl unit in order to yield any data.

Local Connection

To establish a local connection, perform the following:

1. Use the local serial cable supplied with the ProControl to connect the computer you are using to a ProControl unit. One end of the cable terminates with a female 9-pin connector. Use this end to plug into the serial port on your computer. The other end of the serial cable is terminated with a 9-pin RJ-45 "Ethernet" connector. Use this connector to plug into the "RS-232/Serial" port on the right hand side of the ProControl unit.

! *Be sure to disconnect the serial cable from the ProControl unit after you are finished. If you do not, remote communications and alarm reporting will **not** be possible.*

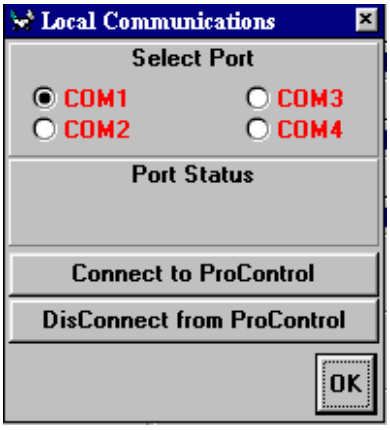
! *If the ProControl unit is powered OFF for any reason, wait 45 seconds after power up before plugging in the cable to attempt a local connection. Otherwise, the ProControl's modem may not be properly configured.*

2. Click on **Local Connection** in the **Communications** menu. You can also use ALT-C.

Or

Click on the **Local Connection** toolbar button. 

You will see the **Local Communications** dialog box.



3. Select the COM port to which the ProControl is connected by clicking on the "radio button" next to the COM port you want to use. COM ports 1 through 4 are supported.

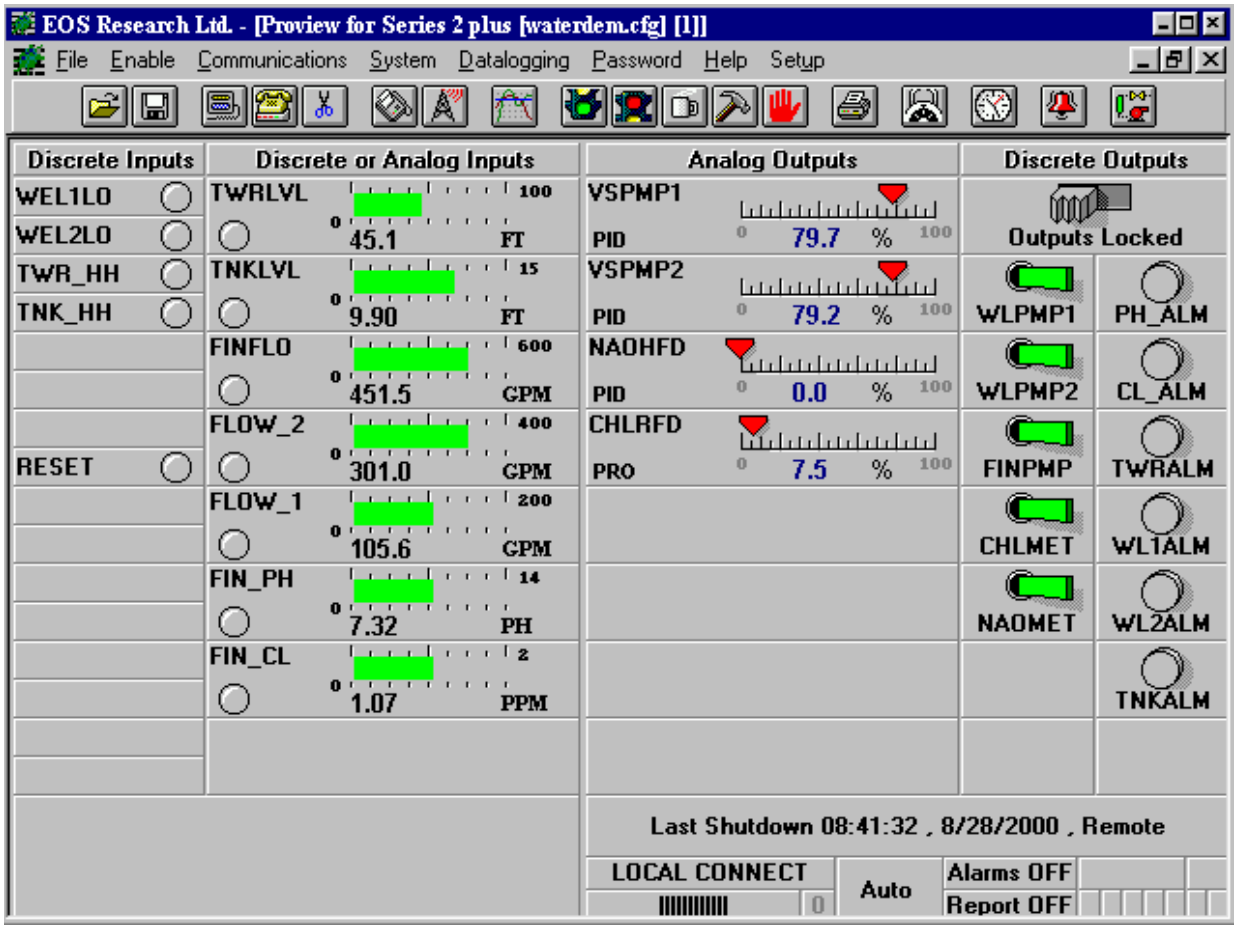
4. Click on the **Connect to ProControl** button.

5. You will see status messages in both the **Port Status** area of the **Local Communications** dialog box and in a small information box near the bottom of the main screen. Usually you will see "Trying Local..." followed by "LOCAL CONNECT" if the attempt is successful. If the attempt is unsuccessful you will see message boxes outlining the suspected problem.

6. After connecting, click on the **OK** button to hide the **Local Communications** dialog box.

After establishing a local connection, ProView will perform an initial scan of site conditions. This will take a few moments during which time the mouse pointer will turn into an hourglass. After the initial scan, data will be updated on the screen every second or so.

Here is a view of the main screen after a local connection has been established:



Note that the screen has been updated to reflect the current operating conditions at the site. At the bottom of the screen, various message panels have been filled in as well.

Remote Connection

For a remote connection, the procedure is a little different. Follow these steps:

1. Make sure that your modem has been installed properly and that the phone line is plugged in to the proper port on the modem.

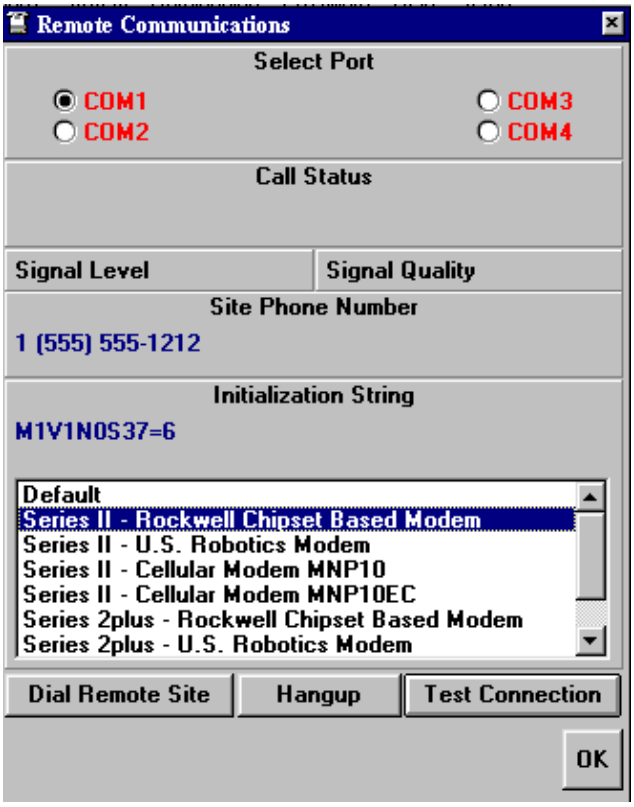
Your modem must be Hayes (AT) compatible and capable of operation at 9600 baud.

2. Click on **Remote Connection** in the **Communications** menu. You can also use ALT-C.

Or

Click on the **Remote Connection** toolbar button. 

You will see the **Remote Communications** dialog box.



3. Select the COM port to which your modem is connected by clicking on the "radio button" next to the COM port you want to use. COM ports 1 through 4 are supported.

4. Check to see that the **Site Phone Number** is the one you want to dial. If not, click on the phone number and change it. If you need to dial an 8, 9 or some other prefix first to get an outside line, add

a comma or two after the prefix to obtain a pause before dialing the main number (e.g., 8,555-1212). Do not add parentheses or dashes.

5. Examine the **Initialization String** to see if it is correct for your type of modem. For Series 2*plus* systems, you will usually use the **Initialization String** for Rockwell Chipset or U.S. Robotics modems. If these do not work, use the Default string instead.

6. Click on the **Dial Remote Site** button.

7. You will see status messages in both the **Call Status** area of the **Remote Communications** dialog box and in the lower portion of the main screen. Usually you will see the following messages:

Trying Remote...	ProView is attempting to contact your PC's modem
OK	ProView has successfully connected to the modem
Setup...	ProView is sending the initialization string to the modem
Dialing...	ProView is dialing the site phone number
CONNECT 9600	Connection has been established with the remote modem
REMOTE CONNECT	Connection has been established with the remote ProControl unit

8. If the attempt is unsuccessful you will see message boxes outlining the suspected problem.

9. After connecting, click on the **OK** button to hide the **Local Communications** dialog box.

Ending a Connection

The simplest way to end a connection, to hang up in essence, is to click on the **Disconnect** button on the Toolbar.  This works for either a local or remote connection.

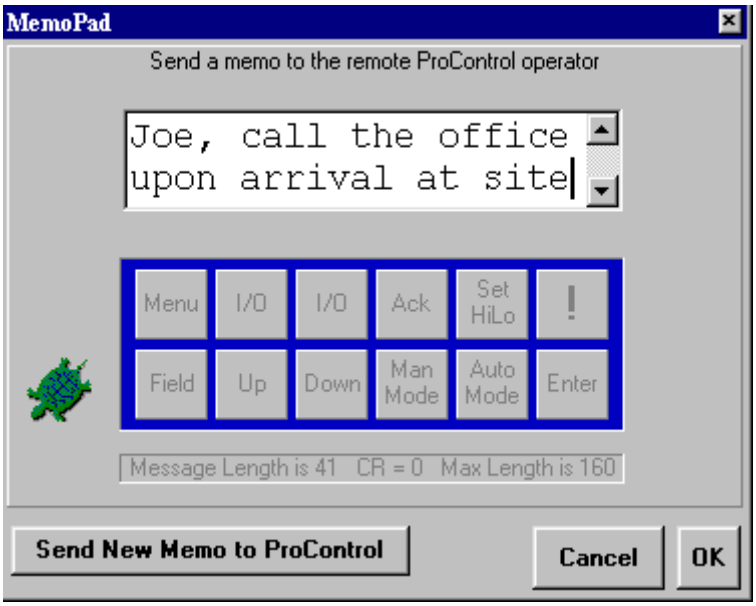
Alternatively, you can re-open the **Local** or **Remote Communications** dialog box and click on either the **Disconnect from ProControl** button (Local) or the **Hangup** button (Remote). After ending the connection, you should see **NOT CONNECTED** in a message box near the bottom of the screen. 

Sending a Memo

A useful feature of the ProControl is the ability to transmit short memos to a site operator. From ProView, you can send a message of up to 160 characters to the display of the ProControl unit. The site operator must acknowledge your memo before returning to his normal display. This feature is useful in communicating with a person at the remote site while the phone line is in use for a connection to the ProControl.

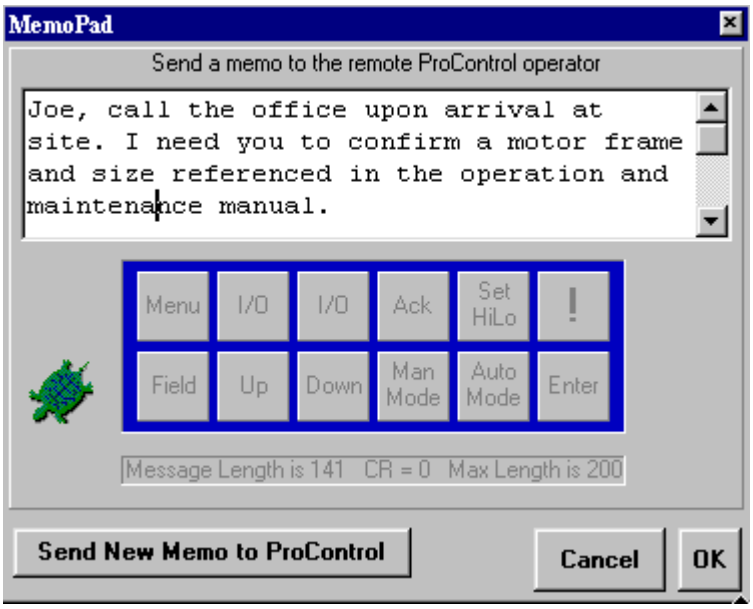
To send a memo, follow these steps:

1. From the **Communications** menu, select **Send Memo**.



2. Type your memo onto the screen of the **MemoPad**. It will appear on the ProControl's display exactly as it appears to you on the MemoPad, two lines at a time. Words will automatically wrap around to the next line, but you may hit Enter (Carriage Return or CR) to jump to the next line if necessary. However, the fewer <CR> characters you use, the longer the text message you can type, since each <CR> represents 20 characters. The **Message Length** counter will keep track of the number of characters you have used. The **Max Length** counter will decrease to let you know how many more characters can be entered.

3. By clicking the right mouse button when the pointer is over the text window, the text window will become larger, allowing you to view more text without having to scroll up and down.



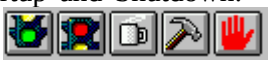
4. Click the **Send New Memo to ProControl** button to send the memo to the ProControl's display, **OK** to temporarily save the memo but not transmit it, or **Cancel** to abort the entire procedure.

5. The **Ack** button on the MemoPad will flash red and your PC will beep to indicate when the ProControl operator has acknowledged your memo.

CHAPTER 4: MANAGING YOUR SITE

This chapter explains how to change the way your ProControl system operates by switching between Manual and Automatic modes, initiating a startup or shutdown sequence, and changing other general system settings.

Switching Between System Modes

There are four modes of operation for the ProControl: Manual, Automatic, Startup and Shutdown. To initiate a switch to a different mode, simply click on the appropriate Toolbar button  or click on **Process Operations** in the **System** menu.

Goto AUTO Mode:  Clicking on the coffee cup will place the ProControl into Automatic mode.

Goto MANUAL Mode:  Clicking on the hammer will place the ProControl into Manual mode.

STARTUP System:  Clicking on the green traffic light causes the ProControl to initiate a Startup sequence.

SHUTDOWN System:  Clicking on the red traffic light causes the ProControl to initiate a Shutdown sequence.

Emergency OFF:  Clicking on the red hand will cause an Emergency Shutdown, which turns off all outputs immediately and places the ProControl in Manual mode.

Be sure you understand the safety risks and other implications of issuing these commands. When the icons are clicked, the actions are ***immediate*** *and equipment may start up or shut down automatically.* ***Most importantly, switching the ProControl to Manual mode will defeat any safeguards programmed into the system and allow equipment to continue running without any process control.*** *Manual mode should only be used on a short-term basis for system troubleshooting or clearing alarm conditions, preferably with de-powered equipment circuits.*

You can monitor the current system mode by looking at the message panel at the bottom of the main screen.

The system is currently in Manual mode.

The system is currently in Auto mode.

The system is currently in Startup mode, the last startup task run was startup task #2.

The system is currently in Shutdown mode, the last shutdown task run was shutdown task #2.

The last action to initiate a Shutdown is listed in another message panel at the bottom of the screen. In the example below, the shutdown was initiated by a remote user.

System Operations

Following are several other operational parameters that can be set by ProView.

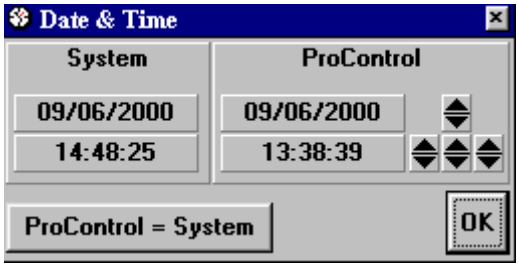
Date & Time

The ProControl unit maintains an internal real-time clock which it uses to time-stamp datalogged information and control other important system functions. To set the **Date & Time**:

1. Click on the **System Time** toolbar button. 

   Or

   Choose **System Operations** from the **System** menu and click **System Time**. You will see the **Date & Time** dialog box.



2. The left side of the dialog box displays the current date and time kept on your PC. The right side of the dialog box is the date and time according to the ProControl unit. Follow the procedure outlined below if you need to change the time.

3. To set the ProControl's clock equal to the PC's clock click on the **ProControl = System** button. To set the ProControl's clock to a specific time use the time spinners  . The upper spinner changes the date and lower set of three spinners change the hour, minute and second (left to right, respectively).

4. To set your PC's time (System time) use the Windows Control Panel.

FYI

Daylight Savings Time is not supported by the ProControl's clock. You will need to make any necessary changes manually.

Changing the time by a large amount can lead to discontinuities in the datalogging history of your ProControl unit, particularly if you move the ProControl's time forward. See the section on Datalogging Setup in Chapter 5 to check on your system's datalogging status.

Alarms

An alarm is only an **audible** indication to the operator that an input signal is in its ***active state***. On the ProControl unit, the beeper sounds if the **Alarms** are **Set**, the unit is in Manual mode and an input is in the active state. The Alarm continues to sound until it either is acknowledged by the operator or times out by itself. In ProView, a "Beep" sounds from the PC if the **Alarms** are **Set**, and an input that has been configured as an **Alarm Input** enters the active state. No acknowledgment is necessary.

The current status of the alarm feature is displayed in a message box at the bottom of the main screen. Alarms OFF

To enable or disable Alarms, click on the **Alarms** toolbar button,  which toggles this feature on and off.

Or

Click on **Set Alarms** in the **Enable** menu.

Remote Reporting

A report is a fax or a pager message sent by the ProControl unit. In order for any reporting to occur, **Remote Reporting** must be enabled. The current status of the reporting feature is indicated in a message box at the bottom of the main screen. Report OFF

To enable or disable remote reporting, click on **Remote Reporting** under the **Enable** menu. A check mark is displayed if reporting is enabled.

Log Off Remote User

This function is used occasionally to reset the remote ProControl's display to the password menu. It is often used to ensure that an on-site user does not change any ProControl settings while you are remotely connected, and to ensure that password protection is restored if the last user did not Log Off locally.

To Log Off the remote user, choose **System Operations** from the **Systems** menu, and click on **Log Off Remote User**.

Initiate FAX NOW!

This function is the equivalent of pressing FAX NOW on the ProControl unit. It is used to generate and send a current fax status report to the currently enabled fax numbers. Fax reports must be enabled in the **FAX Report Setup** dialog box and ProView must be connected via modem (remotely) for this command to proceed.

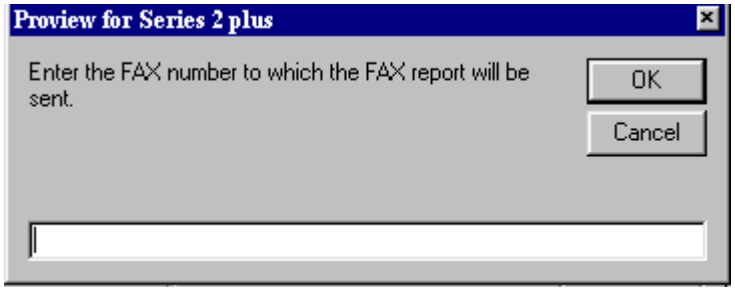
ProView will disconnect from the ProControl unit (hang up) after issuing this command to free the remote phone line for fax use. Normal FAX back operations and times will not be affected.

To initiate the fax, choose **System Operations** from the **Systems** menu, and click on **Initiate FAX NOW!**

Initiate New FAX NOW!

This function is identical to **Initiate FAX NOW!** except that you can specify a number that is not currently enabled to receive faxes from the ProControl. You can use this for testing the fax capabilities or to send a fax update to a third party.

To initiate the fax, choose **System Operations** from the **Systems** menu, and click on **Initiate New FAX NOW!**



ProView will alert you first that you will be disconnected from the system in order for the fax to proceed. Enter the FAX number to which the fax report will be sent, making sure you include a prefix or the numeral 1 and the area code, if necessary. Click the OK button to send the fax report.

CHAPTER 5: CHANGING SYSTEM PARAMETERS

This chapter explains how to change the settings that govern much of the operation of your system, such as the state of a discrete output, analog alarm levels and fax and datalogging setups.

Switching an Output State

The state of a discrete output can be changed manually by clicking on the "switch" associated with its tagname. ProView includes a "locking" feature for discrete outputs as a safety measure to prevent inadvertent output changes; you must "unlock" the outputs in order to turn them on or off. The outputs are locked and unlocked by clicking on the "slide switch" at the top of the **Discrete Outputs** section of the main screen.

You should leave the slide switch in the **Locked** position whenever possible.

Bear in mind that if the ProControl unit is in Auto mode, any discrete output change you make may be "overridden" by a process control task. Do not turn outputs on or off unless you are familiar with the process control in effect for your system.

1. 

To change the state of a discrete output, click on the toggle switch.

2. 

The toggle switch will change positions, and a "?" will appear for a moment after the tagname. This indicates that the command was sent to the ProControl unit but that confirmation of the state change has not yet been received.

3. 

The "?" will disappear after confirmation of the state change has been received from the ProControl unit.

Depending on your site configuration, you may be able to change certain parameters that affect how the discrete outputs in your system operate in Auto mode.

Process Groups

The ability to set a ***Process Group*** is a rarely-used feature that prevents an individual output from being switched by certain process tasks when in Auto mode. If your ProControl has been configured for Process Groups, you can switch between Group 1 (ignore processes 17 – 32) and Group 2 (ignore processes 1 – 16).

Do NOT enable process groups unless your ProControl has been configured specifically to use this feature! *Be sure you understand the safety risks and other implications of issuing these commands.*

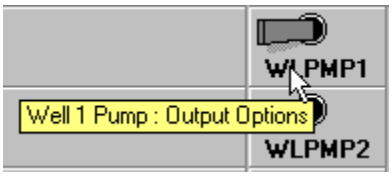
Output Cycle

Some of your outputs may have been configured as "Switched" outputs, where the output is turned on and off according to a timed cycle, or during a specific time of day.

Output Options

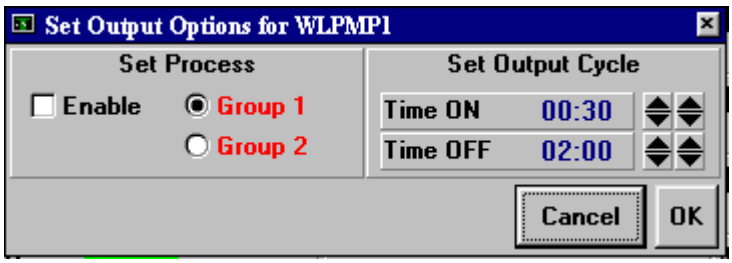
To change an output option, do the following:

1. Place your mouse pointer over the output's tagname until a balloon appears. Click the *right* mouse button until you see **Output Options**.



2. Click the *left* mouse button.

3. You will see the **Set Output Options** dialog box. The **Set Process** or **Set Output Cycle** panels may not be visible if those options do not apply. Both panels will be disabled if ProView is not connected to a ProControl unit.



4. To enable a Process Group click on the **Enable** check box and click either the **Group 1** or **Group 2** radio buttons in the **Set Process** panel. Once again, ***Do NOT enable process groups unless your ProControl has been configured specifically to use this feature!***

5. If the output has been configured to run in a switched mode, you will be able to change the **Output Cycle** times by clicking on the value you want to change and entering the new time in an **hours:minutes** format (be sure to hit Enter after you type in the new time). Alternatively, click on the up or down spinners to increase or decrease the time you want to change.

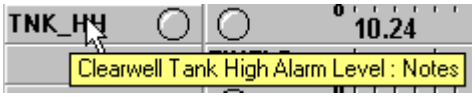
6. Click on the **OK** button to confirm the changes and send them to the ProControl unit. Click on **Cancel** to get rid of any changes.

Notes

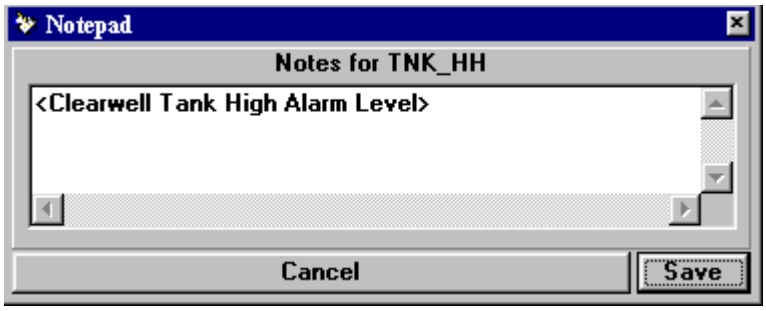
Each I/O point can have its own set of associated ***Notes***. The notes are stored on your PC in a file with a **.not** extension along with your **.pvs** file. You can attach notes which explain the functional purpose of the I/O point or define the I/O point in more detail. This can eliminate uncertainty that may result from the limitation of six characters in each point's tagname.

To edit an I/O point's notes do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, and *right*-click until you see **Notes**.



2. Click the left mouse button to enter the "Notes" feature. The **Notepad** dialog box appears.



3. Click in the **Notes** window to edit or add descriptive text. Any notes enclosed in angle-brackets (i.e. <note>) will appear within the balloon when you position the mouse pointer over the tagname, and at the top of the main screen.

4. Click the **Save** button to save your notes and/or definitions or press **Cancel** to exit without saving. You must also save the site file before exiting ProView to retain any changes made in Notes.

FYI

Sometimes it is a good idea to provide a more complete description of what an input or output does in the Notes; e.g., "Causes System Shutdown" or "Turns ON when Tank is Full". Feel free to customize the notes to suit your purposes; they are stored locally on your PC and do not affect the operation of the ProControl itself.

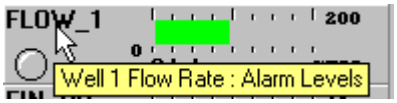
Analog Alarm Levels

The analog alarm levels define what parts of an analog input's range are considered "active" and which are not. This affects not only the color of LED's and bar graphs on the main screen but also can affect process control if the analog input is used in a process task. Depending on how your system has been configured, you

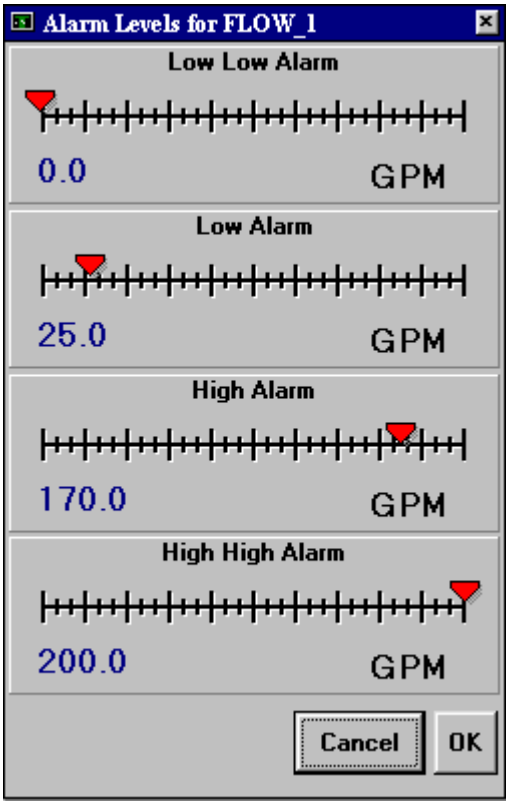
will be able to set up to four "activation levels" that define when an input becomes active. Some ProControl configurations allow you to set a ***Low Alarm Limit*** and a ***High Alarm Limit***, while others allow you to additionally define a ***Low-Low Alarm Limit*** and a ***High-High Alarm Limit***. These activation levels are somewhat more flexible in use than their names imply, in that they are not only used to trigger alarms. If an alarm limit value is exceeded, it could be used to simply turn on a pump or reset a switch, for example.

To set an analog alarm level, do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, *right*-click until you see **Alarm Levels**.

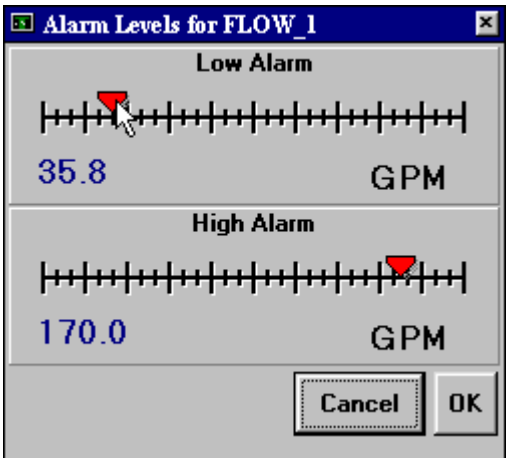


2. Left-click and the **Alarm Levels** dialog box appears.

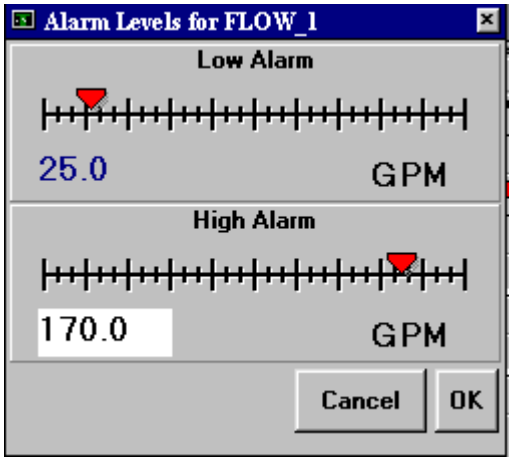


3. The present alarm levels are shown in text as well as in the position of the sliders. Note that the **High Alarm** value must be greater than the **Low Alarm** value, and the **High High Alarm** value must be greater than the **Low Low Alarm** value.

4. You may adjust the alarm values by clicking and holding a red slider and moving it to the left or right. As you move the slider the numeric value is updated to reflect the change you are making. The alarm level will be set to a new value when you release the mouse button.



5. Alternatively, you may click on the alarm level text and edit the value for the alarm level. This is usually a better way to input a precise value. Be sure to hit the Enter key to send the new value to the ProControl unit. Click on the **OK** button to hide the **Alarm Levels** dialog box.



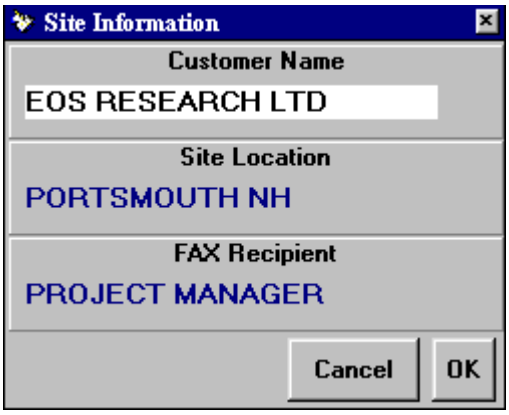
! *Remember that any changes you make to the alarm levels are **immediate** and may impact the process control for your system. Be sure you understand the safety risks and other implications of issuing these commands.*

Site Information

Site Information refers to data used in the fax report and in the various files printed by ProView.

To view or change the Site Information do the following:

1. Click on **Site Information** in the **File** menu. The **Site Information** dialog box appears.



2. To change the **Customer Name**, **Site Location** or **FAX Recipient** click on the text you want to change and edit it. Only uppercase letters, numbers and blank spaces are allowed. The **Customer Name** field also appears on the main screen of the ProControl unit's display.

3. Click on the **OK** button to confirm the changes and send them to the ProControl unit. Click on **Cancel** to get rid of any changes.

FAX Report Setup

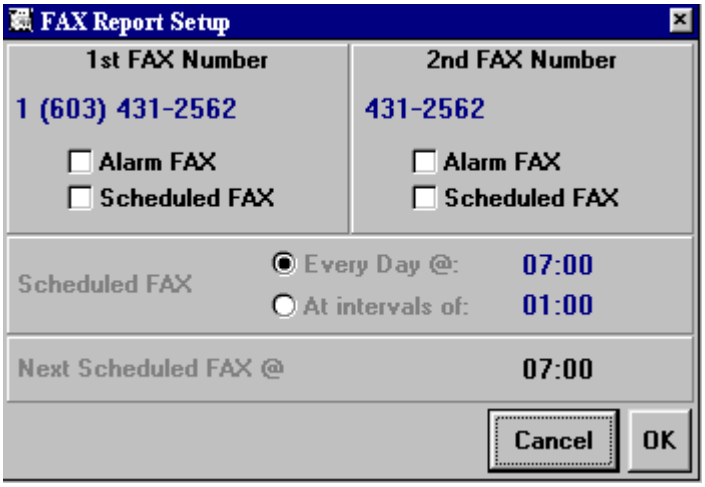
This setup screen is used to change when and where the ProControl's fax report is sent, and whether individual fax recipients are enabled.

To view or change the FAX Report Setup, do the following:

1. Click on **FAX Report Setup** in the **Communications** menu.

Or

Click on the **FAX Report Setup** toolbar button.  You will see the **FAX Report Setup** dialog box.



2. If **Remote Reporting** is not enabled, the contents of the dialog box will appear "grayed out" or disabled.

3. The first and second FAX number panels determine what kinds of fax reports are sent by the ProControl unit and where they will be delivered. There are two kinds of fax reports generated by the ProControl. A **Scheduled FAX** report occurs on a regular basis to provide a status report, while an **Alarm FAX** report will be sent when issued by a Process Task that has been configured to do so (usually to report an alarm condition). To enable either type of fax report click on the **Alarm FAX** or **Scheduled FAX** check boxes. If you enable Scheduled FAX reports the Alarm FAX reports for that same number are automatically enabled as well. You cannot enable only Scheduled FAX reports.

4. To change the phone number to which the ProControl will fax reports click on the phone number and edit it. The ProControl can fax to two different phone numbers. It will make up to three attempts to send the fax. If the first try is unsuccessful, the second try will be initiated 5 minutes later, and a third attempt will be made 5 minutes after that. If the third try is unsuccessful the fax attempt will be abandoned and the ProControl will enter a fax failure into the Events log (see Chapter 6). The ProControl will try both phone numbers (if they are both enabled) on the first try before moving on to a second attempt.

5. In the **Scheduled FAX** panel, you can select when the regularly scheduled faxes are sent. Choose the **Every Day @** button and edit the time to the right of it to have a report sent at the same time every day (24-hour clock). To have a report sent at a specific time *interval*, choose the **At intervals of** button and enter the time interval in HH:MM format. When you hit Enter, the data will be sent to the ProControl unit.

6. The **Next Scheduled FAX** variable indicates when the next *scheduled* fax report will be sent. You can also change it yourself if, for instance, the ProControl is set to fax every hour but you would like it to skip a few hours before resuming. To set the **Next Scheduled FAX** time click on the time in that panel and enter the new time in 24 hour format. Note that if you enter a Next Scheduled FAX time that is earlier than the current time as determined by the ProControl's clock, you will prevent any scheduled faxes from being sent until the next day at that time.

7. Click on the **OK** button to confirm the changes and send them to the ProControl unit.

Paging Setup

This setup screen is used to change where the ProControl's alarm pager messages are sent, and whether individual page recipients are enabled. You will need to contact your paging service directly to obtain some of the information necessary for proper paging setup. The paging capability is similar to the ProControl's fax capability in that you can send information to two pagers and it will make three attempts at reaching each number.

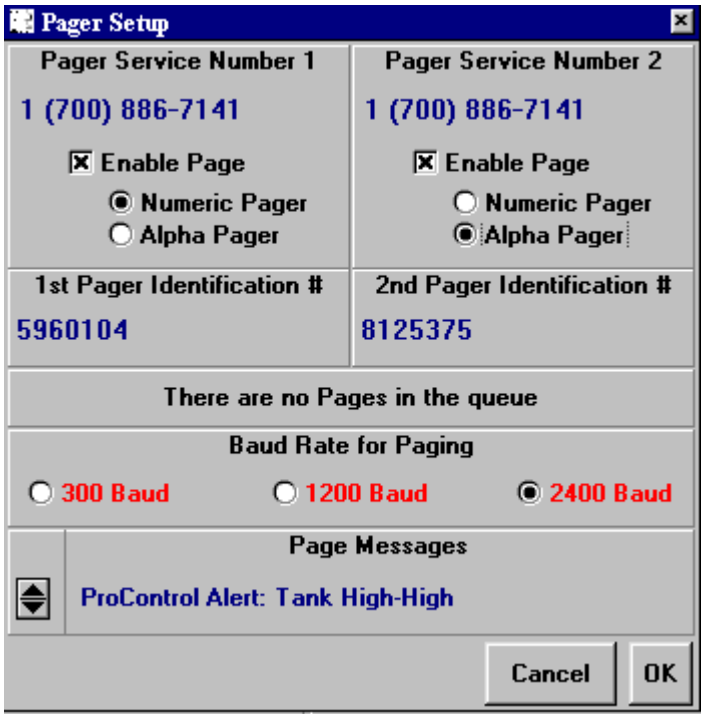
You will need to obtain your pager company's modem dial-up phone number and your pager's modem dial-up ID (this is often different than your regular pager ID). This information is generally not available from the customer service staff at the pager company. You may need to ask for someone in technical support who is familiar with pager modem dial-up.

To view or change the **Paging Setup** do the following:

1. Click on **Paging Setup** in the **Communications** menu.

   Or

   Click on the **Paging Setup** toolbar button.  You will see the **Pager Setup** dialog box.



2. In the **Pager Service Number** panels, enter the telephone number for your pager company's modem dial-up.

3. Click on the **Enable Page** check box, and choose **Numeric Pager** or **Alpha Pager** (text).

4. Enter the pager ID number you obtained from the pager company in the **Pager Identification #** panels.

5. The next panel indicates whether there are any queued pages. In other words, if a page has not yet been successfully completed and you have dialed into the ProControl with ProView, you may be interfering with the ProControl's attempts to send a page.

6. Select the baud rate in the **Baud Rate for Paging** panel, which is the speed at which the page information is sent to your paging company. It is generally recommended that you use 300 baud for the greatest reliability. Even at 300 baud, the ProControl takes only a few seconds to transmit the information to your pager company.

7. The **Pager Message** field allows you to view and/or change the information which will be transmitted to your pager from specific events. If you are using a numeric pager, this message cannot exceed nineteen digits in length and may contain only numerals. If you are using an alphanumeric pager, this message can be up to 80 characters in length. After you edit the message, hit Enter to send the updated message to the ProControl unit. Use the up and down spinners to view the other Process Tasks that cause pages to be sent. You should be familiar with the process control of your system before attempting to make changes to these messages.

8. Once you have finished making your changes click **OK** to close the dialog box.

Datalogging Setup

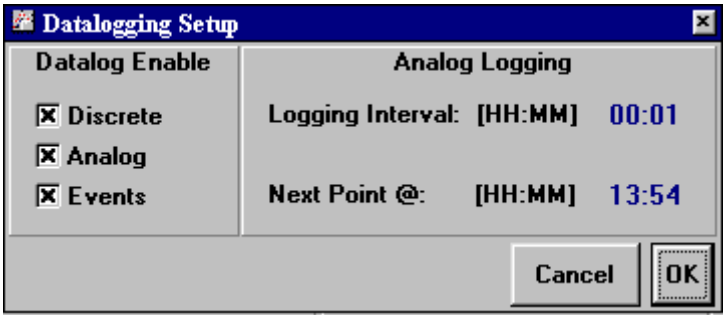
There are three different types of datalogging on the ProControl. Discrete input and output changes are logged as they happen. Events are also logged as they happen, and include changes in control mode (e.g., Auto, Manual), local and remote connections to the ProControl, system startup/shutdowns, fax or page failures, and execution of *Process Tasks*. Analog input and output values are logged at specific time intervals determined by the user. The **Datalogging Setup** dialog box is used to determine how datalogging is carried out in the ProControl unit.

To view or change the **Datalogging Setup** do the following:

1. Click on **Datalogging Setup** in the **Datalogging** menu.

Or

Click on the **Datalogging Setup** toolbar button.  You will see the **Datalogging Setup** dialog box.



2. To enable a type of datalogging click on the **Discrete**, **Analog** or **Event** check boxes located in the **Datalog Enable** panel.

3. To change the logging interval for analog inputs click on the time value indicated for **Logging Interval** and edit it. This interval can range from 1 second to 24 hours, expressed in minute/second

format or hour/minute format (default). Clicking on the **HH:MM** adjacent to the **Logging Interval** will toggle between hour/minute format and minute/second format.

4. The **Next Point @** variable is set by the ProControl every time a data point is logged to show you when the next analog data points will be logged. You can change this value if you wish the ProControl to delay before resuming analog datalogging. Click on the time associated with **Next Point @** and enter the new time in either HH:MM or MM:SS format. Note that if you enter a **Next Point @** time that is earlier than the current time *as determined by the ProControl's clock*, you will prevent any analog datalogging from occurring until the next day at that time (or next hour if using MM:SS format).

4. Once you have finished making your changes click **OK** to close the dialog box.

FYI

When setting your analog logging interval, be aware of the available memory in the ProControl unit you are using. If, for instance, your ProControl has a capacity of 5,000 analog data points per input channel and you specify a 5-minute logging interval, there will be available memory for approximately 17 days worth of analog data. Changing the log interval to 10 minutes will make the memory last twice that long. Once the memory is full, the oldest data is purged to make room for the current data.

Changing the Password

You can change the password for opening a site file in ProView or for access to the ProControl unit from its keypad. The passwords do not have to be the same. If you change the password while ProView is connected to a ProControl unit, the new password will be used for both ProView and the ProControl unit. If you change the password while not connected to a ProControl unit, the new password will be used only for that site file in ProView. In order to save the new password for the site file in ProView, you must save the site file (**File…Save Site**). However, any change to the password in the ProControl unit itself is immediate.

To change the password, follow these steps:

1. Click on the **Password** menu.

Or

Click on the **Password** toolbar button.  You will see the **Security** dialog box.

2. Click on the **Change Password** button. You will prompted to enter the **Old Password** in the text box. Click the **OK** button or hit the enter key. If you do not enter the password correctly, a beep sounds and the security dialog box disappears.

3. You will then be prompted to enter the **New Password** in the text box. Recall that the password can be up to three characters consisting of the numbers 0-9 and the letters A-Z. After clicking on the **OK** button or hitting the enter key, you will be prompted for the new password again.

4. If both new password attempts were identical, the new password will be accepted and the **Security** dialog box will disappear. If ProView is connected to the ProControl, the new password will be in effect for both ProView and the ProControl unit.

Analog Output Options

If your ProControl system is configured with analog outputs, you will be able to adjust the output level, or the parameters used in a control algorithm associated with that output. Your system integrator should have already configured your analog outputs with these algorithms if they apply to your process. Analog outputs can be involved in one of two different types of control scheme: **PID** or **Proportional** control. A **PID** (Proportional-Integral-Derivative) Loop is a feedback-based loop that maintains an analog input at a user-defined ***Setpoint***. The ProControl automatically adjusts the analog output using a mathematical formula that includes ***Gains*** for the proportional, integral and derivative terms. PID control is a commonly-used process control technique, descriptions of which can be found in most control theory texts.

FYI

If you are familiar with PID control terms, note that the PID gains used by the ProControl are defined differently than some of the terms in traditional use. **Proportional Gain** *on the ProControl corresponds with the classic definition of* **proportional band**. *However, the* **Integral Gain** *and* **Derivative Gain** *are the* ***inverse*** *of* **integral (or reset) time** *and* **derivative time**. *Hence, an* ***increase*** *in any of these gains tends to* ***increase*** *the corresponding proportional, integral and derivative action.*

A **PRO** (Open-loop Proportional) algorithm generates an analog output signal that is directly proportional to the value of an analog input. The analog output percentage is computed by multiplying a constant of proportionality by the associated input's percentage of full-scale.

If a control scheme is not assigned to an analog output (or if the output has been placed in **Manual** mode), you can change the output value by clicking on the slider for that output and dragging it up or down, or by highlighting the number beneath the slider scale and typing a new value.

You can modify the PID parameters of a PID-controlled analog output (the **P**, **I** and **D Gains**) if your analog output is not responding smoothly or quickly enough to changes in its associated input. The proportional (**P**) gain specifies the output level based on the error between the **Set Point** (desired input level) and the actual input level. Integral (**I**) gain smoothes the output level based on the tracking history of the input to the **Set Point** and provides a means of better steady state control. Derivative (**D**) gain will allow the output to respond to quick changes in the input and provides a means of establishing good transient or instantaneous control.

In the case of a **PRO** output, you can modify the **P Gain** to alter how much the output value changes as the associated input changes. A value of 100 indicates that the output will be 100% when the input is at full scale. A value of 50 indicates that the output will be 50% when the input is at full scale

The **Max Change** parameter allows you to regulate how much the analog output can change in one control cycle (one control cycle is about 1/4 of a second).

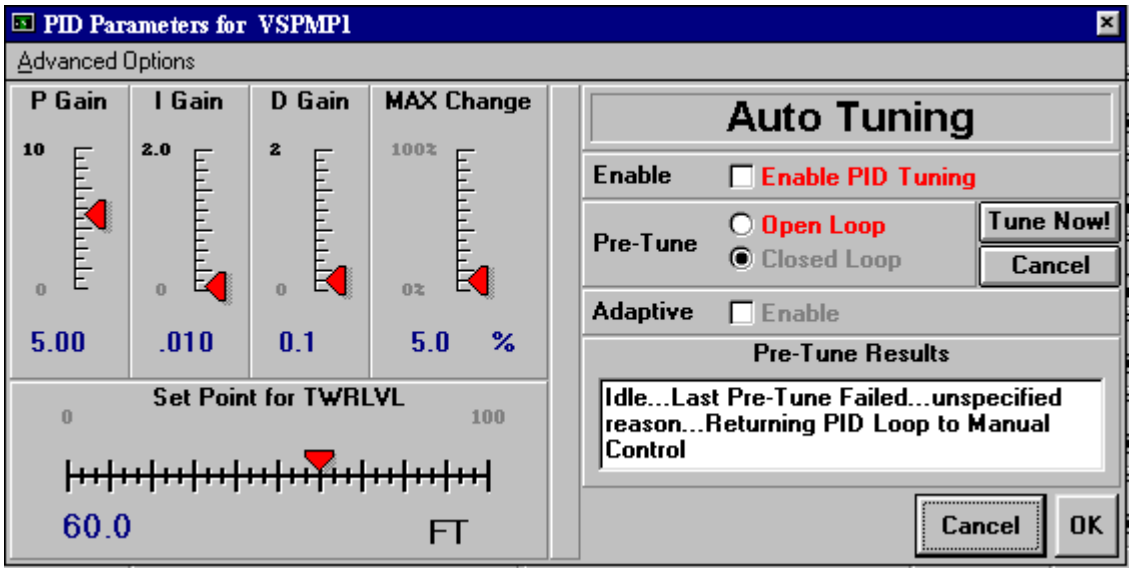
! *Be sure you fully understand PID and proportional control concepts before adjusting any of these parameters. Large changes in output can result from changing the gains or the set point, which can cause equipment damage or unforeseen safety hazards. For help in choosing appropriate gains for your process, contact EOS Research technical support.*

To change the **PRO** or **PID** parameters, **Set Point**, or **Max Change** parameters:

1. It is highly recommended to first place your analog output into **Manual** mode. Click on the **PID** (or **PRO**) beneath the Tagname and wait a second for it to change to **Manual**.

2. Position the mouse pointer over the analog output's tagname until a balloon appears, and *right*-click until you see **PID Options**.

3. Left-click and the **PID Parameters** dialog box appears.



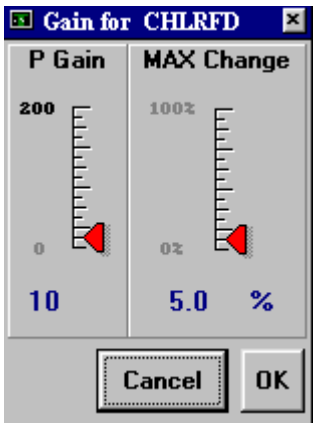
4. To change any of these parameters, you can either click and drag the sliding scale or click the numerical text and enter the value through the keyboard. You can also change the upper limit on all of the gain scales.

5. Click the **OK** button to save your changes. If not, click the **Cancel** button.

6. To restart your PID loop, click the word **Manual** underneath the Tagname and wait a second for it to change to **PID**. Your new parameters are now in use by the ProControl.

One type of auto-tuning algorithm is provided with ProView, and can be used to calculate optimal PID parameters for certain types of process loops. Contact EOS Research technical support to see if auto-tuning may benefit your process.

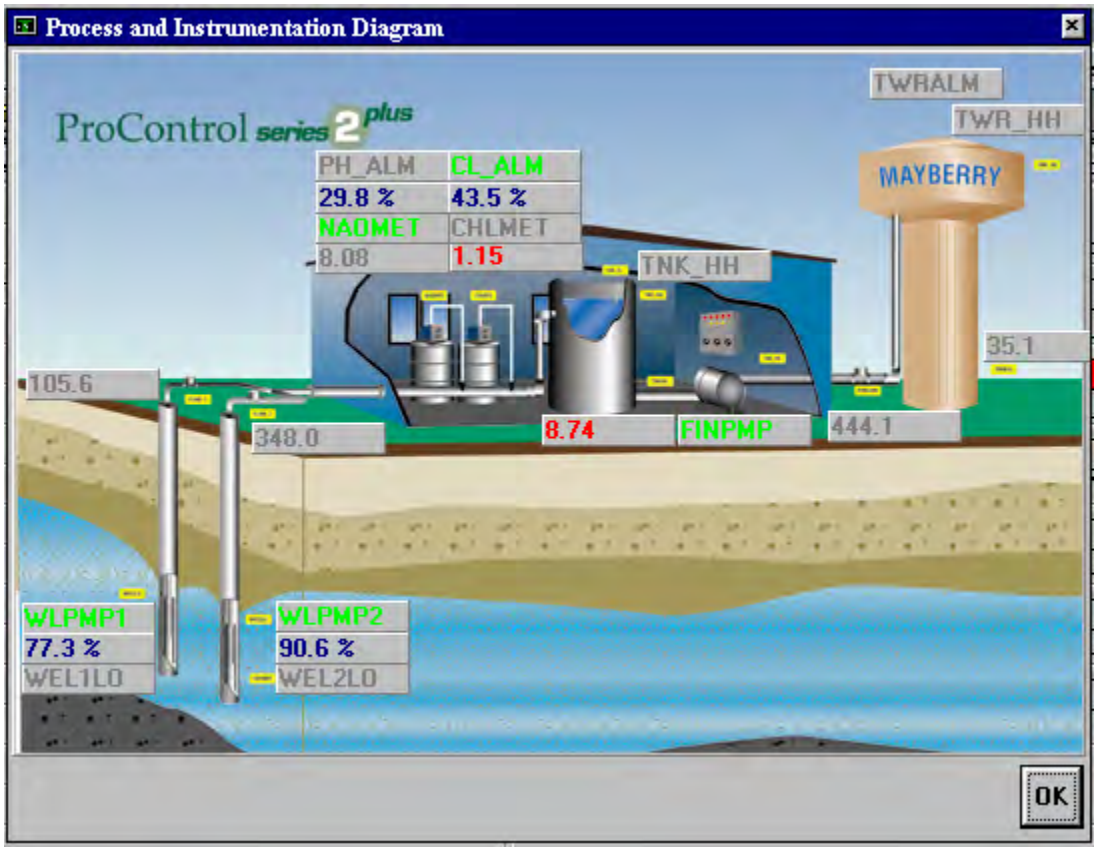
If the analog output is configured for proportional output, the dialog box on the right will be displayed. You can make changes as outlined above.



Process and Instrumentation Diagram

The **P&ID** option allows you to pull up an alternate "process and instrumentation diagram" representation of your system, which can be used to display operating data that is superimposed on a process diagram (or map, or picture of your dog, etc.). The P&ID option is designed to provide an alternate human-machine interface (HMI) for ProView with customizable graphics. Note that the P&ID screen is not interactive like the main ProView screen is; that is, data can be displayed on this screen, but commands cannot be issued from it.

Typically, your system integrator would configure this screen for you. The P&ID capability must be enabled by the integrator in order for you to use this feature. If this option has been included in your system configuration, you can view this diagram by clicking on the P & ID icon  .



The **Process and Instrumentation Diagram** contains a graphical representation of your system. Digital inputs and outputs are displayed as tagname boxes that change color when the I/O point is active (red or green). Analog I/O are displayed as numerical values, with analog outputs also containing the **%** symbol to distinguish them from analog inputs. Click the **OK** button to go back to the main ProView screen.

As discussed above, the P&ID screen is typically supplied by your system integrator. However, if you would like to make changes to the P&ID screen, follow the procedures outlined below. If you want to change the background image, you can create a new **.pid** file. The P&ID must be a bitmap format file (.bmp) that can be

created with Paintbrush™ or other drawing programs. The bitmap image can be any size you choose, the file name must be the same as your ProView site file (**.pvs**) with the filename extension changed to **.pid**, and it must be placed in the same folder as your .pvs file.

When you open the P&ID screen in ProView, you can move or remove the I/O boxes as you choose. Remember to **Save** the site file before you exit ProView to store these changes.

To change the appearance of the P & ID:

1. To move a descriptive box containing either a tagname or value, hold the shift key and click the left mouse button when positioned on the appropriate box. This will enable you to drag and re-position the box wherever you choose.
2. To remove a descriptive box, double-click on the box. Once you have removed a box, it will no longer be available to you unless you restore all boxes.
3. To restore all descriptive boxes, position the mouse at the bottom of the P & ID window in the gray area. Then hold down the control and shift keys while simultaneously clicking the left mouse button.

CHAPTER 6: WORKING WITH LOGGED DATA

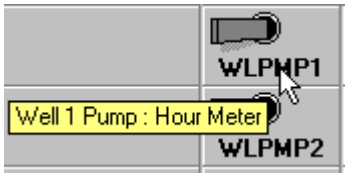
This chapter explains how to gather and analyze logged data that is being stored in the ProControl unit's battery-backed memory.

Hour Meters

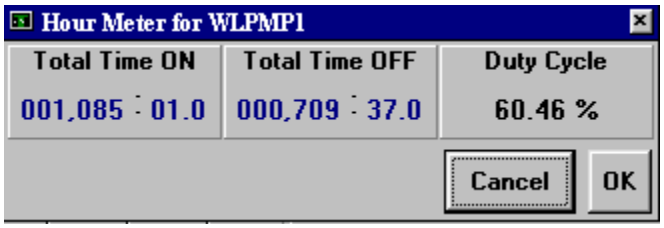
The ProControl maintains **Hour Meters** for inputs and outputs to indicate how long the I/O point has been ON and OFF. The hour meters are particularly useful in keeping track of equipment "run" times (discrete outputs), but are also maintained for discrete and analog inputs. For analog inputs, the hour meters indicate the time the input has been in and out of its *Active State* (see the definition of Active State in the Series 2^{plus} User Manual). The hour meters are updated every second on the ProControl unit. The ON and OFF times are displayed at a resolution of 1/10 (0.1) of a minute.

To read the Hour Meters, follow these steps:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, then *right*-click until you see **Hour Meter**.



2. Click the left mouse button to view the hour meter. The **Hour Meter** dialog box appears.



3. The **Hour Meter** box displays information in the form of **Hours : Minutes.10th Minutes** for both ON time and OFF time. The **Duty Cycle** or ratio of ON time to total time is also displayed. It may take a few seconds for the display to be updated once the dialog box appears.

4. To edit the **Total Time ON** or **Total Time OFF**, click and highlight the total time text and make the required changes. Press the enter key to confirm the changes and send the new value to the ProControl unit. Resetting the time values to zero, for instance, can be used when a motor is changed out, to keep track of lubrication intervals, etc.

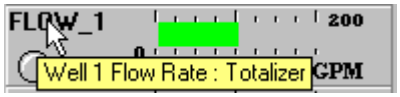
5. Click on the **OK** button to close the **Hour Meter** dialog box.

Totalizers

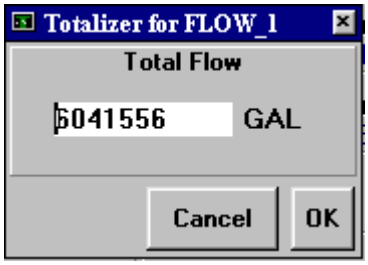
If your site configuration includes an analog input to which a flow meter or pulse counter is connected, it may also include a **Totalizer**. Totalizers provide the ability to view the cumulative total of a flow-based input or accumulated pulses from a counting device.

To view the **Totalizer** do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, then *right*-click until you see **Totalizer**.



2. Click the left mouse button to view the totalizer. The **Totalizer** dialog box appears.



3. The **Total Flow** for this input since the totalizer was last reset is displayed. It is updated every second while the dialog box is visible and while ProView is connected to the ProControl unit.

4. If you would like to set the totalizer to a different value, click on the value displayed in the dialog box. Enter the new value for the totalizer and press the enter key.

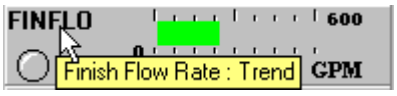
5. Click on the **OK** button to close the **Totalizer** dialog box.

Trend Graphing

ProView can display a real-time trend graph while you are connected either locally or remotely to the ProControl. A 5-minute trend can be displayed in the lower left hand side of the ProView window.

To start trend graphing:

1. Position the mouse pointer over an analog input's tagname until a balloon appears, then *right*-click until you see **Trend**.



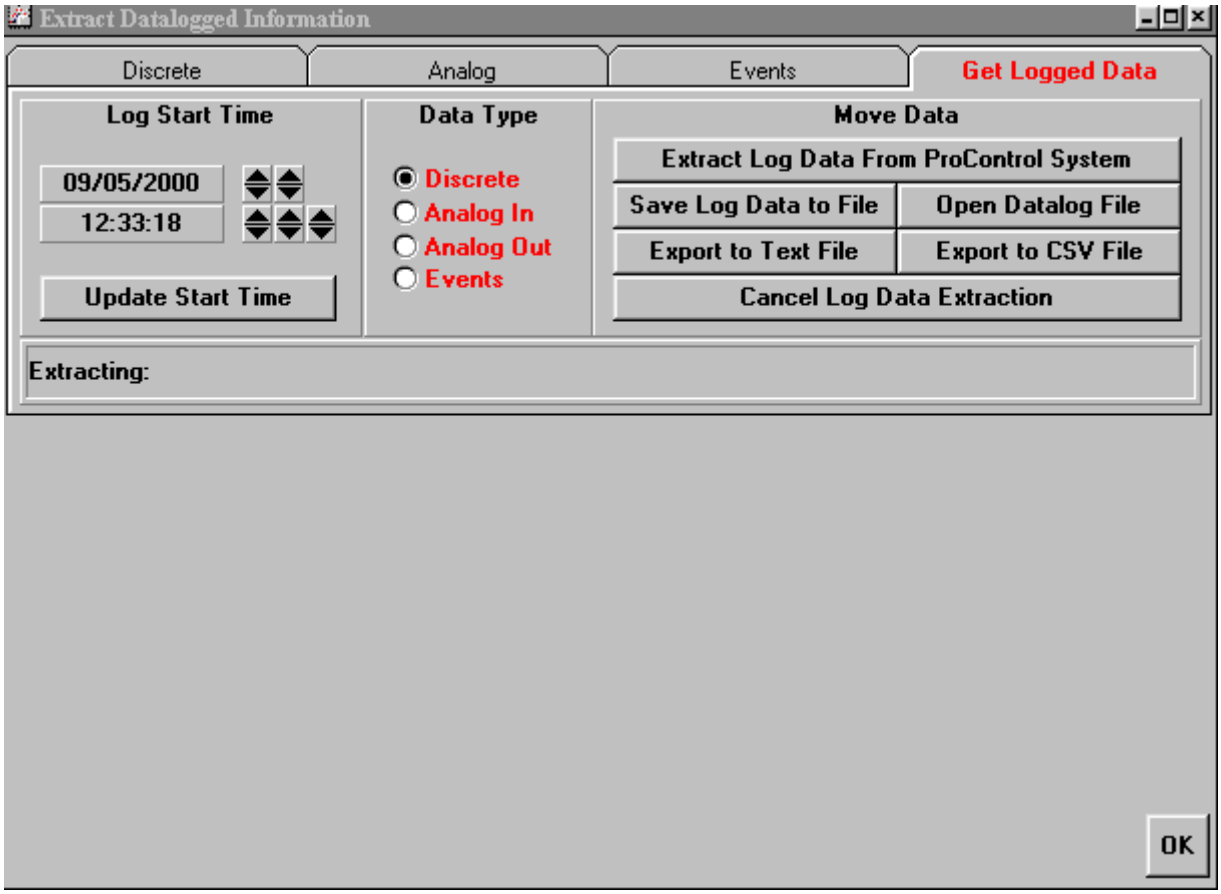
2. Click the left mouse button to produce the **Trend** window for that input.

3. The trend window provides a 5-minute history of the real-time data for that analog input. You will see the trend "drift" from right to left across the window, and it will be updated as long as you are connected to the ProControl. If you wish to observe another trend, click on the tagname of another analog input and the trend window will be refreshed with the new data.

4. To stop trending and empty the trend window, click on the **Trend for…** text block in the trend panel.

Downloading Logged Data

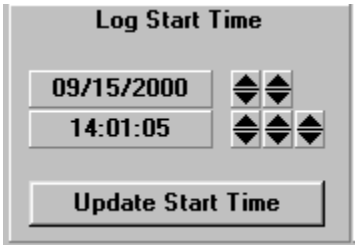
Operations data is stored electronically in the ProControl's memory in accordance with the datalogging setup (Chapter 5). To view the logged data, click on **Get Logged Data** in the **Datalogging** menu. This opens the **Extract Datalogged Information** dialog box.



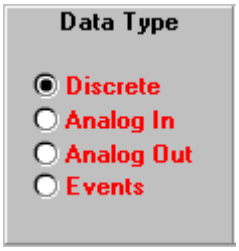
Getting Logged Data

To extract datalogged information from the ProControl unit, do the following:

1. Select the start time in the **Log Start Time** panel. ProView will extract all data that has been logged since this time. Change the start time by clicking on the spin buttons to increase or decrease the Month, Day, Hour, Minute or Second. Click on the **Update Start Time** button to reset the start time to the current time.



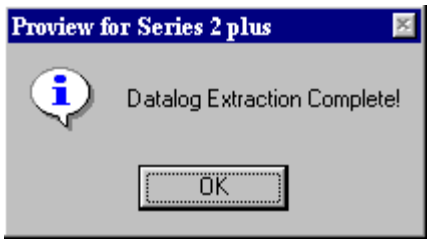
2. Select the type of data you wish to extract. Click on the **Discrete**, **Analog In**, **Analog Out** or **Events** radio button.



3. Click on the **Extract Log Data From ProControl System** button.

4. ProView performs a scan of available data. You can then monitor the progress of the data extraction.

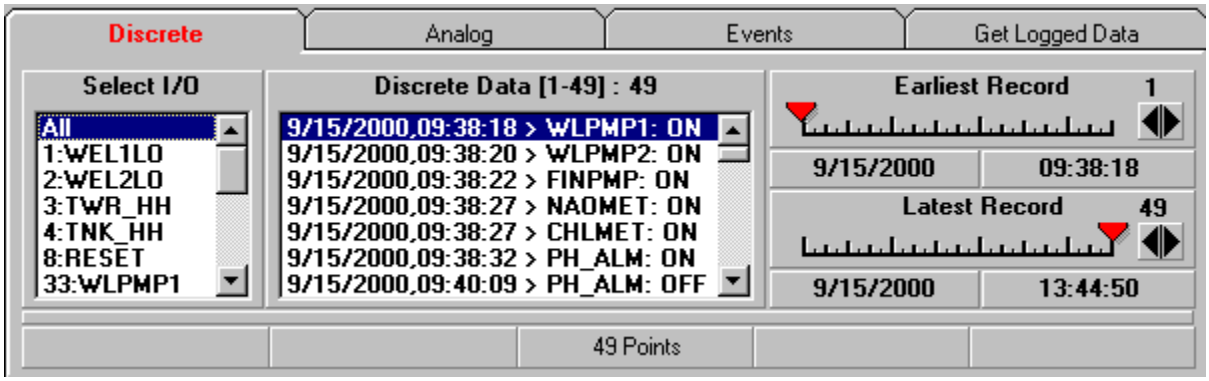
5. A message box will appear when the data extraction process is complete.



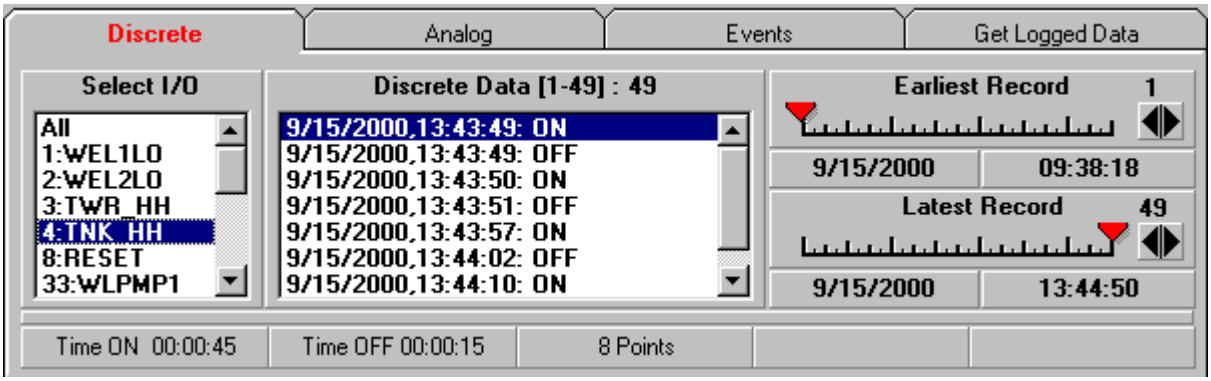
Looking at Discrete Data

To examine the discrete datalog record that you have extracted click on the **Discrete** tab.

The **Discrete** data window appears. On the left, the **Select I/O** list box contains a list of all enabled discrete inputs and outputs. In the middle is the **Discrete Data** record. On the right, the **Earliest Record** extracted is shown as 9:38:18 on 9/15/2000. The **Latest Record** is 13:44:50 on 9/15/2000. A total of 49 records were extracted. Clicking on **All** in the **Select I/O** list box will show the entire discrete record in the **Discrete Data** window. You can scroll through the discrete records in the window.

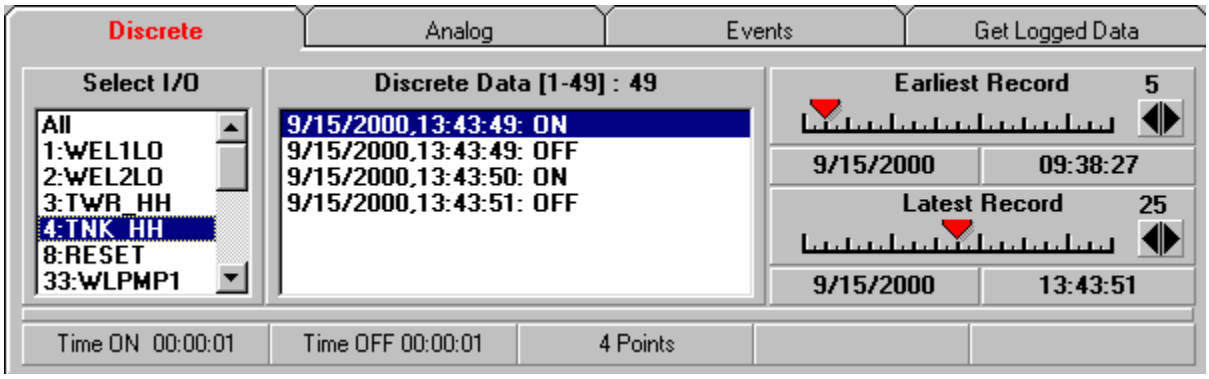


The **Select I/O** list box can be used to filter the data record to include just one discrete input or output. In the example below, the **TNK_HH** input has been selected. Whenever a single input or output is selected, statistics are generated regarding the selected input or output, spanning the period of time from the first state change to the last one in the record. There are 8 data points for **TNK_HH** below, and the input was ON for 45 seconds and OFF for 15 seconds for the period of time between the first and last record.



Moving the **Earliest Record** and **Latest Record** sliders or spin buttons will filter the total record with respect to time. Click and hold a slider and move the mouse to the left or right. You can also click on the spin buttons to change the time window. When you are finished filtering the time, click again on the input you wish to examine in the **Select I/O** list box to see the results of your changes. In the example below, the

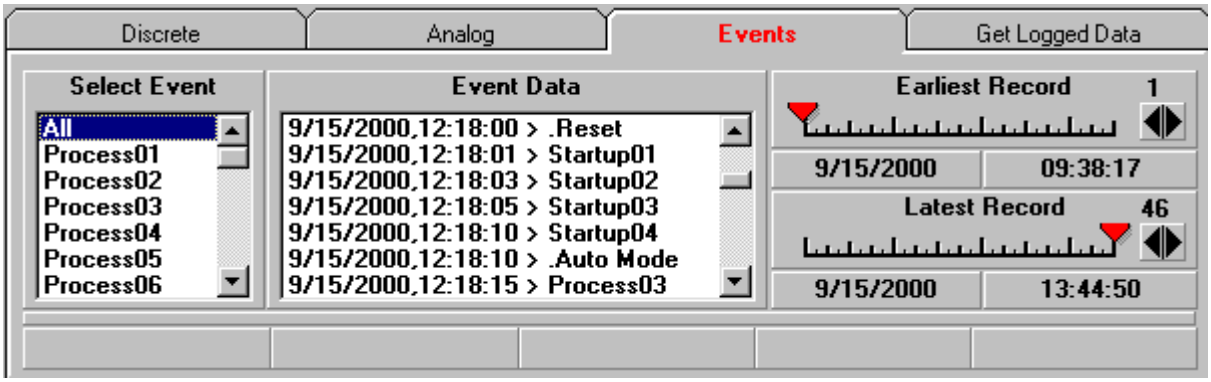
total record has been limited to records 5 through 25. Within this time interval, 4 state changes of **TNK_HH** occurred.



Looking at Events Data

First, go back to the **Get Logged Data** tab and extract the **Events** data. After the data has been extracted, click on the **Events** tab to examine the event datalogging record.

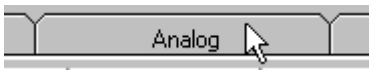
The **Events** data window appears. The **Select Event** list box contains a list of all enabled processes and other ProControl events. In the middle is the **Event Data** record. The **Earliest Record** and **Latest Record** extracted are shown to the right.



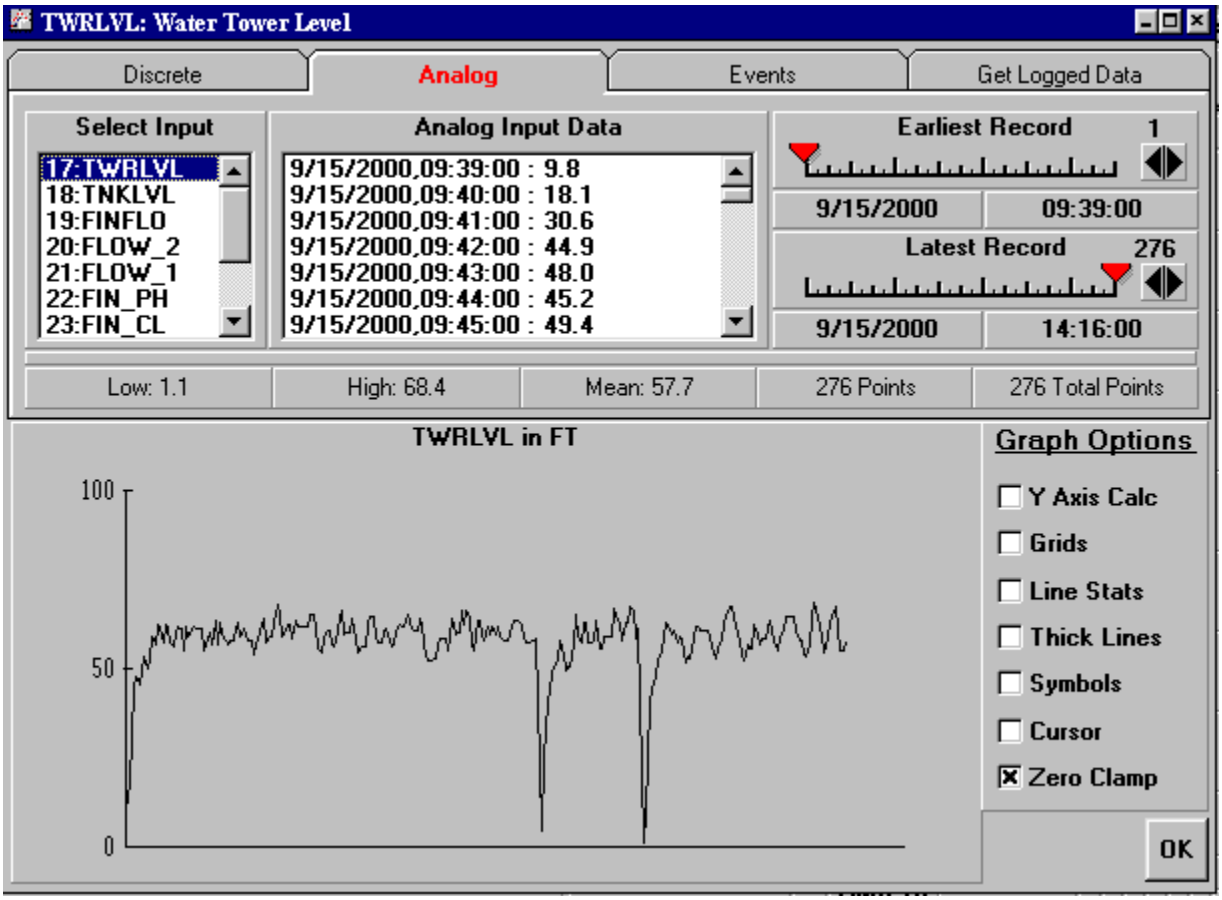
To view the data, follow the same procedure described for **Discrete Data**. Clicking on **All** in the **Select Event** list box will display all the events that were extracted. By clicking on an event in the **Event Data** window, a description is provided in the **Process Description** window below.

Looking at Analog Data

First, go back to the **Get Logged Data** tab and extract the **Analog In** or **Analog Out** data. After the data has been extracted, click on the **Analog** tab to examine the event datalogging record.



The **Analog** data window appears. The **Select Input** list box contains a list of all enabled analog inputs and outputs. In the middle is the **Analog Input Data** record. The **Earliest Record** and **Latest Record** extracted are shown to the right. By clicking on an input or output in the **Select Input** list box, a graph will be displayed in the window below.



In the example above, a water tower level is shown as it varies over time. Immediately above the graph, statistics are shown regarding the selected analog point (in this case there are 276 data points with a **Low** of 1.1, a **High** of 68.4 and a **Mean** of 57.7). As with the digital and events data, the **Earliest Record** and **Latest Record** sliders and spin buttons can be used to filter the total record with respect to time, which is helpful in focusing on a smaller portion of the graph. If you filter the data in this way, be sure to click on the input tagname again in the **Select Input** list box to see the results of your changes.

Graphing Options

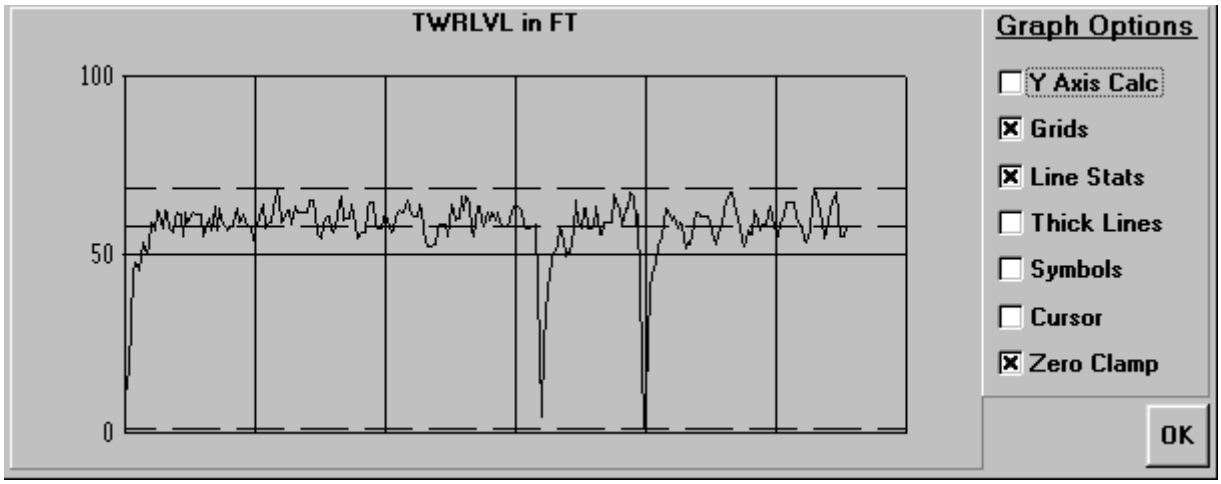
Graph Options are available to change the look of the analog graph. Click on the check box adjacent to the option you want to use to enable it. The graphing options are described below.

Y Axis Calc: The default Y axis range displayed by ProView is that which is configured for that input in the ProControl unit. By clicking on **Y Axis Calc**, ProView redraws the graph with a calculated Y axis range

based on the data in the sample. This will typically "tighten" the vertical axis on the graph to aid in showing smaller changes in the sampled data. Holding down the Shift, Control, or Alt key, respectively, while clicking **Y Axis Calc** will produce progressively tighter calculations of the vertical scale.

Grids: The grid option places some vertical and horizontal lines on the graph for reference.

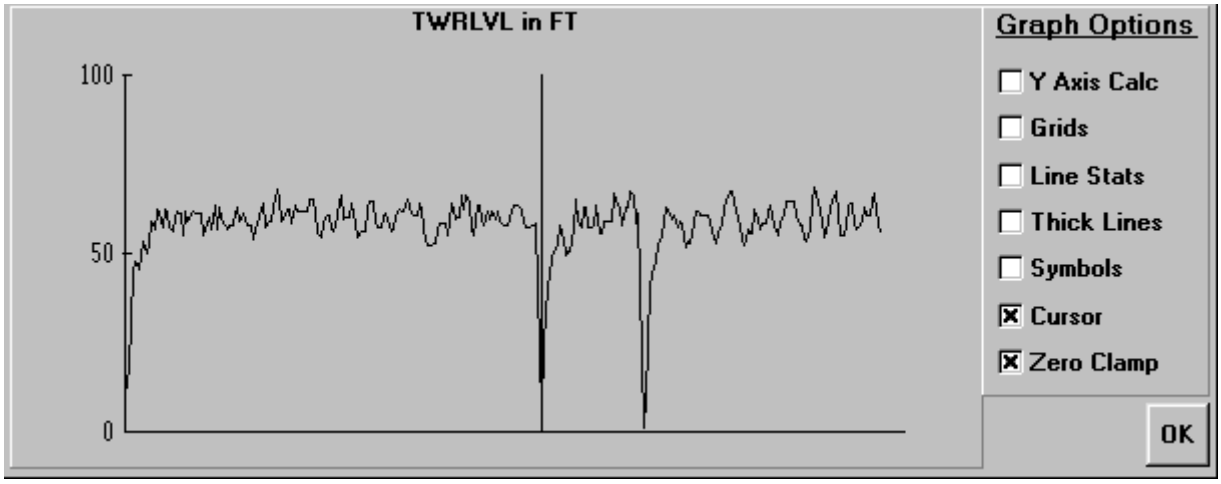
Line Stats: This option will draw dashed lines across the graph at the **Low**, **High** and **Mean** input levels. In the example below, the **Grids** and **Line Stats** options have been checked.



Thick Lines: This option increases the line weight of the graph.

Symbols: This option places a small "+" at each data point.

Cursor: This option places a vertical line on the graph at a data point selected in the **Analog Input Data** window. This option makes it easier to correlate the list data with the graph.



Zero Clamp: This option is selected by default, and forces the graph to display zero at all points where data was logged with a value less than zero. Negative values can be logged when an analog transmitter outputs less than 4 mA.

FYI

Be sure to disable the Zero Clamp option if you are viewing data for an analog input whose value can drop below zero under typical operating conditions.

After you are finished examining the datalogged information, you may want to save it for future reference within ProView or export it to a spreadsheet, database program or word processor.

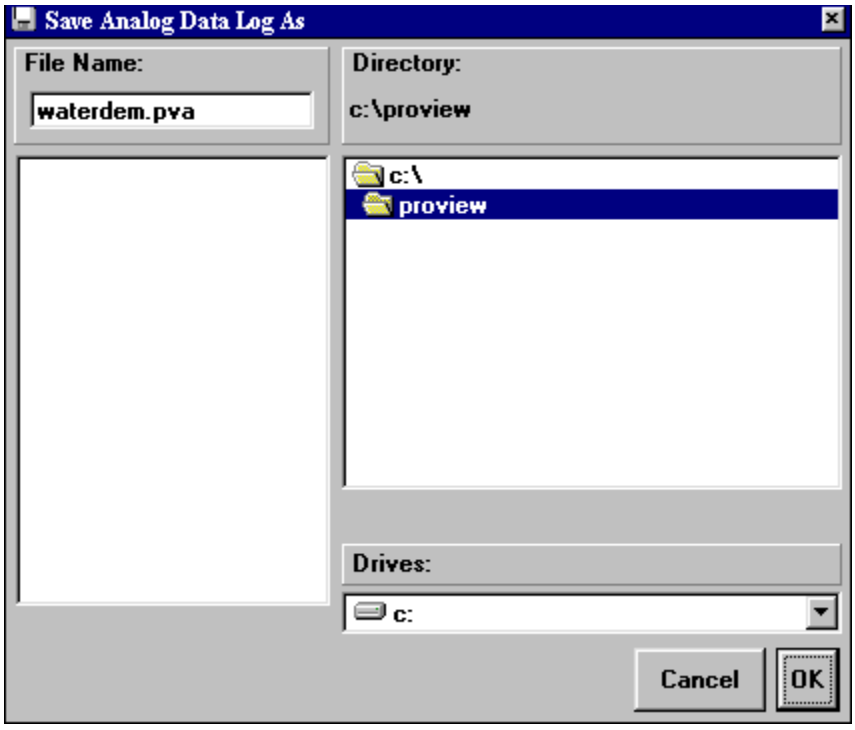
Saving Logged Data to File

To save a datalogging record to a ProView-readable file, do the following:

1. Click on the **Get Logged Data** tab. Select the type of file you wish to save by clicking on the appropriate button in the **Data Type** panel. *Remember that you must have already completed the separate step of extracting the data type you wish to save.*

2. Click on the **Save Log Data to File** button.

3. This opens the **Save *xxxxxx* Data Log As** dialog box, where ***xxxxxx*** is the type of data you wish to save. ProView selects a default file name for you, which is the name of the site configuration file with the .pvd, .pva or .pve file extension depending on the type of data file you intend to save (discrete, analog, or events, respectively). However, you may wish to change the file name to indicate a date representative of the log you are saving, for instance.



5. Click the **OK** button to save the file.

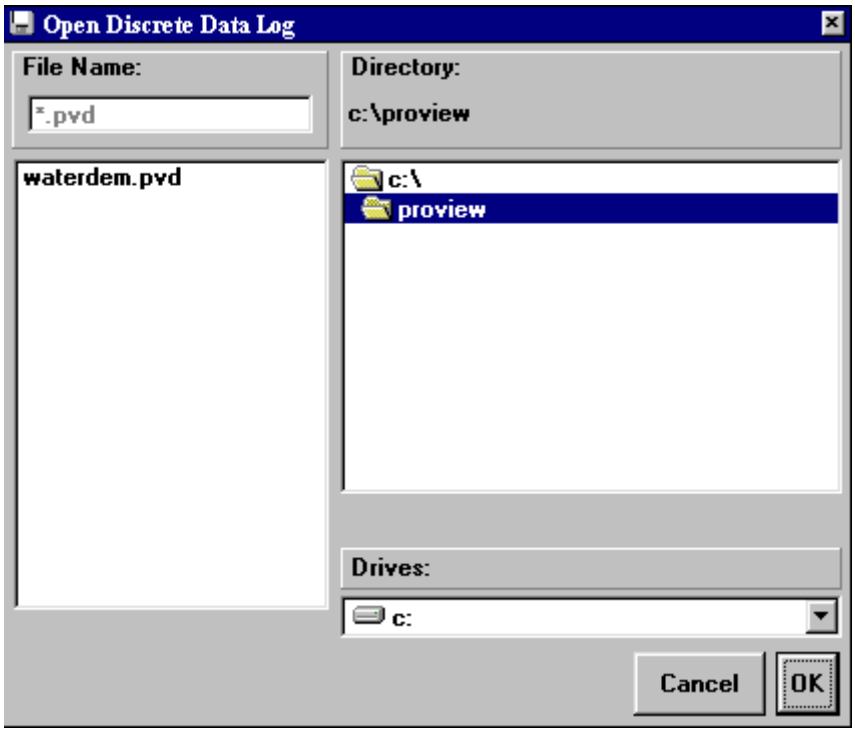
Opening a Datalog File

To view data that was previously saved in ProView-readable format, do the following:

1. In the **Get Logged Data** tab of the **Extract Datalogged Information** dialog box, select the type of data file you wish to open by clicking on the appropriate button in the **Data Type** panel.

2. Click on the **Open Datalog File** button.

3. This opens the **Open *xxxxxx* Data Log As** dialog box, where ***xxxxxx*** is the type of data you wish to view. ProView lists any files in the folder you have selected that contain the .pvd, .pva or .pve file extension (depending on the type of data file you intend to open). Click on the name of the file you wish to open, and it will appear in the **File Name:** text box. If the file you wish to open is stored elsewhere, select the location in the **Drives:** and **Directory:** list boxes.



4. Click on the **OK** button to open the file. View the data as you would any logged data that you have just extracted.

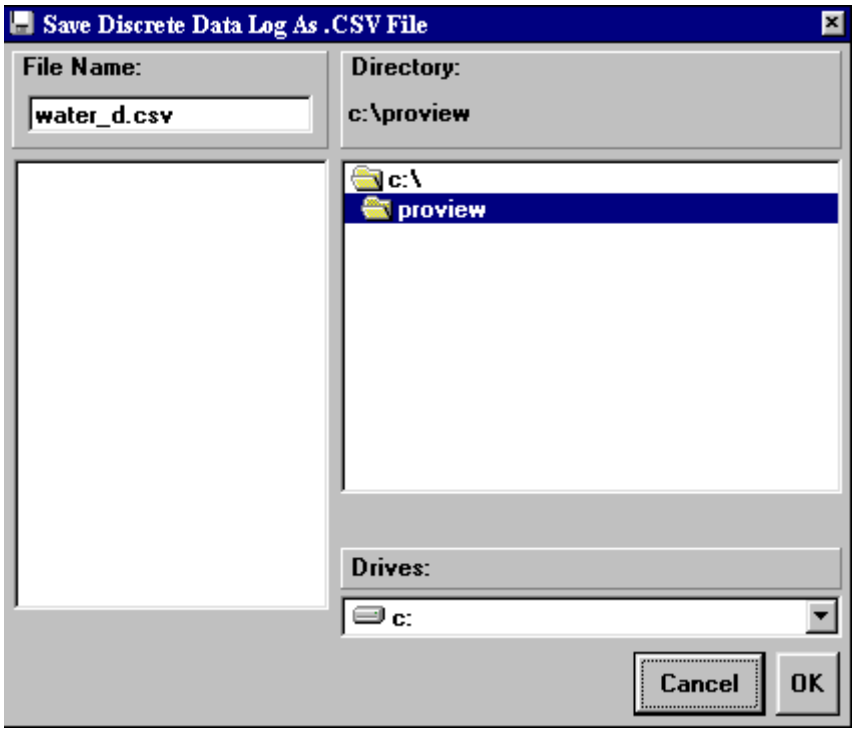
Exporting Logged Data for use in Other Applications

ProView provides users the ability to export data for use in other applications, so that you can take advantage of the data manipulation and graphing capabilities provided by widely-used software. ProView allows you to export analog, discrete or event data to a CSV (Comma-Separated Variable) file, which can then be opened by any spreadsheet or database program (e.g., Microsoft Excel™, Access™). You can also export discrete and event data to a text file for use in a word processor.

1. In the **Extract Datalogged Information** dialog box, click on the **Get Logged Data** tab. Select the type of file you wish to export by clicking on the appropriate button in the **Data Type** panel. Note that analog output data cannot be exported.

2. Click on the **Export to Text File** or **Export to CSV File** button.

3. This opens the **Save Analog Data Log As .CSV File,** the **Save Discrete Data Log As .TXT File** or other dialog box, depending on the type of file you wish to export. The default file name is the truncated name of the site configuration file with the .csv or .txt extension. However, you may wish to change the file name to indicate a date representative of the log you are saving, for instance.



5. Click the **OK** button to export the file.

6. You will be asked whether you would like to include header information in the file that is saved. The header provides two lines of basic site information and titles for the columns of data.

!

*The CSV file format is considered a **Text** format by most spreadsheet and database software. When you open the .csv file created by ProView, be sure to specify that you are opening a Text file. For instance, in Excel, in the **File….Open** dialog box, choose **Text Files** from the list in the **File of type** list box.*

FYI

*A word about the date format in the exported files: Discrete and event data are exported using a time stamp in which the date and the time are in separate columns or separated by a comma (for example, 9/15/2000,09:39:08). Analog data are exported using a combined date/time in standard Windows format (which is the decimal equivalent of the number of days and fractions of a day since January 1, 1900). When an analog data file is opened in a spreadsheet or database software package, you will probably want to reformat the date/time information in the leftmost column. For instance, in Excel, select the column, choose **Format….Cells**, and select a **Number** format that includes both the date and the time.*

CHAPTER 7: OTHER OPERATIONS

This chapter explains how to save the site setup, print current operating data to a file, view the process configuration, use the annunciator feature and exit the program.

Saving the Site Configuration to File

While you work in ProView, you may change certain system settings that are stored in your site configuration (or .pvs) file. Examples of some of the parameters stored with your site file include remote communication settings, passwords, and notes for your tagnames. You should save your .pvs file before closing ProView if you make any changes to these parameters.

FYI

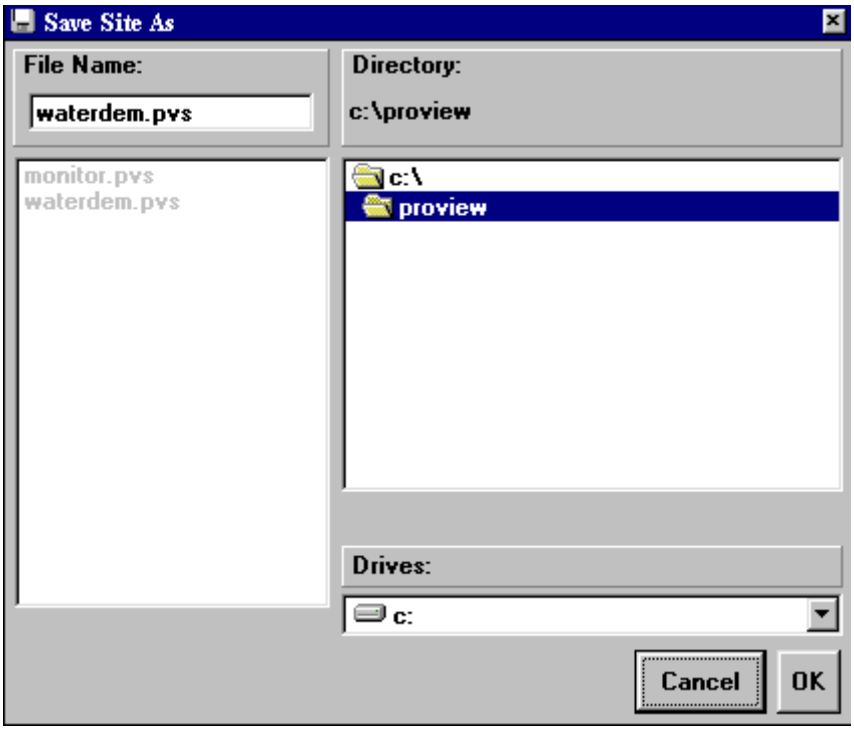
Remember that most operational settings, such as alarm levels, fax report numbers, datalogging setup, PID gains, etc. are stored in the ProControl unit, not in your site file. ProView "pulls up" this information stored in the ProControl unit when you connect to it. There is no need to save your site file if you only make changes to these operational settings.

To save your site configuration do the following:

1. Click on **Save Site** or **Save Site As…** in the **File** menu.

   Or

   Click on the **Save File** button on the toolbar.  The **Save Site As** dialog box appears. If you chose **File…Save Site**, ProView bypasses the dialog box.



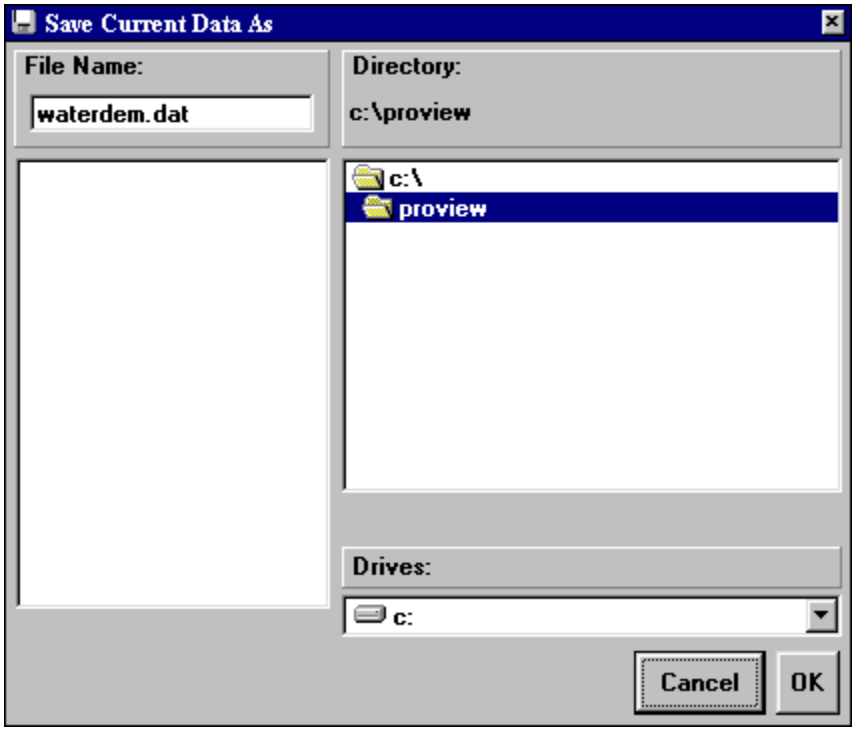
2. Select the **Drive**, **Directory** and **File Name** you would like and click on the **OK** button to save the file. You will be asked whether you wish to overwrite the existing file. Choose **Yes** to complete the file save.

Printing the Current Data to File

While you are connected to your ProControl via ProView, you can print the current operating data to a text file for future reference. This can prove useful for documentation and reporting purposes.

To save your current process data to a text file, do the following:

1. Click on **Print Current Data** in the **File** menu. You will see the **Save Current Data As** dialog box.



2. Select the **Drive**, **Directory** and **File Name** you would like. ProView selects a default file name for you, which is the name of the site configuration file with a .dat file extension. However, you may wish to change the file name to indicate a date representative of the information you are saving, for instance. Click the **OK** button to save the current data to the file.

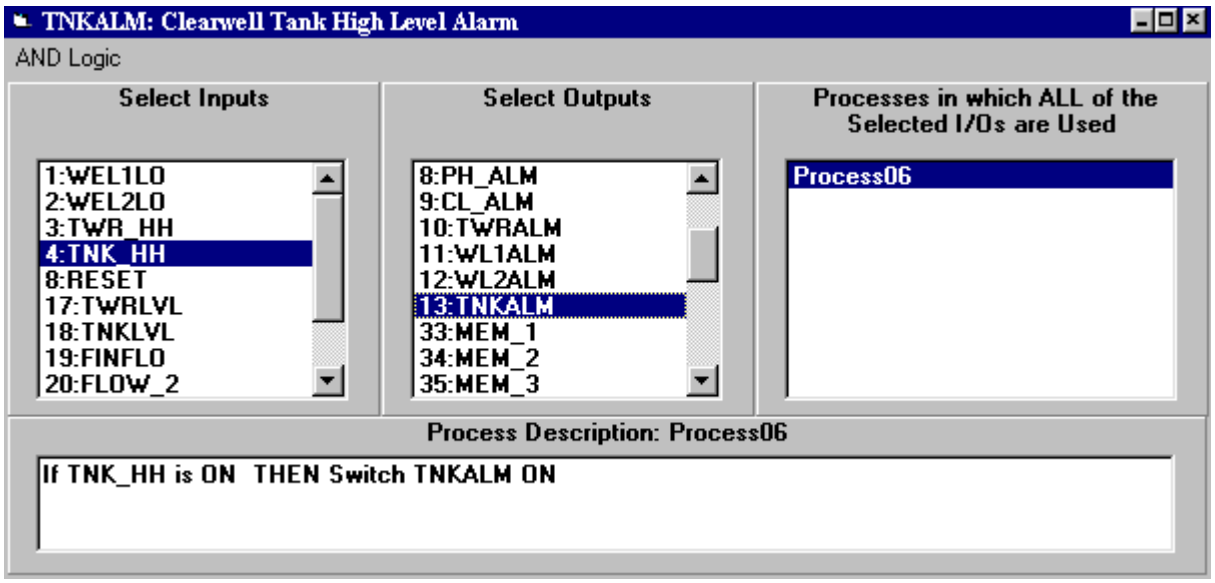
You can examine the current data file with any text editor or word processor. An example of a file generated for our sample operation is shown on the following pages.

```
                        EOS RESEARCH LTD.
                      ProControl Series II+

                ProView Current Operational Information


      ***********************************************************************
      ***** FAX Recipient:     BULLWINKLE MOOSE                          *****
      ***** Customer:          MAYBERRY WATER DEPT                       *****
      ***** Site Location:     MAYBERRY RFD                              *****
      ***********************************************************************
      ***** Setup:             1                                         *****
      ***** Option:            B                                         *****
      ***** Type:              102                                       *****
      ***** Serial Number:     7429                                      *****
      ***** Date:              04/23/2000                                *****
      ***** Time:              14:52:35                                  *****
      ***** ProView:           Version 2.153                             *****
      ***********************************************************************

    ***************************************************************
    ***** Communications State:   REMOTE CONNECT                *****
    ***** System Mode:            Auto 14                       *****
    ***** Last Shutdown:          Last Shutdown 12:28:27 , 2/20/2000 , Remote
                                                                *****
    ***** Alarms:                 Alarms SET                    *****
    ***** FAX:                    Report ON                     *****
    ***************************************************************


THE CURRENT INPUT STATUS:

#  TAGNAME CURRENT VALUE LO ALARM  HI ALARM     TOTALIZER         HOURS ON       HOURS OFF
-- ------- ------------- --------- --------- ---------------    -------------  -------------
1  WEL1LO  is OFF                                               000,000  23.6  002,704  52.8
2  WEL2LO  is OFF                                               000,000  02.7  002,705  13.8
3  TWR_HH  is OFF                                               000,000  01.0  002,705  15.5
4  TNK_HH  is OFF                                               000,000  01.5  002,705  14.9
8  RESET   is OFF                                               000,000  00.8  002,705  15.7
17 TWRLVL  41.0 FT       30.0      55.0                         000,044  36.7  002,660  39.6
18 TNKLVL  10.07 FT      9.00      11.00                        000,018  38.8  002,686  37.7
19 FINFLO  220.0 GPM     0.0       600.0     2,707,032   GAL    000,749  30.0  001,955  46.4
20 FLOW_2  178.1 GPM     0.0       400.0     11,535,456  GAL    000,758  50.8  001,946  25.6
21 FLOW_1  95.8 GPM      35.8      170.0     10,479,505  GAL    000,003  03.4  002,702  13.1
22 FIN_PH  8.39 PH       7.50      8.50                         001,004  05.6  001,701  10.8
23 FIN_CL  0.99 PPM      0.80      1.15                         000,499  10.1  002,206  06.3


THE CURRENT OUTPUT STATUS:

#  TAGNAME CURRENT VALUE                                         HOURS ON       HOURS OFF
-- ------- -------------                                       -------------  -------------
1  WLPMP1  is  ON                                               001,871  40.2  000,833  36.1
2  WLPMP2  is  ON                                               001,871  26.7  000,833  48.8
3  FINPMP  is  ON                                               001,871  27.5  000,833  48.5
4  CHLMET  is  ON                                               001,655  51.6  001,049  24.9
5  NAOMET  is  ON                                               001,099  11.9  001,606  04.6
8  PH_ALM  is OFF                                               000,991  03.1  001,714  13.3
9  CL_ALM  is OFF                                               000,485  39.2  002,219  37.3
10 TWRALM  is OFF                                               000,028  11.2  002,677  05.1
11 WL1ALM  is OFF                                               000,000  12.0  002,705  04.6
12 WL2ALM  is OFF                                               000,000  00.1  002,705  16.5
13 TNKALM  is OFF                                               000,003  42.3  002,701  34.3


THE CURRENT ANALOG OUTPUT STATUS:

#  TAGNAME  VALUE  PID Mode SETPOINT  P Gain I Gain  D Gain  MAX CHG
-- ------- ------- -------- --------- ------ ------- ------- -------
1  VSPMP1  39.1  %   ALG    40.0      10.0   .010    0.1     5.0   %
2  VSPMP2  46.9  %   ALG    10.00     7.33   .010    0.5     5.0   %
3  NAOHFD  32.0  %   ALG    8.25      9.16   .010    0.1     5.0   %
4  CHLRFD  22.3  %   ALG              50                     5.0   %
```

```
ANALOG OUTPUT NOTES
-------------------
VALUE   - The current output level expressed as a percentage 0%=4ma 100%=20ma.
MAN     - (Manual) The PID or PRO control loop algorithm has been turned off.
PID     - The (Proportional, Integral, Derivative) control loop is running.
PRO     - The open loop (Proportional) algorithm is running.
MAX CHG - The maximum amount the output can change in one control cycle.


THE CURRENT REPORTING SETUP:

     ********************************************************************************
     ***** Report Enable:          ON                                           *****
     ***** FAX Number 1:           1 (999) 555-1234                             *****
     ***** FAX Number 2:           555-4321                                     *****
     ***** Scheduled FAX:          Every Day at:       07:00                    *****
     ***** Next Scheduled FAX:     07:00                                        *****
     ***** Pager #1:               Enabled, Numeric                             *****
     ***** Pager #2:               Enabled, AlphaNumeric                        *****
     ***** Paging:                 Will occur at 2400 baud                      *****
     ***** Page Number 1:          1 (700) 555-6789                             *****
     ***** Pager ID    1:          9876543                                      *****
     ***** Page Number 2:          1 (700) 555-6789                             *****
     ***** Pager ID    2:          3456789                                      *****
     ********************************************************************************

THE CURRENT DATALOGGING SETUP:

     ********************************************************************************
     ***** Enabled Datalogging:    Digital ,Analog ,Event                       *****
     ***** Datalogging Interval:   00:01                                        *****
     ***** Next Datalog Time:      13:47                                        *****
     ********************************************************************************
```

Reviewing the Process Configuration

ProView includes a utility that can help you understand the control logic that is programmed into your ProControl unit (if your site file is not the most up-to-date version, note that the control logic shown may not match what is in your ProControl unit). Click on **Process Configuration** under the **File** menu, and the following screen will appear, showing the inputs and outputs that are configured for your system:



By selecting inputs and outputs from the left and center columns, respectively, you will see a listing of process tasks that include your selected I/O. For instance, if you choose an output from the center column, you will see a list of processes that turn that output ON or OFF in the window on the right. Clicking on a process will provide a description in the **Process Description** window. You can select both inputs and outputs to filter the list of processes. To de-select an I/O point, **<Ctrl> - left click** on it.

Annunciators

The Annunciator feature is useful for those ProControl users that remain connected to their systems for extended periods of time via ProView. The Annunciator is a visual alarm indicator for the ProView screen that is designed to draw attention to an alarm condition that *presently exists*, or *has occurred but has now cleared*. Clicking on **Annunciation** in the **File** menu toggles the Annunciation feature on and off. If any discrete or analog input that is configured as an alarm input becomes *active*, the input's tagname will turn red, and the System Status panel (the panel that indicates **Auto** or **Manual** mode) will begin to flash red. The annunciator continues to flash even if the input is no longer active, so that the operator does not miss an alarm condition. To acknowledge the alarm, click on **Clear Annunciators** in the **System** menu. If an alarm condition still exists, the annunciator will begin flashing again. *Note that only those alarm conditions that occur in the current ProView session will be annunciated.*

Exiting ProView

You can exit ProView by clicking on the  at the top of the main screen or by clicking **Exit** in the **File** menu. You will be asked whether you want to save your site file and any logged date that you have extracted.

Model 400 Basic Monitoring

Features & Specifications

Features

INPUT ZONES:

- Flexible inputs that support
  Normally Open or Normally Closed contacts
  Temperature sensors: -20°F to 150°F
  Four channels
- Automatic input type confi guration.
- Programmable recognition times.
- Internal calibration.

ALARM NOTIFICATION:

- Four user defined telephone numbers
- Makes voice phone calls with customized messages for easy identifi cation.
- Built-in alarm test function to simulate and test the notifi cation process.
- Includes telephone Line Seizure.

VOICE MESSAGES

- Built in vocabulary for keypad programming and sensor readings
- Record custom voice phrases in your own voice to describe each input zone
- Record site identification message

MICROPHONE

- Internal microphone for custom voice message recording
- Monitor high sound alarms
- Microphone can also be used for remote listen-in feature

OUTPUT RELAY

- Low voltage NO/NC output relay included
- Manual or automatic alarm response switching

REMOTE ACCESS

- Call in with any Touch-Tone phone to check the status of all monitored conditions
- Make programming changes remotely from any Touch-Tone phone
- Remotely control the output relay

LOCAL ACCESS

- Keypad and speaker for local programming
- Easy voice-prompted programming
- Password-protected to restrict programming access

COMPATIBILITY

- The Sensaphone 400 is a direct replacement for the model 1104 and Cottagesitter

POWER SUPPLY

- Comes with plug-in power supply
- 24 Hour battery backup using 6 size C alkaline batteries (not included)
- Automatically monitors for power failure alarms
- International power options available

BUILT IN COTTAGESITTER CONTROL

- The built in relay can be used to remotely change the temperature of a dual setback thermostat. Provide your own, or order the FGD-0064 Thermostat from Sensaphone

Specifications

Size	7½" W, 2" H, 8½" D
Shipping Weight	4 lbs

Learn More

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Ordering Information

Sensaphone 400
FGD-0400
MSRP: $395.00

Sensaphone 400 w/ International Power Supply
FGD-0400-INT
MSRP: $415.00

Accessories

Accessory Wire
FGD-0010
MSRP: $6.00

ISOTEL Surge Protector
FGD-0023
MSRP: $100.00

Dual Setback Thermostat for 400/800
FGD-0064
MSRP: $69.00

12V Power Supply for Thermostat
XFR-0024
MSRP: $6.00

Monitoring Sensors

Magnetic Reed Switch
FGD-0006
MSRP: $10.00

Infra-Red Motion Detector
FGD-0007
MSRP: $79.00

Spot Water Detector
FGD-0013
MSRP: $90.00

Temp Alert
FGD-0022
MSRP: $65.00

Humidistat
FGD-0027
MSRP: $40.00

Smoke Detector 110VAC
FGD-0049
MSRP: $55.00

Smoke Detector 110VAC with Battery backup
FGD-0049-B
MSRP: $65.00

PowerOut Alert MODEL PS-110
FGD-0054
MSRP: $59.00

Zone Water Detector
FGD-0056
MSRP: $135.00

Extra 10' Water Detection Rope
FGD-0063
MSRP: $70.00

Remote Temperature Sensor 2.8K
FGD-0100
MSRP: $20.00

Batteries	(6) 1.5 Volt "C" cell alkaline (not included)
Telephone Connection	FCC approved RJ-11 plug-in modular connector with 6' cord
Operating Temp. Range	Unit should be kept between 32° F and 120° F
Temperature Sensing Range	-20º F to 150º F with remote temperature sensor
	NRTL listed for compliance with U.L. Standard 60950-1

2.8K Weatherproof Temperature
FGD-0101
MSRP: $30.00

Float Switch
FGD-0222
MSRP: $39.00

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SENSAPHONE®
DESKTOP MONITORING SYSTEM

Model 400
User's Manual

Stay informed and in control of vital environmental conditions and processes with the fully-programmable ***Sensaphone® Model 400.***

PHONETICS, INC.

LIT-0129

SENSAPHONE®

Model 1104

User's Manual

including CottageSitter, BusinessSitter, RemoteControl & 1114 Line Seizure editions

Version 1.43

PHONETICS, INC.

Every effort has been made to ensure that the information in this document is complete, accurate and up-to-date. PHONETICS, INC. assumes no responsibility for the results of errors beyond its control. PHONETICS, INC. also cannot guarantee that changes in equipment made by other manufacturers, and referred to in this manual, will not affect the applicability of the information in this manual.

Revised Edition, version 1.43, November, 2004

Written and produced by Phonetics. Inc.

Please address all comments on this publication to:

PHONETICS, INC.
901 Tryens Road
Aston, PA 19014
www.sensaphone.com

IMPORTANT SAFETY INSTRUCTIONS

Your Model 1104 has been carefully designed to give you years of safe, reliable performance. As with all electrical equipment, however, there are a few basic precautions you should take to avoid hurting yourself or damaging the unit:

- Read the installation and operating instructions in this manual carefully. Be sure to save it for future reference.
- Read and follow all warning and instruction labels on the product itself.
- To protect the Model 1104 from overheating, make sure all openings on the unit are not blocked. Do not place on or near a heat source, such as a radiator or heat register.
- Do not use your Model 1104 near water, or spill liquid of any kind into it.
- Be certain that your power source matches the rating listed on the AC power transformer. If you're not sure of the type of power supply to your facility, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Do not overload wall outlets and extension cords, as this can result in the risk of fire or electric shock.
- Never push objects of any kind into this product through ventilation holes as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.
- To reduce the risk of electric shock, do not disassemble this product, but return it to Sensaphone Customer Service, or other approved repair facility, when any service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the unit is subsequently used.
- If anything happens that indicates that your Model 1104 is not working properly or has been damaged, unplug it immediately and follow the procedures in Appendix D for having it serviced. Return the unit for servicing under the following conditions:

1. The power cord or plug is frayed or damaged.
2. Liquid has been spilled into the product or it has been exposed to water.
3. The unit has been dropped, or the cabinet is damaged.
4. The unit doesn't function normally when you're following the operating instructions.

- Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.

CAUTION

To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the following type and size batteries: Alkaline, size D.
2. Do not dispose of the batteries in a fire. The cell may explode. Check with local codes for possible special disposal instructions.
3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.
4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.
5. Do not mix old and new batteries in this product.

FCC Requirements

Part 68: The Sensaphone® Model 1104 complies with Part 68 of the FCC rules. On the back of the unit there is a label that contains, among other information, the FCC Registration Number and the Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your local telephone company.

The REN is useful to determine the quantity of devices that you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the REN's of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices that you may connect to your line, you may want to contact your local telephone company to determine the maximum REN for your calling area.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

Should the Model 1104 cause harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, the telephone company may temporarily discontinue service without notice and you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC. The telephone company may make changes in its facilities, equipment, operations, or procedures where such action is reasonably required in the operation of its business and is not inconsistent with the rules and regulations of the FCC that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with this equipment, or you need information on obtaining service or repairs, please contact:

PHONETICS, INC.

901 Tryens Road, Aston, PA 19014

610-558-2700 Fax: 610-558-0222

The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

Part 15: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits a designed to provide reasonable protection against harmful interference in a residential 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 the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications Statement

Notice: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, where the company's inside wiring is associated with a single line, individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device to prevent overloading. The termination on loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100. For the Sensaphone® Model 1104, the Load Number is 8.

1 YEAR LIMITED WARRANTY

PLEASE READ THIS WARRANTY CAREFULLY BEFORE USING THE PRODUCT.

THIS LIMITED WARRANTY CONTAINS SENSAPHONE'S STANDARD TERMS AND CONDITIONS. WHERE PERMITTED BY THE APPLICABLE LAW, BY KEEPING YOUR SENSAPHONE PRODUCT BEYOND THIRTY (30) DAYS AFTER THE DATE OF DELIVERY, YOU FULLY ACCEPT THE TERMS AND CONDITIONS SET FORTH IN THIS LIMITED WARRANTY.

IN ADDITION, WHERE PERMITTED BY THE APPLICABLE LAW, YOUR INSTALLATION AND/OR USE OF THE PRODUCT CONSTITUTES FULL ACCEPTANCE OF THE TERMS AND CONDITIONS OF THIS LIMITED WARRANTY (HEREINAFTER REFERRED TO AS "LIMITED WARRANTY OR WARRANTY"). IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS THIS WARRANTY, INCLUDING ANY LIMITATIONS OF WARRANTY, INDEMNIFICATION TERMS OR LIMITATION OF LIABILITY, THEN YOU SHOULD NOT USE THE PRODUCT AND SHOULD RETURN IT TO THE SELLER FOR A REFUND OF THE PURCHASE PRICE. THE LAW MAY VARY BY JURISDICTION AS TO THE APPLICABILITY OF YOUR INSTALLATION OR USE ACTUALLY CONSTITUTING ACCEPTANCE OF THE TERMS AND CONDITIONS HEREIN AND AS TO THE APPLICABILITY OF ANY LIMITATION OF WARRANTY, INDEMNIFICATION TERMS OR LIMITATIONS OF LIABILITY.

1. **WARRANTOR**: In this Warranty, Warrantor shall mean "Dealer, Distributor, and/or Manufacturer."

2. **ELEMENTS OF WARRANTY**: This Product is warranted to be free from defects in materials and craftsmanship with only the limitations and exclusions set out below.

3. **WARRANTY AND REMEDY**: One-Year Warranty — In the event that the Product does not conform to this warranty at any time during the time of one year from original purchase, warrantor will repair the defect and return it to you at no charge.

This warranty shall terminate and be of no further effect at the time the product is: (1) damaged by extraneous cause such as fire, water, lightning, etc. or not maintained as reasonable and necessary; or (2) modified; or (3) improperly installed; or (4) misused; or (5) repaired or serviced by someone other than Warrantors' authorized personnel or someone expressly authorized by Warrantor's to make such service or repairs; (6) used in a manner or purpose for which the product was not intended; or (7) sold by original purchaser.

LIMITED WARRANTY, LIMITATION OF DAMAGES AND DISCLAIMER OF LIABILITY FOR DAMAGES: THE WARRANTOR'S OBLIGATION UNDER

THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AT THE WARRANTOR'S OPTION AS TO REPAIR OR REPLACEMENT. IN NO EVENT SHALL WARRANTORS BE LIABLE OR RESPONSIBLE FOR PAYMENT OF ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL AND/OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO ANY LABOR COSTS, PRODUCT COSTS, LOST REVENUE, BUSINESS INTERRUTPION LOSSES, LOST PROFITS, LOSS OF BUSINESS, LOSS OF DATA OR INFORMATION, OR FINANCIAL LOSS, FOR CLAIMS OF ANY NATURE, INCLUDING BUT NOT LIMITED TO CLAIMS IN CONTRACT, BREACH OF WARRANTY OR TORT, AND WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE. IN THE EVENT THAT IT IS DETERMINED IN ANY ADJUDICATION THAT THE LIMITED WARRANTIES OF REPAIR OR REPLACEMENT ARE INAPPLICABLE, THEN THE PURCHASER'S SOLE REMEDY SHALL BE PAYMENT TO THE PURCHASER OF THE ORIGINAL COST OF THE PRODUCT, AND IN NO EVENT SHALL WARRANTORS BE LIABLE OR RESPONSIBLE FOR PAYMENT OF ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL AND/OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO ANY LOST REVENUE, BUSINESS INTERRUTPION LOSSES, LOST PROFITS, LOSS OF BUSINESS, LOSS OF DATA OR INFORMATION, OR FINANCIAL LOSS, FOR CLAIMS OF ANY NATURE, INCLUDING BUT NOT LIMITED TO CLAIMS IN CONTRACT, BREACH OF WARRANTY OR TORT, AND WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE.

WITHOUT WAIVING ANY PROVISION IN THIS LIMITED WARRANTY, IF A CIRCUMSTANCE ARISES WHERE WARRANTORS ARE FOUND TO BE LIABLE FOR ANY LOSS OR DAMAGE ARISING OUT OF MISTAKES, NEGLIGENCE, OMISSIONS, INTERRUPTIONS, DELAYS, ERRORS OR DEFECTS IN WARRANTORS' PRODUCTS OR SERVICES, SUCH LIABILITY SHALL NOT EXCEED THE TOTAL AMOUNT PAID BY THE CUSTOMER FOR WARRANTORS' PRODUCT AND SERVICES OR $250.00, WHICHEVER IS GREATER. YOU HEREBY RELEASE WARRANTORS FROM ANY AND ALL OBLIGATIONS, LIABILITIES AND CLAIMS IN EXCESS OF THIS LIMITATION.

INDEMNIFICATION AND COVENANT NOT TO SUE: YOU WILL INDEMNIFY, DEFEND AND HOLD HARMLESS WARRANTORS, THEIR OWNERS, DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, SUPPLIERS OR AFFILIATED COMPANIES, AGAINST ANY AND ALL CLAIMS, DEMANDS OR ACTIONS BASED UPON ANY LOSSES, LIABILITIES, DAMAGES OR COSTS, INCLUDING BUT NOT LIMITED TO DAMAGES THAT ARE DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL, AND INCLUDING ATTORNEYS FEES AND LEGAL COSTS, THAT MAY RESULT FROM THE INSTALLATION, OPERATION, USE OF, OR INABILITY TO USE WARRANTORS' PRODUCTS AND SERVICES, OR FROM THE FAILURE OF THE WARRANTORS' SYSTEM TO REPORT A GIVEN EVENT OR CONDITION, WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE.

YOU AGREE TO RELEASE, WAIVE, DISCHARGE AND COVENANT NOT TO SUE WARRANTORS, THEIR OWNERS, DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, SUPPLIERS OR AFFILIATED COMPANIES, FOR ANY AND ALL LIABILITIES POTENTIALLY ARISING FROM ANY CLAIM, DEMAND OR ACTION BASED UPON ANY LOSSES, LIABILITIES, DAMAGES OR COSTS, INCLUDING BUT NOT LIMITED TO DAMAGES THAT ARE DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL, AND INCLUDING ATTORNEYS FEES AND LEGAL COSTS, THAT MAY RESULT FROM THE INSTALLATION, OPERATION, USE OF, OR INABILITY TO USE WARRANTORS' PRODUCTS AND SERVICES, OR FROM THE FAILURE OF THE WARRANTORS' SYSTEM TO REPORT A GIVEN EVENT OR CONDITION, WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE, EXCEPT AS NECESSARY TO ENFORCE THE EXPRESS TERMS OF THIS LIMITED WARRANTY.

EXCLUSIVE WARRANTY: THE LIMITED WARRANTY OR WARRANTIES DESCRIBED HEREIN CONSTITUTE THE SOLE WARRANTY OR WARRANTIES TO THE PURCHASER. ALL IMPLIED WARRANTIES ARE EXPRESSLY DISCLAIMED, INCLUDING: THE WARRANTY OF MERCHANTIBILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR USE AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND THE WARRANTY OF NON-INFRINGEMENT AND/OR ANY WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

It must be clear that the Warrantors are not insuring your premises or business or guaranteeing that there will not be damage to your person or property or business if you use this Product. You should maintain insurance coverage sufficient to provide compensation for any loss, damage, or expense that may arise in connection with the use of products or services, even if caused by Warrantors' negligence. The warrantors assume no liability for installation of the Product and/or interruptions of the service due to strikes, riots, floods, fire, and/or any cause beyond Seller's control, further subject to the limitations expressed in any License Agreement or other Agreement provided by Warrantors to purchaser.

The agreement between the Warrantors and the Purchaser, including but not limited to the terms and conditions herein shall not be governed by the Convention for the International Sale of Goods. Where applicable, the Uniform Commercial Code as adopted by the State of Delaware shall apply.

4. **PROCEDURE FOR OBTAINING PERFORMANCE OF WARRANTY**: In the event that the Product does not conform to this warranty, the Product should be shipped or delivered freight prepaid to a Warrantor with evidence of original purchase.

5. **LEGAL REMEDIES AND DISCLAIMER**: Some jurisdictions may not allow, or may place limits upon, the exclusion and/or limitation of implied warranties, incidental damages and/or consequential damages for some types of goods or products sold to consumers and/or the use of indemnifi-

cation terms. Thus, the exclusions, indemnification terms and limitations set out above may not apply, or may be limited in their application, to you. If the implied warranties can not be excluded, and the applicable law permits limiting the duration of implied warranties, then the implied warranties herein are to be limited to the same duration as the applicable written warranty or warranties herein. The warranty or warranties herein may give you specific legal rights that will depend upon the applicable law. You may also have other legal rights depending upon the law in your jurisdiction.

6. **CHOICE OF FORUM AND CHOICE OF LAW**: In the event that a dispute arises out of or in connection with this Limited Warranty, then any claims or suits of any kind concerning such disputes shall only and exclusively be brought in either the Court of Common Pleas of Delaware County, Pennsylvania or the United States District Court for the Eastern District of Pennsylvania.

Regardless of the place of contracting or performance, this Limited Warranty and all questions relating to its validity, interpretation, performance and enforcement shall be governed by and construed in accordance with the laws of the State of Delaware, without regard to the principles of conflicts of law.

Effective date 05/01/2004
PHONETICS, INC. d.b.a. SENSAPHONE
901 Tryens Road
Aston, PA 19014
Phone: 610.558.2700 Fax: 610.558.0222
www.sensaphone.com

TABLE OF CONTENTS

Chapter 1: Introduction

The Sensaphone® Model 1104 is a fully-programmable, environmental monitoring system that offers extensive on-site and remote monitoring capability to small businesses, private homes, farms, greenhouses, computer rooms, and remote facilities. Designed for desktop or wall mounting, the Model 1104 is simple to install, program and operate; no changes to standard electrical or telephone service are required. Connected to a telephone line, it will respond to an alarm by dialing up to four separate telephone numbers. When the call is answered, an "Alert Condition" message is delivered in digitized speech.

The Model 1104 features built-in sensors to monitor a variety of conditions:

- High sound level
- AC electric power failure
- Battery backup
- Temperature*

*__Note__: While technically not a "built-in" sensor, temperature is factory installed on input 1, and if left installed will limit your additional inputs as listed below to 3.

1104 is equipped with 4 alert inputs. Additional sensors* can be added to extend monitoring capabilities to include:

- Intrusion or unauthorized entry
- Water leaks and seepage
- Temperature
- Humidity
- Equipment operation
- Many other conditions that may require unique monitoring solutions

* Refer to Appendix D for information on additional sensors (available separately from Sensaphone) best suited to your application.

The status of each monitored condition is readily obtained at the unit's installation site, or remotely by telephone. At the close of every Status Report, time is provided for listening to on-site sounds.

To ensure reliable operation, the Model 1104 features power backup capability; in the event of AC power failure, six D-cell batteries (not included) will continue to power the unit for approximately 24 hours.

This manual comprises the instructions and commands for installing and operating the Model 1104. The Quick Start chapter is included to speed understanding of programming and operation. Communication and Alarm Programming chapters demonstrate step-by-step methods for utilizing the full range of available features. The Troubleshooting chapter provides assistance in the event that problems are encountered.

Chapter 8 covers the features, operation and programming of special Model 1104 versions: CottageSitter, BusinessSitter, RemoteControl, and 1114 "Line Seizure" edition.

Technical Support

If any questions arise upon installation or operation of the Model 1104, please contact Sensaphone Technical Service Department, at the number shown below, and have the following information:

- Date of Purchase _____
- Serial number of your Model 1104 _____

Technical Support is available from 8:00AM to 5:00PM EST.

Phonetics, Inc.

901 Tryens Road

Aston, PA 19014

610-558-2700

Fax: 610-558-0222

www.sensaphone.com

Chapter 2: Installation

Correctly installing the Model 1104 will ensure proper functioning of the unit. Please read the entire chapter before starting the installation process.

Within the packaging will be a Warranty Registration Card. Please take the time to fill this out and mail. The One Year Limited Warranty is explained in the back of this manual.

2.1 Operating Environment

The Model 1104 should be installed and operated in a clean, dry area that provides space for wiring sensors to the screw terminals, near an AC power source and telephone line. Operating temperature ranges from 32° Fahrenheit (0° Celsius) to +120° Fahrenheit (+49° Celsius).

NOTE

The Model 1104 is a sensitive electronic device. Do not install the Model 1104 near strong electrostatic, electromagnetic or radioactive fields. Do not expose to humid environments, fumes, or corrosive vapors.

2.2 Mounting

Flat Mount: Place the Model 1104 on top of a desk or other horizontal surface. Wall Mount: Mount on a wall with two screws using the keyholes on the back panel of the unit. Place the screws or bolts 3 13/16" apart at the desired height from the floor. Hook the unit over the screws and toward the floor. Refer to Figure 2-1.

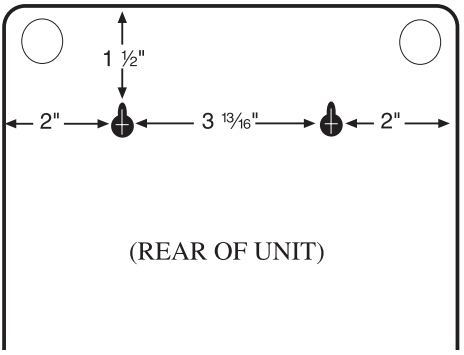


Figure 2-1. Wall Mount

2.3 Power Surge Protection

The Model 1104 can be damaged by power surges and lightning through the telephone line and the 120 VAC power supply. Although the Model 1104 has built-in surge protection, we recommend that additional protection be obtained for the unit and for any electronic equipment that is attached to your power supply and telephone lines. Power surge protection is especially important if you live in a lightning-prone area. The ISOTEL Surge Protector Model IB-4 is available through Phonetics, Inc. See Appendix D.

2.4 Power Supply and Battery Backup

The Model 1104 is provided with an AC power transformer that will plug into any standard 120 VAC outlet and a battery backup (batteries not included) that enables the unit to continue functioning if AC power is removed (due to electric power disruption or failure). The Model 1104 uses six, D-cell alkaline batteries. Do not use rechargeable nicad batteries.

NOTE

Be sure that the AC transformer is plugged into an outlet before installing batteries.

To install the batteries, open the battery compartment hatch located underneath the unit, align batteries according to the diagram shown in Figure 2-2, and replace the hatch.

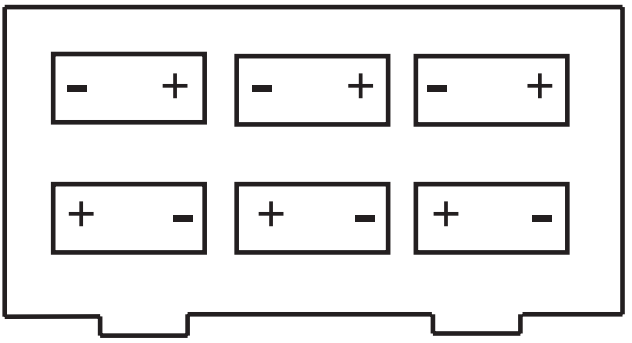


Figure 2-2. Battery Installation

2.5 Starting the Model 1104

When the AC power transformer is first plugged into the electrical outlet, the Model 1104 automatically starts in RUN mode. The red LED light will begin to glow. The unit will respond with,"Hello, this is Sensaphone 1104."

2.6 Run Mode and Standby Mode

Pressing the RUN/STANDBY key on the Model 1104 keypad will alternately activate or deactivate the unit. If the unit is activated and in RUN mode, the red LED (small red light on the upper right of the unit's front panel) glows steadily. In STANDBY mode, the red LED goes out, but will blink every few seconds to indicate that power is still supplied to the unit.

In RUN mode, the Model 1104 is able to receive incoming calls and to dial out automatically in the event of an alarm on one of the monitored conditions. To enter STANDBY mode, press RUN/STANDBY.

As soon as the Model 1104 enters STANDBY mode, it responds with "Have a good day." The red light immediately goes out and then resumes with a blink every few seconds. While in STANDBY mode, all functions are disabled, but programmed memory is preserved. Upon exiting STANDBY mode, any currently existing alert conditions will be announced.

NOTE

STANDBY mode is not equivalent to "power off"—an electrical source, such as the 120 VAC, or the battery backup, continues to provide full power to the unit. If the unit is placed in STANDBY mode, unplugged from the 120 VAC outlet, and placed in storage, the batteries will continue to power the Model 1104, discharging until they fail. Consequently, batteries should always be removed from the unit following disconnection from any 120 VAC outlet, prior to storage.

Press the RUN/STANDBY key again to return to RUN mode.

Figure 2-3. The RUN/STANDBY Key

2.7 Telephone Line

The Model 1104 will operate with all standard telephone systems that accept pulse or tone dialing. The Model 1104 cannot be used on an extension line to dial its own telephone number. Also, it may not be installed on a party line or pay telephone line.

Certain private telephone systems and public switching equipment may not accept the Model 1104 dialing or may generate an unacceptable ring signal. In those cases, a dedicated line may be required. Consult the supplier of your telephone system if you encounter problems.

If you do not have a modular telephone extension at the Model 1104's location, you must contact your local telephone company to have one installed (there is a charge for this service). If you have four-pin jacks, adapters are available to convert them to the modular plugs. Contact your local telephone company or electronics parts store.

CAUTION

Never install telephone wiring during a lightning storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Use caution when installing or modifying telephone lines.

To install the telephone line, plug the modular telephone jack provided into any standard RJ11 phone outlet.
Refer to Figure 2-4.

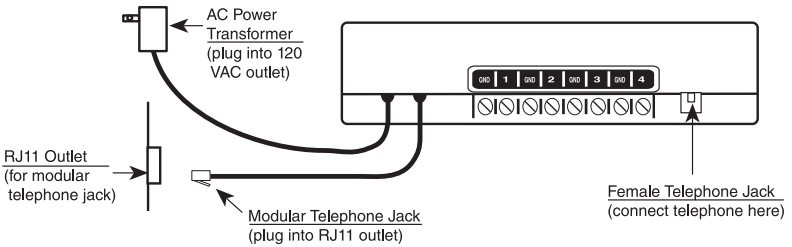


Figure 2-4. Installing the Telephone Line

On the back of the Model 1104 is a female telephone jack. This is provided so that a telephone or other answering device may be used on the same line as the unit. It is not necessary to hook up a telephone for the Model 1104 to operate.

2.8 The Microphone

The Model 1104 is provided with a built-in microphone which is used to monitor high sound levels produced near the installation site. The sensitivity of the microphone is configurable and will detect a continuous as well as a pulsating alarm. Note that beeping alamrs that have a half second or more of silence between beeps will not be detected.

Other programming options that apply to the microphone include setting the length of time before a high sound causes an alarm.

If this sound level exists for 8 consecutive seconds (default) or for the programmed length of time, the Model 1104 will dial out with an alarm message.

NOTE

The proximity of the audible alarm to the microphone is extremely important.

Normally, the Model 1104 and the audible alarm must be in the same room. The maximum distance can vary considerably depending on the alarm, the acoustics, and the size of the room.

During an alarm dial-out, the microphone allows four-second intervals to listen-in to sounds at the Model 1104's location.

When calling for a Status Report, the microphone permits listening to on-site sounds for a programmed time interval.

2.9 Alert Inputs

The Model 1104 can monitor up to 4 inputs (represented by the numbered terminal screws shown in Figure 2-5, below).

Figure 2-5. Alert Inputs

Inputs are configured as either dry contact or temperature. An input configured as dry contact can be used with any normally open (N.O.) or normally closed (N.C.) device. "Open" refers to an opened circuit path; if conditions cause the circuit to close, an alert condition occurs. "Closed" refers to a continuous circuit path; if a closed circuit is opened, an alert condition occurs. The Model 1104 determines the way inputs are configured by the type

of sensor connected to each alert input (refer to Chapter 5, Section 5.1).

An input configured as "temperature" is designed to evaluate a range of settings. The Model 1104 will read the temperature at the sensor's location and compare that value to programmed high and low temperature limits. Temperature inputs must be used with Sensaphone's Remote Temperature Sensor.

NOTE

Before wiring, it is advisable to disable the inputs to prevent accidentally tripping an alarm. See Chapter 5, Section 5.2.

Important Note regarding Ultra-Low temperature freezers:

If you are connecting the Sensaphone to an ultra-low temperature freezer (i.e. Revco, Thermo Forma, Fisher Scientific, etc...) be aware that the Sensaphone can only monitor temperatures between -20 and 150 degrees Fahrenheit. As a result, you can *only* monitor these freezers if they are supplied with the appropriate alarm terminals/contacts. Please refer to your Freezer owner's manual for proper connection.

2.10 Installing the Sensor

After you have selected the sensor, loosen the screw of the alert input and its corresponding ground. Two wire leads are used to connect any monitoring sensor. Fasten one lead to the numbered screw and the other lead to GND. Tighten both screws. If the input was not disabled, the Model 1104 may recite its "Alert Condition Exists" message as you connect the sensor. If it does, just press any key to stop it. Re-enable the input after wiring. Refer to Figures 2-6 and 2-7 for connecting a sensor to an alert input.

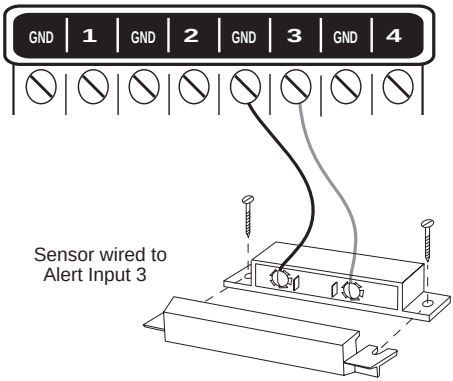


Figure 2-6. Sensor Connected to an Alert Input

Any sensor can be attached to the Model 1104 using 22-gauge wire. The sensor can be several hundred feet from the unit, as long as the total resistance of the circuit is not greater than 50 ohms. Use wire appropriate for the application.

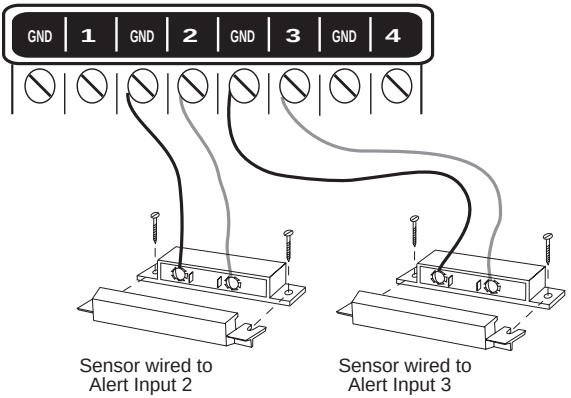


Figure 2-7. Two Sensors Wired to Adjacent Inputs

NOTE

Do not use sensors, switches, or relays that supply any voltage or current to the Model 1104. Be aware of proximity to other electrical wires or components when placing wires that lead from the sensors to the unit. Avoid running the wires near electrical devices that use high voltage or current, such as motors, heavy machinery, etc. This voltage may be inductively coupled into the sensor wiring and could result in damage to the the Model 1104's circuitry. Try to place wires at least 6 inches from other electrical wiring or devices.

2.11 Multiple Sensors

The Model 1104 may have more than one sensor connected to the same alert input, as long as the normal condition for each sensor on the same alert input is identical (either all N.O. or all N.C.). However, only one remote temperature sensor can be used on each input.

When wiring several normally closed sensors on one input, they must be connected in series. Connect one lead from the first sensor to the numbered screw of the alert input. Next, take the other lead from the first sensor and connect it to one lead from the next sensor. Continue connecting sensors end-to-end until you

have connected all of your sensors. Take the second lead from the last sensor and connect it to the ground screw on the Model 1104. See Figure 2-8. Multiple N.C. sensors are typically magnetic reed switches to monitor the security of windows and doors.

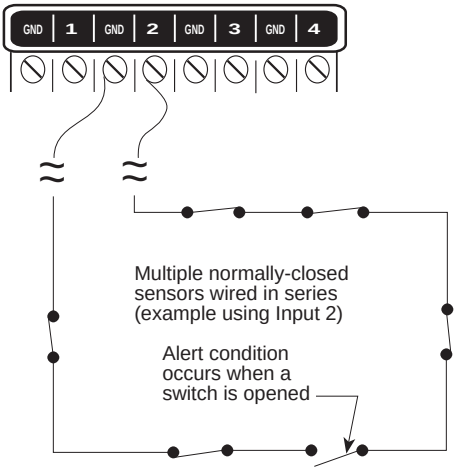


Figure 2-8. Multiple Normally Closed Sensors

To wire several normally open sensors to one alert input, connect them in parallel. To do this, take one lead from each sensor and attach it to the numbered terminal. Then, take the second lead from each sensor and attach each to the corresponding ground screw. Refer to Figure 2-9.

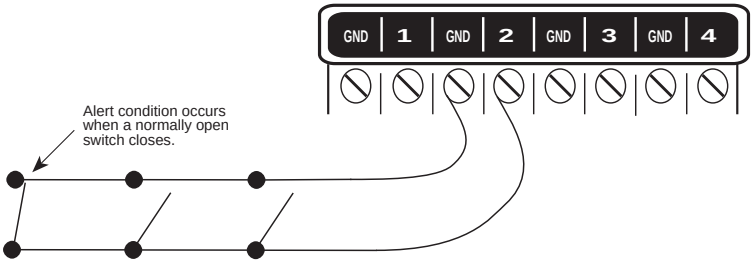


Figure 2-9. Multiple Normally Open Sensors

2.12 Outdoor Wiring

When wiring sensors outdoors, DO NOT allow exposed wires to run freely in open air; under such conditions, the Model 1104 is susceptible to serious damage during a lightning storm.

Depending upon the distance outdoor wiring must travel, consideration should be given to the use of shielded wire inside a metal conduit. Both shield and conduit should be connected to an earth ground. This prevents stray voltage from entering the unit.

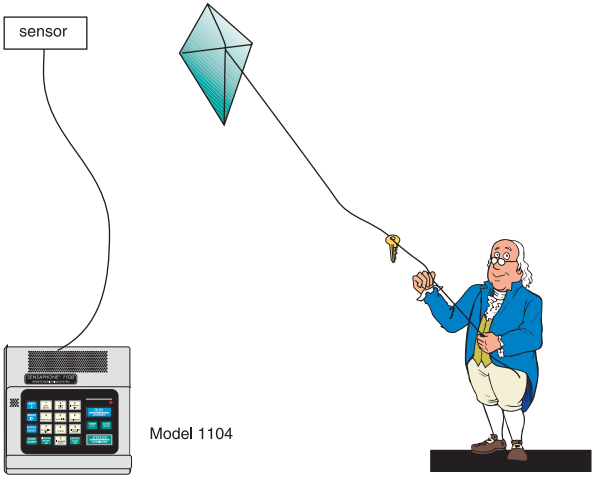


Figure 2-10. Potential Sensor Damage from Stray Electrical Noise

2.13 Disconnecting the Model 1104 for Storage or Seasonal Use.

If you plan to employ the Model 1104 as a seasonal "watchdog" for a few months during the year, **you must disconnect all wires from the unit completely to avoid damage to the circuitry when the unit is not in use**. If the unit is unplugged but left in place with all the sensors still connected, the wires act as antennae that draw in any stray "electrical noise" from such devices as fans, blowers, microwaves, etc.

Additionally, it is important to remove the batteries, or they will discharge until they fail.

Preserve your Model 1104 during the off-season, or when not in use:

- Remove the sensor wires at the screw terminals
- Remove the batteries
- Unplug the unit and store in a safe place

Chapter 3: Quick Start

This section presents a useful guide for first-time programming of the Model 1104. Follow instructions for installation before attempting to program the Model 1104. Refer to Chapter 2: Installation.

3.1 The Local Keypad

Programming is accomplished using the local keypad (shown below, Figure 3-1). Notice that a single key has several functions assigned to it; programming results are determined by the order in which keys are pressed.

Individual keystrokes are illustrated to show programming steps in the correct order. If you make a mistake by entering the wrong key, do not press another key until you hear the message *"Error 1."* Then, start over with the first key in the programming sequence.

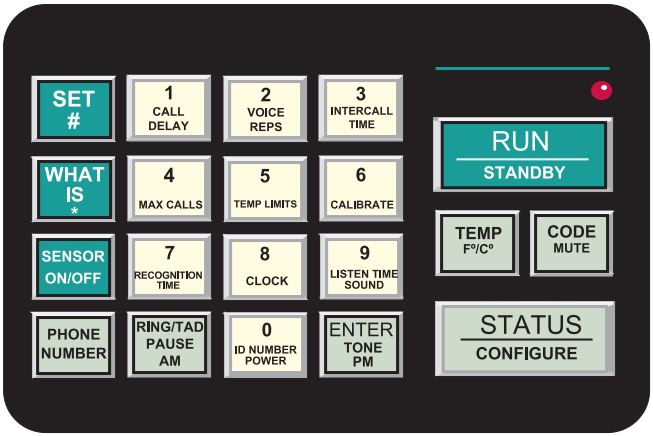


Figure 3-1. The Model 1104 Keypad

3.2 Preparation for Programming

Read complete instructions in Chapter 2: Installation, and make sure to follow these three steps first:

1. Plug the AC adaptor into the 120 VAC outlet.
2. Install the batteries.

3. Connect the Model 1104 to a telephone line.

When these steps are completed, the Model 1104 is fully operational and able to monitor temperature, high sound, AC power failure and battery backup condition; it can also be called on the telephone for a Status Report or used for listening to on-site sounds from any remote location. Now, the unit is ready for programming.

3.3 Quick-Start Programming Steps

Step 1: Set Configuration of Inputs

The Model 1104 will scan the 4 external inputs and determine if they are N.O. (normally open), N.C. (normally closed), or Temperature. If external sensors are added, make sure they are in their normal positions before proceeding—refer to Chapter 5, Section 5.1.

1. Press STANDBY to place the Model 1104 in Standby mode.

2. If you have external sensors available, wire the sensors to the inputs on the back of the Model 1104 (see Chapter 2, Section 2.10). Otherwise, skip this step and move to step 3.

3. Press RUN. The red light glows when the Model 1104 returns to Run mode.

4. Press SET.

5. Press CONFIGURE.

6. The Model 1104 will audibly recite the new configuration for each of the four inputs, responding with "*OK*," if it detects N.O. (normally open), "*beep-OK*," if it detects N.C (normally closed) or "*Temperature*," if it detects temperature (regardless of whether all the inputs have attached sensors or not). If an input is unused, it is treated as normally open.

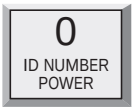
Step 2: Set the ID Number

It is recommended that you set the ID number to reflect the telephone number on which the Model 1104 is installed.

1. Press SET

.

2. Press ID NUMBER.



3. Using the number keys, enter the digits (up to 16 are permitted) for the ID number. The Model 1104 will recite the digits as they are pressed.

4. Press ENTER. The 1104 will respond: "*Enter.*"

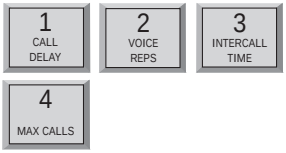
Step 3: Set Dial-Out Telephone Numbers

To program dial-out telephone numbers:

1. Press SET.

2. Press PHONE NUMBER.

3. Select which telephone number to program. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. Model 1104 will respond: "Enter number."



4. Enter the complete telephone number using the number keys.

The Model 1104 will recite the digits as they are pressed.

5. Press ENTER. The unit will respond: "*Enter.*"

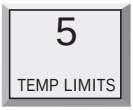
6. Repeat above procedure to program up to four separate telephone numbers.

Step 4: Set Temperature Limits

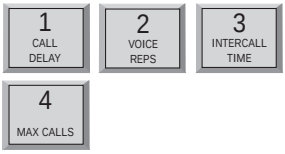
High and low temperature limits can be separately programmed for each input that is configured as temperature. Limits can range from –20° to +150° Fahrenheit, or from –30° to 65° Celsius. Default settings are: 10° F for low temperature and 100° F for high temperature. Do not set temperature limits too close to normal room temperature, since minor fluctuations could result in frequent and unnecessary alarm dialouts.

1. Press SET.

2. Press TEMP LIMITS.



3. From the number keys, press a number (from 1 to 4) that corresponds to the temperature input being programmed.



The Model 1104 responds: "*Enter low temperature limit.*"

4. Using the number keys, enter a value for low temperature limit. The Model 1104 will recite the digits as they are pressed. If a negative number is required, first press PAUSE, then enter the number.

5. Press ENTER.

The Model 1104 responds: "*Enter high temperature limit.*"

6. Using the number keys, enter the value for high temperature limit. The Model 1104 will recite the digits as they are pressed.

7. Press ENTER. The Model 1104 responds: "*Enter.*"

This concludes minimum programming to achieve normal operation of the Model 1104. In additon to the programming just accomplished, default settings for many more features take effect when the unit is first powered. You will be able to reprogram most of these factory-set defaults to suit your application.

For a complete explanation of each feature (with illustrations of keystrokes), refer to Chapter 4: Communications Programming and Chapter 5: Alarm Programming.

To gain a basic understanding of how the alarm dial-out feature works, refer to this chapter, Section 3-4. For extended information regarding dial-out and related programmable parameters, refer to Chapter 7: Operation.

3.4 Summary of the Alarm Dial-Out Process

Action—Response	Programmable Feature
1. THE MODEL 1104 DETECTS AN ALERT CONDITION An alert condition is not the same as a valid alarm—the condition must continue for the programmed time period, or ***Recognition Time***, before it is recognized as a valid alarm.	• **Recognition Time** This is the programmed waiting period to determine if an alert condition has persisted long enough to be considered a valid alarm. If the sensor returns to normal within recognition time, then no alarm will occur.
2. A VALID ALARM IS CONFIRMED An audible, on-site alarm message begins and continues until the alarm is acknowledged. (If the Mute feature is turned on, there is no on-site message.) ***Call Delay*** is activated.	• **Call Delay** This is the programmed waiting period, before the first telephone number is called, to report an alarm.
3. DIAL-OUT BEGINS Dial-out begins by calling telephone number 1 to report an alarm. If there is no acknowledgment, the Model 1104 waits the programmed ***Intercall Time*** before dialing subsequent telephone numbers. Dial-out continues in this manner, cycling through the remaining telephone numbers, for the programmed ***Max Calls***.	• **Intercall Time** This is the programmed waiting period, in between sequential dialing of telephone numbers, to report an alarm. • **Max Calls** This is the total number of telephone calls that will be dialed in response to any valid alarm. Telephone numbers are dialed sequentially, and continue to cycle until the maximum number of calls is reached. If no acknowledgment occurs, then at the completion of Max Calls, all alarms are automatically acknowledged.
4. THE ALARM IS ACKNOWLEDGED When the alarm is acknowledged, the dial-out process is cancelled and the audible, on-site alarm message stops.	

Chapter 4: Communications Programming

This chapter explains the keypad commands for communications programming of the Model 1104, including interrogation and resetting of the following:

- The Unit ID Number
- Dial-out Telephone Numbers
- Tone or Pulse Dialing
- Special Dialing with Pagers, Beepers and Access Numbers.
- Rings Until Answer and Telephone Answering Device Compatibility
- Listen-in Time
- Call Delay
- Local Voice Mute
- Voice Repetitions
- Intercall Time
- Maximum Number of Calls
- The Clock
- Security Code

4.1 The Unit ID Number

The Unit ID Number is the identification number of the Model 1104. This number may be the same as the telephone number where the unit is installed, or it may be designated using any number that best suits your application.

The purpose of the Unit ID Number is to immediately provide the source of any alarm, especially when using multiple Model 1104 units in a complex monitoring system. When the Model 1104 is called from a remote location, it always begins its message with the identification number:

"Hello, this is telephone number (Unit ID Number)."

4.1.1 Programming the ID Number

To program the ID Number:

1. Press SET.

2. Press ID NUMBER.

3. Using the number keys, enter up to 16 digits for the ID number. The Model 1104 will recite the digits as they are pressed.

4. Press ENTER. The Model 1104 will respond: "*Enter.*"

4.1.2 Interrogating the ID Number

To interrogate the ID numbers:

1. Press WHAT IS.

2. Press ID NUMBER. The Model 1104 will recite the Unit ID Number programmed.

4.2 Dial-out Telephone Numbers

The Model 1104 can store up to four 32-digit phone numbers. These are the numbers that will be called during dial-out. In the event of an alarm, the numbers are dialed sequentially, 1 through 4. Begin programming the first telephone number by assigning it to the key labeled with the number 1 on the keypad, and continue to assign any other telephone numbers in numerical order. ***A pause, pound*** or ***asterisk*** can be added to an individual phone number to access different phone and beeper systems. See *Special Dialing, Section 4.4.*

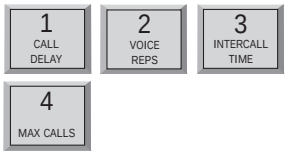
4.2.1 Programming Dial-out Telephone Numbers

To program dial-out telephone numbers:

1. Press SET.

2. Press PHONE NUMBER.

3. Select which telephone number to program. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. The Model 1104 will respond: *"Enter number."*



4. Enter the complete telephone number using the number keys.

5. Press ENTER. The unit will respond with "*Enter.*"

6. Repeat above procedure to program up to four separate telephone numbers.

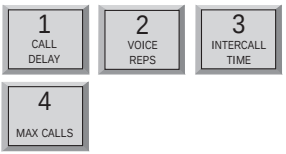
4.2.2 Interrogating a Dial-out Telephone Number

To interrogate dial-out telephone numbers:

1. Press WHAT IS.

2. Press PHONE NUMBER.

3. Press a number key (from 1 to 4).



Model 1104 will recite the corresponding telephone number. If there is no number programmed for a particular key, the unit will respond: "*No number.*"

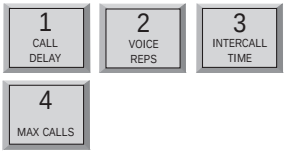
4.2.3 Erasing a Telephone Number

To erase a telephone number:

1. Press SET.

2. Press PHONE NUMBER.

3. Press the number key (from 1 to 4) representing the telephone number you want to erase.



4. Press ENTER. The Model 1104 will say "*Enter.*"

4.3 Tone or Pulse Dialing

The Model 1104 can dial out in pulse or Touch Tone™. Select the type of dialing, in either pulse or tone, depending upon the type of service provided by your telephone company. The default is tone.

To program for either pulse or tone:

1. Press the SENSOR ON/OFF key.

2. Press TONE.

The Model 1104 will respond: "*Off*" to indicate that tone dialing is off and pulse is enabled, or "*On*" to indicate that tone dialing is on and pulse is disabled.

3. Repeat key sequence to switch between settings.

4.4 Special Dialing

The Model 1104 has provisions for special dialing sequences. Special dialing sequences allow:

- Dialing that requires an access number to connect with an outside line.
- Dialing that requires the pound (#) or asterisk (*).
- Dialing to a beeper or pager.

4.4.1 Special Dialing Keys

The following designated keys represent special functions when used with PHONE NUMBER entries:

1. *Pause*

PAUSE represents a four-second pause in dialing. It can be used when an access number is required before dialing to an outside line. (For example, in some cases a "9" or other number, must be dialed first, in order to get a dial tone for an outside line.) When interrogating telephone numbers, PAUSE is audibly represented by a "*beep*."

2. *Pound (#)*

A pound may be required when calling some phone or beeper systems. When interrogating telephone numbers, pound (#) is audibly represented by the word "*twelve.*"

3. *Asterisk (*)*

An asterisk may be required when calling some phone or beeper systems. When interrogating telephone numbers, asterisk (*) is audibly represented by the word "*eleven.*"

4. *Code*

CODE instructs the Model 1104 to wait until the call is answered before continuing. When interrogating telephone numbers, CODE is audibly represented by the word "*fourteen*."

NOTE

Each time a pause, pound (#) or asterisk (*) is incorporated in a programming sequence, it is counted as one digit toward the total of 32 digits allowed.

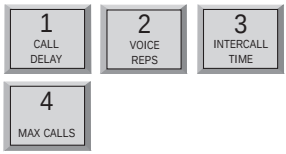
4.4.2 Incorporating a Pause

Incorporate PAUSE to access an outside telephone line:

1. Press SET.

2. Press PHONE NUMBER.

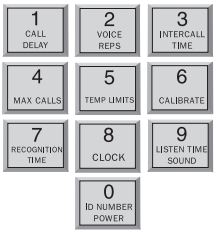
3. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. Model 1104 will respond: "*Enter number.*"



4. From the number keys, enter the access digit (i.e., 9). The Model 1104 will recite the digit.

5. Press PAUSE. The Model 1104 will "*beep*."

6. Enter the complete telephone number (1 + area code) using the number keys. The Model 1104 will recite the digits as they are pressed.



7. Press ENTER. The Model 1104 will say "*Enter*."

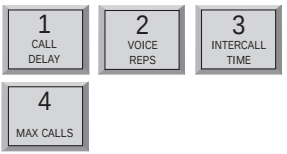
4.4.3 Incorporating a Pound (#) or Asterisk (*)

Incorporate a pound or asterisk if it is normally included in telephone number:

1. Press SET.

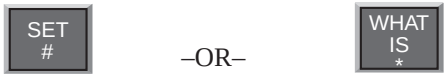
2. Press PHONE NUMBER.

3. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. Model 1104 will respond: "*Enter number*."



4. Enter the telephone number using the number keys. The Model 1104 will recite the digits as they are pressed.

5. Position the pound (#) or asterisk (*) within the telephone number where required by pressing SET (where the pound is located) or WHAT IS (where the asterisk is located). The Model 1104 will *"beep"* each time pound or asterisk is pressed.



6. Enter any remaining digits of the telephone number.
7. Press ENTER. The Model 1104 will say *"Enter."*

4.4.4 Special Dialing to a Beeper or Pager

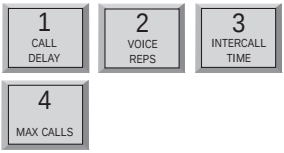
The following example demonstrates just one solution to programming the Model 1104 for dialing to a beeper or pager. Many other key sequences will also work. Start with steps 1–3 below; next, enter special dialing keys where required for your beeper or pager service.

To incorporate a pound or asterisk:

1. Press SET.

2. Press PHONE NUMBER.

3. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry.



4. Enter the complete telephone number using the number keys. The Model 1104 will recite the digits as they are pressed.

5. Press CODE. This instructs the Model 1104 to wait for the telephone call to be answered by the beeper or pager service. (A voice message will not occur—only digital tones are used.) Note that CODE may not work with beepers where there is no ring before the beeper connects. If that proves to be the case for your particular beeper, skip the CODE step and proceed from Step 4 to Step 6.

6. Now press PAUSE once to activate a four second delay. This assumes the call is answered by a beeper/pager service that immediately delivers a prerecorded voice message. PAUSE may be pressed more than once to program more time for the beeper/pager service to finish its message. Each press of PAUSE allocates four additional seconds. The Model 1104 will *"beep"* with each press.

7. Enter a telephone number or custom code number that will identify the Model 1104 as the caller to your beeper or pager. A code may consist of any number(s) you designate. Many users find it convenient to use the telephone number to which the Model 1104 is connected.

8. A pound or asterisk may be required in some dialing situations. If required, position the pound (#) or asterisk (*) within the telephone number where required by pressing SET (where the pound is located) or WHAT IS (where the asterisk is located). The Model 1104 will *"beep"* each time pound or asterisk is pressed. Enter any remaining digits of the telephone number.

–OR–

9. Press ENTER. The Model 1104 will say "*Enter.*"

Example 1 (using CODE key):

1-203-555-1123 - CODE - 621-9977-#
(beeper number) *(unit ID number)*

Example 2 (without using CODE key):

1-203-555-1123 - PAUSE - PAUSE - 621-9977-#
(beeper number) *(unit ID number)*

4.5 Rings Until Answer

Rings Until Answer is the programmed number of times the telephone rings before the Model 1104 will answer an incoming call. This can be set from 1 to 15 rings. The default value is 4.

4.5.1 Programming Rings Until Answer

To program Rings Until Answer:

1. Press SET.

2. Press RING/TAD. The Model 1104 will respond: "*Enter number.*"

3. Using the number keys, enter a value.

4. Press ENTER. The Model 1104 will respond: "*Enter.*"

4.5.2 Interrogating Rings Until Answer

To interrogate Rings Until Answer:

1. Press WHAT IS.

2. Press RING/TAD.

4.5.3 Double Ring Compatibility

In countries that utilize a double-ring pattern, you must enable Double Ring Compatibility in order to have the unit properly answer on the programmed number of rings.

To enable/disable Double Ring Compatibility:

1. Press SET.

2. Press SENSOR ON/OFF.

3. Press 0 to Enable or press 1 to Disable.

4. Press ENTER. The Model 1104 will respond : "*Enter.*"

4.5.4 Interrogating Double Ring Compatibility

To interrogate Double Ring Compatibility:

1. Press WHAT IS.

2. Press SENSOR ON/OFF. The model 1104 will say *"0"* if Double Ring Compatibility enabled and *"1"* if it is disabled.

4.6 TAD (Telephone Answering Device)

The TAD feature is especially useful because it integrates the operation of the Model 1104 with your telephone answering device in a way that retains the full flexibility of each system. This allows you to have on-demand telephone access to the Model 1104, for obtaining a Status Report, or for issuing call-in commands, while your telephone answering device is set to receive outside calls. Programming for use with a telephone answering device (TAD) is always used in conjunction with Rings Until Answer, detailed in section 4.5.

NOTE

The TAD feature only applies to answering devices connected to the same telephone line as the Model 1104.

4.6.1 TAD Enable/Disable

To enable/disable the TAD feature:

1. Press SENSOR ON/OFF.

2. Press RING/TAD.

The Model 1104 will respond: "*On.*" (If the Model 1104 says "*Off,*" repeat steps 1 and 2 to reactivate TAD.)

4.6.2 Using the TAD Feature

1. Make sure the TAD feature is enabled on the Model 1104. (The default setting is disabled, so you must enable it first.)
2. Determine the number of rings your telephone answering device uses to answer the telephone. (Most answering devices require 4 rings; others are selectable.)
3. On the Model 1104, program Rings Until Answer to a greater number than the number of rings set on your answering machine.

Example:

Telephone answering device, rings = 4

Model 1104, Rings Until Answer = 6

Using the procedure just outlined, all incoming calls will be answered by the telephone answering device, allowing it to operate normally. With the programming just accomplished, the Model 1104 can be accessed remotely, by telephone, to obtain the Status Report.

1. Dial the telephone number of the Model 1104.
2. Let the telephone ring once and then hang up.
3. Wait approximately ten seconds
4. Call the Model 1104 back.

It will answer the telephone on the first ring.

Explanation: The pattern of one ring, followed by a second call (within 30 seconds), signals the Model 1104 to answer your incoming call, excluding the telephone answering device.

NOTE

Special Case: If the Model 1104 shares the same line with a telephone answering device, and during certain time periods, frequent, incoming calls are expected on that line, then you may want to temporarily disable the TAD feature. If you leave the TAD enabled, it will not adversely affect normal operation, but if two outside telephone calls are received within the same 30-second time window, the Model 1104 will interpret this pattern as a signal to answer the telephone. If this occurs, press any key on the Model 1104 to hang up.

4.6.3 No TAD In Use

If a telephone answering device is not used on the same telephone line as the Model 1104, make sure that the TAD feature is disabled, or turned off. Only Rings Until Answer programming will determine how incoming calls are answered. For example, if you program Rings Until Answer to 3, incoming calls will be answered in 3 rings.

4.7 Listen-in Time

The Listen-in Time is the amount of time you can listen to sounds from the Model 1104's built-in microphone at its installation site. When you call in for a Status Report, the Model 1104 announces Listen-in Time at the end of its first round of status readings, saying, "*Listen to the sound level for (programmed time entered).*" The programmable range is from 0 to 255 seconds (or up to 4.17 minutes). The default value is 15 seconds.

NOTE

The microphone is also used to monitor high sound level. See Chapter 5, Section 5.10 through Section 5.11.1.

4.7.1 Programming the Listen-in Time

To program the Listen-in Time:

1. Press SET.

2. Press LISTEN TIME. The Model 1104 will respond: "*Enter seconds.*"

3. Using the number keys, enter the seconds. The Model 1104 will recite the digits as they are pressed.

4. Press ENTER. The Model 1104 will respond: "*Enter.*"

4.7.2 Interrogating the Listen-in Time

To interrogate the Listen-in Time:

1. Press WHAT IS.

2. Press LISTEN TIME. The Model 1104 will recite the listen time in seconds programmed.

4.8 Call Delay

Call Delay is the programmed length of time the Model 1104 waits, following detection of an alarm, before it begins the dial-out sequence. This applies only to the first call. (Delay time between calls is also programmable: refer to Intercall Time,

Section 4-11.)

The purpose for Call Delay is to allow time for personnel at the Model 1104's installation site to respond to and cancel an alarm before dial-out begins. During this time, the Model 1104 will audibly repeat its *"alert condition"* message (unless the Local Voice Mute feature has been activated—refer to Section 4.9). The default for Call Delay is 30 seconds. Call Delay can be programmed from 0 seconds to 60 minutes (1 hour).

4.8.1 Programming the Call Delay

To program the Call Delay:

1. Press SET.

2. Press CALL DELAY.

The Model 1104 will respond: "*Enter minutes.*"

3. Using the number keys, enter the minutes.

The Model 1104 recites the digits as they are pressed.

4. Press ENTER. The Model 1104 responds: "*Enter seconds.*"

5. Using the number keys, enter the seconds. The Model 1104 recites the digits as you press them.
6. Press ENTER. The Model 1104 responds: "*Enter.*"

4.8.2 Interrogating Call Delay

To interrogate Call Delay:

1. Press WHAT IS.

2. Press CALL DELAY.

The Model 1104 will recite the programmed Call Delay.

4.9 Local Voice Mute

When the Model 1104 dials out to report an alarm, it also audibly recites the alarm message at its installation site. The Local Voice Mute command allows you to turn off the voice at the Model 1104's site during alarm dialouts and status call-ins. This feature is used to prevent intruders or unauthorized persons from hearing the alarm dial-out message or from hearing the Status Report during an off-site call.

4.9.1 Enable/Disable Local Voice Mute

To enable/disable Local Voice Mute:

1. Press SENSOR ON/OFF.

2. Press MUTE.

The Model 1104 will say *"On"* to indicate that Local Voice Mute is enabled, or *"Off"* to indicate that it is disabled.

3. Repeat key sequence to switch between enabled or disabled Local Voice Mute.

4.10 Voice Repetitions

The Voice Repetitions feature allows programming of the number of times the alarm message is delivered *per phone call* during alarm dial-out.

The maximum repetitions may be set to 10; the default is

3 repetitions.

4.10.1 Programming Voice Repetitions

To program Voice Repetitions:

1. Press SET.

2. Press VOICE REPS.

The Model 1104 will respond: "*Enter number.*"

3. Using the number keys, enter a value from 0 to 10.

4. Press ENTER. The Model 1104 will respond: "*Enter.*"

4.10.2 Interrogating Voice Repetitions

To interrogate Voice Repetitions:

1. Press WHAT IS.

2. Press VOICE REPS.

The Model 1104 will recite the number programmed.

4.11 Intercall Time

The Intercall Time is the programmable period of time the Model 1104 waits in calling subsequent telephone numbers. Intercall Time is activated ***only after alarm dial-out to the first telephone number fails to be acknowledged***. This period can be programmed from 10 seconds to 60 minutes. The default intercall time is 1 minute.

If an incoming telephone call is made to the Model 1104 during Intercall Time (in between its dialing of subsequent telephone numbers to report an alarm), it will answer the incoming call and immediately report any existing alarms. The manner in which the incoming call is answered depends upon whether or not TAD is enabled or disabled:

- If TAD (Telephone Answering Device) is enabled, Rings Until Answer will be 1.
- If TAD is disabled, Rings Until Answer will be 10.

Refer to Section 4.5, Rings Until Answer; and Section 4.6, TAD (Telephone Answering Device).

4.11.1 Programming Intercall Time

To program Intercall Time:

1. Press SET.

2. Press INTERCALL TIME.

The Model 1104 will respond: "*Enter minutes.*"

3. Using the number keys, enter the minutes.

The Model 1104 recites the digits as you press them.

4. Press ENTER. The Model 1104 will respond: "*Enter seconds.*"

5. Using the number keys, enter the seconds. The Model 1104 recites the digits as you press them.

6. Press ENTER. The Model 1104 responds: "*Enter.*"

4.11.2 Interrogating Intercall Time

To interrogate Intercall Time:

1. Press WHAT IS.

2. Press INTERCALL TIME.

The Model 1104 will recite the programmed Intercall Time.

4.12 Maximum Number of Calls (Max Calls)

The Max Calls feature controls the total number of repeated calling attempts by the Model 1104 in the event of an alarm. When an alarm occurs, the dial-out process begins, and continues to cycle through your programmed telephone numbers until a maximum number of calls is reached. The Max Calls setting regulates the number of calls that will be made as a result of any alarms; if more than one alarm is detected at once, or if a second alarm occurs during dial-out on the first alarm, the Max Calls setting will start the calling process from zero, until the programmed number of calling attempts are completed.

The default setting for Max Calls is 100, but it may be programmed from 0 to 255 calls. Max Calls is cancelled when an alarm is acknowledged. If the maximum number of calls is completed and no alarm acknowledgement has occurred, the Model 1104 will automatically acknowledge any alarm and stop the dial-out.

NOTE

If only one telephone number is programmed, the Model 1104 will dial out a maximum of 15 times to report an alarm.

4.12.1 Programming Max Calls

To program Max Calls:

1. Press SET.

2. Press MAX CALLS.

The Model 1104 will respond: "*Enter number.*"

3. Using the number keys, enter a value. The Model 1104 will recite the digits as you press them.

4. Press ENTER. The Model 1104 responds: "*Enter.*"

4.12.2 Interrogating Max Calls

To interrogate Max Calls programmed:

1. Press WHAT IS.

2. Press MAX CALLS.

The Model 1104 will recite the value set for Max Calls.

4.13 The Clock

The Model 1104 has a built-in clock. The power-up time is 12 AM. The clock will keep time from 12 AM until you program the current time. It will then keep time from your programmed time. If the AC power fails, the clock will continue to keep time until the battery back-up fails. It will then reset to 12 AM when power is restored. ***An incorrect time is a good indication that the power has failed and the batteries have been expended.***

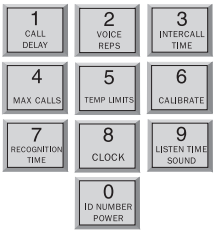
4.13.1 Setting the Clock

To set the clock:

1. Press SET.

2. Press CLOCK.

3. Using the number keys, enter the correct time. The Model 1104 will recite the digits as they are pressed.



4. If the time is AM, press the AM key. The Model 1104 will *"beep."* (If the time is PM , there is no key to press—the clock will be automatically set to PM if AM is not set.)

5. Press ENTER. The Model 1104 will say *"Enter."*

Example: You want to set the clock to 9:45 AM. Press the following keys in the order shown:

SET…CLOCK…0…9…4…5…AM…ENTER.

4.13.2 Interrogating for the Current Time

To interrogate the Model 1104 for the current time:

1. Press WHAT IS.

2. Press CLOCK. The Model 1104 will recite the programmed time.

4.14 The Security Code

The Security Code is the last step after setting all other programming parameters for the Model 1104. The code consists of a 4-digit number you select and will effectively prevent unauthorized changes to the Model 1104's programming. When the Security Code is activated, all keyboard programming is inaccessible. The Model 1104 may be interrogated using the WHAT IS key, but the keyboard must be unlocked, via the Security Code, before any additional programming is possible.

4.14.1 Locking the Keypad

To program the Security Code:

1. Press SET.

2. Press CODE.

The Model 1104 will say "*Enter security code.*"

3. Using the number keys, enter 4 digits. The Model 1104 says, "*OK.*" The keyboard is now locked.

If unauthorized persons attempt to set a parameter, an error message, "*Error 2,*" is returned. Whenever any operation except WHAT IS takes place without entering the security code first, this error message occurs.

4.14.2 Unlocking the Keypad

To unlock the keyboard:

1. Press WHAT IS.

2. Press CODE.

The Model 1104 will say "*Enter Security Code.*"

3. Using the number keys, enter the digits for the code.

If the correct code is entered, the Model 1104 will say "*OK*." If the wrong code is entered, the Model 1104 will say "*Error 2*."

Chapter 5: Alarm Programming

This chapter explains the alarm programming and monitoring capabilities of the Model 1104, with specific instructions for the following features:

- Configure inputs as dry contact or temperature
- Enable/disable inputs
- Program alarm Recognition Time for each input
- Program high and low temperature limits
- Disable alarm response to high or low temperature
- Program temperature in Fahrenheit or Celsius scale
- Calibrate temperature
- Obtain current temperature
- Program AC power-failure Recognition Time
- Enable/disable AC power monitoring
- Program sound level sensitivity
- Program high sound Recognition Time
- Disable alarm response to high sound
- Use Exit Delay via Status Report

5.1 Input Configuration

In preparing the Model 1104 to sense an alert condition, the inputs must be configured as dry contact (either open or closed) or as temperature inputs. The default setting for input 1 is temperature; for inputs 2-4, the default is dry contact and open. To configure input normality, sensors are first wired to the terminal strip at the back of the unit. (Refer to Chapter 2, Section 2.9–2.12, for an explanation on wiring inputs.)

The configuration process directs the Model 1104 to initialize the 4 inputs and establish normal settings. Any change in the status of an input (for example, from a normally open contact to a suddenly closed contact) is recognized as an ***alert condition***. In the case of a temperature input, an alert condition is recognized when established temperature limits are exceeded.

NOTE

Before starting keyboard commands to configure input normality on the Model 1104, ***it is very important to check that the sensors you have wired to the unit are set in their normal, non-alarm positions.***

For example, if a magnetic reed switch (a normally-closed sensor used to detect unauthorized entry) has been wired to the Model 1104, make sure that the door or window to be monitored is shut before configuring the input. If a motion-detector is wired to the unit, it is advisable to block all sources of motion from the sensor before and during configuration.

5.1.1 Programming Input Configuration

1. Press STANDBY to place the Model 1104 in Standby mode.

2. Wire sensors to the inputs to the back of the Model 1104 (see Chapter 2, Section 2.10).

3. Press RUN. The red light glows when the Model 1104 returns to Run mode.

4. Press SET.

5. Press CONFIGURE.

6. The Model 1104 audibly recites the configuration for each of the four inputs:

- If the input is ***normally open***, the Model 1104 recites the number of the input and says *"OK."*
- If the input is ***normally closed***, the Model 1104 recites the number of the input, followed by a *"beep"* and *"OK."*
- If the input is configured as ***temperature***, the Model 1104 recites the number of the input, followed by *"Temperature."*

5.1.2 Verifying Input Configuration

Input configuration can be verified when interrogating the Model 1104 for a complete Status Report. Refer to Chapter 6 for a more detailed description of the Status Report.

5.2 Enable/Disable Inputs

This function allows you to enable or disable an input's response to an alert condition. An enabled input will respond to an alert condition and allow dial-out. A disabled input will cause dial-out to be suppressed, but any existing alert conditions will be revealed during the Status Report. Enable/disable programming is useful during wiring of inputs (see Chapter 2) or when a condition needs to be monitored, but is not critical enough to be programmed for dial-out reporting. It is important to verify input status after performing any task that requires disabling. The default setting for all inputs is enabled (ON).

If an alert condition exists when inputs are re-enabled,

Recognition Time will restart—refer to Section 5.3.

5.2.1 Changing Enabled/Disabled Input Status

1. Press SENSOR ON/OFF.

2. Press the number (1 to 4) of the selected input to enable/disable. The Model 1104 says *"Off"* to indicate disabled or *"On"* to indicate enabled.

5.2.2 Verifying Enabled/Disabled Input Status

1. Press WHAT IS.

2. Press STATUS.

The Model 1104 audibly recites the current status of every input. In a Status Report, each input is first identified by its input number, followed by a report that specifies parameters currently affecting that input. ***If an input is disabled, the word "Off" immediately follows the number recited for that input.***

For example, input 3 is configured as a normally open, dry contact input. During the Status Report:

- ***If disabled***, the Model 1104 recites: "*Number 3—**Off**—OK,*" for input 3.
- ***If enabled***, the Model 1104 recites: "*Number 3—OK,*" for input 3.

In another example, input 2 is configured as a temperature input. The current temperature is 76 degrees. During a Status Report:

- ***If disabled***, the Model 1104 recites: "*Number 2—**Off**—76 degrees—OK.*"
- ***If enabled***, the Model 1104 recites: "*Number 2—76 degrees—OK.*"

5.3 Input Recognition Time

The Input Recognition Time is the length of time an alert condition must be present before a valid alarm exists and dial- out is activated. This time period is programmable, from 0 minutes, 0 seconds (for immediate response) up to a period of 272 minutes, 0 seconds. If an alert condition begins and then clears within the established Recognition Time, no dial-out will occur. When an alert condition continues beyond the programmed Recognition Time, the Model 1104 initiates dial-out. The default setting for Input Recognition Time is 0 minutes, 3 seconds.

5.3.1 Programming Input Recognition Time

1. Press SET.

2. Press RECOGNITION TIME.

3. Press the number (1 to 4) of the selected input to be programmed.

The Model 1104 responds: "*Enter minutes.*"

4. Using the number keys, enter the minutes. For example, to set a Recognition Time of five minutes, simply press "*5*" on the keypad. The Model 1104 recites the digits as they are pressed.

5. Press ENTER. The Model 1104 responds: "*Enter seconds.*"

6. Using the number keys, enter the seconds. The Model 1104 recites the digits as they are pressed.

7. Press ENTER. The Model 1104 responds: "*Enter.*"

5.3.2 Interrogating Input Recognition Time

1. Press WHAT IS.

2. Press RECOGNITION TIME.

3. Press the corresponding input key (1 to 4).

The Model 1104 recites the programmed Recognition Time for that input.

5.4 Establishing High and Low Temperature Limits

High and low temperature limits can be separately programmed for each input configured as temperature. Limits can range from –20° to +150° Fahrenheit, or from –30° to 65° Celsius.

When temperature limits exceed high or low settings, the Model 1104 will dial out with an alarm message. Default settings are: 10° F for low temperature and 100° F for high temperature.

5.4.1 Programming Temperature Limits for a Selected Input

1. Press SET.

2. Press TEMP LIMITS.

3. From the number keys, press a number (from 1 to 4) that corresponds to the temperature input being programmed.

The Model 1104 responds: "*Enter low temperature limit.*"

4. Using the number keys, enter a value for low temperature limit. The Model 1104 will recite the digits as they are pressed. If a negative number is required, first press PAUSE, then enter the number.

5. Press ENTER.

The Model 1104 responds: "*Enter high temperature limit.*"

6. Using the number keys, enter the value for high temperature limit. The Model 1104 recites the digits as they are pressed.

7. Press ENTER. The Model 1104 responds: "*Enter.*"

NOTE

Do not set temperature limits too close to normal room temperature. Minor temperature fluctuations could result in frequent and unnecessary alarm dialouts.

5.4.2 Disabling Alarm Response to High or Low Temperature

To disable alarm response to either high or low temperature settings exclusively, enter the maximum temperature limit when programming the selected input. (The Model 1104 will not respond to temperatures encountered at maximum settings or beyond.) Begin by following the key sequence shown in Section 5.4.1, and when prompted to enter the high or low temperature value:

- Set high temperature to either +150º F or +65º C (high temperature limit) to prevent the Model 1104 from responding to a high temperature alarm.
- Set low temperature to either -20° F or -30° C to prevent the Model 1104 from responding to a low temperature alarm.

5.4.3 Interrogating High and Low Temperature Limits

1. Press WHAT IS.

2. Press TEMP LIMITS.

3. Press the number key corresponding to the selected temperature input.

5.5 Temperature Scale

Temperature inputs may be set in either Fahrenheit or Celsius degrees. The default temperature scale is Fahrenheit. To change to Celsius:

1. Press SENSOR ON/OFF.

2. Press TEMP. The Model 1104 responds: "*Off,*" indicating Celsius scale has replaced Fahrenheit scale.

3. To return to Fahrenheit scale, repeat the key sequence. The Model 1104 responds: "*On,*" indicating Fahrenheit scale is in effect.

NOTE

When switching from Fahrenheit to Celsius, or vice versa, the change applies to all inputs configured to read temperature. When switching temperature scales it is important to reset high and low temperature limits on all temperature inputs. Refer to Section 5.4.1 to reset temperature limits.

5.6 Temperature Calibration

To compensate for minor variances in sensor accuracy, an offset may be programmed for each temperature input. The amount of offset is measured in degrees Fahrenheit or degrees Celsius. Adjustments are possible within a range from -10 degrees to +10 degrees. For example, if input 3 is sensing temperature and is reading 1 degree too high, then the calibration for input 3 is set at -1 to obtain an accurate reading.

5.6.1 Programming Temperature Calibration

1. Press SET.

2. Press CALIBRATE.

3. Press the number (1 to 4) of the selected temperature input to be calibrated.

4. Enter the number required to offset the current temperature reading so a correct reading is obtained.

- To program a positive offset number (up to +10 degrees), enter the number on the keypad. The Model 1104 recites the digits as they are pressed.
- To program a negative offset number (up to –10 degrees), first press PAUSE. The unit responds with a "*beep*." Next, enter the number on the keypad. The unit recites the digits as they are pressed.

5. Press ENTER. The Model 1104 responds: "*Enter.*"

NOTE

If you find that your calibration offset exceeds more than + 5 or –5 degrees, other complicating factors could be affecting normal operation of the Model 1104. Call Sensaphone for technical assistance.

5.6.2 Interrogating Temperature Calibration

1. Press WHAT IS.

2. Press CALIBRATE.

3. Press the number key corresponding to the selected temperature input.

If a "*beep*" precedes the number as it is recited, then a negative offset is indicated.

5.7 Obtaining Current Temperature

Current temperature readings for each temperature input may be accessed at any time. The Model 1104 recites the input number, and the actual temperature detected by the attached sensor, for all inputs configured as temperature. To obtain current temperature:

1. Press WHAT IS.

2. Press TEMP.

5.8 AC Power Monitoring Enable/Disable

The Model 1104 monitors AC power failure. This command enables or disables the power failure detection feature.When enabled, the Model 1104 will monitor power and dial out when AC power failure exceeds a programmable span of time (refer to AC Power Failure Recognition Time, Section 5.9).

The default setting for AC power monitoring is enabled (on). When disabled, the Model 1104 will not dial-out to report power failure.

5.8.1 Enabling/Disabling the AC Power Alarm

1. Press SENSOR ON/OFF.

2. Press POWER.

   - The Model 1104 will say *"Off"* to indicate that the power alarm is disabled, or
   - The Model 1104 will say *"On"* to indicate that the power alarm is enabled.

3. Repeat key sequence to change settings.

5.9 AC Power Failure Recognition Time

The AC Power Failure Recognition Time is the length of time that AC electric power is off before a valid alarm is recognized and dial-out begins. The default setting is 5 minutes, 0 seconds, but is programmable from 0 seconds to a maximum of 272 minutes.

When AC power failure occurs, and throughout the programmed Recognition Time, the Model 1104 steadily repeats the message *"the electricity is off"* at the unit's installation site. There is no Call Delay programming available for AC power failure. Immediately following Recognition Time, the Model 1104 begins the dial-out process to report power failure.

To cancel the power-failure message locally at the keypad (during or after Recognition Time) press any key on the Model 1104

keypad. This action also cancels the dial-out process. The AC power failure alarm may also be cancelled remotely, by telephone acknowledgment (see Chapter 6, Section 6.1).

5.9.1 Programming Power Failure Recognition Time

1. Press SET.

2. Press RECOGNITION TIME.

3. Press POWER. The Model 1104 responds: "*Enter minutes.*"

4. Using the number keys, enter the number of minutes. The Model 1104 will recite the digits as they are pressed.

5. Press ENTER. The Model 1104 responds: "*Enter seconds.*"

6. Using the number keys, enter the number of seconds. The Model 1104 will recite the digits as they are pressed.

7. Press ENTER. The Model 1104 responds: "*OK.*"

5.9.2 Interrogating Power Failure Recognition Time

1. Press WHAT IS.

2. Press RECOGNITION TIME.

3. Press POWER.

The Model 1104 will recite the power Recognition Time.

5.10 Sound Alarm Monitoring

This feature allows you to program the level and duration of sound that will cause the Model 1104 to respond to an alarm and dial-out. It may be useful to desensitize the Model 1104 to sound if it is installed in an area with a relatively high noise level, or where a loud noise occurs frequently but is not associated with an alarm. In some applications, it may be desirable to increase sound sensitivity to low sound levels.

5.10.1 Programming Sound Alarm Sensitivity

The sensitivity setting for sound alarm monitoring ranges from 1 to 255. A value of 1 makes the microphone the MOST sensitive to changes in sound. The value 255 makes the microphone the LEAST sensitive to sound. The default value is **32**.

1. Press SET.

2. Press CALIBRATE.

3. Press SOUND. The Model 1104 responds*:* "*Enter number.*"

4. Using the number keys, enter a value for sound sensitivity.

The Model 1104 recites the digits as you press them.

5. Press ENTER. The Model 1104 responds: "*Enter.*"

5.10.2 Interrogating Sound Sensitivity

1. Press WHAT IS.

2. Press CALIBRATE.

3. Press SOUND. The Model 1104 recites the programmed sound sensitivity level.

5.10.3 Programming High Sound Alarm Recognition Time

The Recognition Time for sound alarm monitoring ranges from 2 seconds to 59 seconds. The default value is **8** seconds.

1. Press SET.

2. Press RECOGNITION TIME.

3. Press SOUND. The Model 1104 responds: *"Enter seconds."*

4. Using the number keys, enter the number of seconds. The Model 1104 will recite the digits as they are pressed.

5. Press ENTER.

5.11 High Sound Alarm Enable/Disable

The Model 1104 monitors sound through the built-in microphone. When the sound level suddenly exceeds the programmed high sound limit, the Model 1104 will respond to an alert condition. The increased sound level must continue throughout the programmed recognition time. The default for high sound alarm is enabled (on).

NOTE

The microphone is also used for listening to on-site sounds. Refer to Chapter 4, Section 4.7. Disabling the sound alarm does not affect listen-in capability.

5.11.1 Changing Enabled/Disabled High Sound Alarm

1. Press SENSOR ON/OFF.

2. Press SOUND. The Model 1104 will say *"Off"* to indicate disabled or *"On"* to indicate enabled.

3. Repeat key sequence to change settings.

5.12 Exit Delay

When tripping an alarm is unavoidable, yet a true alert condition has not actually occurred, the alarm response, including dial-out, can be temporarily suppressed.

The Model 1104 is able to suppress and then reset its dial-out function automatically through use of the Status Report. This is especially convenient when an alert condition is created upon exiting a monitored door, and there is no way to cancel from the local keypad.

Example: You are planning to exit through a monitored door. Prior to exiting, you initiate a Status Report recitation at the Model 1104 keypad by pressing WHAT IS, followed by STATUS, (key sequence shown below). This allows you approximately 30 seconds to exit without activating the Model 1104's programmed response to an alarm. At the conclusion of the status report, normal alarm response is reactivated.

To use exit delay, initiate the Status Report.

1. Press WHAT IS.

2. Press STATUS. The Model 1104 recites the full Status Report; during this time, you are able to exit the monitored area without tripping an alarm.

Chapter 6: Acknowledgment, Status Report & Remote Access

In addition to communication and alarm monitoring capabilities, the Model 1104 will also respond to your instructions and provide you with access to information on monitored conditions at all times.

By issuing commands to the unit, either at the installation site or over standard telephone lines, the following features may be activated:

- Acknowledgment of existing alarms
- The Status Report on all monitored conditions.

6.1 Alarm Acknowledgment

When the Model 1104 dials out with an alarm message, it will request acknowledgment before hanging up. Acknowledgment indicates to the unit that the alarm message has been received. Upon acknowledgment, the Model 1104 will cancel the dial-out sequence.

There are three ways* that an alarm is acknowledged directly:

- Local Acknowledgment
- Touch-Tone™ Acknowledgment
- Callback Acknowledgment

* A fourth method of alarm acknowledgment is indirect. Refer to Max Calls, Chapter 4, Section 4.12 for an example of automatic alarm acknowledgment.

6.1.1 Local Acknowledgment

To acknowledge an alarm locally (directly at the installation site of the Model 1104), press any key.

6.1.2 Touch-Tone™ Acknowledgment

This method of remote alarm acknowledgment works with a Touch-Tone™ telephone.

Example: You receive a call from the Model 1104, reporting that an alarm exists. The message concludes: "*Indicate you have received warning message.*" Now, or at any time during this call, you may acknowledge the alarm with the code **"555"** if you are using a Touch-Tone™ telephone.

- To enter "555," press the number (5) key on the Touch-Tone™ phone keypad three times. The Model 1104 will respond: * ***"Warning message received by telephone number (last number dialed)."*** The Model 1104 will hang up and the dial-out sequence, including any further response to the alarm, will be cancelled.
- If you enter the wrong code or do not enter it within 10 seconds following the conclusion of the message, the Model 1104 will respond: ***"Dial telephone number (the programmed unit phone number) within (Intercall Time)."*** Then, the Model 1104 will hang up. The alarm is still not acknowledged until you call back. The alarm is still not acknowledged until you call back. You have a period equal to the programmed Intercall Time to call the unit back and enter the "555" acknowledgment code. If you are calling from a pulse or rotary telephone, refer to Callback Acknowledgment, Section 6.1.3, below.

6.1.3 Callback Acknowledgment

Callback Acknowledgement is a feature that allows you to acknowledge an alarm without entering Touch-Tones. This feature is disabled by default and must be enabled by entering the key sequence below. When Callback Acknowledgment is enabled, simply call the unit back and allow the line to ring 10 times. The unit will then answer the call, recite a Status Report, then say *"Warning message received by telephone number ..."* and recite the telephone number last dialed. This indicates that the alarm has been acknowledged.

To enable or disable Callback Acknowledgement:

1. Press SENSOR ON/OFF.

2. Press PHONE NUMBER.

The Model 1104 will say *"On"* to indicate that Callback Acknowledgment is Enabled, or *"Off"* to indicate that Callback Acknowledgement is Disabled. This method of remote alarm acknowledgment works with any telephone: pulse, rotary, or Touch-Tone.

Example: The Model 1104 calls you with an alarm message. You answer the call with a rotary or pulse telephone, and do the following:

- You listen to the message and hang up.
- Then you call the Model 1104 back on any telephone. You must wait for 10 rings—this signals the Model 1104 to answer your telephone call. (Make sure to call back within the programmed setting for Intercall Time—refer to Chapter 4, Section 4.11.)

When the Model 1104 answers your return call, it gives a Status Report (refer to Section 6.2). Then it says: "*Warning message received by* ..." and recites the telephone number last dialed. This indicates that the alarm has been acknowledged.

NOTE

If you have the TAD feature (telephone answering device) enabled, the Model 1104 will answer the telephone on the first ring. If it is disabled, the telephone must be allowed to ring 10 times. This serves as a precaution against a random alarm acknowledgment. Refer to Chapter 4, Section 4.6, for complete information on using the TAD feature.

6.2 Status Report

The Status Report allows access to complete information on all monitored conditions either locally, from the keypad, or by telephone, from any location. The Model 1104 will answer an incoming telephone call following the programmed Rings Until Answer (refer to Chapter 4, Section 4.5). Included with the Status Report are messages related to alarm conditions, AC power, battery backup and sound level. It also provides an opportunity for listening to on-site sounds (refer to Listen-in Time, Chapter 4, Section 4.7).

To initiate the Status Report:

1. Press WHAT IS.

2. Press STATUS.

Sections 6.2.1, 6.2.2, and 6.2.3 demonstrate two different Status Report recitations. The Status Report starts with:

"Hello. This is telephone number 555-1234 (or the programmed ID)."
"The time is 12:15PM (or the current time)."

The Model 1104 proceeds with a separate report for each input. Each input identifies itself by reciting the input number.

6.2.1 Example: Status Report, No Alarms

Inputs 2, 3, and 4 are configured as dry contact and input 1 is configured as temperature. No alarms exist. The Status Report begins by saying, *"Hello, this is telephone number 555-1234; the time is 12:15PM."*

Following this introduction, the report continues:

"Number 1, 74 degrees, OK."

"Number 2, OK."

"Number 3, OK."

"Number 4, OK."

"The electricity is ON." This refers to AC power.

"Battery condition, OK." Other possible responses: *"Battery condition low"* or *"Replace batteries."* (Refer to Section 6.2.4 for additional information regarding battery condition.)

"Sound level, OK."

"Listen to the sound level for 10 seconds." In this case, the programmed Listen-in Time is set at 10 seconds. (This feature is not available when obtaining the Status Report on-site, directly at the keypad.)

The Status Report repeats once more and the Model 1104 concludes the call, saying: *"Have a good day."* (The Status Report will not repeat if obtained at the keypad; *"Have a good day,"* is also not recited.)

The phrase *"no number"* at the end of a Status Report indicates that no dial-out phone numbers have been programmed.

6.2.2 Example: Status Report, Existing Alarms

Inputs 2, 3,and 4 are configured as dry contact and input 1 is configured as temperature. An emergency situation is at hand: a

fire in a greenhouse has tripped a smoke alarm and electrical power has been disrupted. In addition to high sound and AC power alarms, separate alarms exist on inputs 1, 2, 3, and 4. You happen to call in for the Status Report, which begins with, "*Hello, this is telephone number 555-1234; the time is 12:15PM.*" Following this introduction, the report continues:

"*Number 1, 110 degrees, HIGH.*"

"*Number 2, EXISTS.*"

"*Number 3, EXISTS.*"

"*Number 4, EXISTS.*"

"*The electricity is OFF.*"

"*Battery condition, OK.*"

"*Sound level, HIGH.*"

"*Warning message received by ...(last telephone number dialed*).*"

"*Listen to the sound level for 10 seconds.*"

The Status Report repeats once more and the Model 1104 concludes the call by saying: "*Have a good day.*"

* The "*last telephone number dialed*" refers to any one of the programmed, dial-out telephone numbers through which the Model 1104 was able to receive alarm acknowledgment, prior to your call for a Status Report; this could also refer to the Model 1104's I.D. Number (identification number), if the alarms are acknowledged at the keypad by someone present at the site.

6.2.3 Example: Status Report, Disabled Inputs

If an input is disabled, the dial-out feature for that input is deactivated, but all other programmed parameters remain in effect. In the example below, all 4 inputs are disabled, although inputs 1 and 3 are detecting alarms. AC power and Sound Level is also disabled for dial-out. (Note that to indicate disabled status, only AC power will return two audible "*beeps*," rather than the word "*OFF.*") When you call the Model 1104 for a Status Report, you hear the following:

"*Hello, this is telephone number 555-1234.*

"*The time is 12:15PM.*"

"Number 1, OFF, 96 degrees, HIGH."

"Number 2, OFF, 74 degrees, OK."

"Number 3, OFF, EXISTS."

"Number 4, OFF, OK."

"The electricity is (beep, beep) ON." If the electricity is off, or the AC adaptor is disconnected, you will hear: *"The electricity is (beep, beep) OFF."*

"Battery condition, OK."

"Sound level OFF, OK." If the sound level is high you will hear: *Sound level OFF, HIGH."*

"Listen to the sound level for 10 seconds."

The Status Report repeats once more and the Model 1104 concludes the call, saying: *"Have a good day."*

6.2.4 Battery Condition

During a Status Report, you may hear one of three possible messages regarding battery power. The Model 1104 determines the appropriate message by measuring battery voltage. Depending upon the remaining voltage, it may respond:

- *"Battery Condition OK,"* if over 8.2 Volts.
- *"Battery Condition low,"* if between 7.2 and 8.2 Volts.
- *"Replace batteries,"* if below 7.2 Volts.

6.2.5 Remote Access by Touch-Tone™ Telephone

Calling the Model 1104 for a Status Report provides the opportunity to access other functions, using Touch-Tone™ push-button commands. Remote telephone commands include:

- Disabling/enabling any input.
- Disabling/enabling High Sound Alarm monitoring.
- Disabling/enabling AC Power monitoring.
- Activation of Listen-In Time.
- Activation of the Status Report.

To issue commands by telephone, first dial the number of the Model 1104 to access the Status Report. The Status Report will be followed by the programmed Listen-In Time. If you remain on the telephone, the Status Report will be repeated, followed by a 10

second waiting period and hang-up. During this 10 second waiting period, or ***at any time during the call, other commands may by accessed by pressing any push button on the telephone.***

If a Security Code is in effect, the Model 1104 will prompt you with: "*Enter Security Code.*" If no Security Code is set, then it will say "*O.K.*"

- Enter your Security Code (4 digits) with the telephone push buttons. If the code you enter is correct, the Model 1104 will respond: "*OK.*"
- If you enter the wrong Security Code, the Model 1104 says, "*Error. Have a good day,*" and hangs up.

Disabling/enabling inputs – If an input is set to detect an alert condition, it can be disabled to prevent the Model 1104 from dialing out, or re-enabled at any time.

This feature allows the convenience of disabling an input, even if you are away from the site of the Model 1104. One such application may involve an input programmed to detect unauthorized entry. You are in another locale, but must allow someone else temporary access to the area monitored by the Model 1104. Using a Touch-Tone™ telephone, you can disable the appropriate input (thereby disabling any alarm dial-out response). The input remains disabled until you issue the same command, which effectively returns it to its former, enabled state.

Press the following push-buttons on the Touch-Tone™ telephone to execute the desired command:

*** (asterisk), 1**

...equal to Sensor On/Off, for input 1. To re-enable the input, repeat the same Touch-Tone™ button sequence used for disabling.

*** (asterisk), 2**

...equal to Sensor On/Off for input 2, and so on, for inputs up to 4. To re-enable the input, repeat the same Touch-Tone™ button sequence used for disabling.

Disabling/enabling High Sound Monitoring –

*** (asterisk), 9**

...equal to SENSOR ON/OFF for High Sound Alarm monitoring. To re-enable High Sound Alarm, repeat the command.

Disabling/enabling AC Power –

*** (asterisk), 0**

...equal to Sensor On/Off for AC Power monitoring. To re-enable AC Power monitoring , repeat the command.

Activating Listen-In Time –

 # (pound), 1

...initiates Listen-In Time for listening to on-site sounds for the programmed time available.

Activating Status Report –

 # (pound), 2

...initiates a full recitation of the Status Report.

Exiting –

 # (pound), # (pound)

...forces exit. The 1104 says, "*Have a good day,*" and hangs up.

Chapter 7: Operation

After installation and programming is completed, the Model 1104 is fully operational. This chapter explains the sequence of events that occur during an alarm dialout to illustrate how the Model 1104 operates.

7.1 Alarm Detection, Dial-out and Acknowledgment

Generally, an alarm event is structured in the following manner:

I. The Model 1104 detects an alert condition due to a change at the sensor.
II. A valid alarm is recognized.
III. Dial-out begins.
IV. The alarm is acknowledged.

Often, an alarm does not proceed through all stages: either an alert condition does not persist long enough to be considered valid, or a valid alarm is cancelled.

The table on the following pages explains the alarm detection, dial-out and acknowledgment features and lists important variable factors affecting their operation.

I.Model 1104 Detects a Change at the Sensor	Variable Factors
• Model 1104 detects a change in the monitored condition (from the sensor wired to one of the inputs). This is considered an alert condition, and does not qualify as a valid alarm at this point. • The condition continues throughout the programmed Recognition Time. If the condition (or sensor) reverts to its normal state before the Recognition Time is reached, no alarm will occur.	*Input Type: (1) An open circuit closes, (2) a closed circuit opens, or (3) temperature limits are exceeded.* *Recognition Time: Activated*
II. A Valid Alarm Is Recognized	**Variable Factors**
• The condition must persist long enough to meet or exceed the programmed Recognition Time. When Recognition Time has expired, but the alert condition continues, the Model 1104 will determine that a valid alarm exists.	*Recognition Time: Expired*
• When a valid alarm is determined, Call Delay is activated, forcing the Model 1104 to wait for a programmed period of time before starting the dial-out process. Call Delay applies to the period just prior to dial-out, before the first telephone call is made.	*Valid Alarm: Exists* *Call Delay: Activated*
• Call Delay provides the opportunity to cancel a valid alarm at the Model 1104's installation site, before dial-out occurs. An audible voice message indicates which of the inputs is in alarm. If on-site personnel acknowledge the alarm within the Call Delay time, the Model 1104 will not dial out. (Local Voice Mute is disabled, so that alarm messages can be heard at the site.)	*Alarm Message: Audible, On-site Activated* *Local Voice Mute: Disabled*

III. Dial-out Begins	Variable Factors
• The dial-out process is activated as soon as the Call Delay time expires (if the alarm has not been cancelled at the Model 1104's installation site.) The dial-out begins with telephone number 1 and proceeds sequentially, through the remaining telephone numbers.	*Call Delay: Expired*
• If the alarm is not acknowledged with the first dial-out telephone call, the Model 1104 waits the duration of Intercall Time before dialing the next telephone number. Intercall Time is the programmed waiting period in between each dial-out telephone call.	*Intercall Time: Activated*
• When the telephone is answered, the programmed Voice Repetitions determine the number of times per call the Model 1104 recites the alarm message.	*Voice Repetitions: Activated*
• Call Progress, an automatic feature, enables the Model 1104 to detect whether or not the telephone call is answered. After 8 rings, or if a busy signal is encountered, the Model 1104 will hang up, wait the programmed Intercall Time, and proceed to dial the next telephone number.	*Call Progress: Activated*
• If no telephone calls are answered, the Model 1104 dials out sequentially, through the remaining telephone numbers and continues to cycle until the programmed Maximum Number of Calls is reached.	*Max Calls: Activated*
• When the telephone is answered, the Model 1104 will immediately begin reciting a message that indicates which of the inputs is in alarm. At the same time, the alarm message is repeating at the Model 1104's installation site. The Model 1104 will request acknowledgment, if it has not yet occurred.	*Alarm Messages: By Telephone and On site*

IV. The Alarm Is Acknowledged	Variable Factors
• At any time after a valid alarm is determined, the alarm may be acknowledged at the Model 1104's installation site, by pressing any key.	*Local, On-site Acknowledgment*
• When the Model 1104 dials out and the call is answered via Touch-Tone telephone, any alarm may be instantly acknowledged by pressing "555."	*Touch-Tone Acknowledgment: Fast Code 555*
• If the alarm message repeats for the number of programmed Voice Repetitions, and "555" has not been entered, the Model 1104 will say:	
"*Indicate that you have received warning message.*"	
The Model 1104 waits 10 seconds for the Touch-Tone code "555" to be entered. If the code is entered within 10 seconds, it responds:	*Touch-Tone Acknowledgment: Normal Code 555*
Warning message received by telephone number...(the dialed phone number)."	
The alarm is considered acknowledged and the dialout concludes.	
• If the Model 1104 does not receive the Touch-Tone code within 10 seconds, it recites the following and then hangs up:	*Tone or Pulse Callback Acknowledgment: Within Intercall Time*
"*Dial telephone number (gives the Unit ID Number) within...(the programmed Intercall Time.)*"	
The recipient of this message must call the Model 1104 back within the period programmed for Intercall Time, in order to acknowledge the alarm. If Local Voice Mute is off, the unit will beep at the installation site while waiting for this call.	
• Callback: The Model 1104 waits 10 rings before answering to guard against random acknowledgment. If an	

IV. The Alarm Is Acknowledged	Variable Factors
answering device is connected to the same line as the Model 1104 (and TAD is enabled), the Model 1104 will answer on the first ring. First, it recites the Status Report, followed by: "*Warning message received by telephone number...(the last number dialed).*" "*Have a good day.*"	*Tone or Pulse Callback Acknowledgment: TAD Enabled*
When the Model 1104 hangs up, the alarm is acknowledged and dial-out stops.	
• If calls remain unanswered, or if they are received by an answering machine or FAX, the Model 1104 continues the dialout sequence; it waits the Intercall Time and proceeds to dial the next telephone number. Telephone numbers are dialed sequentially, and this cycle continues for the number of Max Calls programmed. If no acknowledgment occurs, then at the completion of Max Calls, the alarm is automatically acknowledged and the dial-out process is terminated.	*Max Calls Acknowledgment*

NOTE

Acknowledging the alarm does not correct the situation! The alarm condition will still exist until the sensor is restored to its normal state.

7.2 Example: A Dial-out Telephone Call

The following parameters are selected for demonstration purposes:

- Model 1104 Unit ID Number is set to 555-5674. It is currently installed at your place of business.
- Dial-out Telephone Number 1 is programmed to 555-1234, your home telephone number.
- Voice Repetitions are set to 4.

The Model 1104 is detecting an alarm on input 2.

The telephone rings at 555-1234, your home number.

You answer the telephone and hear the following message:

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Indicate you have received warning message.*"

NOTE

It is important that your dial-out telephone numbers be answered by you or other authorized personnel in order to ensure adequate response to an alarm.

Chapter 8: Model 1104 Special Editions

The Sensaphone Model 1104 also comes in three editions with additional special features: the CottageSitter, BusinessSitter, RemoteControl, and Model 1114 Line Seizure models. If you have purchased one of these versions of the 1104, please refer to this chapter for additional information specific to the operation of your unit.

8.1 Sensaphone 1104 CottageSitter Edition

The Sensaphone 1104 CottageSitter allows you to monitor and check on the status of your cottage or cabin from any cellular or ordinary telephone. The Sensaphone 1104 CottageSitter also allows you to turn a device on or off using the 1104 keypad or using your touch-tone telephone. You can also inquire about the status of the device during a voice status report.

This Sensaphone contains a relay contact on the rear of the unit *(see Figure 1)*. The relay contact supports both a normally open and a normally closed contact, commonly referred to as a "double throw" relay.

When the Sensaphone relay is turned ON, a connection is made between the ON and C (common) terminals and the connection to the OFF terminal is disconnected. When the Sensaphone relay is turned OFF, a connection is made between the OFF and the C (common) terminals and the connection between the ON and C (common) is disconnected *(See Figure 1).* When the Sensaphone unit is put in standby mode, the relay remains in its last known state. If the Sensaphone is completely shut down by removing the batteries and unplugging it from power, the relay returns to an OFF state, connecting the OFF terminal to the C (common).

The Sensaphone relay is a low voltage relay. Only voltages less than 30 volts AC 2AMPS, or 30 volts DC 2 AMPS may be switched. For higher voltages, an additional high-voltage relay would be required.

Always enlist the services of a licensed electrician when working with high voltages. Improper wiring can cause harm to you or your property.

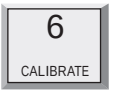
> **NOTE:** For safety reasons it is highly recommended that the unit only be used to switch low voltage signals (30 volts or less). If you intend to control higher voltages you must install the unit in an NEC approved electrical panel or enclosure and have wiring performed by a qualified electrician.

8.1.1 Switching the Output using the Keypad

To switch the output **ON** from the keypad:

1. Press STATUS.

2. Press 6.



To switch the output **OFF** from the keypad:

1. Press STATUS.

2. Press 3.

8.1.2 Switching the Output over the Telephone

1. Call the Sensaphone. When the unit answers, it will begin reciting a status report. At any time during the call, press a touch-tone. The unit will respond with "*OK*." The Sensaphone is now ready to accept touch-tone commands.
2. On your phone, press # 6 to turn **ON** the output. The Sensaphone will respond "*ON*."

3. Press pound # 3 to turn **OFF** the output. The Sensaphone will respond "*OFF*."

4. To check the present state of the relay press # 2.

This initiates a full recitation of the Status Report. At the end of the status report, the Sensaphone will say "*Number five On/Off.*"

8.1.3 Heating up your Cottage or Cabin Remotely

If you keep your cottage or cabin open all year around, or if you do not drain your pipes and antifreeze your plumbing, you likely keep your furnace active when you are away but at a very low temperature. The Sensaphone will provide an invaluable service to you by keeping you updated to any change in the status of your furnace operation. Prior to your arrival at your cottage or cabin, you can remotely use your phone to instruct the furnace to increase the heat.

Most furnaces use a typical 4-wire (heat/cooling) or 3-wire (heat only) thermostat. The Sensaphone can easily control these types of thermostats. ***If your heating source consists of high voltage electric baseboard heaters, you should consult a qualified electrician or heating professional for proper installation of the Sensaphone remote control facility.*** Electric baseboard heaters may utilize either a low voltage (2-wire) thermostat or a direct control high voltage thermostat. Only the low voltage thermostat may be directly connected to the Sensaphone.

8.1.4 The Dual Thermostat Concept

When a three or four wire low voltage thermostat is used, it is easy to connect the Sensaphone to your furnace with the addition of a secondary thermostat. One thermostat is set to your preferred "away" temperature and the other thermostat is set to your preferred "home" temperature. With your Sensaphone CottageSitter, you will be able to switch between these two thermostats.

Ideally, the "away" thermostat would be in your pump or furnace room. Remember that your "away" thermostat will be the only thermostat that keeps your cottage or cabin at minimal heat while you are away. It should not be located near a window or where direct sunlight might warm it, near a furnace radiator or vent, or any heat source such as a pilot light.

The second thermostat, the one pre-set for your preferred temperature when you arrive at your cottage or cabin, should be located in your normal living space. This would likely be your existing thermostat, already located in a suitable location by your heating professional at the time your furnace was installed.

By connecting these two thermostats together in a parallel fashion, and by passing the low voltage supply through the Sensaphone *(See Figure 1)*, you can remotely or locally decide which thermostat is in control of your furnace.

It is recommended that the "away" thermostat be connected to the OFF terminal while the "home" thermostat be connected to the ON terminal of the Sensaphone. This way, it's easy to understand which state your furnace is in: *ON = Home* and *OFF = Away*. The supply voltage from your furnace (typically the wire labeled R or 24VAC), should always be connected to the C (Common) terminal on the CottageSitter.

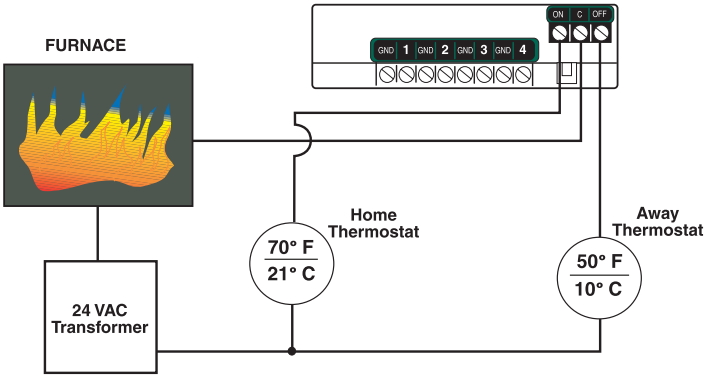


Figure 1: Dual Thermostat Setup

Note: This is a typical configuration when using standard single-zone heat/cool thermostats. For ease-of-use it is recommended that both thermostats be the same model. Note also that all thermostats may not be compatible with the dual-thermostat wiring diagram. Consult your heating/cooling professional for installation assistance.

8.1.5 Controlling Lights or other devices

Using X10 technology, you can remotely activate any electrical device or appliance in your home through your Sensaphone. X10 technology is a suite of control modules that plug into your existing electrical outlets and transmit coded signals to lamps, lights, and appliances to turn them on or off (See Figure 2).

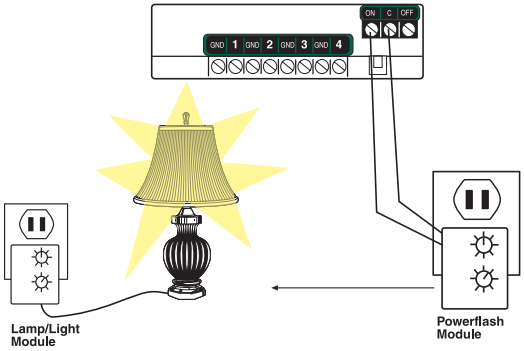


Figure 2: X10 Lighting Control Setup

Sensaphone supports these devices through use of the popular X10 Powerflash relay interface. To learn more about this technology, consult X10 products on the web at www.x10.com or visit your local electronics shop such as Radio Shack.

Such applications may include turning on a lamp or exterior lights remotely from your cellular telephone when arriving at your cottage or cabin late at night. Or you can use the X10 Powerflash Module (set to momentary contact) in conjunction with the X10 Universal Module to remotely control your electric garage door opener over the telephone—an ideal way of letting in your cottage or cabin service personnel without being on-site. You may also use the X10 technology to send the ON/OFF signal to a furnace or heater if your thermostat is not easy to wire directly.

Finally, in addition to remotely controlling devices, X10 technology lets you extend the reach of certain Sensaphone sensors such as door contacts, motion sensors, or water sensors. This of great benefit where it is impossible to wire directly from your sensors to your Sensaphone. Consult a qualified electrician or your heating professional for assistance with locating your remote sensors or contact your Sensaphone dealer.

8.1.6 Relay Output Specifications

Rated Load:	2 A at 30 VAC 2 A at 30 VDC
Max. Operating Voltage:	30 VAC 30 VDC
Max. Operating Current:	2 A
Max. Switching Capacity:	60 VA 60 W

8.2 Sensaphone 1104 BusinessSitter Edition

The Sensaphone 1104 BusinessSitter allows you to monitor and check on the status of your facility from any cellular or ordinary telephone. The Sensaphone 1104 BusinessSitter turns a device on when an alarm occurs. You can also inquire about the status of the device during a voice status report.

This Sensaphone edition contains a relay contact on the rear of the unit *(see Figure 3)*. The relay contact supports a normally open relay.

When the Sensaphone detects an alarm condition, it closes this relay, which then activates the device attached to the relay. The relay remains closed throughout the alarm process, even while the Sensaphone is making its alarm-response telephone calls out to you. Reset of the alarm relay may occur either locally or remotely via the telephone. This is discussed further in following sections.

The Sensaphone relay is a low voltage relay. Only voltages less than 30 volts AC 2AMPS, or 30 volts DC 2 AMPS may be switched. For higher voltages, an additional high-voltage relay would be required.

Always enlist the services of a licensed electrician when working with high voltages. Improper wiring can cause harm to you or your property.

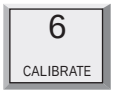
NOTE: For safety reasons it is highly recommended that the unit only be used to switch low voltage signals (30 volts or less). If you intend to control higher voltages you must install the unit in an NEC approved electrical panel or enclosure and have wiring performed by a qualified electrician.

8.2.1 Switching the Output using the Keypad

To switch the output **ON** from the keypad:

1. Press STATUS.

2. Press 6.



To switch the output **OFF** from the keypad:

1. Press STATUS.

2. Press 3.

8.2.2 Switching the Output over the Telephone

1. Call the Sensaphone. When the unit answers it will begin reciting a status report. At any time during the call, press a touch-tone. The unit will respond with *"OK."* The Sensaphone is now ready to accept touch-tone commands.
2. On your phone, press # 6 to turn **ON** the output. The Sensaphone will respond *"ON."*

3. Press # 3 to turn **OFF** the output. The Sensaphone will respond *"OFF."*

4. To check the present state of the relay press # 2.

This initiates a full recitation of the Status Report. At the end of the status report, the Sensaphone will say, *"Number five On/Off."*

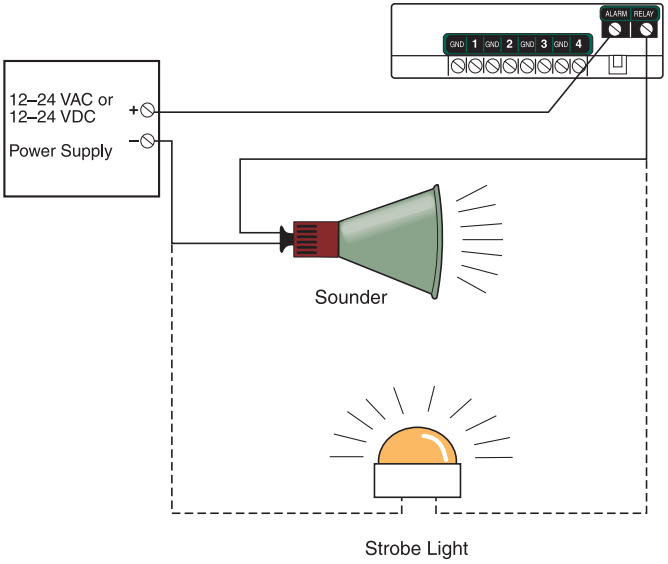


Figure 3: Activating a Sounder or Strobe on Alarm

8.2.3 Relay Output Specifications

Rated Load:	2 A at 30 VAC 2 A at 30 VDC
Max. Operating Voltage:	30 VAC 30 VDC
Max. Operating Current:	2 A
Max. Switching Capacity:	60 VA 60 W

8.3 Sensaphone 1104 RemoteControl Edition

The Sensaphone 1104 RemoteControl allows you to monitor and check on the status of your facility from any cellular or ordinary telephone. The Sensaphone 1104 RemoteControl also allows you to turn a device on or off using the 1104 keypad or using your touch-tone telephone. You can also inquire about the status of the device during a voice status report.

This Sensaphone contains a relay contact on the rear of the unit *(See Figure 4)*. The relay contact supports both a normally open and a normally closed contact, commonly referred to as a "double throw" relay.

When the Sensaphone relay is turned ON, a connection is made between the ON and C (common) terminals and the connection to the OFF terminal is disconnected. When the Sensaphone relay is turned OFF, a connection is made between the OFF and the C (common) terminals and the connection beetween the ON and C (common) is disconnected *(See Figure 4)*. When the Sensaphone unit is put in standby mode, the relay remains in its last known state. If the Sensaphone is completely shut down by removing the batteries and unplugging it from power, the relay returns to an OFF state, connecting the OFF terminal to the C (common).

The Sensaphone relay is a low voltage relay. Only voltages less than 30 volts AC 2AMPS, or 30 volts DC 2 AMPS may be switched. For higher voltages, an additional high-voltage relay would be required.

Always enlist the services of a licensed electrician when working with high voltages. Improper wiring can cause harm to you or your property.

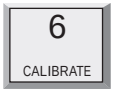
> **NOTE:** For safety reasons it is highly recommended that the unit only be used to switch low voltage signals (30 volts or less). If you intend to control higher voltages you must install the unit in an NEC approved electrical panel or enclosure and have wiring performed by a qualified electrician.

8.3.1 Switching the Output using the Keypad

To switch the output **ON** from the keypad:

1. Press STATUS.

2. Press 6.



To switch the output **OFF** from the keypad:

1. Press STATUS.

2. Press 3.

8.3.2 Switching the Output over the Telephone

1. Call the Sensaphone. When the unit answers it will begin reciting a status report. At any time during the call, press a touch-tone. The unit will respond with "*OK*." The Sensaphone is now ready to accept touch-tone commands.
2. On your phone, press # 6 to turn **ON** the output. The Sensaphone will respond "*ON*."

3. Press # 3 to turn **OFF** the output. The Sensaphone will respond "*OFF*."

4. To check the present state of the relay press # 2.

This initiates a full recitation of the Status Report. At the end of the status report, the Sensaphone will say "*Number five On/Off.*"

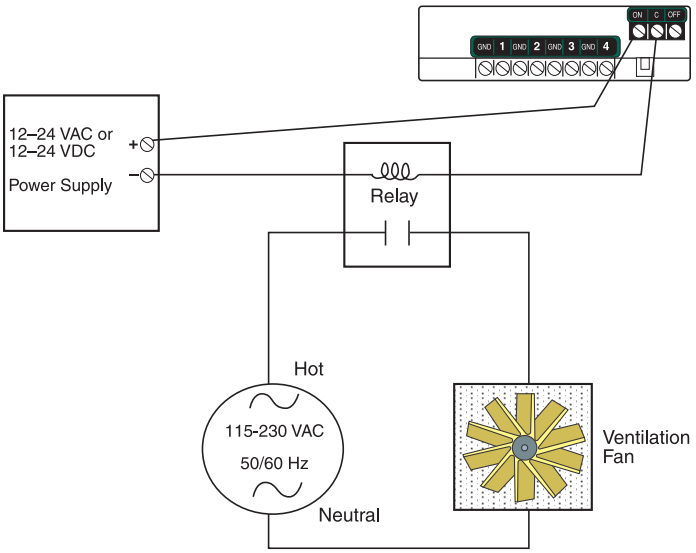


Figure 4: Controlling a Ventilation Fan

8.3.3 Controlling Lights or other devices

Using X10 technology, you can remotely activate any electrical device or appliance in your home through your 1104. X10 technology is a suite of control modules that plug into your existing electrical outlets and transmit coded signals to lamps, lights, and appliances to turn them on or off *(See Figure 5)*.

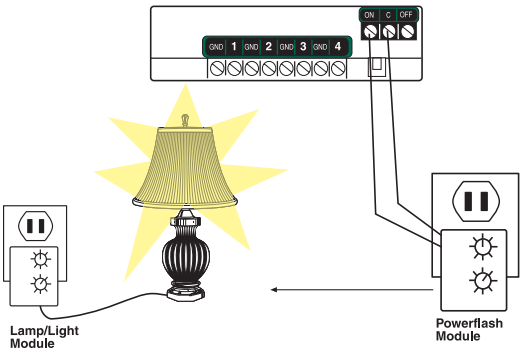


Figure 5: X10 Lighting Control Setup

The Model 1104 supports these devices through use of the popular X10 Powerflash relay interface. To learn more about this

technology, consult X10 products on the web at www.x10.com or visit your local electronics shop such as Radio Shack.

Such applications may include turning on a lamp or exterior lights remotely from your cellular telephone when arriving at your cottage or cabin late at night. Or you can use the X10 Powerflash Module (set to momentary contact) in conjunction with the X10 Universal Module to remotely control your electric garage door opener over the telephone—an ideal way of letting in your cottage or cabin service personnel without being on-site. You may also use the X10 technology to send the ON/OFF signal to a furnace or heater if your thermostat is not easy to wire directly.

Finally, in addition to remotely controlling devices, X10 technology lets you extend the reach of certain Sensaphone sensors such as door contacts, motion sensors, or water sensors. This is of great benefit where it is impossible to wire directly from your sensors to your Sensaphone. Consult a qualified electrician or your heating professional for assistance with locating your remote sensors or contact your Sensaphone dealer.

8.3.4 Relay Output Specifications

Rated Load:	2 A at 30 VAC 2 A at 30 VDC
Max. Operating Voltage:	30 VAC 30 VDC
Max. Operating Current:	2 A
Max. Switching Capacity:	60 VA 60 W

8.4 Model 1114 Line Seizure Edition

The Sensaphone Model 1114 operates identically to the Model 1104 except for the "line seizure" feature. The following is an explanation of the setup procedures unique to the Model 1114.

8.4.1 How Line Seizure Works

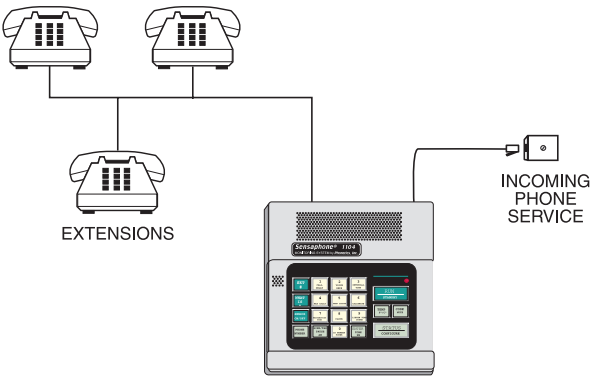
Line seizure gives the Sensaphone the ability to "seize" the telephone line when it needs to dial out. For example, if an emergency occurs that puts the Sensaphone into alert mode, the Sensaphone will be able to dial out even if a telephone has been left off the hook.

8.4.2 Hookup to the Phone Line

Programming and installation of the Sensaphone Model 1114 is identical the Model 1104 except for the telephone line hookup.

On the unit there are two RJ11C phone jacks:

- The six-foot telephone cord with the male RJ11C jack on the end is to be connected to the incoming line of your phone service, ahead of all other phones or telephone extensions.
- The female RJ11C telephone jack on the back of the unit is to be connected to all extensions.



Appendix A: Weekly Testing Procedure

We recommend that you test your Sensaphone weekly to be sure it is functioning properly. This will ensure that when a problem arises the Sensaphone will be ready to alert the appropriate personnel.

There are several tests that can be performed:

1) Call the unit and listen to the Status Report. This will test the unit's ability to answer the phone and speak a message. It will also verify that all of the inputs are reading properly, the alarm conditions are OK, the electricity is on, the microphone is functioning, and the batteries are OK.

2) Create an alarm on each input by tripping all connected sensors.

   Temperature sensors: Heat or cool the sensor.

   Motion sensors: Have someone walk in front of the sensor.

   Door/window sensors: open the door/window.

   Water sensors: Apply a small amount of water beneath the sensor or use a wet towel and touch it to the sensor probes.

   Humidity sensors: Raise the humidity around the sensor by holding a cup of very hot water beneath the sensor.

   Allow the unit to contact all programmed telephone numbers. This will make sure that the Sensaphone is programmed properly. It will also prepare personnel to respond appropriately when they receive a call from the Sensaphone.

3) Test the batteries by unplugging the AC adapter and making sure that the Sensaphone continues to function. Press WHAT IS, then STATUS on the keypad, and listen to the status report. Make sure the report states that "*the electricity is off*" and "*battery condition OK*." Keep the AC adapter unplugged so that a Power Failure alarm occurs. Allow the unit to dial all programmed telephone numbers while running on battery backup. Plug in the AC adapter after the unit has finished dialing all of the telephone numbers.

4) If you are using your Sensaphone to listen for a smoke alarm, then be sure to test the smoke alarm to make sure that the Sensaphone picks up the audible signal and triggers a high-sound-level alarm. Allow the unit to dial all programmed telephone numbers.

5) Keep a log of your tests, noting the date and whether the 1104 passed in each category tested. An example of such a log is shown below. *(See "Test Log" at the end of this manual.)*

1104 Test Log

Date	Inputs		Dialout		Call-in		Tested by
	Pass	Fail	Pass	Fail	Pass	Fail	
7/1/04	☒	☐	☒	☐	☒	☐	Bob H
7/15/04	☒	☐	☒	☐	☒	☐	Alex G.
7/22/04	☒	☐	☒	☐	☒	☐	Bob H.
	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	

If you require assistance, call Sensaphone Technical Support at 610-558-2700.

Appendix B: Troubleshooting

In the event that a problem is encountered, this section will assist you in determining the cause, so you can return the unit to its usual monitoring routine with minimal interruption.

Most problems with the Model 1104 are easy to identify and quickly corrected, and are found under the following general headings:

- Error Messages
- Communications/dial-out functions
- Temperature monitoring
- Sound level monitoring
- Other monitoring functions

If you have tried the solutions outlined in this section and are not satisfied with the results, call Sensaphone Technical Support at 610-558-2700, or follow the guidelines for shipping the Model 1104 to PHONETICS, INC. for repair (see Appendix F).

Error Messages

Problem	Cause	Solution
1. The unit says “Error 1.”	An invalid value has been entered or too much time has passed without entering a value.	Only enter values within the allowed programming range, and make programming changes in a timely fashion.
2. The unit says “Error 2.”	Programming changes were attempted without unlocking the keypad.	Unlock the keypad, then make programming changes.

Communications / Dial-out:

Problem	Cause	Solution
1. The Model 1104 fails to dial out.	a) The telephone number may be incorrectly programmed.	Recheck programming steps. Refer to Chapter 4, Section 4.2.1.
	b) Tone or pulse (the current dialing method) is not compatible with the telephone line on which the Model 1104 is installed.	Switch from the current setting: from tone to pulse, or from pulse to tone. Refer to Chapter 4, Section 4.3.
	c) Recognition Time is too long. An alert condition does not remain in effect long enough to become a valid alarm.	Reprogram Recognition Time. Set the Recognition Time to the minimum duration required to create a valid alarm. If possible, test the new setting by deliberately creating an alert condition. Refer to Chapter 5, Section 5.3.
	d) Max Calls is set to zero.	Reprogram Max Calls. It is a good idea to set your Max Calls to at least equal the number of dial-out telephone numbers programmed. Refer to Chapter 4, Section 4.12.1.

Communications / Dial-out:

Problem	Cause	Solution
	e) The Model 1104 is connected to an incompatible telephone line.	The Model 1104 must be connected to a standard (2-wire analog) telephone line, ***not a digital extension*** to a phone system. If the unit will not dial out and the factors previously listed have been ruled out, try connecting the unit to a standard residential telephone line.
2. The Model 1104 will not answer the telephone when called for a Status Report or alarm acknowledgment.	a) Rings Until Answer is incorrectly programmed.	Recheck programming of Rings Until Answer. Refer to Chapter 4, Section 4.5.1.
	b) The Model 1104 is connected to an incompatible telephone line.	Some telephone systems will not allow the telephone to ring beyond 4 rings. If your Model 1104's Rings Until Answer is set at more than 4 rings, you may not be able to access the unit. Try setting the Rings Until Answer to less than 4 rings. If this does not correct the problem, it may indicate telephone line incompatibility. In this case, try connecting the Model 1104 to a standard, residential telephone line.

3. The Model 1104 will not answer the telephone for Callback Acknowledgement.	You did not allow the telephone to ring 10 times. Note: If the TAD (telephone answering device) is disabled, the telephone rings ten times before the Model 1104 answers. If the TAD is enabled, the telephone rings once before the Model 1104 answers the call.	When calling the Model 1104, and the TAD is disabled, allow the telephone to ring 10 times. Refer to Chapter 6, Section 6.1.3, and Chapter 4, Section 4.6.3.
4. The Model 1104 recites the alarm message or Status Report over the telephone, but is silent at the installation site.	The local voice mute feature is in effect.	Deactivate local voice mute. Refer to the programming steps in Chapter 4, Section 4.9.
5. The Model 1104 dials out correctly but fails to audibly recite its alarm message when you answer the call.	Voice Reps is set to zero.	Reprogram Voice Reps to 1 or greater. Refer to Chapter 4, Section 4.10.
6. The Model 1104 and telephone answering device (sharing the same line) answer incoming calls simultaneously.	The Model 1104's number of Rings Until Answer is set to equal the number of rings set for the telephone answering device.	Change the number of Rings Until Answer for the Model 1104. Refer to Chapter 4, Section 4.5.

Temperature Monitoring:

Problem	Cause	Solution
1. Can't program temperature limits; or the unit won't read the temperature sensor.	The input isn't configured to read a temperature sensor.	Press SET and CONFIGURE to program the input. (See Section 5.1.1 for more information on configuring inputs.)
2. The temperature reading is -20° F or -30° C.	The temperature sensor has been disconnected or has broken wires.	Examine the wires to temperature sensor and connect or replace wiring.
3. Temperature reads 150° F or 65° C.	Temperature sensor wires are touching or have shorted.	Verify and correct wiring.
4. Temperature reading is inaccurate.	a) Temperature sensing may be affected by a source of ambient heat (ie., direct sunlight, or heat duct proximity).	Try moving the unit to a different location.
	b) Temperature may require calibration.	After moving or placing the unit away from ambient heat sources, the temperature may be calibrated to offset inaccurate normal reading by several degrees. Refer to Chapter 5, Section 5.6.
	c) The unit is using the wrong temperature scale (Fahrenheit vs. Celsius).	Verify temperature scale. Refer to Chapter 5, Section 5.5.

5. False high temperature alarms from freezer.	Most freezers have a defrost cycle during which the temperature will rise considerably, thus causing an alarm to occur.	Program an input recognition time longer than the defrost cycle.
6. The Sensaphone calls with a high/low temperature alarm but recites a temperature that's within the programmed limits.	The Sensaphone recites the "current" temperature when it calls you, not the temperature at the time the alarm occurred. It is likely that the temperature has changed since the time the alarm was detected and has since returned to normal operating conditions.	Shorten the Call Delay or lengthen the Input Recognition Time.

Sound Level Monitoring:

Problem	Cause	Solution
1. False high sound alarms occur frequently.	The programmed sound sensitivity results in over-sensitivity to non-alarm sound as well as alarm sound.	Reprogram the sound sensitivity. Refer to Chapter 5, Section 5.10.
	Sound Recognition Time is too short.	Lengthen the sound Recognition Time. Refer to Chapter 5, Section 5.10.
2. High sound does not cause an alarm.	The unit is not close enough to the high sound source, or the programmed sound setting results in a lack of sensitivity to high sound.	Move the unit closer or reprogram the sound sensitivity. Refer to Chapter 5, Section 5.10.

Other Monitoring:

Problem	Cause	Solution
1. Alarm status of an alert input is incorrect.	Incorrect input normality.	Reconfigure the input. Refer to Chapter 5, Section 5.1.
2. False power out alarms	Programmed Recognition Time is too short.	AC power is often subject to brief interruptions. To avoid frequent, false alarms, increase the power Recognition Time. Refer to Chapter 5, Section 5.9.
3. The Model 1104 does not recognize power failure.	a) Batteries are either incorrectly installed or drained.	To verify proper battery function, unplug the unit and verify continued operation using batteries only. If unit ceases to function, first try reinstalling the batteries. If this is not successful, replace the batteries. Refer to Chapter 2, Section 2.4 for complete instructions.
	b) Recognition time setting is too long.	Reprogram Recognition Time. Set the Recognition Time to the minimum required before a valid alarm occurs. If possible, test the condition by deliberately creating an alert condition. Refer to Chapter 5, Section 5.9.

4.	The Model 1104 does not recognize any alarm.	a) Inputs for alarm are disabled.	Enable the inputs for alarm. Refer to Chapter 5, Section 5.2.
		b) Programmed Recognition Time is too long.	Reprogram Recognition Time. Set the Recognition Time to the minimum required for a monitored condition to become a valid alarm. If possible, test the condition by deliberately creating an alert condition. Refer to Chapter 5, Section 5.3.
5.	The batteries drain prematurely.	The unit's AC transformer is unplugged or for some other reason, full AC power is not available to the unit.	The batteries will take over powering the unit when the AC transformer is unplugged from the 120 VAC outlet. When storing the unit, be sure to remove the batteries. Refer to Chapter 2, Section 2.4. *Be sure to use alkaline batteries—do not use rechargeable nicad batteries.*

If the solutions offered above do not appear to correct the problem, apply the following steps, in the order shown.

- Remove the batteries.
- Unplug the unit.
- Wait one minute for the Model 1104 to completely power down.
- Plug in the unit's AC adaptor into a standard 120 VAC outlet.
- Replace the batteries.

Refer to Chapter 2, Installation, for additional information on batteries and installation procedures.

Appendix C: 1104 QUICK REFERENCE

Parameter	Description	Key Sequence*	Range	Default
Call Delay	Time delay until first call is made	[SET] or [WHAT IS] + [CALL DELAY]	Min: 00:00 Max 60:00 (min:sec)	00:30 (min:sec)
Voice Reps	Number of times alarm message is repeated over the phone	[SET] or [WHAT IS] + [VOICE REPS]	Min: 0 reps Max: 10 reps	3 reps
Intercall Time	Time delay between phone calls	[SET] or [WHAT IS] + [INTERCALL TIME]	Min: 00:10 Max: 60:00 (min:sec)	01:00 (min:sec)
Max Calls	Number of calls until unit self-acknowledges	[SET] or [WHAT IS] + [MAX CALLS]	Min: 0 calls Max: 255 calls	100 calls
Temp Limits	High and low temperature alarm limits	[SET] or [WHAT IS] + [TEMP LIMITS] + [input #]	Min: -20°F/-30°C Max: 150°F/65°C	Low: 10°F High: 100°F
Calibrate	Temperature Correction factor	[SET] or [WHAT IS] + [CALIBRATE] + [input #]	Min: -10° Max: 10°	0°
Recognition Time: inputs 1–4	Length of time a fault condition must exist to trip an alarm	[SET] or [WHAT IS] + [RECOGNITION TiME] + [input#]	Min: 00:00 Max: 272:00 (min:sec)	00:03 (min:sec)
Recognition Time: Power Failure	Length of time the power must be off to trip an alarm	[SET] or [WHAT IS] +[RECOGNITION TIME]+[POWER]	Min: 00:00 Max: 272:00 (min:sec)	05:00 (min:sec)
Recognition Time: High Sound Level	Length of time the sound must be high to trip an alarm	[SET] or [WHAT IS] +[RECOGNITION TIME] + [SOUND]	Min: 00:00 Max: 272:00 (min:sec)	00:08 (min:sec)
Clock	Real time clock	[SET] or [WHAT IS] + [CLOCK] + [time] + [AM] or [PM]	Min: Max:	12:00 AM
High Sound Level Alarm Sensitivity	Microphone sensitivity for high sound level alarm	[SET] or [WHAT IS] + [CALIBRATE] + [SOUND]	Min: 1 unit Max: 255 units	32 units
Listen Time	Length of listen-in time during call-in status report	[SET] or [WHAT IS] + [LISTEN TIME]	Min: 0 sec Max: 255 sec	00:15 (min:sec)
Rings Until Answer	Number of rings until unit answers an incoming call	[SET] or [WHAT IS] + [RING]	Min: 1 ring Max: 15 rings	4 rings

* press [ENTER] after all Key Sequences starting with [SET]

Parameter	Description	Key Sequence	Response	Default
Speaker Mute	Turns off the speaker during alarm conditions	[SENSOR ON/OFF] + [MUTE]	On or Off	off
Input Enable/Disable	Turns input alarm detection on or off	[SENSOR ON/OFF] + [input#]	On or Off	Enabled
Power Alarm Enable/Disable	Turns power alarm detection on or off	[SENSOR ON/OFF] + [POWER]	On or Off	Enabled
Sound Alarm Enable/Disable	Turns high sound level alarm detection on or off	[SENSOR ON/OFF] + [SOUND]	On or Off	Enabled
Temperature Scale	Selects between Fahrenheit and Celsius	[SENSOR ON/OFF] + [F/C]	On or Off	Fahrenheit (on)
Security Code	Prohibits programming changes	[SET] or [WHAT IS] + [CODE] + [4 digit code]		none
Callback Acknowledgment	Turns Callback Acknowledgment on or off	[SENSOR ON/OFF] + [PHONE]	On or Off	off

SPECIAL KEY FUNCTIONS:

RING/TAD/PAUSE/AM
1) Used to enter a minus sign for negative temperature limits or temperature calibrations.
2) Used to program a 4 second pause into dialout phone numbers.

CODE/MUTE Key
Used to program a "wait for answer" into dialout phone numbers.

SET/# Key
Used to program a "#" into dialout phone numbers.

WHAT IS/* Key
Used to program an "*" into dialout phone numbers.

PROGRAMMING THE 1104 FOR USE WITH A PAGER
Press [SET/#] + [PHONE NUMBER] key + the phone number of the pager + [RING/TAD/**PAUSE**/AM]***** + the phone number of the 1104 (+ optional [SET/#] if required by your pager service) + [ENTER].

***NOTE**: You may have to press the [PAUSE] key multiple times to coordinate with the delay in your pager service's answering function. We recommend you try pressing [PAUSE] twice.

REMOTE TOUCH-TONE COMMANDS

Enable/Disable Alert Inputs: [*] + [input #]
Enable/Disable High Sound Level: [*] + [9]
Enable/Disable AC Power: [*] + [0]

Activate Listen-in: [#] + [1]
Activate Status Report: [#] + [2]
Disconnect: [#] + [#]

Appendix D: Accessories

The sensors listed below are available from Phonetics, Inc., and represent the most commonly used input devices. Other dry contact sensors, designed for more specialized applications, may also be used. Commercial or industrial electrical supply houses can provide devices to monitor virtually any condition. For further information, contact Sensaphone Customer Service at 610-558-2700.

PART #	SENSOR / SWITCH
FGD-0006	Magnetic Reed Switch
FGD-0007	Passive Infra-Red Detector
FGD-0010	50' two-conductor #22AWG shielded Accessory Cable
FGD-0013	Spot Water Detector
FGD-0022	Temp° Alert
FGD-0023	ISOTEL Surge Protector
FGD-0027	Humidistat
FGD-0049	Smoke Detector with Built-in Relay
FGD-0054	Power-Out Alert™
FGD-0056	Zone Water Detector w/Water Rope
FGD-0063	10' Water Rope for FGD-0056
FGD-0100	Remote Temperature Sensor
FGD-0101	Weatherproof Temperature Probe
FGD-0200	Phonecell SX3e Cellular Phone

Appendix E: Specifications

Alert Inputs

Number of Inputs: 4 (thermistor installed on input #1 for local temperature monitoring)

Input Connector: terminal block

Input Types: N.O./N.C. contact, 2.8K thermistor (-20 to 150° F or -30 to 65° C)

Input Characteristics: 5.6K to 5V (Short circuit current: 1mA max.)

A/D Converter Resolution: 10 bits ±2 LSB

Input Protection: 5.5VDC Metal Oxide Varistor with fast acting diode clamps.

Microphone

Internal Electret Condenser: For listening in to on-site sounds and detecting high sound levels.

Phone Interface

6' Cord w/RJ11 Plug: For connection to a two-wire analog telephone line.

Extension RJ11 Jack: For connecting other devices on the same telephone line.

Line Seizure RJ11 Jack (Model 1114 Only): Devices connected to this jack are disconnected in the event that the 1114 must dial out for an alarm.

Phone Line Protection: Metal Oxide Varistor & self-resetting fuse

LED Indicator

System LED: On steady when the unit is in RUN mode. LED blinks once every few seconds while in STANDBY mode.

Relay Output (1104-CS/BS/RC only)

Rated for 2A 30VAC/2A 30VDC maximum.

Power Supply

Power Supply: 120VAC/8VAC 60Hz 12W wall plug-in transformer w/6' cord.

Power Consumption: 5 Watts

Power Protection: Metal Oxide Varistor

Battery Backup: Six size-D alkaline batteries (not included), providing up to 24 hours of back-up time.

Environmental

Operating Temperature: 32–122° F (0–50° C)

Operating Humidity: 0–90% RH non-condensing

Storage Temperature: 32–140 deg F

Physical

Dimensions: 2.1"h x 7.8"w x 8.8"d

Weight: 2 lbs.

Enclosure: Indoor-rated plastic housing suitable for wall or desktop installation.

Certifications

NRTL Listed—File #E112098. Complies with UL60950-1/ CSA60950-1.

FCC Part 68 certified.

FCC Part 15 class B certified.

Industry Canada CS03 certified.

Appendix F: Returning the Unit for Repair

In the event that the Model 1104 does not function properly, we suggest that you do the following:

1) Record your observations regarding the Model 1104's malfunction.

2) Call the Technical Service Department at 610-558-2700 prior to sending the unit to Sensaphone for repair.

If the unit must be sent to Sensaphone for Servicing, please do the following:

1) Unplug the AC power supply from the wall outlet, remove the batteries, and disconnect all sensors from the alert inputs.

2) Carefully pack the unit to avoid damage in transit. Use the original container (if available) or a sturdy shipping box.

3) **You must include the following information to avoid shipping delays:**

   a) Your name, address and telephone number.

   b) A note explaining the problem.

4) Ship your package to the address below:

SERVICE DEPARTMENT
Phonetics, Inc.
901 Tryens Road
Aston, PA 19014

5) Ship prepaid and insured via UPS or US Mail to ensure a traceable shipment with recourse for damage or replacement.

Test Log

Date	Inputs	Dialout	Call-In	Battery		Tested By
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	

Date	Inputs	Dialout	Call-In	Battery		Tested By
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	

larger image

T50 Quartz AC Hour Meter I.
T50 Quartz AC Hour Meter

Specifications

Series	T50
Display	6-Digit
Voltage	115 V AC
Reset	None
Size	1.68W x 1.68H x 1.26D Inch
Face Dia - Flange	2.31 Inch
Face Dia - Cutout	2 Inch
Weight	2 oz.
Mounting Style	Panel Mount
Power	Less than 0.4 W

Print Back

DIEHL Controls

24 HOUR & 7 DAY TIMESWITCH

Series 884 • Digital Timeswitch 1 Channel

General Description

Compact digital timeswitch which provides precise timing with the flexibility of daily and/or weekly programming. Simple and fast setting by means of push buttons and display prompts.

Features

- 24 hour/7 day timing combined
  8 on/off operations daily
- Repeat programs provide up to 56 switching cycles per week
- Minimum time setting: 1 minute
- Lithium battery provides minimum 5 year reserve (unpowered)
- 24 hour display (military or AM/PM)
- Manual override
- Skip a day

Applications

Popular applications include: Heaters, filters, pumps, fans, signs, blowers, indoor and outdoor lighting, feeders, security/alarm systems, and process controls.

BORG

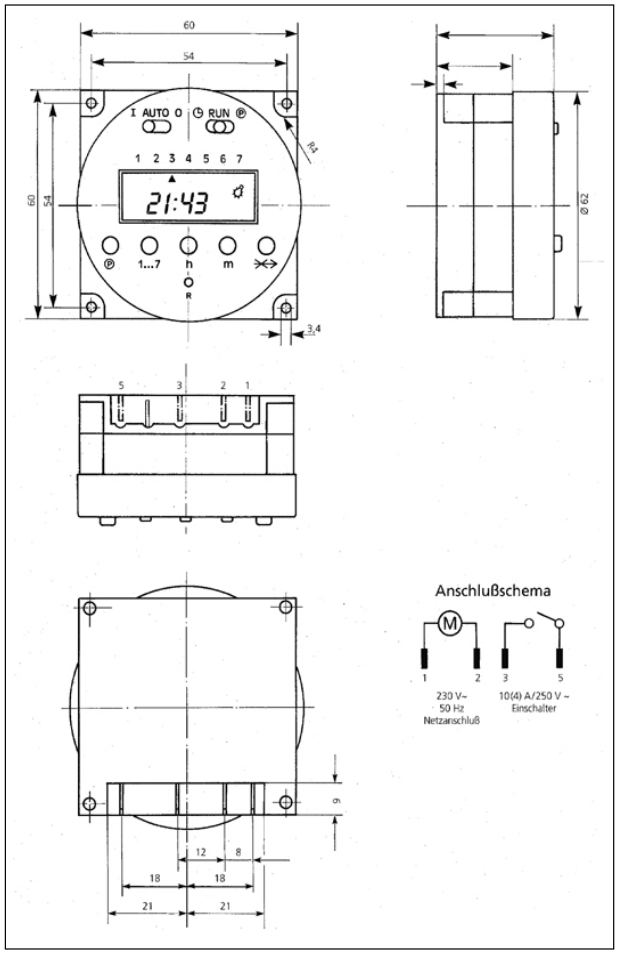
BORG GENERAL CONTROLS
1386 Jarvis Avenue
Elk Grove Village, IL 60007

800/338-1260
847/640-4635
F: 847/640-7934

e-mail: sales@borggeneral.com
www.borggeneral.com

24 HOUR & 7 DAY TIMESWITCH

Series 884 • Digital Timeswitch 1 Channel



Technical Data

Operating voltages:
- 120 VAC, 50/60 Hz
- 240 VAC, 50/60 Hz
- 24 VAC, 50/60 Hz
- 12 VDC
- 24 VDC

Rated Power:
- 3.5 VA

Switching:
- SPST
- SPDT

Connections:
- 6.3 x 0.8mm tab terminals (complies with DIN 46244)

Switch rating:
- 16 Amps @ 45°C
- 10 Amps @ 55°C

Operating Temperature Range
- 14°F (-10°C) to 131°F (55°C)

Setting Options

- Time of day
- Single day
- Repeat programs for daily recurring switching times
- 1-2-3-4-5 (Monday through Friday)
- 1-2-3-4-5-6 (Monday through Saturday)
- 1-2-3-4-5-6-7 (Monday through Sunday)
- 6-7 (Saturday and Sunday)
- Skip function (⇥) for skipping all the switching programs for the next calendar day
- Reset function for clearing the whole switching program

Mounting

- Terminal orientation: top, bottom
- Mounting accessories available

Approvals

UL
CSA Pending
VDE (@240 VAC)

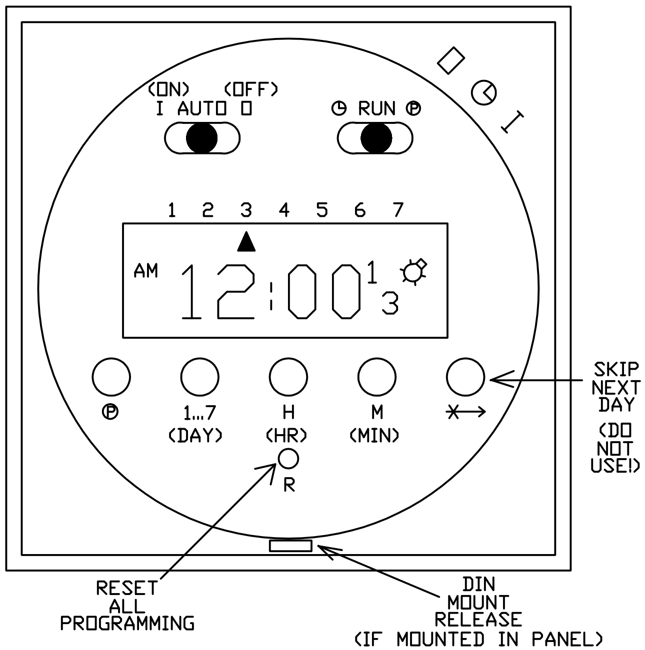
DIEHL Controls

BORG GENERAL CONTROLS LLC.
1386 Jarvis Avenue
Elk Grove Village, IL 60007

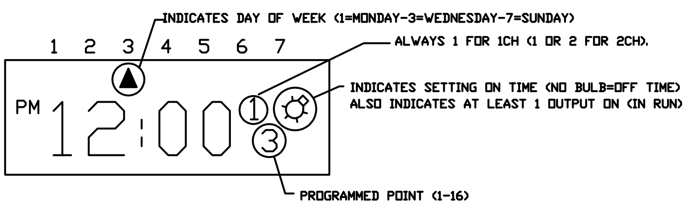
800/338-1260 F: 847/640-7934

Printed in U.S.A.

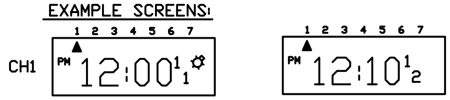
SINGLE CHANNEL 884.1K2



PROGRAMMING MODE SCREEN



EXAMPLE SCREENS:



1. TIMER CH1 ON TIME SET FOR 12:00 PM MON.

2. TIMER CH1 OFF TIME SET FOR 12:10 PM MON.

TYPICAL 1 CHANNEL TIMER DRAWING (FOR REFERENCE)

NUMBER OF TIMERS MAY VARY PER INDIVIDUAL PROJECT.

TIMER 1
(T1)

	PT	SETTING DOTW (SEE NOTE 4)	SETTING TIME
MON. ON	1	1	12:00 PM
MON. OFF	2	1	12:10 PM
WED. ON	3	3	12:00 PM
WED. OFF	4	3	12:10 PM
FRI. ON	5	5	12:00 PM
FRI. OFF	6	5	12:10 PM
SAT. ON	7	6	12:00 PM
SAT. OFF	8	6	12:10 PM
	9		0:00
	10		0:00
	11		0:00
	12		0:00
	13		0:00
	14		0:00
	15		0:00
	16		0:00

Example settings:
To set solenoid open (or turn a motor on) for 10 minutes on Mon, Wed, Fri, Sat. Set the 8 memory points as shown in table to left.

To Program:
1. Slide run switch to "P"
2. Press "P" button
3. Enter first time in Memory Location 1
4. Select day of week (DOTW) using button with 1-7; where Mon=1, Tues = 2, etc
5. Enter desired hour by pressing "H" button
6. Minutes by pressing "M" button
7. Press "P" to save and advance to next memory location
8. When done programming slide Run switch back to RUN.

To Review Programming:
1. Slide Run switch to "P"
2. Press "P" button and cycle through points
3. slide switch back to RUN.

To Set Time:
1. Slide Run switch to clock symbol.
2. Press 1...7 button to set day.
2. Press H button to set hours
3. Press M button to set minutes.
4. Slide switch back to RUN.

To Zero A Memory Point:
1. While in programming mode go to desired point. Press skip button x--> then P button (simultaneously) for 3 full seconds. Value should go to zero.
2. Zero corresponding point (on and off times).

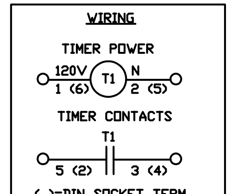
To Manually switch timer on:
1. Slide Auto switch to "I" position.
To Manually switch timer off:
1. Slide Auto switch to "0" position.

NOTE:
1. ODD NUMBERED TIMER SETTINGS WILL TURN INSTRUMENTS TO AN "ON" STATE.
2. EVEN NUMBERED TIMER SETTINGS WILL TURN INSTRUMENTS TO AN "OFF" STATE.
3. EACH TIMER SETTING MUST HAVE AN ON AND OFF VALUE SET OR ALL ZEROS.
4. SCHEDULE CAN BE RUN AS FOLLOWS:
   A. INDIVIDUAL DAYS (1 OR 2 OR 3 OR ...7) DAY
   B. WEEKDAYS (1-5)
   C. WEEKENDS (6-7)
   D. WEEKDAYS + ONE (1-6)
   E. FULL SEVEN DAY WEEK (1-7)

   1 =MONDAY
   2 =TUESDAY
   3 =WEDNESDAY
   4 =THURSDAY
   5 =FRIDAY
   6 =SATURDAY
   7 =SUNDAY

5A. BATTERY LIFE IS RATED FOR 3 YEARS BY MANUFACTURER.
5B. BATTERY IS A REPLACEABLE COIN CELL (CR2032) AND IS AVAILABLE AT MOST PHARMACIES.
6. SEE MANUFACTURER'S MANUAL IF NECESSARY
7. TEXT IN PARENTHESES ( ) DOES NOT APPEAR ON UNIT.
8. TO ACCESS BATTERY REMOVE TIMER: SQUEEZE EDGES OF GREY BODY INSERT CREDIT CARD AND UNHOOK (4) GREY CLIPS.

WIRING



NES
NATIONAL ENVIRONMENTAL SYSTEMS

TIMER PROGRAMMING (1 CHANNEL DIGITAL)
REFERENCE DRAWING

NES PROJECT #: REF		SHEET: 1 OF 1	
DATE: 1/18/10	DRAWN: MS		REV:
SCALE: N. T. S.	DESIGN: RJD		

Operating instructions for built-in electronic timers with Day and Week programms

Series 884

Attention:

This operating manual is destined for our OEM customers and is intended as a basis for the instruction manual of their appliances.

Subject to technical modifications and availability.

Operating instructions for built-in electronic timers with Day and Week programmes

Series 884

Electronic timers with Day/Week programmes enable operation on individual days or series of days which are precise to the minute (e.g. Monday to Friday or Saturday to Sunday)

Available with 1 Channel and 2 Channel-set-up

Fig. 1: 1 Channel set-up

Fig. 2: 2 Channel set-up

Contents

1 General

1.1 How to Use the Manual

Please read this operating instruction carefully bevor installing, connecting or operating this electronic timer.

1.2 Safety Notes

- **This timer may only be fitted by a qualified electrician.**
- **Warning! Shock hazard! This timer uses the specified supply voltage. Fit the timer appropriately before connecting it to the mains supply. Never touch the live contacts at the back of the timer.**
- **In the case of 12 or 24 V models, the outputs do not correspond to the conditions for safety driven electrical disconnection. The supply voltage to the appliance should only be at SELV (low safety voltage) when a low safety voltage is applied equally to the output. If that is not the case operation with low safety voltage (SELV) is forbidden.**
- **Protection against touch contact must be ensured by a proper mounting. When fitting the timer, make sure that during normal operation of the appliance the timer was fitted in it is impossible to touch the live parts.**
- **When fitting the timer, make sure that during normal operation it is impossible for the end user of the appliance it was fitted in to remove the timer by pulling it to the front and exposing the live parts.**
- **Avoid any contact of the timer with water.**
- **In case of timers with radio time signal receiver (DCF 77) care should be taken to design the antenna and the connecting wires for a supply voltage of 230V. In other words, double or stronger isolation is required.**

1.3 Your Timer

The 884 timer is an electronic **built-in range timer** designed to be fitted into electrical appliances or installations. **The timer may only be operated after installation in a protective housing.**

Series 884

Diehl AKO Stiftung & Co. KG, Werk Nürnberg, Donaustraße 120, 90451 Nürnberg

1.4 Timer features

The 884 timer switches appliances such as kitchen stoves, baking ovens, sauna heating, drying appliances, annealing ovens, burning ovens and laboratory equip-

ment at a particular time or for a preset running time. It thus adds to the operating convenience of such appliances and increases their functional scope.

Depending on the variant either a relay or a transistor is switching the connected appliance.

1.5 Functional Scope

- Day, hour and minute are selectable
- 56 switching programmes (1 Channel set-up)
  112 switching programmes (2 Channel set-up)
- Particularly rugged electronics design
- Fast and easy programming
- Optical signals indicate the running of the programmed time
- Easy reading Display with univocal functional symbols
- Time format in 12-hour mode or 24-hour mode
- Radio time reception (DCF) is optional
- Fast and easy selection and setting of the function via six buttons and two sliding switches
- Compact housing

2 Description of the Functional Parts

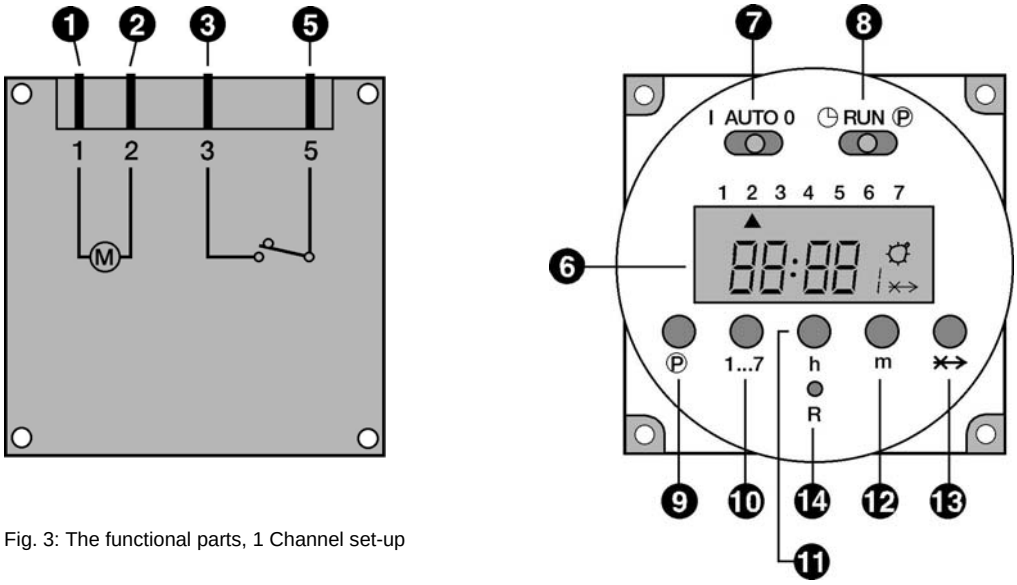


Fig. 3: The functional parts, 1 Channel set-up

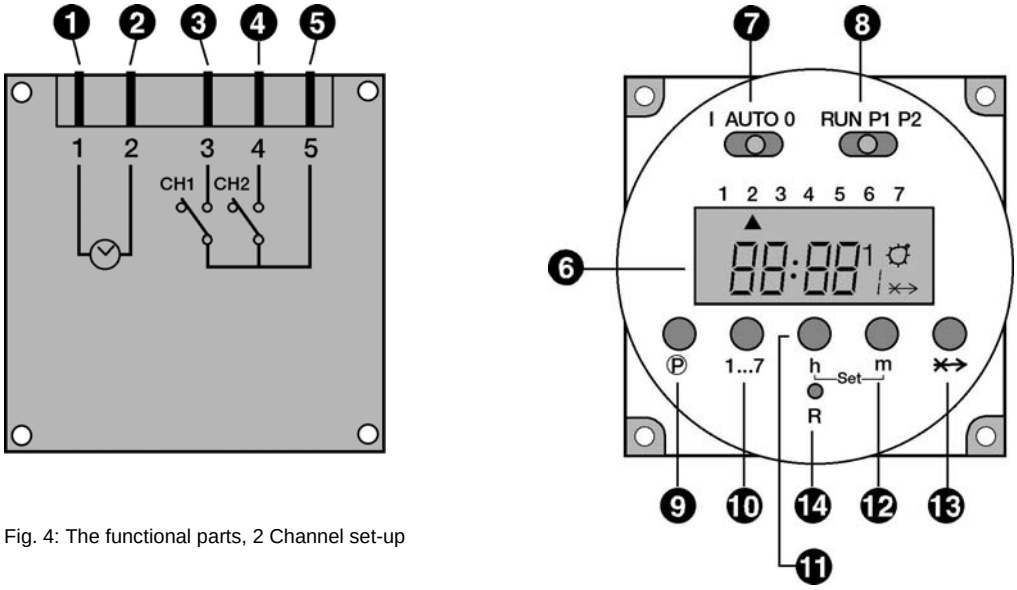


Fig. 4: The functional parts, 2 Channel set-up

Please note:
In relation to days of the week, the timer may be optionally printed with:

1	2	3	4	5	6	7	1...7

or

M	T	W	Th	F	S	Su	DAY

(1), (2) Contacts for connection to the mains supply

(3), (4), (5) Relay contacts

(6) LCD-Display

(7) Sliding switches to set operating mode:
I: Permanently ON
AUTO: Switches on and off in accordance with programmed switch times
O: Permanently OFF

(8) Sliding switches to set Time and Switch Times:

For 1 Channel set-up:
🕒: Set current time
RUN: Switch program and clock run
Ⓟ: Input switch times

For 2 Channel set-up:
RUN: Switch program and clock run
P1: Input switch times for Channel 1
P2: *Input switch times for Channel 2*

(9) Ⓟ Button for programming the 16 switch points;
When time switch points 1, 3, 5, 7, 9, 11, 13, 15, (activate time points) are selected, the symbol ✸ will appear in the right of the display.
If time switch points 2, 4, 6, 8, 10, 12, 14, 16 (switch off time points) are selected, there will be no symbol.

(10) 1...7: Button to input the day of the week (current day and switching day). When programming timing points and individual days the following block day programmes are also possible:

1..5 (Monday to Friday)	1..6 (Monday to Saturday)
6..7 (Saturday to Sunday)	1..7 (Monday to Sunday)

(11) h: Button to input hours
(for current time and switching time)

(12) m: Button to input minutes
(for current time and switching time)

(11+12)-Set in the 2 Channel set-up:
simultaneously pressing of buttons „h“ and „m“ for 2-3 seconds enables the time of day to be set.

General information for buttons „P“, „1...7“, „h“ und „m“:
Short pressing of these buttons gives: counting up by 1 digit
Pressing for longer than 3 seconds effects: more rapid and continuous counting up.

(13) -X-> Skip-Function:
Pressing the Skip-button '-X->' results in the fitted timer

reverting to the opposite function mode.

For example: If the timer is in „switched on“ mode, it will be immediately switched off and vice-versa.

(14) R: Reset button will delete all switching times and current time of day

3 Timer Fitting and Connection

Important! When fitting the timer, see the dimensioned drawing in the product data sheet.

1. Use the contacts (3) and (5) (1 Channel) or (3), (4), (5) (2 Channel) if you wish to connect an appliance or an appliance module to the timer
2. Use the contacts (1) and (2) to connect the timer to the mains supply.
3. Fit the timer by pushing it from the rear into the cutout provided on your appliance and fix it with four screws.

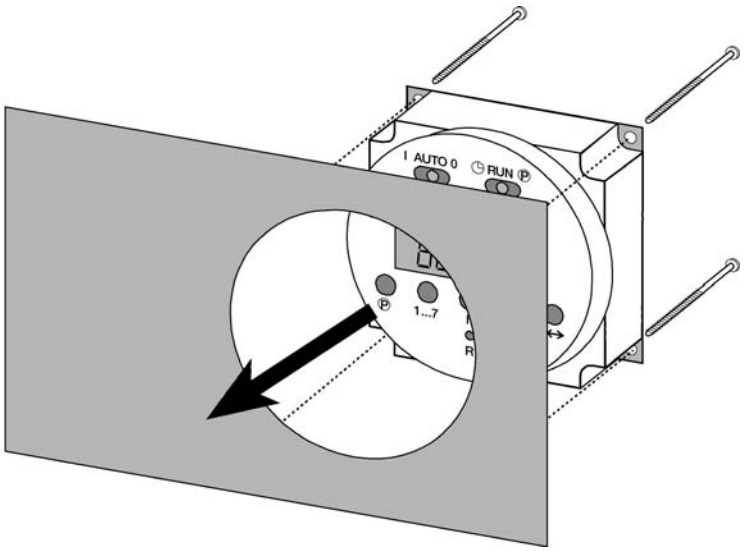


Fig. 5: Fitting the 884

4 Operating the 884

The timer is ready for service after a Reset.

4.1 Reset

Before the first commissioning/progamming a Reset must be carried out:

	1 Channel	*2 Channel*
1.	Ensure that the right sliding switch is in the RUN position.	
2.	Press button „R“ with the point of a biro or similar implement. The Display will start to flash 0:00.	

4.2 Setting the Time and Day

Proceed as follows:

	1 Channel	*2 Channel*
1.	Set the right sliding switch to position 🕒	Set the right sliding switch to position RUN and next press buttons „h“ and „m“ simultaneously for 2 to 3 seconds (Set function).
2.	Press button „1...7“ to input the day of the week 1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday An arrow will be seen in the Display indicating the day of the week.	
3.	Use buttons „h“ and „m“ to set the time.	
4.	Set the right sliding switch to the RUN position. The time of	After 15 seconds the times will automatically pick up the time of

day will be activated.	day. (The colon in the Display will start to flash.) Or set the right sliding switch briefly to P1 or P2 and then back to RUN. The time of day will be activated immediately.

4.3 Setting Operation Modes

Operation Mode	*1 Channel*	*2 Channel*
Permanently ON The appliance(s) connected is/are permanently switched on	• Set the left sliding switch to position I. • The symbol ✸ shows in Display.	• Set the left sliding switch to position 1. • Choice of Channel is effected using the Skip button „X->". **Choice**: Channel 1: ON or Channel 2: ON or (the other Channel stays in the previous setting) or Channel 1 and 2: ON **Set Channel:** Channel 1: press once Channel 2: press twice Channel 1 and 2: First select Channel 1 or 2. Then press the Skip button again to select the second Channel. ▪ The symbol ✸ appears as soon as at least one Channel has been selected. • To delete a selected Channel set the left sliding switch for 2-3 seconds to AUTO and then back to I. The permanently ON Channel can be selected again.
Permanently OFF The appliance(s) connected is/are permanently switched off	• Set the left sliding switch to position 0 The symbol ✸ is extinguished	• Set the left sliding switch to postition O. • Choice of Channel is effected using the Skip button „-X->". **Choice**: Channel 1: OFF or Channel 2: OFF (the other Channel stays in the previous setting) or Channel 1 and 2: OFF **Set channel:** Channel 1: press once Channel 2: press twice Channel 1 and 2: First select Channel 1 or 2. Then press the Skip button again to select the second Channel. The selected Channel number(s) show in the Display. • No ✸ symbol. • To delete a selected Channel set the left sliding switch for 2-3 seconds to AUTO and then back to 0. The permanently OFF Channel can be selected again
AUTO The appliance(s) connected switch according to a pre-set programme	• Set the left sliding switch to position AUTO. • ON mode: symbol ✸ appears. OFF mode: symbol ✸ is extinguished.	• Set the left sliding switch to position AUTO. • No Channel selection is possible in this setting – both Channels switch according to how they have been programmed. • ON mode: symbol ✸ and the relevant Channel number(s) show up in the Display. • OFF mode: symbol ✸ disappears.

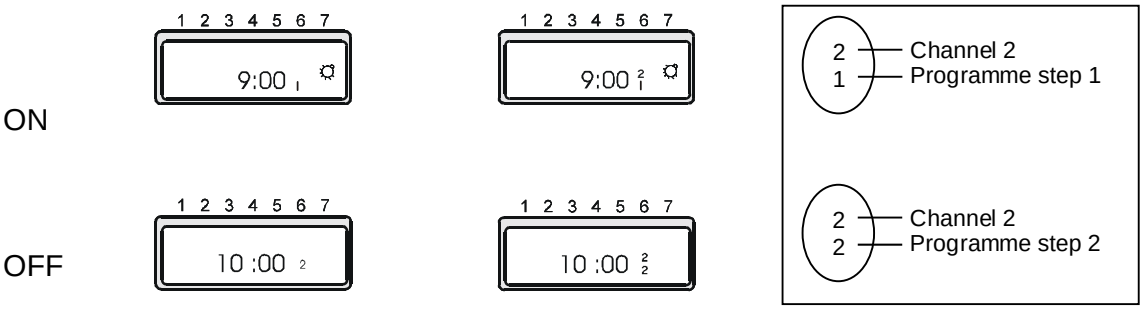
4.4 Switching Times

4.4.1 Programming

Each Channel has 16 programmeable Switching Points (8 x ON, 8 x OFF):
Nos. 1, 3, 5, 7, 9, 11, 13, 15 are Switch On points (symbol ✷).
Nos. 2, 4, 6, 8, 10, 12, 14, 16 are Switch Off points (no symbol).

The Switch Time selected will be indicated by a number in the lower right of the Display and the symbol ✷.
In addition for 2 Channel set-up the Channel No will be indicated above right.

1 Channel set-up **2 channel set-up**



Please note when programming:
Each switch on point is closely linked to the following switch off point

Switch-point 1: switch on
Switch-point 2: switch off
Switch-point 3: switch on
Switch-point 4: switch off
usw.

They should always be programmed in pairs to avoid errors.
Attention: The shortest possible switching interval is 1 minute!

Proceed as follows:

1 Channel	*2 Channel*
1. Set the right sliding switch to position P .	Set the right sliding switch to position P1 (Channel 1) or P2 (Channel 2).
The first switch point (switch on) is displayed.	

2. Setting the Switch On Point

Press button „1...7“ to input the day of the week or blocks of days.

Continuous pressing of this button allows you to select individual days and the following blocks of days:

Press once:	Day 1	(Monday)
Press twice:	Day 2	(Tuesday)
Press three times:	Day 3	(Wednesday)
Press four times::	Day 4	(Thursday)
Press five times:	Day 5	(Friday)
Press six times:	Day 6	(Saturday)
Press seven times:	Day 7	(Sunday)
Press eight times:	Block 1 to 5	(Monday to Friday)
Press nine times:	Block 6 to 7	(Samstag to Sunday)
Press ten times:	Block 1 to 6	(Monday to Saturday)
Press eleven times:	Block 1 to 7	(Monday to Sunday)

Arrows in the Display indicate days of the week.

- Press buttons „h“ and „m“ to set the time.

3. Setting the Switch Off Point

- Press button „P“.
  The next switch point (switch off) is displayed.
- Press button „1...7“ to input the day of the week or blocks of days. Continuous pressing of this button allows you to select individual days or blocks of days.
- Press buttons „h“ and „m“ to set the time.

4. Repeat steps 2 to 3 as often as required.

5. After setting the desired switching times: Set the left sliding switch to position AUTO and the rightsliding switch to position RUN.

   The timer will now operate according to the programmed switching times.

4.4.2 Programme Running

When reaching the Switch On Point the connected appliance will be switched on. During the activated time the symbol ✸ will be shown in the display. When reaching the Switch Off Point the connected appliance will be switched off and the symbol disappears.

4.4.3 Checking, changing and deleting switching times

Proceed as follows:

	1 Channel	*2 Channel*
1.	Set the right sliding switch to position P	Set the right sliding switch to position P1 (Channel 1) or P2 (Channel 2).
2.	**Checking** Press button „P“ as often as necessary to show the desired switching point in the Display. The Switching Points which are not activated will be indicated by flashing „0:00“.	Press buttons „P1“ or „P2“ as often as necessary to show the desired switching point in the Display.
3.	**Changing** Use button „P“ to flag up the desired „saved“ location. Press buttons „1...7“ to change the day of the week. Press buttons „h“ and „m“ to change the switching time, as described earlier.	
4.	**Deleting** Use button „P“ to flag up the desired „saved“ location. Then press button ”-X->” and button „P simultaneously for 3 – 4 seconds. The Display will show a flashing 0:00 and the switching point is deleted.	
5.	If the check, change or deletion is complete set the right sliding switch back to position RUN.	

4.4.4 Skip-Function (Soft-Override)

The Skip Function changes the switching mode of the appliance connected until the next step of programme is reached.
For instance: if the appliance is in ON mode, pressing the Skip-button '-X->'will immediately turn it off and vice-versa.

Proceed as follows:

	1 Channel	*2 Channel*
1.	Set the right sliding switch to position RUN.	
2.	Press the Skip button "-X->".	Pressing Skip button „-X->" once switches Channel 1. Pressing Skip button „-X->" twice switches Channel 2.
	The appliance will change over to the opposite switching mode. The Skip symbol (-X->) show up in the Display..	
3.	Further pressing of the Skip button „-X->" brings up the Skip Function again.	

Please note in connection with the Skip Function:
- Display of the number and the symbol occurs after a lapse of about 3 seconds.
- The Skip Function only operates until the next programmed switch time is reached. At this point the Skip Function is deleted and the programmed switch time cycles are activated again.

5 Programming Errors

Every switch on point is closely linked to the following switch off point. Therefore the following combinations of on/off switching can, for example, lead to errors:

Switch on time	Switch off time
Switch on time programmed	No setting
No setting	Switch off time programmed
Day block (e.g. 1, 2, 3, 4, 5)	Different day block (e.g. 1, 2, 3, 4, 5, 6)
Day block	Week day
Switch on time programmed (e.g. Wednesday, 09:00)	Switch off time is *before* the switch on time on the same day (e.g. Wednesday, 08:59)
On and Off switch times occur at the same time (e.g. Wednesday, 09:00)	

6 Technical Data

Functions	
Installation:	in appliances of Safety Class I and II
Time switch:	day and week programme
Shortest intervall:	1 min.
Output:	Relay or transistor output
Action:	type 1B (relay switching version), type 1Y (transistor version)
Operation:	via 6 buttons and 2 sliding switches
Display:	LCD
Power failure bridging:	> 5 Years with lithium battery (3 V)
Product features **1 channel**	
Switching capability:	16 (8 x ON, 8 x OFF), with day blocks up to 56 switching possibilities
Breaking capacity:	10 A/250 V AC (ohm.) or 4 A/250 V AC (ind.)
Product features **2 channel**	
Switching capability:	16 each channel (8 x ON, 8 x OFF), with day blocks up to 112 switching possibilities
Breaking capacity:	2x5 A/250 V AC (ohm.) or 2x2 A/250 V AC (ind.)
DCF	In the case of 2 channel set-up, DCF input/reception (radio reception in accordance with german time standard) is available for option. Attention, antenna and connecting cables have to be for 230V. Please follow the safety instructions on page 3.
Specifications	
Mains voltage (VDE-tested):	12 VAC/DC, 24 VAC/DC, 230-240 VAC ± 10%
Mains voltage (UL-tested):	110-120 VAC, 220-240 VAC ± 10 %
Mains frequency:	50/60 Hz
Power input	ca. 3,2 VA
Ambient temperature	0 °C - +55 °C
Control pollution:	Normal
Connection	
Electrical connections:	connection to the mains supply and power relay via flat plug 6.3 x 0.8 mm according to DIN 46244
Conformity mark:	VDE or UL
	Subject to technical modifications

Product Data Sheet

QO327M100RB

LOAD CENTER QO MB 240V 100A 3PH 27SP

SQUARE D by Schneider Electric

List Price	$1,185.00 USD
Availability	**Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Ampere Rating	100A
Approvals	UL Listed
Enclosure Type	Outdoor/Rainproof
Cover Type	Surface
Application	Designed to meet residential, commercial and industrial requirements to protect electrical systems, equipment and people.
Box Number	6R
Bus Material	Tin Plated Copper
Short Circuit Current Rating	25kA
Maximum Tandem Circuit Breakers	0
Phase	3-Phase
Main Type	Convertible Mains - Breaker
Spaces	27
Enclosure Rating	NEMA 3R
Maximum Single Pole Circuits	27
Grounding Bar	Order separately
Voltage Rating	208Y/120 Vac - 240/120 Vac Delta - 240 Vac Delta
Wire Size	#4 to 2/0 AWG(Al/Cu)
Wiring Configuration	4-Wire

Notes:
Side hinge door device allow 1.25 inches on the left side for door to open.

Shipping and Ordering

Category	00017 - Load Centers, 3 phase, Outdoor
Discount Schedule	DE3
GTIN	00785901295488
Package Quantity	1
Weight	32.41 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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Schneider Electric

40269-469-02
03/2006
Lexington, KY, USA

Instruction Bulletin

Replaces 40269-469-01 03/1983

QO® Circuit Breaker Load Centers

Retain for future use.

INSTALLATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Remove Knockouts

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Drive center knockout inward and alternately pry up or drive in outer rings, one at a time.

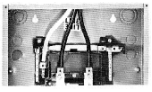
Mount Box

Position box so Line marking is up for top feed and down for bottom feed.

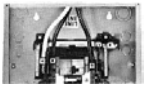
Pull Conductors Into Box

NOTE: Conductors must enter the box through approved wire clamps, conduit bushing or by other methods approved for the purpose, to prevent damage to conductor insulation.

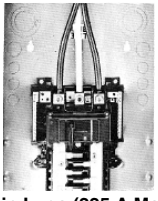
Figure 1: Wire Mains and Neutral



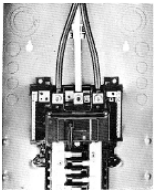
Main Lugs (125 A Max.)



Main Circuit Breaker (125 A Max.)



Main Lugs (225 A Max.)



Main Circuit Breaker (225 A Max.)

INSTALLATION AND WIRING BRANCH CIRCUIT BREAKERS

⚠ WARNING

HAZARD OF EQUIPMENT DAMAGE

- This equipment is designed and tested by Square D® to performance levels which exceed Underwriter's Laboratories Standards.
- Use of other than Square D® circuit breakers may adversely affect user safety and impair reliability. Schneider Electric disclaims all liability for damage, injury or non-performance caused by the use or failure of non-Square D circuit breakers.

Failure to follow these instructions can result in death or serious injury.

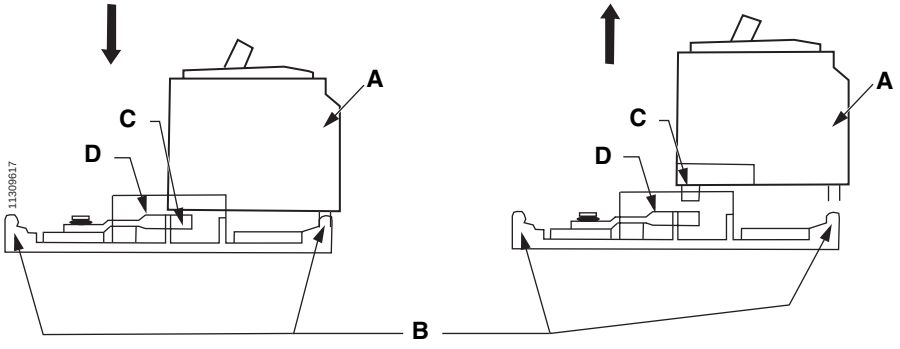
Installing Circuit Breaker

1. Turn OFF (O) circuit breaker.
2. Snap wire terminal end (A) of circuit breaker onto mounting rail (B).
3. Push circuit breaker inward until plug-on jaws (C) plug securely onto bus bar connector (D).
4. Install wire(s).

Removing Circuit Breaker

1. Turn OFF (O) circuit breaker.
2. Remove wire(s).
3. Disconnect plug-on jaws (C) from connector by pulling circuit breaker outward until it disengages from mounting rail (B).

Figure 2: Installing and Removing Circuit Breaker



INSTALLATION FOR QOT CIRCUIT BREAKERS

NOTE: Square D® Class CTL load centers are designed to restrict the installation of more overcurrent devices than that number for which each was designed, rated and approved. To accomplish this, the mounting means for QOT® circuit breakers is different from QO® and Q1® circuit breakers.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Before energizing load center, turn main and branch circuit breakers to OFF (O) position. After power is turned on to load center, turn main circuit breaker ON (I) and then turn on branch circuit breakers.
- See lug data chart on load center wire diagram for lug torque specifications.
- See circuit breaker marking for circuit breaker lug torque specifications.
- The QOT mounting cam is thick, hardened steel. Excessive force to improperly install a tandem circuit breaker where no mounting slot is provided will destroy the circuit breaker case.

Failure to follow these instructions may result in equipment damage.

Installation

NOTE: Type QOT tandem circuit breakers may be installed only in load centers where the mounting rail has a slot at the center line of the desired pole place.

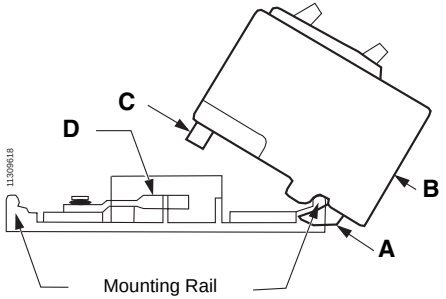
1. Turn OFF (O) circuit breaker.
2. Hold QOT circuit breaker at a 30° angle and insert mounting cam (A) in mounting rail (B) as far as possible.
3. Rotate circuit breaker until plug-on jaws (C) plug securely onto bus bar connector (D).

   NOTE: Bottom of circuit breaker case should remain against mounting rail.
4. Install wires.

Removal

1. Turn OFF (O) circuit breaker.
2. Remove wires.
3. Disconnect circuit breaker by rotating the plug-on jaws (C) away from bus bar connector (D) until the jaws disengage.
4. Remove circuit breaker from the mounting rail (B).

Figure 3: Tandem Circuit Breaker Mounting and Removal



REMOVE COVER TWISTOUTS

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Remove main circuit breaker twistout only when main circuit breaker is installed. Close unused circuit breaker openings with filler plates.

Failure to follow this instruction will result in equipment damage.

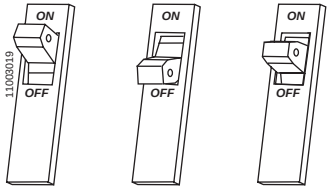
NOTE: Remove only those twistouts which match installed circuit breakers by twisting out with pliers at center of twistout.

Table 1: Filler Plates

Type	Usage
QOFP	Closes 1-pole branch circuit breaker opening.
QOM1FP	Closes 70–125 A main circuit breaker opening.
QOM2FP	Closes 150–225 A main circuit breaker opening.

IDENTIFY CIRCUITS

1. Identify branch circuits on directory label.
2. Handle at mid-position and red Visi-Trip® indicator show circuit breaker is tripped.
3. To reset, move handle to OFF (O) position, then to ON (I) position.



ON (I) OFF (O) TRIPPED

NOTE: If load center is used as service equipment, apply "Service Disconnect" label to cover near main circuit breaker handle. If load center is not used as service equipment, apply "Main" label to cover near main circuit breaker handle.

Schneider Electric USA
1601 Mercer Road
Lexington, KY 40511 USA
1-888-SquareD (1-888-778-2733)
www.us.SquareD.com

Product Data Sheet

H323NRB

SW FUSIBLE 240V 100A 3P NEMA3R/NEUTRAL

SQUARE D by Schneider Electric

List Price	$1,278.00 USD
Availability	**Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Disconnect Type	Fusible
Type of Duty	Heavy Duty
Enclosure Rating	NEMA 3R
Action	Single Throw
Short Circuit Current Rating	10kA (Class H or K) - 200kA (Class R,J or L)
Ampere Rating	100A
Enclosure Type	Rainproof and Sleet/Ice proof (Indoor/Outdoor)
Mounting Type	Surface
Enclosure Material	Galvannealed Steel
Number of Poles	3-Pole
Approvals	UL Listed
Terminal Type	Lugs
Factory Installed Neutral	Yes
Electrical Interlock	None
Maximum Voltage Rating	240VAC/250VDC
Wire Size	#12 to #1/0 AWG(Al) or #14 to #1/0 AWG(Cu)
Depth	6.38 Inches
Height	21.25 Inches
Width	8.50 Inches

Shipping and Ordering

Category	00009 - Safety Switch, Heavy Duty, 2 & 3 Pole, 30-200 Amp, Outdoor
Discount Schedule	DE1
GTIN	00785901480297
Package Quantity	1
Weight	18.28 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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Schneider Electric

SMVector | Features and Benefits:

The SMVector continues our price leadership tradition in the highly competitive AC drive market. Its performance and flexibility make it an attractive solution for a broad range of applications including:

- Food processing machinery
- Packaging machinery
- Material handling/conveying systems
- HVAC systems

The SMVector makes good its promise of price leadership in delivering unparalleled performance and simplicity. The SMVector is the right choice when you need it all – performance, power, packaging and intuitive programming.

SMV NEMA 4X (IP65)

SMV NEMA 1 (IP31)

Two Year Warranty

Superior Performance

- Modes of Operation:
  - V/Hz (Constant and Variable)
  - Enhanced V/Hz (Constant and Variable)
  - Vector Speed Control
  - Vector Torque Control
- Dynamic Torque Response
- Sophisticated Auto-tuning (Motor Calibration)
- Impressive Low Speed Operation

Flexible Power Ranges

- International Voltages:
  - 120/240V, 1Ø (up to 1.5 Hp)
  - 200/240V, 1/3Ø (up to 3 Hp)
  - 200/240V, 3Ø (up to 20 Hp)
  - 400/480V, 3Ø (up to 30 Hp)
  - 480/600V, 3Ø (up to 30 Hp)

Industrial Grade Packaging

- NEMA Type 1 (IP31) Enclosure
- NEMA 4X (IP65) Indoor Only
- NEMA 4X (IP65) Indoor/Outdoor

Simplicity

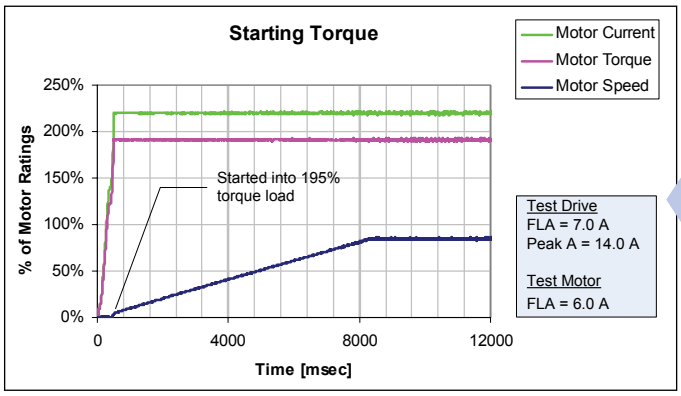
- Intuitive User Interface
- Electronic Memory Module (EPM)
- Optional Disconnect Switch (NEMA 4X only)
- Optional Potentiometer Switch (NEMA 4X only)

EPM | Just think of it as ... Ever Present Memory

When you need to program or replace a drive, whether it is 1 or 100 drives, the Electronic Programming Module (EPM) gets it done simply, quickly and most important, accurately. There is no hassle of reconfiguring each parameter or reseting the drive to factory or user default settings.

When drive reset is necessary, reset to factor default or customer settings in seconds with the EPM. When the EPM equipped drive is used on a line containing multiple drives with the identical setup, it takes just minutes to program the entire line. And EPMs can be replaced with or without power connected. When a drive must be replaced, the parameter confighuration is not lost, simply plug in the pre-programmed EPM. You are good to go with Ever Present Memory.

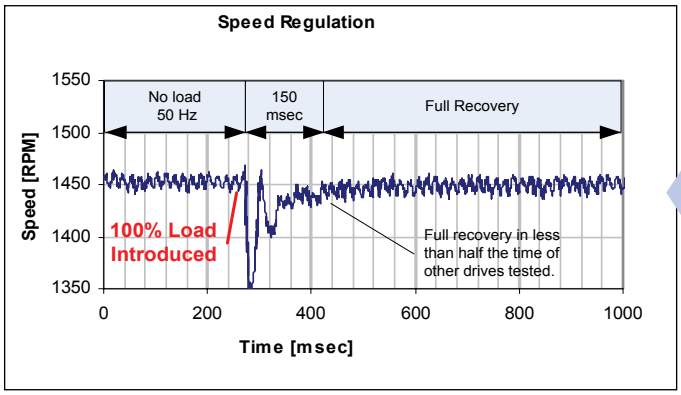
SMVector | Performance



Exceptional Starting Torque

Overpower demanding applications

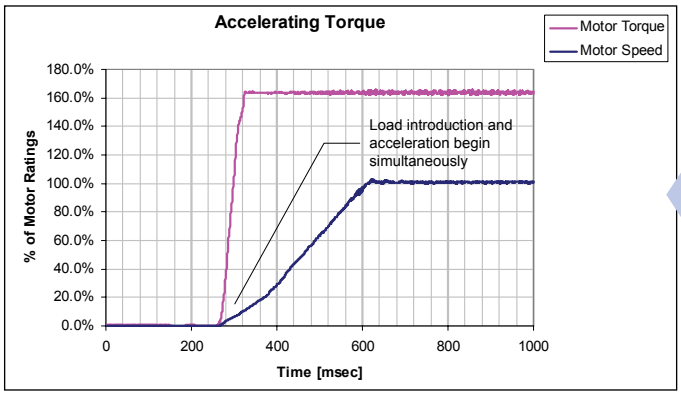
The SMVector is peerless in controlling the motor's ability to convert current into torque. In this example, the SMVector is started into a stiff 195% torque load. Not only does the motor start the load, but it also delivers a full 195% torque while accelerating to 50 Hz in 8 seconds.



Dynamic Speed Regulation

Recovery from 100% shock load in 0.15 seconds

Shock loads are no match for the SMVector. Here an instantaneous 100% load is dealt with in a mere 0.15 seconds. Remarkably, this level of speed regulation is achieved open loop without the benefit of a feedback device.



Quick Acceleration

0 to 100 in 0.33 seconds!

Motors controlled by the SMVector benefit from a sophisticated motor control algorithm that drives motor performance to maximum levels. In this application the the motor is able to drive a 165% torque load while accelerating from 0 to 100% speed in an impressive 0.33 seconds.

The SMV Thrives in Harsh Environments

Plastic Housing/Black Anodized Heatsink
- Light weight and corrosion resistant
- Available for indoor and indoor/outdoor use

Totally Enclosed Non-Ventilating Housing

Compact Enclosures

Optional Potentiometer

SMV NEMA 4X (IP65)
With Disconnect and Potentiometer

Optional Disconnect Switch
- Available on certain models

High Pressure Washdown Version
- Can be ordered without keypad and display

Optional Integrated EMC Filters
- Meets CE regulations

SMVector | Specifications

World Class Control

Modes of Operation
- Open Loop Flux Vector, Speed or Torque Control with Auto Tuning
- V/Hz (Constant or Variable)
- Base Frequency Adjustable to Motor Specs
- Enhanced V/Hz with Auto-tuning

Acceleration/Deceleration Profiles
- Two Independent Accel Ramps
- Two Independent Decel Ramps
- Linear, S-Type
- Auxiliary Ramp(or Coast)-to-Stop

Fixed Accel Boost for Improved Starting

500 Hz Output Frequency

High Carrier (PWM Sine-Coded) Frequency
- 4, 6, 8, 10 or 12 kHz

Universal Logic Assertion (Selectable)
- Positive or Negative Logic Input
- Digital Reference Available

Braking Functions
- DC Injection Braking
- Optional Dynamic Braking

Speed Commands
- Keypad, Potentiometer
- Jog, 8 Preset Speeds
- Floating Point Control
- Voltage: Scalable 0 –10 VDC
- Current: Scalable 4 – 20 mA

Process Control
- PID Modes: Direct and Reverse Acting
- PID Sleep Mode
- Analog Output (Speed, Load, Torque, kW)
- Network Speed (Baud Rate)
- Terminal and Keypad Status
- Elapsed Run or Power On Time (Hours)

Status Outputs
- Programmable Form “A” Relay Output
- Programmable Open Collector Output
- Scalable 0-10 VDC / 2-10 VDC Analog Output
- 4-20mA w/500 Ohm Total Impedance

Environment

Ambient Temperature
- -10 to 55°C @ 6 kHz
- Derate 2.5% per °C Above 40°C

Comprehensive Diagnostic Tools

Real Time Monitoring
- 8 Register Fault History
- Software Version
- Drive Network ID
- DC Bus Voltage (V)
- Motor Voltage (V)
- Output Current (%)
- Motor Current (A)
- Motor Torque (%)
- Power (kW)
- Energy Consumption (kWh)
- Heatsink Temperature (°C)
- 0 – 10 VDC Input (User Defined)
- 4 – 20 mA Input (User Defined)
- PID Feedback (User Defined)

Vigilant System Protection

Voltage Monitoring
- Low and High DC Bus V Protection
- Low Line V Compensation

Current Monitoring
- Motor Overload Protection
- Current Limiting Safeguard
- Ground Fault
- Short Circuit Protection

Three ReStarts
- Two Flying and One Auto
- User Enabled

Loss of Follower Management
- Protective Fault
- Go to Preset Speed or Preset Setpoint
- Initiate System Notification

Over Temperature Protection

International Voltages

+10/-15% Tolerance
120/240V, 1Ø
200/240V, 1 or 3Ø
200/240V, 3Ø
400/480V, 3Ø
480/600V, 3Ø

Global Standards

UL GOST
cUL C-Tick
CE Low Voltage (EN61800-5-1)
CE EMC (EN61800-3) with optional EMC filter

Simple Six Button Programming

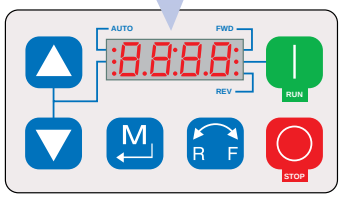
Start
Stop
Forward/Reverse
Scroll Up
Scroll Down
Enter/Mode

Informative LED Display

Vivid Illumination
Easily Read from a Distance

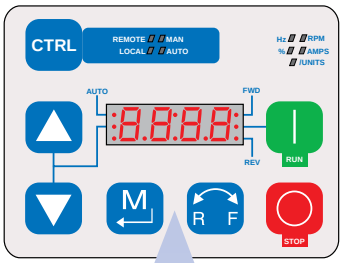
Five Status LEDs
- Run
- Automatic Speed mode
- Manual Speed Mode
- Forward Rotation
- Reverse Rotation

Status Display
- Motor Status
- Fault Management
- Operational Information



NEMA1 (Up to 10HP), NEMA4/4x Keypad

NEMA1 15-30HP Keypad

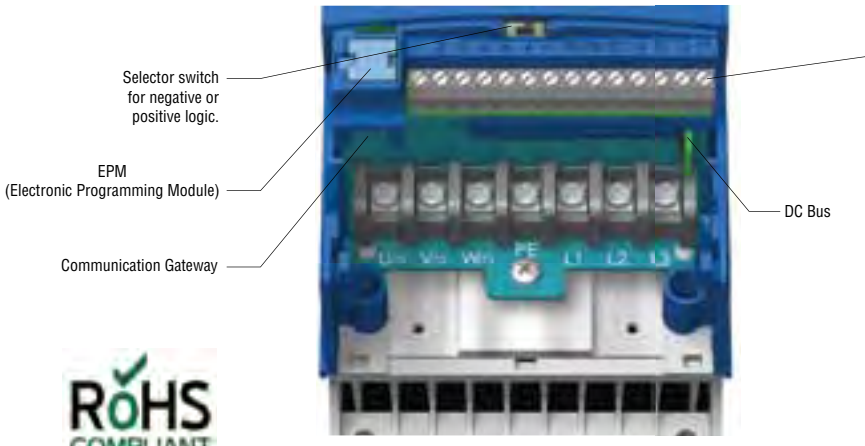


Additional CTRL Button

Switch between control modes
- Local-Manual
- Local-Auto
- Remote-Manual
- Remote-Auto

Additional LED Indicators

Define the units being displayed
- Hz
- RPM
- %
- Amps
- /Units



Removable terminal cover and steel conduit plate (not shown).
Easy access for control & power wiring.
An extra IP21 finger guard ships with every drive.

Control Terminals

Digital Inputs
- Dedicated Start/Stop
- (3) Programmable

Digital Outputs
- Form “A” Relay
- Open Collector

Analog Inputs
- 0 - 10 VDC
- 4 - 20 mA

Analog Outputs
- 0 - 10 VDC/2 - 10 VDC

Power Supplies
- 10 VDC Potentiometer Ref
- 12 VDC, 20 mA Digital Input Ref or 0VDC Common
- 12 VDC, 50 mA Supply

Common

Additional Control Terminals

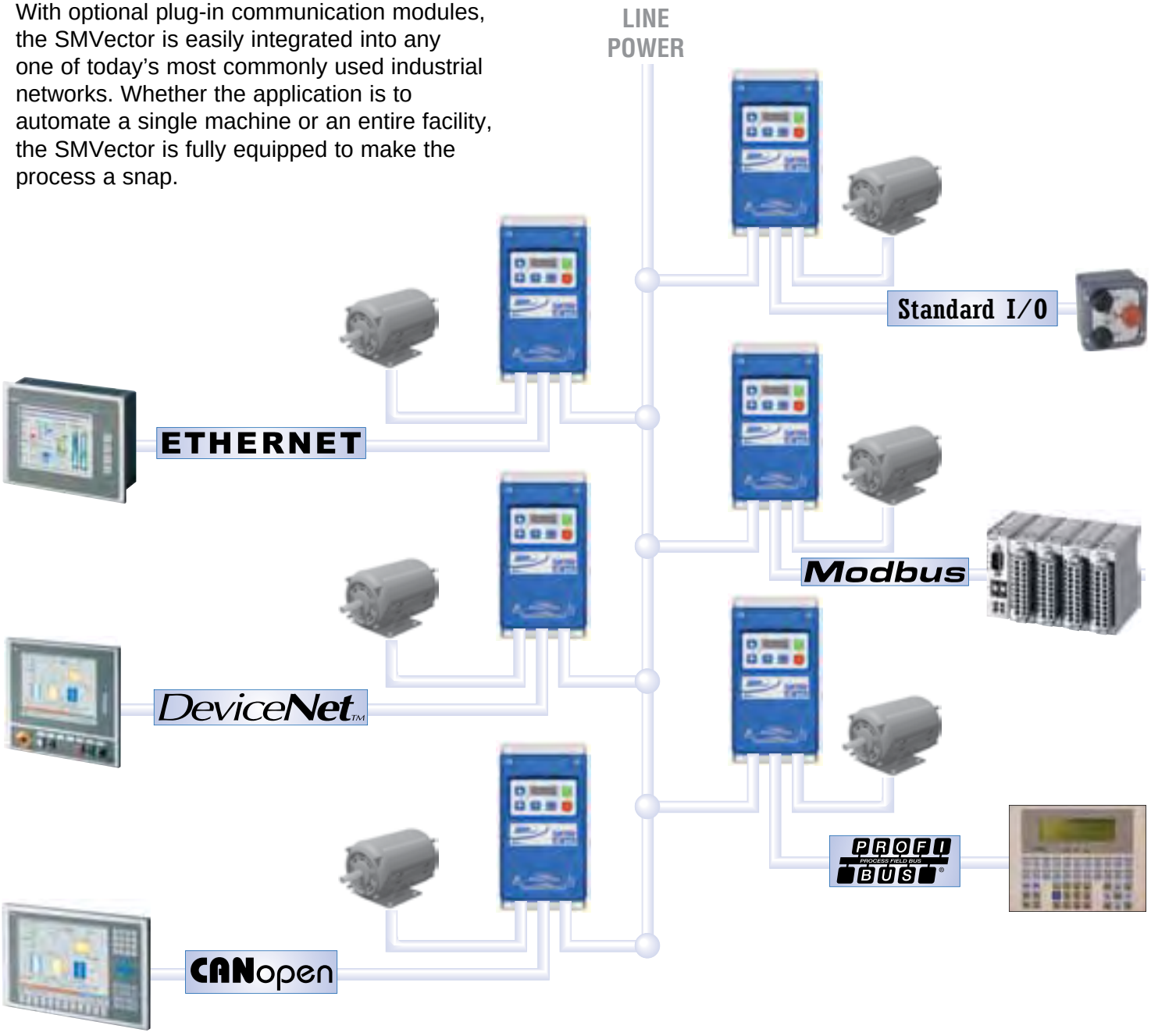
(NEMA1, 15-30 HP only)
1 Programmable Digital Input
1 Common
RS-485 Modbus Communications
- TXA
- TXB

Lenze AC Tech

RoHS COMPLIANT

SMVector | Connectivity

With optional plug-in communication modules, the SMVector is easily integrated into any one of today's most commonly used industrial networks. Whether the application is to automate a single machine or an entire facility, the SMVector is fully equipped to make the process a snap.



NOTE: Communication options are available in NEMA 1 (IP31) and NEMA 4X (IP65) models.

Communication Module

Setting up a drive in a network has never been so simple. Order the SMVector and your choice of communication module. Simply snap the communication module into the terminal cover and the drive is ready to connect to the network. Or if the SMVector is already installed it can be easily upgraded in the field.

Lenze AC Tech

SMVector | Ratings & Dimensions

120/240V* - 1Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C]/Outdoor[E]		NEMA4X w/Disconnect -Indoor	
Hp	kW	Model	Size	Model	Size	Model	Size
0.33	0.25	ESV251N01SXB	G1		N/A		
0.5	0.37	ESV371N01SXB	G1	ESV371N01SX[C] or [E]	R1	ESV371N01SMC	AA1
1	0.75	ESV751N01SXB	G1	ESV751N01SX[C] or [E]	R1	ESV751N01SMC	AA1
1.5	1.1	ESV112N01SXB	G2	ESV112N01SX[C] or [E]	R2	ESV112N01SMC	AA2

*120/240V models provide 0-230V output even with 120V input applied.

200/240V - 1 or 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C]/Outdoor[E]*		NEMA4X w/Disconnect - Indoor**	
Hp	kW	Model	Size	Model	Size	Model	Size
0.33	0.25	ESV251N02SXB***	G1		N/A		
0.5	0.37	ESV371N02YXB	G1	ESV371N02YX[C] or [E]	R1	ESV371N02YMC	AA1
1	0.75	ESV751N02YXB	G1	ESV751N02YX[C] or [E]	R1	ESV751N02YMC	AA1
1.5	1.1	ESV112N02YXB	G2	ESV112N02YX[C] or [E]	R2	ESV112N02YMC	AA2
2	1.5	ESV152N02YXB	G2	ESV152N02YX[C] or [E]	R2	ESV152N02YMC	AA2
3	2.2	ESV222N02YXB	G2	ESV222N02YX[C] or [E]	S1	ESV222N02YMC	AD1

*Filter versions are also available in 1-phase: Replace the "YX" in the Model Part Number with an "SF".
**Filter versions are also available in 1-phase: Replace the "YM" in the Model Part Number with an "SL".
***Model ESV251N02SXB is single-phase input only.

200/240V - 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]		NEMA4X w/Disconnect - Indoor	
Hp	kW	Model	Size	Model	Size	Model	Size
1.5	1.1	ESV112N02TXB	G2		N/A		
2	1.5	ESV152N02TXB	G2		N/A		
3	2.2	ESV222N02TXB	G2		N/A		
5	4	ESV402N02TXB	G3	ESV402N02TX[C] or [E]	V1	ESV402N02TMC	AC1
7.5	5.5	ESV552N02TXB	H1	ESV552N02TX[D] or [F]	T1	ESV552N02TMD	AB1
10	7.5	ESV752N02TXB	H1	ESV752N02TX[D] or [F]	T1	ESV752N02TMD	AB1
15	11	ESV113N02TXB	J1	ESV113N02TX[D] or [F]	W1	ESV113N02TMD	AF1
20	15	ESV153N02TXB	J1	ESV153N02TX[D] or [F]	W1	ESV153N02TMD	AF1

400/480V - 3Ø Input (3Ø Output)

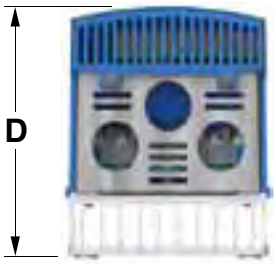
Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]*		NEMA4X w/Disconnect - Indoor**	
Hp	kW	Model	Size	Model	Size	Model	Size
0.5	0.37	ESV371N04TXB	G1	ESV371N04TX[C] or [E]	R1	ESV371N04TMC	AA1
1	0.75	ESV751N04TXB	G1	ESV751N04TX[C] or [E]	R1	ESV751N04TMC	AA1
1.5	1.1	ESV112N04TXB	G2	ESV112N04TX[C] or [E]	R2	ESV112N04TMC	AA2
2	1.5	ESV152N04TXB	G2	ESV152N04TX[C] or [E]	R2	ESV152N04TMC	AA2
3	2.2	ESV222N04TXB	G2	ESV222N04TX[C] or [E]	R2	ESV222N04TMC	AA2
5	4	ESV402N04TXB	G3	ESV402N04TX[C] or [E]	V1	ESV402N04TMC	AC1
7.5	5.5	ESV552N04TXB	H1	ESV552N04TX[C] or [E]	V1	ESV552N04TMC	AC1
10	7.5	ESV752N04TXB	H1	ESV752N04TX[D] or [F]	T1	ESV752N04TMD	AB1
15	11	ESV113N04TXB	J1	ESV113N04TX[D] or [F]	W1	ESV113N04TMD	AE1
20	15	ESV153N04TXB	J1	ESV153N04TX[D] or [F]	W1	ESV153N04TMD	AE1
25	18.5	ESV183N04TXB	J1	ESV183N04TX[D] or [F]	W1	ESV183N04TMD	AF1
30	22	ESV223N04TXB	J1	ESV223N04TX[D] or [F]	X1	ESV223N04TMD	AF1

*Filter versions are also available in 1-phase: Replace the "X" in the Model Part Number with an "F".
**Filter versions are also available in 1-phase: Replace the "M" in the Model Part Number with an "L".

600V - 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]		NEMA4X w/Disconnect - Indoor	
Hp	kW	Model	Size	Model	Size	Model	Size
1	0.75	ESV751N06TXB	G1	ESV751N06TX[C] or [E]	R1	ESV751N06TMC	AA1
2	1.5	ESV152N06TXB	G2	ESV152N06TX[C] or [E]	R2	ESV152N06TMC	AA2
3	2.2	ESV222N06TXB	G2	ESV222N06TX[C] or [E]	R2	ESV222N06TMC	AA2
5	4	ESV402N06TXB	G3	ESV402N06TX[C] or [E]	V1	ESV402N06TMC	AC1
7.5	5.5	ESV552N06TXB	H1	ESV552N06TX[C] or [E]	V1	ESV552N06TMC	AC1
10	7.5	ESV752N06TXB	H1	ESV752N06TX[D] or [F]	T1	ESV752N06TMD	AB1
15	11	ESV113N06TXB	J1	ESV113N06TX[D] or [F]	W1	ESV113N06TMD	AE1
20	15	ESV153N06TXB	J1	ESV153N06TX[D] or [F]	W1	ESV153N06TMD	AE1
25	18.5	ESV183N06TXB	J1	ESV183N06TX[D] or [F]	W1	ESV183N06TMD	AF1
30	22	ESV223N06TXB	J1	ESV223N06TX[D] or [F]	X1	ESV223N06TMD	AF1

SMV NEMA 1 (IP31)



Bottom Entry with NEMA 1 Steel Conduit Plate

Bottom Entry with IP31 Finger Guard

Dimensions

	H		W		D	
	in.	*mm*	*in.*	*mm*	*in.*	*mm*
G1	7.50	190	3.90	99	4.40	111
G2	7.60	191	3.90	99	5.50	138
G3	7.60	191	3.90	99	5.80	147
H1	9.90	250	5.20	130	6.30	160
J1	12.50	318	7.00	176	8.10	205
R1	8.00	203	6.30	160	4.50	114
R2	8.00	203	6.30	160	6.30	160
S1	8.00	203	7.10	181	6.80	172
T1	10.00	254	8.10	204	8.00	203
V1	10.00	254	9.00	228	8.00	203
W1	14.40	366	9.40	240	9.50	241
X1	18.50	470	9.40	240	9.50	241
AA1	11.00	279	6.30	160	5.40	136
AA2	11.00	279	6.30	160	7.20	182
AB1	13.00	330	8.10	204	8.90	225
AC1	13.00	330	9.00	228	9.00	226
AD1	11.00	279	7.10	181	7.70	194
AE1	14.40	366	9.40	240	10.30	261
AF1	18.50	470	9.40	240	11.20	285

Lenze
AC Tech

SMVector - Frequency Inverter
Operating Instructions

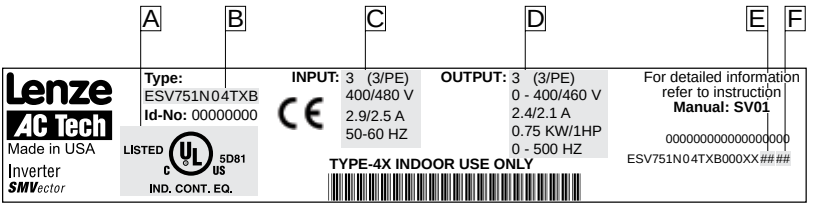
Contents

About These Instructions

This documentation applies to the SMV frequency inverter and contains important technical data regarding the installation, operation, and commissioning of the inverter.

These instructions are only valid for SMV frequency inverters with software revision 4.0 or higher (refer to drive nameplate, an example is shown below).

Please read these instructions in their entirety before commissioning the drive.



A	B	C	D	E	F
Certifications	Type	Input Ratings	Output Ratings	Hardware Version	Software Version

Scope of delivery	Important
• 1 SMV Inverter with EPM installed (see Section 4.4) • 1 Operating Instructions manual	After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. Lenze AC Tech does not accept any liability for deficiencies claimed subsequently. Claim: • visible transport damage immediately to the forwarder. • visible deficiencies /incompleteness immediately to your Lenze AC Tech representative

1 Safety Information

General

Some parts of Lenze AC Tech controllers can be electrically live and some surfaces can be hot. Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel and/or damage to equipment.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of variable frequency drives and the application for which it is being used.

Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport, handling, installation or maintenance. Do not touch any electronic components or contacts. This drive contains electrostatically sensitive components, which can easily be damaged by inappropriate handling. Static control precautions must be adhered to during installation, testing, servicing and repairing of this drive and associated options. Component damage may result if proper procedures are not followed.

To ensure proper operation, do not install the drive where it is subjected to adverse environmental conditions such as combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

This drive has been tested by Underwriters Laboratory (UL) and is UL Listed in compliance with the UL508C Safety Standard. This drive must be installed and configured in accordance with both national and international standards. Local codes and regulations take precedence over recommendations provided in this and other Lenze AC Tech documentation.

The SMVector drive is considered a component for integration into a machine or process. It is neither a machine nor a device ready for use in accordance with European directives (reference machinery directive and electromagnetic compatibility directive). It is the responsibility of the end user to ensure that the machine meets the applicable standards.

Electrical Connection

When working on live drive controllers, applicable national safety regulations must be observed. The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, protective earth [PE] connection). While this document does make recommendations in regards to these items, national and local codes must be adhered to.

The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

Application

The drive must not be used as a safety device for machines where there is a risk of personal injury or material damage. Emergency Stops, over-speed protection, acceleration and deceleration limits, etc must be made by other devices to ensure operation under all conditions.

The drive does feature many protection devices that work to protect the drive and the driven equipment by generating a fault and shutting the drive and motor down. Mains power variances can also result in shutdown of the drive. When the fault condition disappears or is cleared, the drive can be configured to automatically restart, it is the responsibility of the user, OEM and/or integrator to ensure that the drive is configured for safe operation.

Explosion Proof Applications

Explosion proof motors that are not rated for inverter use lose their certification when used for variable speed. Due to the many areas of liability that may be encountered when dealing with these applications, the following statement of policy applies:

Lenze AC Tech Corporation inverter products are sold with no warranty of fitness for a particular purpose or warranty of suitability for use with explosion proof motors. Lenze AC Tech Corporation accepts no responsibility for any direct, incidental or consequential loss, cost or damage that may arise through the use of AC inverter products in these applications. The purchaser expressly agrees to assume all risk of any loss, cost or damage that may arise from such application.

Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). The controller may be adapted to your application as described in this documentation.

DANGER!

- After the controller has been disconnected from the supply voltage, live components and power connection must not be touched immediately, since capacitors could be charged. Please observe the corresponding notes on the controller.
- Close all protective covers and doors prior to and during operation.
- Do not cycle input power to the controller more than once every two minutes.
- For SMVector models that are equipped with a Disconnect Switch (11th character in model number is L or M), the Disconnect Switch is intended as a motor service disconnect and does not provide branch circuit protection to the inverter or motor. When servicing the motor, it is necessary to wait 3 minutes after turning this switch to the off position before working on motor power wiring as the inverter stores electrical power. To service the inverter, it is necessary to remove mains ahead of the drive and wait 3 minutes.

Safety Notifications

All safety information given in these Operating Instructions includes a visual icon, a bold signal word and a description.

Signal Word! (characterizes the severity of the danger)

NOTE (describes the danger and informs on how to proceed)

Icon	Signal Word	Meaning	Consequences if ignored
	**DANGER!**	Warns of hazardous electrical voltage.	Death or severe injuries.
	**WARNING!**	Warns of potential, very hazardous situations.	Risk of severe injury to personnel and/or damage to equipment.
	**WARNING! Hot Surface**	Warns of hot surface and risk of burns. Labels may be on or inside the equipment to alert people that surfaces may reach dangerous temperatures.	Risk of severe injury to personnel.
	**STOP!**	Warns of potential damage to material and equipment.	Damage to the controller/drive or its environment.
	**NOTE**	Designates a general, useful note.	None. If observed, then using the controller/ drive system is made easier.

Harmonics Notification in accordance with EN 61000-3-2, EN 61000-3-12:

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

Directive	Total Power connected to Mains (public supply)	Additional Measures Required for Compliance (2)
EN 61000-3-2	< 0.5kW	with mains choke
	0.5 ... 1kW	with active filter
	> 1kW	complies without additional measures
EN 61000-3-12	16 ... 75amp	Additional measures are required for compliance with the standard

(1) For compliance with EMC regulations, the permissable cable lengths may change.

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

Safety Information in accordance with EN 61800-5-1:

DANGER! Hazard of Electrical Shock
Capacitors retain charge for approximately 180 seconds after power is removed. Allow at least 3 minutes for discharge of residual charge before touching the drive.

WARNING!
- This product can cause a d.c. current in the PE conductor. Where a residual current-operated (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM Type B is allowed on the supply side of this product.
- Leakage Current may exceed 3.5mA AC. The minimum size of the PE conductor shall comply with local safety regulations for high leakage current equipment.
- In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.

NOTE
Control and communications terminals provide reinforced insulation when the drive is connected to a power system rated up to 300V rms between phase to ground (PE) and the applied voltage on Terminals 16 and 17 is less than 150VAC between phase and ground.

Control and communications terminals provide basic insulation when the drive is connected to a power system rated up to 300V between phase to ground (PE) and the applied voltage on terminals 16 and 17 is less than 250 VAC between phase phase and ground (PE).

Safety Information in accordance with UL:

Note for UL approved system with integrated controllers: UL warnings are notes which apply to UL systems. The documentation contains special information about UL.

c UL us
Warnings!

- Suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, at the maximum voltage rating marked on the drive.
- Use minimum 75 °C copper wire only.
- Shall be installed in a pollution degree 2 macro-environment.
- NEMA 1 (IP31) models shall be installed in a pollution degree 2 macro-environment.
- All models are suitable for installation in a compartment handling Conditioned Air (i.e., plenum rated).

Torque Requirements (in accordance with UL) are listed in section 3.2.1, Power Connections.

2 Technical Data

2.1 Standards and Application Conditions

Conformity	CE	Low Voltage (2006/95/EC) & EMC (2004/108/EC) Directives
Approvals	UL508C	Underwriters Laboratories -Power Conversion Equipment
Input voltage phase imbalance	≤ 2%	
Supported Power Systems	TT TN	– For central grounded systems, operation is permitted without restrictions. – For corner grounded 400/500V systems, operation is possible but reinforced insulation to control circuits is compromised.
Humidity	≤ 95% non-condensing	
Temperature range	Transport	-25 … +70°C
	Storage	-20 … +70°C
	Operation	-10 … +55°C (with 2.5%/°C current derating above +40°C)
Installation height	0 - 4000m a.m.s.l.	(with 5%/1000 m current derating above 1000m a.m.s.l.)
Vibration resistance	acceleration resistant up to 1.0g	
⚠ **Earth leakage current**	> 3.5 mA to PE	
Max Permissable Cable Length (1)	<= 4.0 Hp (3.0 kW)	30 meters shielded, 60 meters un-shielded
	=> 5.0 Hp (3.7 kW)	50 meters shielded, 100 meters un-shielded.
Enclosure	IP31/NEMA 1	IP65/NEMA 4X
	NEMA 1 and NEMA 4X model enclosures are plenun rated in accordance with UL 508C and are suitable for installation in a compartment handling conditioned air.	
Protection measures against	short circuit, earth fault, phase loss, over voltage, under voltage, motor stalling, over temperature, motor overload	
Compliance with EN 61000-3-2 Requirements (2)	< 0.5kW	with mains choke
	0.5 ... 1kW	with active filter
	> 1kW	without additional measures
Compliance with EN 61000-3-12 Requirements (2)	16 ... 75amp	Additional measures required for compliance with EN 61000-3-12

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

(1) The stated cable lengths are permissible at default carrier frequencies (refer to parameter P166).

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

2.2 SMV Type Number Designation

The table herein describes the Type numbering designation for the SMVector Inverter models.

ESV	152	N0	2	T	X	B

Electrical Products in the SMVector Series

Power Rating in kW:

251 = 0.25kW (0.33HP)	113 = 11.0kW (15HP)
371 = 0.37kW (0.5HP)	153 = 15.0kW (20HP)
751 = 0.75kW (1HP)	183 = 18.5kW (25HP)
112 = 1.1kW (1.5HP)	223 = 22.0kW (30HP)
152 = 1.5kW (2HP)	303 = 30.0kW (40HP)
222 = 2.2kW (3HP)	373 = 37.5kW (50HP)
302 = 3.0kW (4HP)	453 = 45.0kW (60HP)
402 = 4.0kW (5HP)	
552 = 5.5kW (7.5HP)	
752 = 7.5kW (10HP)	

Installed I/O & Communication Module(s):

C_ = CANopen (Available all models)	The "_" blank can be:
D_ = DeviceNet (Available all models)	0 = Standard Keypad
E_ = Ethernet/IP, ModBus TCP/IP (Avail all models)	
R_ = RS-485 / ModBus /Lecom (Avail all models)	
P_ = ProfiBus-DP (Available all models)	
N_ = No Communications installed	

Input Voltage:

1 = 120 VAC (doubler output) or 240 VAC
2 = 240 VAC
4 = 400/480 VAC
6 = 600 VAC

Input Phase:

S = Single Phase Input only
Y = Single or Three Phase Input
T = Three Phase Input only

Input Line Filter

F = Integral EMC Filter
L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
X = No EMC Filter/ No Disconnect Switch

Enclosure:

B = NEMA 1/IP31; Indoor only
C = NEMA 4X/IP65; Indoor only; Convection cooled
D = NEMA 4X/IP65; Indoor only; Fan cooled
E = NEMA 4X/IP65; Indoor/Outdoor; Convection cooled
F = NEMA 4X/IP65; Indoor/Outdoor; Fan cooled

NOTE
Prior to installation make sure the enclosure is suitable for the end-environment
Variables that influence enclosure suitability include (but are not limited to) temperature, airborne contaminates, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).

2.3 Ratings

120V / 240VAC Models

Mains = 120V Single Phase (1/N/PE) (90...132V), 240V Single Phase (2/PE) (170...264V); 48...62Hz									
Type	Power		Mains Current		Output Current		Heat Loss (Watts)		
	Hp	kW	120V A	240V A	Cont (I_n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
ESV251--1S--	0.33	0.25	6.8	3.4	1.7	200	24		
ESV371--1S--	0.5	0.37	9.2	4.6	2.4	200	32	32	
ESV751--1S--	1	0.75	16.6	8.3	4.2	200	52	41	
ESV112--1S--	1.5	1.1	20	10.0	6.0	200	74	74	

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

240VAC Models

Mains = 240V Single Phase (2/PE) (170...264V); 48...62Hz								
Type	Power		Mains Current	Output Current		Heat Loss (Watts)		
	Hp	kW	240V A	Cont (I_n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
ESV251--2S--	0.33	0.25	3.4	1.7	200	20		
ESV371--2S--	0.5	0.37	5.1	2.4	200			30
ESV751--2S--	1	0.75	8.8	4.2	200			42
ESV112--2S--	1.5	1.1	12.0	6.0	200			63
ESV152--2S--	2	1.5	13.3	7.0	200			73
ESV222--2S--	3	2.2	17.1	9.6	200			97

240V Single Phase (2/PE) (170...264V), 240V Three Phase (3/PE) (170...264V); 48...62Hz									
Type	Power		Mains Current		Output Current		Heat Loss (Watts)		
	Hp	kW	1~ (2/PE) A	3~ (3/PE) A	Cont (I_n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
ESV371--2Y--	0.5	0.37	5.1	2.9	2.4	200	27	26	
ESV751--2Y--	1	0.75	8.8	5.0	4.2	200	41	38	
ESV112--2Y--	1.5	1.1	12.0	6.9	6.0	200	64	59	
ESV152--2Y--	2	1.5	13.3	8.1	7.0	200	75	69	
ESV222--2Y--	3	2.2	17.1	10.8	9.6	200	103	93	

240V Three Phase (3/PE) (170...264V); 48...62Hz								
Type	Power		Mains Current	Output Current		Heat Loss (Watts)		
	Hp	kW	240V A	Cont (I_n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
ESV112--2T--	1.5	1.1	6.9	6	200	64		
ESV152--2T--	2	1.5	8.1	7	200	75		
ESV222--2T--	3	2.2	10.8	9.6	200	103		
ESV402--2T--	5	4.0	18.6	16.5	200	154	139	
ESV552--2T--	7.5	5.5	26	23	200	225	167	
ESV752--2T--	10	7.5	33	29	200	274	242	
ESV113--2T--	15	11	48	42	180	485	468	
ESV153--2T--	20	15	59	54	180	614	591	

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

400...480VAC Models

400 ... 480V Three Phase (3/PE) (400V: 340...440V), (480V: 340...528V); 48...62Hz											
Type	Power		Mains Current		Output Current				Heat Loss (Watts)		
	Hp	kW	400V A	480V A	Cont (I_n) A		Max I %		N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
					400V	480V	400V	480V			
ESV371--4T--	0.5	0.37	1.7	1.5	1.3	1.1	175	200	23	21	25
ESV751--4T--	1	0.75	2.9	2.5	2.4	2.1	175	200	37	33	37
ESV112--4T--	1.5	1.1	4.2	3.6	3.5	3.0	175	200	48	42	46
ESV152--4T--	2	1.5	4.7	4.1	4.0	3.5	175	200	57	50	54
ESV222--4T--	3	2.2	6.1	5.4	5.5	4.8	175	200	87	78	82
ESV302--4T--	4	3.0	8.3	7.0	7.6	6.3	175	200			95
ESV402--4T--	5	4.0	10.6	9.3	9.4	8.2	175	200	128	103	111
ESV552--4T--	7.5	5.5	14.2	12.4	12.6	11.0	175	200	178	157	165
ESV752--4T--	10	7.5	18.1	15.8	16.1	14.0	175	200	208	190	198
ESV113--4T--	15	11	27	24	24	21	155	180	418	388	398
ESV153--4T--	20	15	35	31	31	27	155	180	493	449	459
ESV183--4T--	25	18.5	44	38	39	34	155	180	645	589	600
ESV223--4T--	30	22	52	45	46	40	155	180	709	637	647
ESV303--4T--	40	30	68	59	60	52	155	180	1020		
ESV373--4T--	50	37.5	85	74	75	65	155	180	1275		
ESV453--4T--	60	45	100	87	88	77	155	180	1530		

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

For 400...480 VAC models, the output current maximum (%) in the 400V column is used when P107 = 0
For 400...480 VAC models, the output current maximum (%) in the 480V column is used when P107 = 1

600VAC Models

600V Three Phase (3/PE) (425...660V); 48...62Hz								
Type	Power		Mains Current	Output Current		Heat Loss (Watts)		
	Hp	kW	A	Cont (I_n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
ESV751--6T--	1	0.75	2	1.7	200	37	31	
ESV152--6T--	2	1.5	3.2	2.7	200	51	43	
ESV222--6T--	3	2.2	4.4	3.9	200	68	57	
ESV402--6T--	5	4	6.8	6.1	200	101	67	
ESV552--6T--	7.5	5.5	10.2	9	200	148	116	
ESV752--6T--	10	7.5	12.4	11	200	172	152	
ESV113--6T--	15	11	19.7	17	180	380	356	
ESV153--6T--	20	15	25	22	180	463	431	
ESV183--6T--	25	18.5	31	27	180	560	519	
ESV223--6T--	30	22	36	32	180	640	592	
ESV303--6T--	40	30	47	41	180	930		
ESV373--6T--	50	37.5	59	52	180	1163		
ESV453--6T--	60	45	71	62	180	1395		

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

STOP!

- For installations above 1000m a.m.s.l., derate I_n by 5% per 1000m, do not exceed 4000m a.m.s.l.
- Operation above 40°C, derate I_n by 2.5% per °C, do not exceed 55°C.

Output Current (In) derating for Carrier Frequency (P166) for NEMA 1 (IP31) Models:

- If P166=2 (8 kHz), derate I_n to 92% of drive rating
- If P166=3 (10 kHz), derate I_n to 84% of drive rating

Output Current (In) derating for Carrier Frequency (P166) for NEMA 4X (IP65) Models:

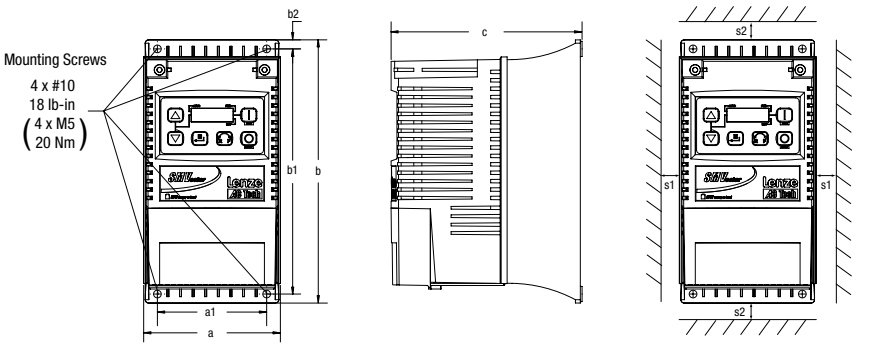
- If P166=1 (6 kHz), derate I_n to 92% of drive rating
- If P166=2 (8 kHz), derate I_n to 84% of drive rating
- If P166=3 (10 kHz), derate I_n to 76% of drive rating

3 Installation

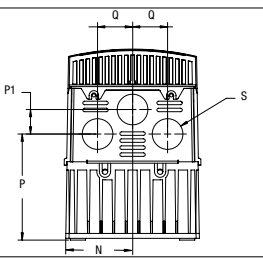
3.1 Dimensions and Mounting

WARNING!
Drives must not be installed where subjected to adverse environmental conditions such as: combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

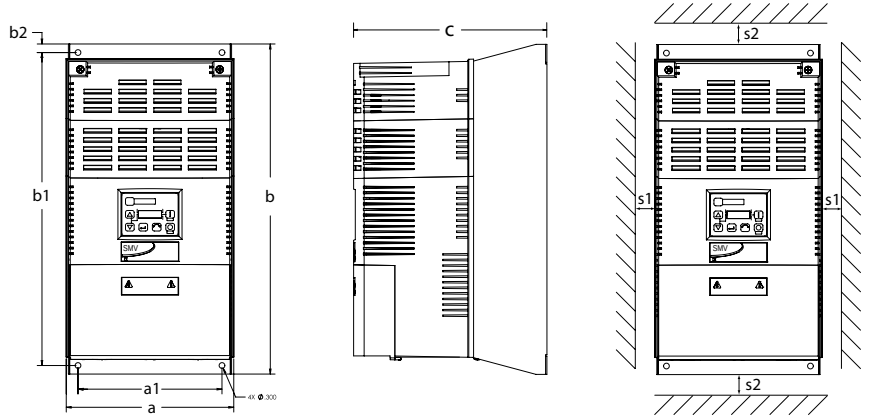
3.1.1 NEMA 1 (IP31) Models ≤ 30HP (22kW)



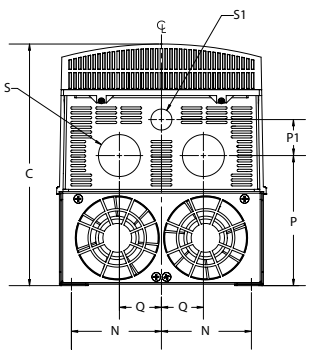
	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
G1	ESV251~~~~~B; ESV371~~~~~B ESV751~~~~~B	3.90 (99)	3.12 (79)	7.48 (190)	7.00 (178)	0.24 (6)	4.35 (111)	0.6 (15)	2.0 (50)	2.0 (0.9)
G2	ESV112~~~~~B; ESV152~~~~~B ESV222~~~~~B	3.90 (99)	3.12 (79)	7.52 (191)	7.00 (178)	0.26 (7)	5.45 (138)	0.6 (15)	2.0 (50)	2.8 (1.3)
G3	ESV402~~~~~B	3.90 (99)	3.12 (79)	7.52 (191)	7.00 (178)	0.30 (8)	5.80 (147)	0.6 (15)	2.0 (50)	3.2 (1.5)
H1	ESV552~~~~~B; ESV752~~~~~B	5.12 (130)	4.25 (108)	9.83 (250)	9.30 (236)	0.26 (7)	6.30 (160)	0.6 (15)	2.0 (50)	6.0 (2.0)
J1	ESV113~~~~~B; ESV153~~~~~B ESV183~~~~~B; ESV223~~~~~B	6.92 (176)	5.75 (146)	12.50 (318)	11.88 (302)	0.31 (8)	8.09 (205)	0.6 (15)	2.0 (50)	13.55 (6.15)

Conduit Hole Dimensions	Type	N in (mm)	P in (mm)	P1 in (mm)	Q in (mm)	S in (mm)
	G1	1.84 (47)	1.93 (49)	.70 (18)	1.00 (25)	.88 (22)
	G2	1.84 (47)	3.03 (77)	.70 (18)	1.00 (25)	.88 (22)
	G3	1.84 (47)	3.38 (86)	.70 (18)	1.00 (25)	.88 (22)
	H1	2.46 (62)	3.55 (90)	.13 (3)	1.38 (35)	1.13 (29) .88 (22)
	J1	3.32 (84)	4.62 (117)	.73 (19)	1.40 (36)	1.31 (33) .88 (22)

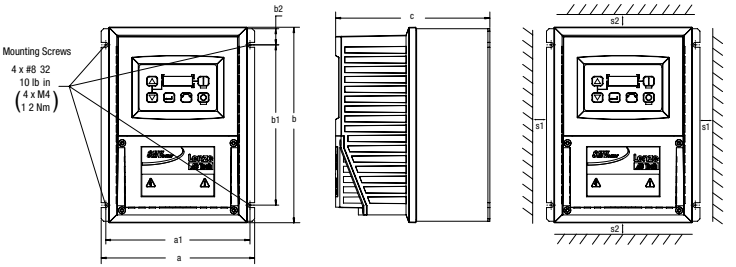
3.1.2 NEMA 1 (IP31) Models > 30HP (22kW)



	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
K1	ESV303~~4~~B; ESV303~~6~~B	8.72 (221)	7.50 (190)	14.19 (360)	13.30 (338)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	24 (10.9)
K2	ESV373~~4~~B; ESV373~~6~~B	8.72 (221)	7.50 (190)	17.19 (436)	16.30 (414)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	31 (14.1)
K3	ESV453~~4~~B ESV453~~6~~b	8.72 (221)	7.50 (190)	20.19 (513)	19.30 (490)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	35 (15.9)

Conduit Hole Dimensions	Type	N in (mm)	P in (mm)	P1 in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
	K1	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)
	K2	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)
	K3	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)

3.1.3 NEMA 4X (IP65) Models

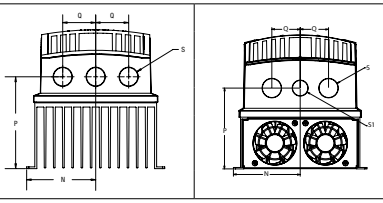


	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
R1	ESV371N01SX_; ESV751N01SX_; ESV371N02YX_; ESV751N02YX_; ESV371N04TX_; ESV751N04TX_; ESV751N06TX_; ESV371N02SF_; ESV751N02SF_; ESV371N04TF_; ESV751N04TF_;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	0.66 (17)	4.47 (114)	2.00 (51)	2.00 (51)	3.6 (1.63)
R2	ESV112N01SX_; ESV112N02YX_; ESV152N02YX_; ESV112N04TX_; ESV152N04TX_; ESV222N04TX_; ESV152N06TX_; ESV222N06TX_; ESV112N02SF_; ESV152N02SF_; ESV112N04TF_; ESV152N04TF_; ESV222N04TF_; ESV302N04TF_;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	0.66 (17)	6.31 (160)	2.00 (51)	2.00 (51)	5.9 (2.68)
S1	ESV222N02YX_; ESV222N02SF_	7.12 (181)	6.74 (171)	8.00 (203)	6.56 (167)	0.66 (17)	6.77 (172)	2.00 (51)	2.00 (51)	7.1 (3.24)
T1	ESV552N02TX~; ESV752N02TX~ ESV752N04TX~; ESV752N06TX~; ESV752N04TF~	8.04 (204)	7.56 (192)	10.00 (254)	8.04 (204)	0.92 (23)	8.00 (203)	4.00 (102)	4.00 (102)	10.98 (4.98)
V1	ESV402N02TX_; ESV402N04TX_; ESV552N04TX_; ESV402N06TX_ ESV552N06TX_; ESV402N04TF_; ESV552N04TF_	8.96 (228)	8.48 (215)	10.00 (254)	8.04 (204)	0.92 (23)	8.00 (203)	4.00 (102)	4.00 (102)	11.58 (5.25)
W1	ESV113N02TX~; ESV153N02TX~ ESV113N04TX~; ESV153N04TX~ ESV113N04TF~; ESV153N04TF~ ESV113N06TX~; ESV153N06TX~ ESV183N04TX~; ESV183N04TF~ ESV183N06TX~	9.42 (240)	8.94 (228)	14.50 (368)	12.54 (319)	0.92 (24)	9.45 (241)	4.00 (102)	4.00 (102)	22.0 (10.0)
X1	ESV223N04TX~; ESV223N04TF~ ESV223N06TX~	9.42 (240)	8.94 (228)	18.5 (470)	16.54 (420)	0.92 (24)	9.45 (241)	4.00 (102)	4.00 (102)	25.5 (11.6)

_ = Last digit of part number: C = N4X Indoor (convection cooled) E = N4X In/Outdoor (convection cooled)

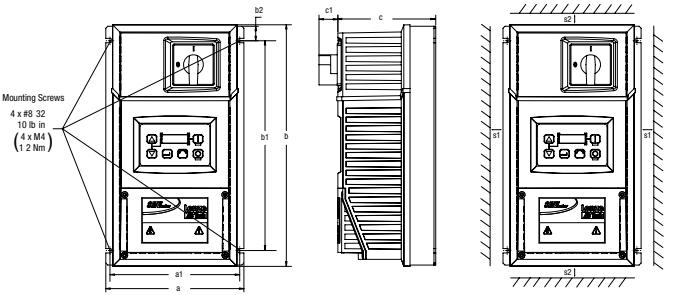
~ = Last digit of part number: D = N4X Indoor (fan cooled) F = N4X In/Outdoor (fan cooled)

Conduit Hole Dimensions



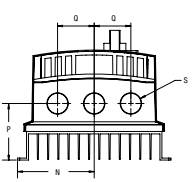
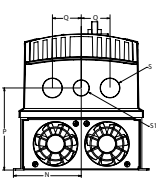
Type	N in (mm)	P in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
R1	3.14 (80)	2.33 (59)	1.50 (38)	.88 (22)	n/a
R2	3.14 (80)	4.18 (106)	1.50 (38)	.88 (22)	n/a
S1	3.56 (90)	4.63 (118)	1.50 (38)	.88 (22)	n/a
T1	4.02 (102)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
V1	4.48 (114)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
W1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)
X1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)

3.1.4 NEMA 4X (IP65) Models with Disconnect Switch



	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	c1 in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
AA1	ESV371N01SM_; ESV371N02YM_; ESV371N02SL_; ESV371N04TM_; ESV371N04TL_; ESV371N06TM_; ESV751N01SM_; ESV751N02YM_; ESV751N02SL_; ESV751N04TM_; ESV751N04TL_; ESV751N06TM_;	6.28 (160)	5.90 (150)	10.99 (279)	9.54 (242)	0.66 (17)	4.47 (114)	.86 (22)	2.00 (51)	2.00 (51)	4.7 (2.13)
AA2	ESV112N01SM_; ESV112N02YM_; ESV112N02SL_; ESV112N04TM_; ESV112N04TL_; ESV152N02YM_; ESV152N02SL_; ESV152N04TM_; ESV152N04TL_; ESV152N06TM_; ESV222N04TM_; ESV222N04TL_; ESV222N06TM_; ESV302N04TL_;	6.28 (160)	5.90 (150)	10.99 (279)	9.54 (242)	0.66 (17)	6.31 (160)	.86 (22)	2.00 (51)	2.00 (51)	7.9 (3.58)
AD1	ESV222N02SL_; ESV222N02YM_;	7.12 (181)	6.74 (171)	10.99 (279)	9.54 (242)	0.66 (17)	6.77 (172)	.86 (22)	2.00 (51)	2.00 (51)	9.0 (4.08)
AB1	ESV552N02TM~; ESV752N02TM~ ESV752N04TM~; ESV752N06TM~; ESV752N04TL~	8.04 (204)	7.56 (192)	13.00 (330)	11.04 (280)	0.92 (23)	8.00 (203)	.86 (22)	4.00 (102)	4.00 (102)	13.9 (6.32)
AC1	ESV402N02TM_; ESV402N04TM_; ESV552N04TM_; ESV402N06TM_; ESV552N06TM_; ESV402N04TL_; ESV552N04TL_	8.96 (228)	8.48 (215)	13.00 (330)	11.04 (280)	0.92 (23)	8.04 204)	.86 (22)	4.00 (102)	4.00 (102)	14.7 (6.66)
AE1	ESV113N04TM~; ESV153N04TM~, ESV113N06TM~; ESV153N06TM~	9.42 (240)	8.94 (228)	14.50 (368)	12.54 (319)	0.92 (24)	9.45 (241)	0.73 (19)	4.00 (102)	4.00 (102)	23.0 (10.4)
AF1	ESV113N02TM~; ESV153N02TM~ ESV113N04TL~; ESV153N04TL~ ESV183N04TL~; ESV223N04TL~ ESV183N04TM~; ESV223N04TM~ ESV183N06TM~; ESV223N06TM~	9.42 (240)	8.94 (228)	18.5 (470)	16.54 (420)	0.92 (24)	9.45 (241)	0.73 (19)	4.00 (102)	4.00 (102)	28.5 (12.9)

_ = Last digit of part number: C = N4X Indoor (convection cooled) ~ = Last digit of part number: D = N4X Indoor (fan cooled)

Conduit Hole Dimensions		Type	N in (mm)	P in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
		AA1	3.14 (80)	2.33 (59)	1.50 (38)	.88 (22)	n/a
		AA2	3.14 (80)	4.18 (106)	1.50 (38)	.88 (22)	n/a
		AD1	3.56 (90)	4.63 (118)	1.50 (38)	.88 (22)	n/a
		AB1	4.02 (102)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		AC1	4.48 (114)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		AE1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)
		AF1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)

3.2 Electrical Installation

Installation After a Long Period of Storage

STOP!
Severe damage to the drive can result if it is operated after a long period of storage or inactivity without reforming the DC bus capacitors.

If input power has not been applied to the drive for a period of time exceeding three years (due to storage, etc), the electrolytic DC bus capacitors within the drive can change internally, resulting in excessive leakage current. This can result in premature failure of the capacitors if the drive is operated after such a long period of inactivity or storage.

In order to reform the capacitors and prepare the drive for operation after a long period of inactivity, apply input power to the drive for 8 hours prior to actually operating the motor.

3.2.1 Power Connections

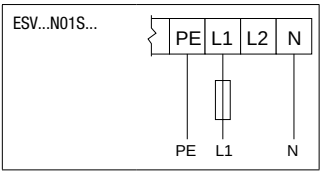
STOP!
If the kVA rating of the AC supply transformer is greater than 10 times the input kVA rating of the drive(s), an isolation transformer or 2-3% input line reactor must be added to the line side of the drive(s).

DANGER! Hazard of electrical shock!
Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.

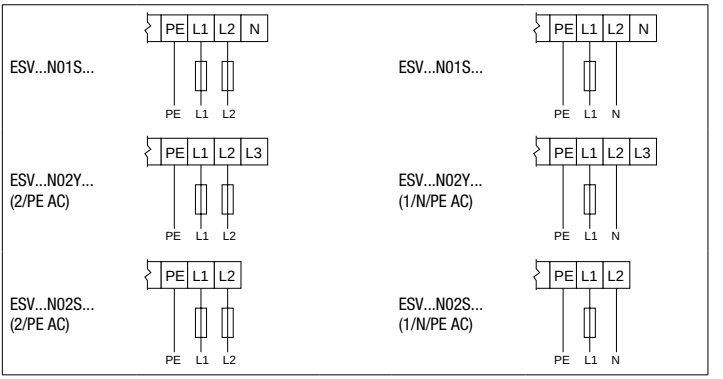
STOP!
- Verify mains voltage before connecting to drive.
- Do not connect mains power to the output terminals (U,V,W)! Severe damage to the drive will result.
- Do not cycle mains power more than once every two minutes. Damage to the drive may result.

Mains and Motor Terminations		
Type	**Torque**	**Strip Length**
<5HP	12 lb-in (1.3 Nm)	0.25 in (6mm)
ESV552xx2T, ESV752xx2T, ESV113xx4/6, ESV153xx4/6, ESV183xx6, ESV223xx6	16 lb-in (1.8 Nm)	0.25 in (6mm)
ESV552xx4Txx, ESV752xx4Txx, ESV552xx6Txx, ESV752xx6Txx	12 lb-in (1.3Nm)	0.25 in (6mm)
ESV113xx2xxx, ESV153xx2xxx, ESV183xx4xxx, ESV223xx4xxx	24 lb-in (2.7 Nm)	0.25 in (6mm)
Torque: N4X/IP65 Door Screws		
N4X/IP65	6-7 lb-in (0.67-0.79 Nm)	0.25 in (6mm)

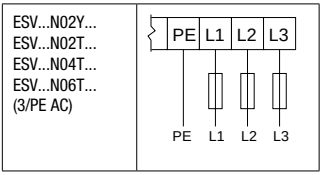
3.2.1.1 Mains Connection to 120VAC Single-Phase Supply



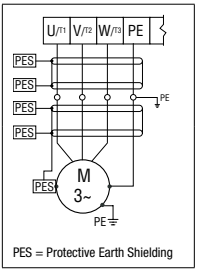
3.2.1.2 Mains Connection to 240VAC Single-Phase Supply



3.2.1.3 Mains Connection to Three-Phase Supply



3.2.1.4 Motor Connection



WARNING!
If the cable connection between the drive and the motor has an in-line contactor or circuit breaker then the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.

WARNING!
Leakage current may exceed 3.5 mA AC. The minimum size of the protective earth (PE) conductor shall comply with local safety regulations for high leakage current equipment.

STOP!
In the case of a Spinning Motor:

To bring free-wheeling loads such as fans to a rest before starting the drive, use the DC injection braking function. Starting a drive into a freewheeling motor creates a direct short-circuit and may result in damage to the drive.

Confirm motor suitability for use with DC injection braking.
Consult parameter P110 for starting / restarting into spinning motors.

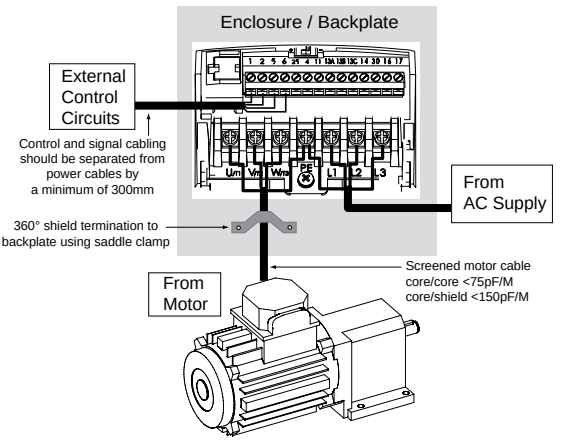
3.2.1.5 Installation Recommendations for EMC Compliance

For compliance with EN 61800-3 or other EMC standards, motor cables, line cables and control or communications cables must be shielded with each shield/screen clamped to the drive chassis. This clamp is typically located at the conduit mounting plate.

The EMC requirements apply to the final installation in its entirety, not to the individual components used. Because every installation is different, the recommended installation should follow these guidelines as a minimum. Additional equipment (such as ferrite core absorbers on power conductors) or alternative practices may be required to meet conformance in some installations.

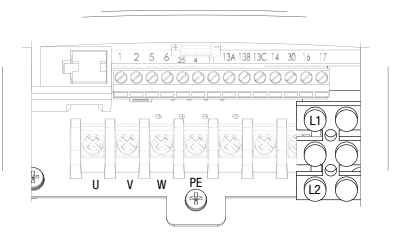
Motor cable should be low capacitance (core/core <75pF/m, core/shield <150pF/m). Filtered drives can meet the class A limits of EN 55011 and EN 61800-3 Category 2 with this type of motor cable up to 10 meters.

NOTE: Refer to Appendix A for recommended cable lengths. Any external line filter should have its chassis connected to the drive chassis by mounting hardware or with the shortest possible wire or braid.

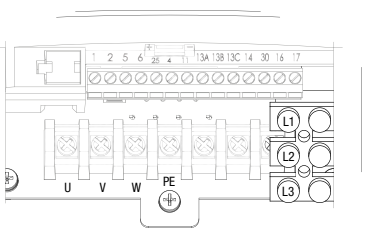


3.2.1.6 NEMA 4X (IP65) Input Terminal Block

For NEMA 4X (IP65) models with integrated EMC filter and/or integrated line disconnect, the input terminal block is located on the right-hand side of the SMV inverter in the NEMA 4 X (IP65) enclosure. The single and three phase models are illustrated herein. Refer to paragraph 3.2.3 Control Terminals for pin out information.



Single Phase (2/PE)
With Filter and/or integrated line disconnect

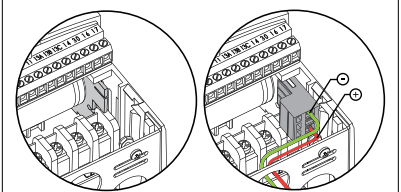
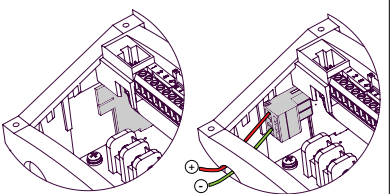


Three Phase (3/PE)
With Filter and/or integrated line disconnect

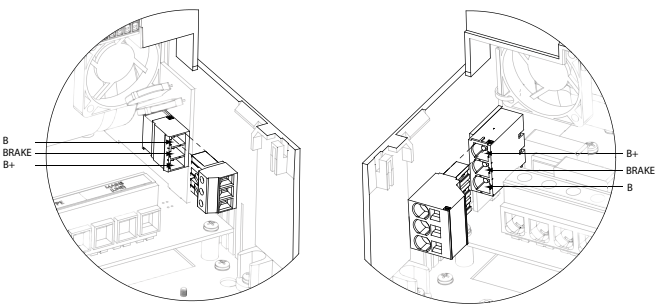
WARNING
Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

3.2.1.7 Dynamic Brake Connections

For NEMA 1 and NEMA 4X Drives rated up to 30HP (22kW) the Dynamic Brake connections are made as illustrated herein. Refer to the SMV Dynamic Brake Instructions (DBV01) for complete information.

NEMA 1 (IP31) up to 30HP (22kW)	NEMA 4X (IP65) up to 30HP (22kW)
	

The SMV 40...60Hp (30...45kW) models include a dynamic brake transistor as standard and only require the connection of an external resistor kit for dynamic braking operation. The dynamic brake resistor connections for 40...60 Hp (30.0...45.0 kW) drives are standard built-in connections as illustrated in the diagram below. In the 40Hp (30kW) model drives, the dynamic brake connector is on the right-hand side of the drive and the terminals from top to bottom are B-, BRAKE and B+. In the 50/60HP (37.5/45 kW) model drives, the dynamic brake connector is on the left-hand side of the drive and the terminals from top to bottom are B+, BRAKE and B-.



40HP 50/60HP

External resistor kits must be connected to terminals B+ and BRAKE (no connection to B-). Refer to the table herein for external resistor kit selection. Refer to parameter P189 for enabling the dynamic brake function in the 40...60Hp (30...45kW) models.

400/480 VAC SMV Inverter			Resistor Kit		
Type	**Hp**	**kW**	**Resistance (Ω)**	**Power (W)**	**Catalog #**
ESV303**4T**	40	30	23.5	1020	841-013
ESV373**4T**	50	37	17	1400	841-015
ESV453**4T**	60	45	17	1400	841-015
600 VAC SMV Inverter			**Resistor Kit**		
Type	**Hp**	**kW**	**Resistance (Ω)**	**Power (W)**	**Catalog #**
ESV303**6T**	40	30	35	1070	841-014
ESV373**6T**	50	37	24	1560	841-016
ESV453**6T**	60	45	24	1560	841-016

3.2.2 Fuses/Cable Cross-Sections

NOTE: Observe local regulations. Local codes may supersede these recommendations

Type		Recommendations				
		Fuse	Miniature circuit breaker[1]	Fuse[2] or Breaker[3] (N. America)	Input Power Wiring (L1, L2, L3, PE)	
					[mm²]	[AWG]
120V 1~ (1/N/PE)	ESV251N01SXB	M10 A	C10 A	10 A	1.5	14
	ESV371N01SXB, ESV371N01SX*	M16 A	C16 A	15 A	2.5	14
	ESV751N01SXB, ESV751N01SX*	M25 A	C25 A	25 A	4	10
	ESV112N01SXB, ESV112N01SX*	M32 A	C32 A	30A	4	10
240V 1~ (2/PE)	ESV251N01SXB, ESV251N02SXB, ESV371N01SXB, ESV371N02YXB, ESV371N02SF*	M10 A	C10 A	10 A	1.5	14
	ESV751N01SXB, ESV751N02YXB, ESV751N02SF*	M16 A	C16 A	15 A	2.5	14
	ESV112N02YXB, ESV112N02SFC, ESV112N01SXB ESV112N01SX*	M20 A	C20 A	20 A	2.5	12
	ESV152N02YXB, ESV152N02SF*	M25 A	C25 A	25 A	2.5	12
	ESV222N02YXB, ESV222N02SF*	M32 A	C32A	30 A	4	10
240V 3~ (3/PE)	ESV371N02YXB, ESV751N02YXB, ESV371N02Y_*, ESV751N02Y_*	M10 A	C10 A	10 A	1.5	14
	ESV112N02YXB, ESV152N02YXB, ESV112N02TXB, ESV152N02TXB, ESV112N02Y_*, ESV152N02Y_*	M16 A	C16 A	12 A	1.5	14
	ESV222N02YXB, ESV222N02TXB, ESV222N02YX*	M20 A	C20 A	20 A	2.5	12
	ESV402N02TXB, ESV402N02T_*	M32 A	C32 A	30 A	4.0	10
	ESV552N02TXB, ESV552N02T_~	M40 A	C40 A	35 A	6.0	8
	ESV752N02TXB, ESV752N02T_~	M50 A	C50 A	45 A	10	8
	ESV113N02TXB, ESV113N02TX~, ESV113N02TM~	M80 A	C80 A	80 A	16	6
	ESV153N02TXB, ESV153N02TX~, ESV153N02TM~	M100 A	C100 A	90 A	16	4
400V or 480V 3~(3/PE)	ESV371N04TXB ...ESV222N04TXB ESV371N04T_* ...ESV222N04T_* ESV371N04TF* ...ESV222N04TF*	M10 A	C10 A	10 A	1.5	14
	ESV302N04T_*	M16 A	C16 A	15 A	2.5	14
	ESV402N04TXB, ESV402N04T_*	M16 A	C16 A	20 A	2.5	14
	ESV552N04TXB, ESV552N04T_*	M20 A	C20 A	20 A	2.5	14
	ESV752N04TXB, ESV752N04T_~	M25 A	C25 A	25 A	4.0	10
400V or 480V 3~(3/PE)	ESV113N04TXB, ESV113N04T_~	M40 A	C40 A	40 A	4	8
	ESV153N04TXB, ESV153N04T_~	M50 A	C50 A	50 A	10	8
	ESV183N04TXB, ESV183N04T_~	M63 A	C63A	70 A	10	6
	ESV223N04TXB, ESV223N04T_~	M80 A	C80 A	80 A	16	6
	ESV303N04TXB	M100 A	C100 A	100 A	25	4
	ESV373N04TXB	M125 A	C125 A	125 A	35	2
	ESV453N04TXB	M160 A	C160 A	150 A	35	1
600V 3~(3/PE)	ESV751N06TXB ...ESV222N06TXB ESV751N06T_* ...ESV222N06T_*	M10 A	C10 A	10 A	1.5	14
	ESV402N06TXB, ESV402N06T_*	M16 A	C16 A	12 A	1.5	14
	ESV552N06TXB, ESV552N06T_*	M16 A	C16 A	15 A	2.5	14
	ESV752N06TXB, ESV752N06T_~	M20 A	C20 A	20 A	2.5	12
	ESV113N06TXB, ESV113N06TX~, ESV113N06TM~	M32 A	C32 A	30 A	4	10
	ESV153N06TXB, ESV153N06TX~, ESV153N06TM~	M40 A	C40 A	40 A	4	8
	ESV183N06TXB, ESV183N06TX~, ESV183N06TM~	M50 A	C50 A	50 A	6	8
	ESV223N06TXB, ESV223N06TX~, ESV223N06TM~	M63 A	C63 A	60 A	10	8
	ESV303N06TXB	M80 A	C80 A	70 A	16	6
	ESV373N06TXB	M100 A	C100 A	90 A	16	4
	ESV453N06TXB	M125 A	C125 A	110 A	25	2

Notes for Fuse and Cable Table:

(1) Installations with high fault current due to large supply mains may require a type D circuit breaker.
(2) UL Class CC or T fast-acting current-limiting type fuses, 200,000 AIC, preferred. Bussman KTK-R, JJN or JJS or equivalent.
(3) Thermomagnetic type breakers preferred.

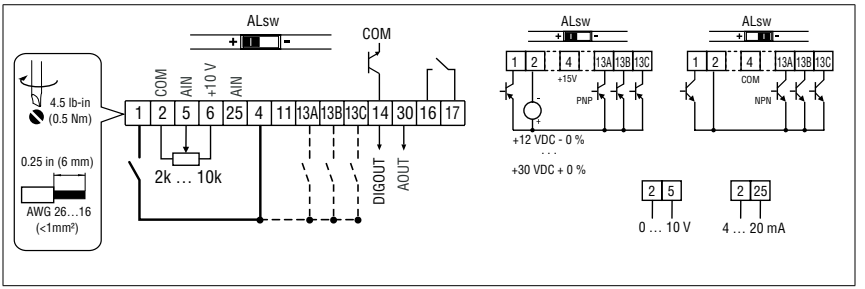
_ 11th digit of part number:	F = Integral EMC Filter
	L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
	M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
	X = No EMC Filter/ No Disconnect Switch
* = Last digit of part number:	C = N4X Indoor only (convection cooled)
	E = N4X Indoor/Outdoor (convection cooled)
~ = Last digit of part number:	D = N4X Indoor only (fan cooled)
	F = N4X Indoor/Outdoor (fan cooled)

Observe the following when using Ground Fault Circuit Interrupters (GFCIs):

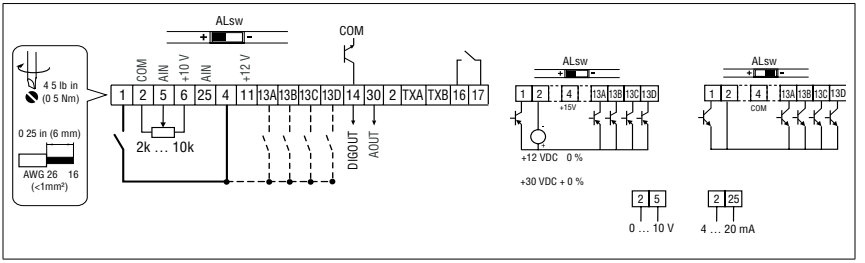
- Installation of GFCI only between supplying mains and controller.
- The GFCI can be activated by:
  - capacitive leakage currents between the cable screens during operation (especially with long, screened motor cables)
  - connecting several controllers to the mains at the same time
  - RFI filters

3.2.3 Control Terminals

Control Terminal Strip for 0.33 - 10 HP (0.25 - 7.5 kW):



Control Terminal Strip for 15HP (11 kW) and Greater Drives:



NOTE
Control and communications terminals provide basic insulation when the drive is connected to a power system rated up to 300V between phase to ground (PE) and the applied voltage on terminals 16 and 17 is less than 250 VAC between phase to phase and ground (PE).

Control Terminal Strip Descriptions

Terminal	Description	Important
1	Digital Input: Start/Stop	input resistance = 4.3kΩ
2	Analog Common	
5	Analog Input: 0...10 VDC	input resistance: >50 kΩ
6	Internal DC supply for speed pot	+10 VDC, max. 10 mA
25	Analog Input: 4...20 mA	input resistance: 250Ω
4	Digital Reference/Common	+15 VDC / 0 VDC, depending on assertion level
11	Internal DC supply for external devices	+12 VDC, max. 50 mA
13A	Digital Input: Configurable with P121	input resistance = 4.3kΩ
13B	Digital Input: Configurable with P122	
13C	Digital Input: Configurable with P123	
13D*	Digital Input: Configurable with P124	
14	Digital Output: Configurable with P142, P144	DC 24 V / 50 mA; NPN
30	Analog Output: Configurable with P150…P155	0…10 VDC, max. 20 mA
2*	Analog Common	
TXA*	RS485 TxA	
TXB*	RS485 TxB	
16	Relay output: Configurable with P140, P144	AC 250 V / 3 A DC 24 V / 2 A … 240 V / 0.22 A, non-inductive
17		

***** = Terminal is part of the terminal strip for the 15HP (11kW) and higher models only.

Assertion level of digital inputs

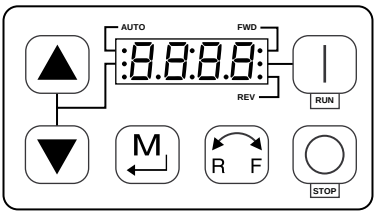
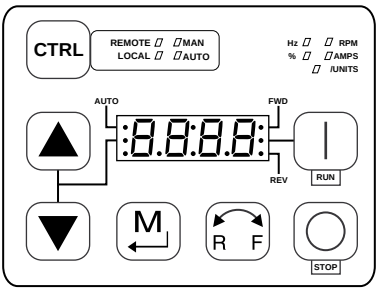
The digital inputs can be configured for active-high or active-low by setting the Assertion Level Switch (ALsw) and P120. If wiring to the drive inputs with dry contacts or with PNP solid state switches, set the switch and P120 to “High” (+). If using NPN devices for inputs, set both to “Low” (-). Active-high (+) is the default setting.

HIGH = +12 … +30 V
LOW = 0 … +3 V

NOTE
An **F_AL** fault will occur if the Assertion Level switch (ALsw) position does not match the parameter P120 setting and P100 or any of the digital inputs (P121...P124) is set to a value other than 0.

4 Commissioning

4.1 Local Keypad & Display

SMV Models: 0.33-10HP (0.25-7.5kW)	SMV Models: 15HP (11kW) and greater
	
4-Character Display	4-Character plus CTRL Display

Display	START BUTTON
	In Local Mode (P100 = 0, 4, 6), this button will start the drive.
	STOP BUTTON
	Stops the drive, regardless of which mode the drive is in. ⚠ **WARNING!** When JOG is active, the STOP button will not stop the drive!
	ROTATION
	In Local Mode (P100 = 0, 4, 6), this selects the motor rotation direction: - The LED for the present rotation direction (FWD or REV) will be on - Press R/F; the LED for the opposite rotation direction will blink - Press M within 4 seconds to confirm the change - The blinking direction LED will turn on, and the other LED will turn off When rotation direction is changed while the drive is running, the commanded direction LED will blink until the drive is controlling the motor in the selected direction.
	MODE
	Used to enter/exit the Parameter Menu when programming the drive and to enter a changed parameter value.
	UP AND DOWN BUTTONS
	Used for programming and can also be used as a reference for speed, PID setpoint, or torque setpoint. When the ▲ and ▼ buttons are the active reference, the middle LED on the left side of the display will be on.

Display	INDICATING LEDs (on 4-character display)
	FWD LED: Indicate the present rotation direction is forward. Refer to ROTATION description above.
	REV LED: Indicate the present rotation direction is reverse. Refer to ROTATION description above.
	AUTO LED: Indicates that the drive has been put into Auto mode from one of the TB13 inputs (P121…P124 set to 1…7). Indicates that PID mode is active (if PID mode is enabled). Indicates that sequencer mode is active (if sequencer mode is enabled).
	RUN LED: Indicates that the drive is running.
	▲ ▼ LED: Indicates that the ▲ ▼ are the active reference.
	NOTE If the keypad is selected as the auto reference (P121…P124 is 6) and the corresponding TB-13 input is closed, the AUTO LED and ▲ ▼ LEDs will both be on.
	FUNCTIONS THAT FOLLOW ARE APPLICABLE TO SMV DRIVES 15HP (11kW) AND HIGHER
CTRL	**CTRL** The CTRL pushbutton selects the start and speed reference control sources for the drive. Press [M] mode button to accept the new control mode selection.

CTRL LEDs		START CONTROL	REFERENCE CONTROL
REMOTE ▯ ▮ MAN LOCAL ▮ ▯ AUTO	[LOCAL] [MAN]	Keypad	P101 Settings
REMOTE ▯ ▯ MAN LOCAL ▮ ▮ AUTO	[LOCAL] [AUTO]	Keypad	Terminal 13x Settings
REMOTE ▮ ▮ MAN LOCAL ▯ ▯ AUTO	[REMOTE] [MAN]	Terminal Strip	P101 Settings
REMOTE ▮ ▯ MAN LOCAL ▯ ▮ AUTO	[REMOTE] [AUTO]	Terminal Strip	Terminal 13x Settings
If P100 = 6 the CTRL button is used to toggle start control between the terminal strip [REMOTE] and the keypad [LOCAL]		- REM/LOC LED indicating the present start control source is ON - Press [CTRL]; the LED for other start control source will blink - Press [M] within 4 sec to confirm the change - Blinking LED will turn ON (the other LED will turn OFF)	
If P113 = 1 the CTRL button is used to toggle reference control between the TB-13x setup [AUTO] and P101 [MANUAL]		- AUT/MAN LED indicating present reference control is ON - Press [CTRL]; the other reference control will blink - Press [M] within 4 sec to confirm change - Blinking LED will turn ON (the other LED will turn OFF)	
If P100 = 6 and P113 = 1, it is possible to change the start and reference control sources at the same time			

Display	START CONTROL	
	The REMOTE/LOCAL LEDs indicate the current start control source. If the start control source is a remote keypad or the network, then both LEDs will be OFF.	
	REFERENCE CONTROL	
	The AUTO/MANUAL LEDs indicate the current reference control source.	
	IF P113 = 0 or 2, the AUTO/MANUAL LEDs will match the AUTO LED on the 4-character display. IF P113 = 0 and no AUTO reference has been setup on the terminal strip, the MANUAL LED will turn ON and the AUTO LED will turn OFF.	
	IF P113 = 1, the AUTO/MANUAL LEDS show the commanded reference control source as selected by the [CTRL] button. If the [CTRL] button is used to set the reference control source to AUTO but no AUTO reference has been setup on the terminal strip, reference control will follow P101 but the AUTO LED will remain ON.	
	UNITS LEDs	
	HZ: current display value is in Hz	In Speed mode, if P178 = 0 then HZ LED will be ON. If P178 > 0, the Units LEDs follow the setting of P177 when the drive is in run (non-programming) mode. In Torque mode, the HZ LED will be ON when the drive is in run (non-programming) mode. In Pid mode, the Units LEDs follow the setting of P203 when the drive is in run (non-programming) mode. If P179 > 0, the Units LEDs will show the unit of the diagnostic parameter that is being displayed.
	%: current display value is in %	
	RPM: current display value is in RPM	
	AMPS: current display value is in Amps	
	/UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)	

4.2 Drive Display and Modes of Operation

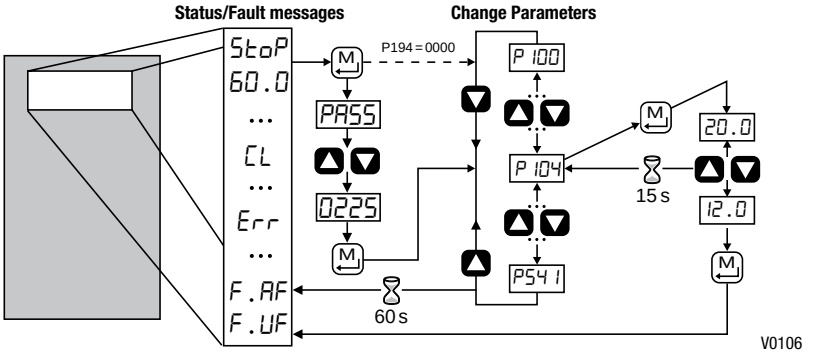
Speed Mode Display
In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive's output frequency.

PID Mode Display
When the PID mode is enabled and active, the normal run display shows the actual PID setpoint. When PID mode is not active, the display returns to showing the drive's output frequency.

Torque Mode Display
When the drive is operating in Vector Torque mode, the normal run display shows the drive's output frequency.

Alternate (Run-Screen) Display
When P179 (Run Screen Display) is set to a value other than 0, one of the diagnostic parameters (P501…P599) is displayed. Example: if P179 is set to 1, then diagnostic parameter P501 (Software version) is displayed. If P179 =2, then P502 (Drive ID) is displayed.

4.3 Parameter Setting



4.4 Electronic Programming Module (EPM)

The EPM contains the drives operational memory. Parameter settings are stored in the EPM and setting changes are made to the "User settings" in the EPM.

An optional EPM Programmer (model EEPM1RA) is available that allows:

- An EPM to be copied directly to another EPM.
- An EPM to be copied to the memory of the EPM Programmer.
- Stored files can be modified in the EPM Programmer.
- Stored files can be copied to another EPM.

EPM Module in SMV Drive

As the EPM Programmer is battery operated, parameter settings can be copied to an EPM and inserted into a drive without power being applied to the drive. This means that the drive will be fully operational with the new settings on the next application of power.

Additionally, when the drives parameter settings are burned into an EPM with the EPM Programmer, the settings are saved in two distinct locations; the "User settings" and the "OEM default settings". While the User settings can be modified in the drive, the OEM settings cannot. Thus, the drive can be reset not only to the "factory" drive default settings (shown in this manual), but can be set to the Original Machine settings as programmed by the OEM.

The user area contents of the EPM are what are copied into the OEM space by the EPM programmer. When parameter modifications are made to the drive and then a copy made via the EPM Programmer, these are the settings that will be available by the OEM selections from P199. The EPM Programmer is the only way to load the OEM area of the EPM.

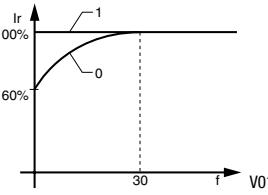
While the EPM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing EPM will trigger an F_F I fault)

4.5 Parameter Menu

4.5.1 Basic Setup Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 100	Start Control Source	0	0 Local Keypad	Use RUN button on front of drive to start
			1 Terminal Strip	Use start/stop circuit wired into the terminal strip. Refer to section 3.2.3
			2 Remote Keypad Only	Use RUN button on optional Remote Keypad to start
			3 Network Only	• Start command must come from network (Modbus, CANopen, etc) • Requires optional communication module (refer to the network module documentation). • Must also set one of the TB-13 inputs to 9 (Network Enable); see P121...P124
			4 Terminal Strip or Local Keypad	Allows start control to be switched between terminal strip and local keypad using one of the TB-13 inputs. See note below.
			5 Terminal Strip or Remote Keypad	Allows start control to be switched between terminal strip and optional remote keypad using one of the TB-13 inputs. See Note below
			6 CTRL button select	Allows start control to be switched between terminal strip and local keypad using the CTRL button. **NOTE:** P100 Selection 6 is applicable to SMV 15HP (11kW) and higher models only.
		⚠	**WARNING!** P100 = 0 disables TB-1 as a STOP input! STOP circuitry may be disabled if parameters are reset back to defaults (see P199)	
		ℹ	**NOTE** • P100 = 4, 5: To switch between control sources, one of the TB-13 inputs (P121...P124) must be set to 08 (Control Select); TB-13x OPEN (or not configured): Terminal strip control TB-13x CLOSED: Local (P100 = 4) or Remote (P100 = 5) keypad • P100 = 0, 1, 4, 6: Network can take control if P121...P124 = 9 and the corresponding TB-13x input is CLOSED. • The STOP button on the front of the drive is always active except in JOG mode. • TB-1 is an active STOP input if P100 is set to a value other than 0. • An F_AL fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and P100 is set to a value other than 0.	
P 101	Standard Reference Source	0	0 Keypad (Local or Remote)	Selects the default speed or torque reference when no Auto Reference is selected using the TB-13 inputs.
			1 0-10 VDC	
			2 4-20 mA	
			3 Preset #1	
			4 Preset #2	
			5 Preset #3	
			6 Network	
			7 Preset Sequence Segment #1	Selections 7, 8 & 9 are not valid for PID setpoint or torque reference.
			8 Preset Sequence Segment #2	
			9 Preset Sequence Segment #3	

(1) Any changes to this parameter will not take effect until the drive is stopped

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P102	Minimum Frequency	0.0	0.0	{Hz}	P103	• P102, P103 are active for all speed references • When using an analog speed reference, also see P160, P161
P103	Maximum Frequency	60.0	7.5	{Hz}	500	
			NOTE • P103 cannot be set below Minimum Frequency (P102) • To set P103 above 120 Hz: - Scroll up to 120 Hz; display shows HiFr (flashing). - Release ▲ button and wait one second. - Press ▲ button again to continue increasing P103.			
	WARNING! Consult motor/machine manufacturer before operating above rated frequency. Overspeeding the motor/machine may cause damage to equipment and injury to personnel!					
P104	Acceleration Time 1	20.0	0.0	{s}	3600	• P104 = time of frequency change from 0 Hz to P167 (base frequency) • P105 = time of frequency change from P167 to 0 Hz • For S-ramp accel/decel, adjust P106
P105	Deceleration Time 1	20.0	0.0	{s}	3600	
	EXAMPLE: IF P103 = 120 Hz, P104 = 20.0 s and P167 (base frequency) = 60 Hz; then the rate of frequency change from 0 Hz to 120 Hz = 40.0 s					
P106	S-Ramp Integration Time	0.0	0.0	{s}	50.0	• P106 = 0.0: Linear accel/decel ramp • P106 > 0.0: Adjusts S-ramp curve for smoother ramp
P107[1]	Line Voltage Selection	1*	0 Low (120, 200, 400, 480VAC) 1 High (120, 240, 480, 600VAC)			* The default setting is 1 for all drives except when using "reset 50" (Parameter P199, selection 4) with 480V models. In this case, the default setting is 0.
P108	Motor Overload	100	30	{%}	100	P108 = motor current rating x 100 SMV output rating Example: if motor = 3amps and SMV = 4amps, then P108 = 75%
			NOTE Do not set above rated motor current as listed on the motor dataplate. The motor thermal overload function of the SMV is UL approved as a motor protection device. Cycling power after an overload fault could result in significantly reducing the motor life.			
P109	Motor Overload Type	0	0 Speed Compensation 1 No Speed Compensation			

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P110	Start Method	0	0 Normal	
			1 Start on Power-up	Drive will automatically start when power is applied.
			2 Start with DC Brake	When start command is applied, drive will apply DC braking according to P174, P175 prior to starting the motor
			3 Auto Restart	Drive will automatically restart after faults, or when power is applied.
			4 Auto Restart with DC Brake	Combines settings 2 and 3
			5 Flying Start/Restart #1	• Drive will automatically restart after faults, or when power is applied. • After 3 failed attempts, drive will Auto Restart with DC brake. • P110 = 5: Performs speed search, starting at Max Frequency (P103)
			6 Flying Start/Restart #2	• P110 = 6: Performs speed search, starting at the last output frequency prior to faulting or power loss • If P111 = 0, a flying START is performed when a start command is applied.
			NOTE • P110 = 0, 2: Start command must be applied at least 2 seconds after power-up; F_UF fault will occur if start command is applied too soon. • P110 = 1, 3…6: For automatic start/restart, the start source must be the terminal strip and the start command must be present. • P110 = 2, 4…6: If P175=999.9, dc braking will be applied for 15s. • P110 = 3…6: Drive will attempt 5 restarts; if all restart attempts fail, drive displays LC (fault lockout) and requires manual reset. • P110 = 5, 6: If drive cannot catch the spinning motor, drive will trip into F_rF fault.	
	WARNING! Automatic starting/restarting may cause damage to equipment and/or injury to personnel! Automatic starting/restarting should only be used on equipment that is inaccessible to personnel.			
P111	Stop Method	0	0 Coast	Drive's output will shut off immediately upon a stop command, allowing the motor to coast to a stop
			1 Coast with DC Brake	The drive's output will shut off and then the DC Brake will activate (refer to P174, P175)
			2 Ramp	The drive will ramp the motor to a stop according to P105 or P126.
			3 Ramp with DC Brake	The drive will ramp the motor to 0 Hz and then the DC Brake will activate (refer to P174, P175)
P112	Rotation	0	0 Forward Only	If PID mode is enabled, reverse direction is disabled (except for Jog).
			1 Forward and Reverse	

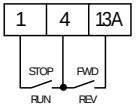
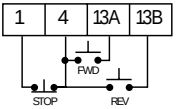
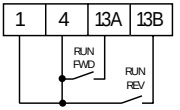
Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P113	Auto/Manual Control	0	0 Terminal Strip Control	The reference is dictated by the settings and state of the TB-13x terminals. If no AUTO reference has been setup on the terminal strip then reference control is dictated by P101.
			1 Auto/Manual (CTRL button select)	Allows the reference to be switched between auto and manual using the CTRL pushbutton on the drive keypad. If the CTRL pushbutton has selected AUTO reference but no AUTO reference has been setup on the terminal strip, then reference control is dictated by P101.
			2 Manual Control Only	Reference is dictated by P101 regardless of any AUTO source that may be selected by the TB-13x terminals.
		ℹ	**NOTE** P113 is applicable to SMV 15HP (11kW) and higher models only.	
P115	MOP Speed Initialization at Power-Up	0	0 Set to last MOP speed at power up	
			1 Set to 0.0Hz at power up	
			2 Set to Preset #3 at power up	

4.5.2 I/O Setup Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P120	Assertion Level	2	1 Low 2 High	P120 and the Assertion Level switch must both match the desired assertion level unless P100, P121…P124 are all set to 0. Otherwise an F.AL fault will occur.
P121 P122 P123 P124	TB-13A Input Function TB-13B Input Function TB-13C Input Function TB-13D* Input Function **NOTE: P124** is applicable to SMV 15HP (11kW) and higher models only	0	0 None 1 AUTO Reference: 0-10 VDC 2 AUTO Reference: 4-20 mA 3 AUTO Reference: Preset #1 * 13D: 3 = Reserved 4 AUTO Reference: MOP Up 5 AUTO Reference: MOP Down 6 AUTO Reference: Keypad 7 AUTO Reference: Network 8 Control Select 9 Network Enable 10 Reverse Rotation 11 Start Forward 12 Start Reverse 13 Run Forward 14 Run Reverse 15 Jog Forward 16 Jog Reverse 17 Accel/Decel #2 18 DC Brake 19 Auxiliary Ramp to Stop 20 Clear Fault 21 External Fault F_EF 22 Inverse External Fault F_EF 23 AUTO Ref: Sequence Segment #1 24 Start Sequence 25 Step Sequence 26 Suspend Sequence	Disables input For frequency mode, see P160...P161, For PID mode, see P204…P205, For vector torque mode, see P330 For frequency mode see P131...P137, For PID mode, see P231…P233, For torque mode see, P331…P333 • Normally open: Close input to increase or decrease speed, PID or torque setpoint. • MOP Up is not active while in STOP Use when P100 = 4, 5 to switch between terminal strip control and local or remote keypad control. Required to start the drive through the network. Open = Forward Closed = Reverse Refer to Note for typical circuit Refer to Note for typical circuit Jog Forward speed = P134 Jog Reverse speed = P135 ⚠ Active even if P112 = 0 Refer to P125, P126 Refer to P174; close input to override P175 Normally closed: Opening input will ramp drive to STOP according to P127, even if P111 is set to Coast (0 or 1). Close to reset fault Normally closed circuit; open to trip Normally open circuit; close to trip Works in Speed Mode only Transition from non-asserted to asserted state

⚠ **WARNING**
Jog overrides all STOP commands! To stop the drive while in Jog mode, the Jog input must be deactivated or a fault condition induced.

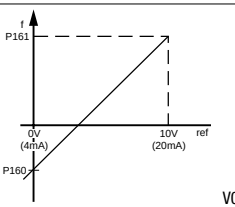
⚠ **WARNING**
If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

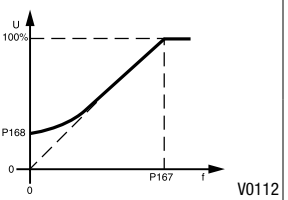
Code No.	Name	Possible Settings Default	Selection			IMPORTANT
	NOTE • When input is activated, settings 1...7 override P101 • When TB-13A...TB-13D are configured for Auto References other than MOP, TB-13D overrides TB-13C, TB-13C overrides TB-13B and TB-13B overrides TB-13A. Any other Auto Reference will have priority over MOP. • Settings 10...14 are only valid in Terminal Strip mode (P100 = 1, 4, 5, 6) • If Start/Run/Jog Forward and Start/Run/Jog Reverse are both activated, drive will STOP • If Jog input is activated while drive is running, the drive will enter Jog mode; when Jog input is deactivated, drive will STOP • An F_AL fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and any of the digital inputs (P121...P124) are set to a value other than 0. • An F_IL fault will occur under the following conditions: - TB-13A...TB-13D settings are duplicated (each setting, except 0 and 3, can only be used once) - One input is set to "MOP Up" and another is not set to "MOP Down", or vice-versa. - One input is set to 10 and another input is set to 11…14. - One input is set to 11 or 12 and another input is set for 13 or 14. • Typical control circuits are shown below: - If any input is set to 10, 12 or 14, P112 must be set to 1 for Reverse action to function. Run / Stop with Direction P121 = 10  Start Forward / Start Reverse P121 = 11, P122 = 12  Run Forward / Run Reverse P121 = 13, P122 = 14  					
P125	Acceleration Time 2	20.0	0.0	{s}	3600	• Selected using TB-13A...TB-13D (P121...P124 = 17) • For S-ramp accel/decel, adjust P106
P126	Deceleration Time 2	20.0	0.0	{s}	3600	
P127	Deceleration Time for Auxiliary Ramp to Stop	20.0	0.0	{s}	3600	• Selected using TB-13A...TB-13D (P121...P124 = 19). • For S-ramp accel/decel, adjust P106 • Once executed, this ramp time has priority over P105 and P126.
P129	Automatic Accel/ Decel rate switch threshold	0.0	0.0	{Hz}	1000	If Actual Frequency < P129 Use Accel/decel time #2 (P125/P126) If Actual Frequency > P129 Use Accel/decel time #1 (P104/P105)
P131	Preset Speed #1	0.0	0.0	{Hz}	500	PRESET SPEED / 13A / 13B / 13C / 13D 1 / X / -- / -- / -- 2 / -- / X / -- / -- 3 / -- / -- / X / -- 4 / X / X / -- / -- 4 (alternate) / -- / -- / -- / X 5 / X / -- / X / -- 6 / -- / X / X / -- 7 / X / X / X / -- 8 (alternate) / -- / X / -- / X 8 (alternate / -- / -- / X / X • Speed setting is used by P158 • 13D available on 15HP (11kW) & higher drives.
P132	Preset Speed #2	0.0	0.0	{Hz}	500	
P133	Preset Speed #3	0.0	0.0	{Hz}	500	
P134	Preset Speed #4	0.0	0.0	{Hz}	500	
P135	Preset Speed #5	0.0	0.0	{Hz}	500	
P136	Preset Speed #6	0.0	0.0	{Hz}	500	
P137	Preset Speed #7	0.0	0.0	{Hz}	500	
P138	Preset Speed #8	0.0	0.0	{Hz}	500	

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P140	Relay Output TB-16, 17	0	0 None	Disables the output
			1 Run	Energizes when the drive is running
			2 Reverse	Energizes when reverse rotation is active
			3 Fault	De-energizes when the drive trips, or power is removed
			4 Inverse Fault	Energizes when the drive trips
			5 Fault Lockout	P110 = 3...6: De-energizes if all restart attempts fail
			6 At Speed	Energizes when output frequency = commanded frequency
			7 Above Preset Speed #6	Energizes when output frequency > P136
			8 Current Limit	Energizes when motor current = P171
			9 Follower Loss (4-20 mA)	Energizes when 4-20 mA signal falls below 2 mA
			10 Loss of Load	Energizes when motor load drops below P145; Refer to P146 also
			11 Local Keypad Control Active	Energizes when the selected source is active for start control
			12 Terminal Strip Control Active	
			13 Remote Keypad Control Active	
			14 Network Control Active	
			15 Standard Reference Active	Energizes when P101 reference is active
			16 Auto Reference Active	Energizes when Auto Reference is activated using TB-13 input; refer to P121...P124
			17 Sleep Mode Active	Refer to P240...P242
			18 PID Feedback < Min. Alarm	Energizes when PID feedback signal < P214
			19 Inverse PID Feedback < Min. Alarm	De-energizes when PID feedback signal < P214
			20 PID Feedback > Max Alarm	Energizes when PID feedback signal > P215
			21 Inverse PID Feedback > Max Alarm	De-energizes when PID feedback signal > P215
			22 PID Feedback within Min/Max Alarm range	Energizes when PID feedback signal is within the Min/Max Alarm range; refer to P214, P215
			23 PID Feedback outside Min/Max Alarm range	Energizes when PID feedback signal is outside the Min/Max Alarm range; refer to P214, P215
			24 Reserved	
			25 Network Controlled	Requires optional communication module (refer to the network module documentation).
			26 Loss of 0-10V Input	
			27 Sequencer Controlled	State set in individual sequencer segments
			28 Sequencer Active	
			29 Sequencer Suspended	
			30 Sequence Done	End Sequence
			31 Actual Speed = 0.0Hz	
P142	TB-14 Output	0	0...23 (same as P140)	
			24 Dynamic Braking	For use with Dynamic Braking option
			25...31 (same as P140)	

<table>
<tr><th colspan="2">Code</th><th colspan="3">Possible Settings</th><th rowspan="2">IMPORTANT</th></tr>
<tr><th>No.</th><th>Name</th><th>Default</th><th colspan="3">Selection</th></tr>
<tr><td>P144</td><td>Digital Output Inversion</td><td></td><td colspan="3"><table><tr><th>P144</th><th>Invert P142</th><th>Invert P140</th></tr><tr><td>0</td><td>NO</td><td>NO</td></tr><tr><td>1</td><td>NO</td><td>YES</td></tr><tr><td>2</td><td>YES</td><td>NO</td></tr><tr><td>3</td><td>YES</td><td>YES</td></tr></table></td><td>Used to invert the selections for P140 (Relay Output) and P142 (TB-14 Output).
EXAMPLE: When P140 = 6 (AT SPEED), the relay is energized when output frequency = commanded frequency. IF P144=1 or 3, then P140 is inverted (INVERSE AT SPEED) and the relay is energized when the output frequency does not equal the command frequency.</td></tr>
<tr><td></td><td></td><td colspan="4">NOTE
Inverting P140 or P142 when the parameter is set to NONE (0) will result in the output being energized continuously.</td></tr>
<tr><td></td><td></td><td colspan="4">NOTE
For SMVector drives rated at 0.33 to 10 HP (0.25 to 7.5 kW), P144 is only available with software versions 3.0 and higher (refer to P501).</td></tr>
<tr><td>P145</td><td>Loss of Load Threshold</td><td>0</td><td>0</td><td>{%}</td><td>200</td><td rowspan="2">P140, P142 = 10: Output will energize if motor load falls below the P145 value longer than the P146 time</td></tr>
<tr><td>P146</td><td>Loss of Load Delay</td><td>0.0</td><td>0.0</td><td>{s}</td><td>240.0</td></tr>
<tr><td>P149</td><td>Analog Offset</td><td>0.0</td><td>0</td><td>{%}</td><td>100</td><td>Scaled value. Example: P149 = 10%, Scaled variable = freq, P150 = 1, P152 = 60Hz; then TB30 = 0VDC below 6Hz</td></tr>
<tr><td>P150</td><td>TB-30 Output</td><td>0</td><td colspan="3">0 None</td><td rowspan="9">2-10 VDC signal can be converted to 4-20 mA with a total circuit impedance of 500 Ω</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">1 0-10 VDC Output Frequency</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">2 2-10 VDC Output Frequency</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">3 0-10 VDC Load</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">4 2-10 VDC Load</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">5 0-10 VDC Torque</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">6 2-10 VDC Torque</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">7 0-10 VDC Power (kW)</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">8 2-10 VDC Power (kW)</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">9 Network Controlled</td><td>Requires optional communication module (refer to the network module documentation).</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">10 Sequencer Controlled</td><td>Value set in individual sequencer segments</td></tr>
<tr><td>P152</td><td>TB-30 Scaling: Frequency</td><td>60.0</td><td>3.0</td><td>{Hz}</td><td>2000</td><td>If P150 = 1 or 2, sets the frequency at which output equals 10 VDC</td></tr>
<tr><td>P153</td><td>TB-30 Scaling: Load</td><td>200</td><td>10</td><td>{%}</td><td>500</td><td>If P150 = 3 or 4, sets the Load (as a percent of drive current rating) at which output equals 10 VDC.</td></tr>
<tr><td>P154</td><td>TB-30 Scaling: Torque</td><td>100</td><td>10</td><td>{%}</td><td>1000</td><td>If P150 = 5 or 6, sets the Torque (as a percent of motor rated torque) at which output equals 10 VDC</td></tr>
<tr><td>P155</td><td>TB-30 Scaling: Power (kW)</td><td>1.0</td><td>0.1</td><td>{kW}</td><td>200.0</td><td>If P150 = 7 or 8, sets the power at which output equals 10 VDC</td></tr>
</table>

4.5.3 Advanced Setup Parameters

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 156	Analog Inputs Configuration		0 TB5: (0-10 VDC); TB25: (4-20mA)			
			1 TB5: (0 - 5 VDC); TB25: (4-20mA)			
			2 TB5: (2 - 10 VDC); TB25: (4-20mA)			
			3 TB5: (-10 - +10 VDC); TB25: (4-20mA)			Available on special option module only
			4 TB5: (0-10 VDC); TB25: (0-20mA)			
			5 TB5: (0 - 5 VDC); TB25: (0-20mA)			
			6 TB5: (2 - 10 VDC); TB25: (0-20mA)			
			7 TB5: (-10 - +10 VDC); TB25: (0-20mA)			Available on special option module only
P 157	TB5 (0-10V) Analog Input Monitoring Action		0 No Action			Selects the reaction to a loss of the 0-10V signal at TB5 Minimum time above/below Monitoring Level (P158) before triggering action is 500ms.
			1 P157 < P158 - Trip Fault F_FAU			
			2 P157 < P158 - Run Preset #8			
			3 P157 < P158 - Run Preset Seq. #16			
			4 P157 > P158 - Trip Fault F_FAU			
			5 P157 > P158 - Run Preset #8			
			6 P157 > P158 - Run Preset Seq. #16			
P 158	TB5 (0-10V) Analog Input Monitoring Level (ML)	0.0	-10.0	{VDC}	10.0	
P 159	0-10V Analog Input Deadband	0.0	0	{VDC}	10.0	Not active if [-10 to +10 VDC] option is selected.
P 160	Speed at Minimum Signal	0.0	-999.0	{Hz}	1000	 V0111
P 161	Speed at Maximum Signal	60.0	-999.0	{Hz}	1000	
			NOTE • P160 sets the output frequency at 0% analog input • P161 sets the output frequency at 100% analog input • P160 or P161 < 0.0 Hz: For scaling purposes only; does not indicate opposite direction! • P160 > P161: Drive will react inversely to analog input signal			
P 162	Analog Input Filter	0.01	0.00	{s}	10.00	Adjusts the filter on the analog inputs (TB-5 and TB-25) to reduce the effect of signal noise
P 163	TB-25 (4-20mA) Analog Input Monitoring Action	0	0 No Action			• Selects the reaction to a loss of the 4-20 mA signal at TB-25. • Signal is considered lost if it falls below 2 mA • Digital outputs can also indicate a loss of 4-20 mA signal; see P140, P142
			1 P163 < P164 - Trip Fault F_FoL			
			2 P163 < P164 - Run Preset #7			
			3 P163 < P164 - Run Preset Seq. #15			
			4 P163 ≥ P164 - Trip Fault F_FoL			
			5 P163 ≥ P164 - Run Preset #7			
			6 P163 ≥ P164 - Run Preset Seq. #15			

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 164	TB-25 (4-20mA) Analog Input Monitoring Level	2.0	0.0	{mA}	20.0	
P 165	Base Voltage		15	{V}	1000	Valid for V/Hz mode only. Set voltage for bus compensation in V/Hz mode
P 166	Carrier Frequency	See Notes	0 4 kHz 1 6 kHz 2 8 kHz 3 10 kHz			• As carrier frequency is increased, motor noise is decreased • Observe derating in section 2.3 • Automatic shift to 4 kHz at 120% load • NEMA 4X (IP65) Models: Default = 0 (4kHz) • NEMA 1 (IP31) Models: Default = 1 (6kHz)
P 167 (1)	Base Frequency	60.0	25.0	{Hz}	1500	
P 168	Fixed Boost		0.0	{%}	40.0	
			NOTE • P167 = rated motor frequency for standard applications • P165, P168 = default setting depends on drive rating			
P 169	Accel Boost	0.0	0.0	{%}	20.0	Accel Boost is only active during acceleration
P 170	Slip Compensation	0.0	0.0	{%}	40.0	Increase P170 until the motor speed no longer changes between no load and full load conditions.
P 171 (1)	Current Limit	Max I	30	{%}	Max I	• When the limit is reached, the drive displays CL (Current Limit), and either the acceleration time increases or the output frequency decreases. • Digital outputs can also indicate when the limit is reached; see P140, P142. • Refer to section 2.3 for the maximum output current Max I (%)
P 172	Current Limit Reduction	0	0 Current Limit Reduction Active - Normal response 1 Current Limit Reduction Active - Fast response 2 Current Limit Reduction Disabled - Normal response 3 Current Limit Reduction Disabled - Fast response			In field weakening, the Current Limit is inversely proportional to the speed.
P 173	Decel Override Time	2.0	0.0	{s}	60.0	Maximum time before drive trips into HF fault.
P 174	DC Brake Voltage	0.0	0.0	{%}	50.0	Setting is a percent of the nominal DC bus voltage.

(1) Any changes to this parameter will not take effect until the drive is stopped

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P175	DC Brake Time	0.0	0.0	{s}	999.9	
			NOTE: CONFIRM MOTOR SUITABILITY FOR USE WITH DC BRAKING DC Brake voltage (P174) is applied for the time specified by P175 with the following exceptions: • If P111=1, 3 and P175=999.9 the brake voltage will be applied continuously until a run or fault condition occurs. • If P110=2, 4…6 and P175=999.9, brake voltage will be applied for 15s • If P121…P124=18 and the corresponding TB-13 input is CLOSED, brake voltage will be applied until the TB-13 input is OPENED or a fault condition occurs.			
P176	Keypad Setpoint Single Press Increment	0.1	0.1		100.0	Used for run screen setpoint editing only. If P176 >0.1 then scrolling of keypad setpoint is disabled.
P177 (2)	Speed Units	0	0 Hz 1 RPM 2 % 3 /UNITS 4 NONE			Select the UNITS LED that will be illuminated when the drive is running in speed control mode. For this parameter to be used, P178 must be set to a value other than 0. IF P178 is set to 0, the Hz LED will be illuminated regardless of the value set in P177.
P178	Display Frequency Multiplier	0.00	0.00		650.00	• Allows frequency display to be scaled • P178 = 0.00: Scaling disabled • P178 > 0.00: Display = Actual Frequency X P178
			EXAMPLE If P178 = 29.17 and actual frequency = 60 Hz, then Drive displays 1750 (rpm)			
P179	Run Screen Display	0	0 {Parameter Number}		599	• 0 = Normal Run Screen, this display depends on mode of operation. Refer to section 4.2. • Other selections choose a diagnostic parameter to display (P501…P599). • Parameters P560 - P564 are selectable if the sequencer is enabled (P700 is not 0). P560-P564 are not visible until P700 is enabled.
P180	Oscillation Damping Control	0	0		80	0 = Damping disabled Compensation for resonances within drive
P181	Skip frequency 1	0.0	0.0	{Hz}	500	• Drive will not run in the defined skip range; used to skip over frequencies that cause mechanical vibration • P181 and P182 define the start of the skip ranges • P184 > 0 defines the bandwidth of both ranges.
P182	Skip frequency 2	0.0	0.0	{Hz}	500	
P184	Skip frequency bandwidth	0.0	0.0	{Hz}	10.0	
			NOTE Bandwidth (Hz) = f_s (Hz) + P184 (Hz) f_s = P181 or P182 EXAMPLE: P181 = 18 Hz and P184 = 4 Hz; skip range is from 18 to 22 Hz			
P185	Voltage Midpoint V/Hz characteristic	0	0.0	{V}	P165	Valid only when P300 = 0 or 2. Use with P187 to define midpoint on V/Hz curve.
P187 (2)	Frequency Midpoint V/Hz characteristic	0.0	0.0	{Hz}	P167	Valid only when P300 = 0 or 2. Use with P185 to define midpoint on V/Hz curve.
P189 (3)	Integrated Dynamic Brake		0 Disabled 1 Enabled			

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

(3) Parameter applicable to SMV models 40HP (30kW) and higher.

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 190	Motor Braking		0 Disabled 1 Braking with BUS threshold 2 Braking always on with deceleration 3 Braking with bus regulator 4 Special (Consult factory before using)	
P 191	Motor Brake Level	0	0 {%} 75 (flux braking disabled)	Active when P190 > 0 and drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. **NOTE:** Over usage of P190 can cause frequent 'overload' trips "F.PF" Not active for P300 = 5 (Torque mode)
P 192	Motor Braking Deceleration Reduction Level	0.0	0 P167 (base freq) Raising the value of P191 reduces the drive deceleration rate during flux braking.	Active when P190 > 0 and P192 > 0.0, Drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. **NOTE**: Usage of P192 can cause the drive to decelerate faster than settings in P105/P127. Not active for P300 = 5 (Torque mode)
P 194	Password	0	0000 9999	• Must enter password to access parameters • P194 = 0000: Disables password
P 197	Clear Fault History	0	0 No Action 1 Clear Fault History	
P 199	Program Selection		0 Operate from User settings	
			1 Operate from OEM settings	Refer to Notes 1, 2 and 3
			2 Reset to OEM default settings	Refer to Note 1
			3 Reset to 60 Hz default settings	• Refer to Note 4 • Parameters are reset to the defaults listed in this manual. • For P199=4, the following exceptions apply: - P103, P152, P161, P167 = 50.0 Hz - P304 = 50 Hz; - P305 = 1450 RPM - P107 = 0 (480 V drives only)
			4 Reset to 50 Hz default settings	
			5 Translate	Refer to Note 5
		⚠	**WARNING!** Modification of P199 can affect drive functionality! STOP and EXTERNAL FAULT circuitry may be disabled! Check P100 and P121...P124	
		ℹ	**NOTE 1** If the EPM does not contain valid OEM settings, a flashing CF will be displayed when P199 is set to 1 or 2. **NOTE 2** When P199 is set to 1, the drive operates from the OEM settings stored in the EPM Module and no other parameters can be changed (CE will be displayed if attempted). **NOTE 3** Auto Calibration is not possible when operating from OEM Settings. **NOTE 4** Reset 60 and Reset 50 will set the Assertion Level (P120) to "2" (High). P120 may need to be reset for the digital input devices being used. An F_AL fault may occur if P120 and the Assertion switch are not set identically. **NOTE 5** - on next page.	

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P199	Program Selection		**NOTE 5** If an EPM that contains data from a previous compatible software version is installed: • The drive will operate according to the previous data, but parameters cannot be changed (cE will be displayed if attempted) • To update the EPM to the current software version, set P199 = 5. The parameters can now be changed but the EPM is incompatible with previous software revisions.	

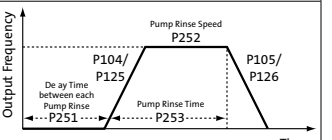
4.5.4 PID Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P200	PID Mode	0	0 Disabled 1 Normal-acting 2 Reverse-acting 3 Normal-acting, Bi-directional 4 Reverse-acting, Bi-directional	• Normal-acting: As feedback increases, motor speed decreases • Reverse-acting: As feedback increases, motor speed increases • PID mode is disabled in Vector Torque mode (P300 = 5) • Selections 3, 4: If P112=1, PID controller output sets the speed, (range -max freq to +max freq)
			NOTE To activate PID mode, one of the TB-13 inputs (P121...P124) must be used to select the Auto Reference that matches the desired PID setpoint reference. If the selected PID setpoint reference uses the same analog signal as the PID feedback (P201), an F_IL fault will occur. **Example:** The desired PID setpoint reference is the keypad (▲ and ▼). Set TB-13x = 6 (Auto Reference: Keypad): • TB-13x = closed: PID mode is active • TB-13x = open: PID mode is disabled and the drive speed will be controlled by the reference selected in P101.	
P201	PID Feedback Source	0	0 4-20 mA (TB-25) 1 0-10 VDC (TB-5) 2 Drive Load (P507) 3 Feedback from Network	Must be set to match the PID feedback signal
P202	PID Decimal Point	1	0 PID Display = XXXX 1 PID Display = XXX.X 2 PID Display = XX.XX 3 PID Display = X.XXX 4 PID Display = .XXXX	Applies to P204, P205, P214, P215, P231...P233, P242, P522, P523
P203 (2)	PID Units	0	0 % 1 /UNITS 2 AMPS 3 NONE	Select the UNITS LED that will be illuminated when the drive is running in PID control mode
P204	Feedback at Minimum Signal	0.0	-99.9 3100.0	Set to match the range of the feedback signal being used **Example:** Feedback signal is 0 - 300 PSI; P204 = 0.0, P205 = 300.0
P205	Feedback at Maximum Signal	100.0	-99.9 3100.0	

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P207	Proportional Gain	5.0	0.0	{%}	1000.0	Used to tune the PID loop: • Increase P207 until system becomes unstable, then decrease P207 by 10-15% • Next, increase P208 until feedback matches setpoint • If required, increase P209 to compensate for sudden changes in feedback
P208	Integral Gain	0.0	0.0	{s}	20.0	
P209	Derivative Gain	0.0	0.0	{s}	20.0	
			NOTE • Derivative Gain is very sensitive to noise on the feedback signal. Use with care. • Derivative Gain is not normally required in pump and fan applications			
P210	PID Setpoint Ramp	20.0	0.0	{s}	100.0	• time of setpoint change from P204 to P205 or vice versa. • Used to smooth the transition from one PID setpoint to another, such as when using the Preset PID Setpoints (P231...P233)
P214	Minimum Alarm	0.0	P204		P205	Use with P140, P142 = 18...23
P215	Maximum Alarm	0.0	P204		P205	
P231	Preset PID Setpoint #1	0.0	P204		P205	TB-13A activated; P121 = 3 and P200 = 1 or 2
P232	Preset PID Setpoint #2	0.0	P204		P205	TB-13B activated; P122 = 3 and P200 = 1 or 2
P233	Preset PID Setpoint #3	0.0	P204		P205	TB-13C activated; P123 = 3 and P200 = 1 or 2
P234(2)	Preset PID Setpoint #4	0.0	P204		P205	TB-13D activated; P124 = 3 and P200 = 1 or 2
P240	Sleep Threshold	0.0	0.0	{Hz}	500.0	• If drive speed < P240 for longer than P241, output frequency = 0.0 Hz; drive display = SLP • P240 = 0.0: Sleep mode is disabled. • P200 = 0…2: Drive will start again when speed command is above P240 • P242 > 0.0: Drive will restart when the PID feedback differs from the setpoint by more than the value of P242 **or** when the PID loop requires a speed above P240.
P241	Sleep Delay	30.0	0.0	{s}	300.0	
P242	Sleep Bandwidth	0.0	0.0 Where: B_{max} = |(P205 - P204)|		B_{max}	
P243	Feedback Sleep Entry Threshold	0.0	P204		P205	Active only when P244 = 1 or 2
P244	Sleep Entry Mode	0	0 Enter SLEEP if Drive Speed <P240			For time longer than P241
			1 Enter SLEEP if Feedback >P243			For time longer than P241 or same as Sel 0
			2 Enter SLEEP if Feedback <P243			For time longer than P241 or same as Sel 0
P245	Sleep Entry Stop Type	0	0 Coast to Stop			
			1 Ramp to Stop			
			2 Stop with P111 settings			
P246	Feedback Recovery from Sleep Threshold	0.0	P204		P205	Active only when P247 = 1 or 2
P247	Sleep Recovery Mode	0	0 Recovery if Speed Setpoint > P240 or if PID feedback differs from setpoint by more than P242			
			1 Recovery only if Feedback < P246			
			2 Recovery only if Feedback > P246			

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P250	Auto Rinse in Sleep Mode	0	0 Disabled 1 Enabled			Activated in sleep mode only. Sleep Recovery cancels Auto Rinse
P251	Time Delay between Auto Rinses	30.0	0.0	{min}	6553.5	Time delay reset by re/entering sleep mode
P252	Auto Rinse Speed	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign = reverse direction
P253	Auto Rinse Time	0.0	0.0	{sec}	6553.5	Does not include time to decel back to speed
			Auto Pump Rinse Setup: P250=1 (Enabled) P251=# minutes between each PumpRinse P252=Hz speed of Pump Rinse P253=# seconds Pump Rinse duration			

4.5.5 Vector Parameters

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P300 (1)	Drive Mode	0	0 Constant V/Hz			Constant torque V/Hz control for general applications
			1 Variable V/Hz			Variable torque V/Hz control for centrifugal pump and fan applications
			2 Enhanced Constant V/Hz			For single or multiple motor applications that require better performance than settings 0 or 1, but cannot use Vector mode, due to: • Missing required motor data • Vector mode causing unstable motor operation
			3 Enhanced Variable V/Hz			
			4 Vector Speed			For single-motor applications requiring higher starting torque and speed regulation
			5 Vector Torque			For single-motor applications requiring torque control independent of speed
			NOTE To configure the drive for either Vector mode or Enhanced V/Hz mode: • P300 = 4, 5: - Set P302...P306 according to motor nameplate - Set P399 = 1 or 2 (if option 1 failed or in case of non-standard motor) - Make sure motor is cold (20° - 25° C) and apply a Start command - Display will indicate CAL for about 40 seconds - Once the calibration is complete, the display will indicate StoP; apply another Start command to actually start the motor - If an attempt is made to start the drive in Vector or Enhanced V/Hz mode before performing the Motor Calibration, the drive will display Fault and will not operate • P300 = 2, 3: Same as above but only need to set P302…P304			
P302 (1)	Motor Rated Voltage		0	{V}	600	• Default setting = drive rating • Set to motor nameplate data
P303 (1)	Motor Rated Current		0.1	{A}	500.0	

(1) Any changes to this parameter will not take effect until the drive is stopped

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P304 (1)	Motor Rated Frequency	60	0	{Hz}	1000	Set to motor nameplate data
P305 (1)	Motor Rated Speed	1750	300	{RPM}	65000	
P306 (1)	Motor Cosine Phi	0.80	0.40		0.99	
			NOTE If motor cosine phi is not known, use one of the following formulas: cos phi = motor Watts / (motor efficiency X P302 X P303 X 1.732) cos phi = cos [sin ^{1} (magnetizing current / motor current)]			
P310 (1)	Motor Stator Resistance		0.00	{Ω}	64.00	• P310, 311 default setting depends on drive rating • Will be automatically programmed by P399 • Changing these settings can adversely affect performance. Contact factory technical support prior to changing
P311 (1)	Motor Stator Inductance		0.0	{mH}	2000	
P315	Dead Time Compensation Factor	0.0	-50.0	{%}	+50.0	• Adjust dead time correction from internal default • Takes effect when P399 = 3.
P330	Torque Limit	100	0	{%}	400	When P300 = 5, sets the maximum output torque.
P331	Preset Torque Setpoint #1	100	0	{%}	400	TB-13A activated; P121 = 3 and P300 = 5
P332	Preset Torque Setpoint #2	100	0	{%}	400	TB-13B activated; P122 = 3 and P300 = 5
P333	Preset Torque Setpoint #3	100	0	{%}	400	TB-13C activated; P123 = 3 and P300 = 5
P334 (2)	Preset Torque Setpoint #4	100	0	{%}	400	TB-13D activated; P124 = 3 and P300 = 5
P340 (1)	Current Loop P Gain	0.25	0.00		16.0	Changing these settings can adversely affect performance. Contact factory technical support prior to changing.
P341 (1)	Current Loop I Gain	65	12	{ms}	9990	
P342 (1)	Speed Loop Adjust	0.0	0.0	{%}	20.0	
P343	Slip Compensation Response Filter	99	90	{ms}	9999	Low pass filter time constant for varying the slip compensation response to changes in the motor current.
P399	Motor Auto-calibration	0	0 Calibration Not Done 1 Standard Calibration Enabled 2 Advanced Calibration Enabled 3 Bypass Calibration, enable operation in vector mode w/o Auto Calibration 4 Standard Calibration Complete 5 Advanced Calibration Complete			• If P300 = 4 or 5, motor calibration must be performed if P399 is not set to 3 (bypass calibration). • If P300=2 or 3, motor calibration is recommended. • Use option 2 if option 1 failed or in case of non-standard motors • An alternating CAL / Err will occur if: - attempt motor calibration with P300 = 0 or 1 - motor calibration is attempted before programming motor data
			NOTE: To run the Auto Calibration: – Set P302...P306 according to motor nameplate – Set P399 = 1 or 2 (if option 1 failed or in case of non-standard motor) – Make sure motor is cold (20° - 25° C) – Apply a Start command – Display will indicate CAL for about 40 seconds – Once the calibration is complete, the display will indicate StoP; apply another Start command to actually start the motor – Parameter P399 will now be set to 4 or 5.			

(1) Any changes to this parameter will not take effect until the drive is stopped

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

4.5.6 Network Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P400	Network Protocol		0 Not Active 1 Remote Keypad 2 Modbus RTU 3 CANopen 4 DeviceNet 5 Ethernet 6 Profibus 7 Lecom-B 8 I/O Module	This parameter setting is based upon the network or I/O module that is installed.
P401	Module Type Installed	0	0 No Module Installed 1 Basic I/O (0x0100, 1.0.0) 2 RS485/Rem. Keypad (0x0200, 2.0.0) 3 CANopen (0x0300, 3.0.0) 11 PROFIBUS (0x1100, 11.0.0) 12 Ethernet (0x1200, 12.0.0)	Module type format: 0xAABC; Drive Display: AA.B.C AA = Module Type B = Major revision C = minor revision
P402	Module Status	0	0 Not Initialized 1 Initialization: Module to EPM 2 Initialization: EPM to Module 3 Online 4 Failed Initialization Error 5 Time-out Error 6 Initialization Failed 7 Initialization Error	 Module type mismatch P401 Protocol selection mismatch P400
P403	Module Reset	0	0 No Action 1 Reset parameters to default values	Returns module parameters 401…499 to the default values shown in the manual
P404	Module Timeout Action	0	0 No Fault 1 STOP (see P111) 2 Quick Stop 3 Fault (F_ntF)	Action to be taken in the event of a Module/ Drive Time-out. Time is fixed at 200ms STOP is by the method selected in P111.
P405	Current Network Fault		0 No Fault 1 F.nF1 2 F.nF2 3 F.nF3 4 F.nF4 5 F.nF5 6 F.nF6 7 F.nF7	 NetIdle Mode Loss of Ethernet I/O connection Network Fault Explicit Message Timeout Overall Network Timeout Overall Explicit Timeout Overall I/O Message Timeout
P406	Proprietary			Manufacturer specific
P407 … P499		Module Specific Parameters		Refer to the Communications Reference Guide specific to the network or I/O module installed.

4.5.7 Diagnostic Parameters

Code		Display Range (READ ONLY)			IMPORTANT
No.	Name				
P500	Fault History				• Displays the last 8 faults • Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the **F.**) • Refer to section 5.3
P501	Software Version				Format: x.yz
P502	Drive ID				A flashing display indicates that the Drive ID stored in the EPM does not match the drive model it is plugged into.
P503	Internal Code				Alternating Display: xxx-; -yy
P505	DC Bus Voltage	0	{VDC}	1500	
P506	Motor Voltage	0	{VAC}	1000	
P507	Load	0	{%}	255	Motor load as % of drive's output current rating. Refer to section 2.3.
P508	Motor Current	0.0	{A}	1000	Actual motor current
P509	Torque	0	{%}	500	Torque as % of motor rated torque (vector mode only)
P510	Output Power kW	0.00	{kW}	650.0	
P511	Total kWh	0.0	{kWh}	9999999	Alternating display: xxx-; yyyy when value exceeds 9999
P512	Heatsink Temp	0	{°C}	150	Heatsink temperature
P520	0-10 VDC Input	0.0	{VDC}	10.0	Actual value of signal at TB-5
P521	4-20 mA Input	0.0	{mA}	20.0	Actual value of signal at TB-25
P522	TB-5 Feedback	P204		P205	TB-5 signal value scaled to PID feedback units
P523	TB-25 Feedback	P204		P205	TB-25 signal value scaled to PID feedback units
P524	Network Feedback	P204		P205	Network signal value scaled to PID feedback units
P525	Analog Output	0	{VDC}	10.0	Refer to P150…P155
P527	Actual Output Frequency	0	{Hz}	500.0	
P528	Network Speed Command	0	{Hz}	500.0	Command speed if (Auto: Network) is selected as the speed source
P530	Terminal and Protection Status				Indicates terminal status using segments of the LED display. (Refer to section 4.5.7.1)
P531	Keypad Status				Indicates keypad button status using segments of the LED display. (Refer to section 4.5.7.2)
P540	Total Run Time	0	{h}	9999999	Alternating display: xxx-; yyyy when value exceeds 9999
P541	Total Power On Time	0	{h}	9999999	
P550	Fault History	1		8	• Displays the last 8 faults • Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the **F.**) • Refer to section 5.3
P551	Fault History Time	0	{h}	999999	Display: "n.hh-" "hhhh" "mm.ss" = fault #, hours, seconds The "hhhh" screen is displayed after hours exceed 999.
P552	Fault History Counter	0		255	Number of sequential occurrences of a fault. For example: 3 external faults occur over a period of time with no other errors occurring. Then P552 will indicate 3, P550 will indicate the error EF and P551 will indicate the time of the first fault occurrence.

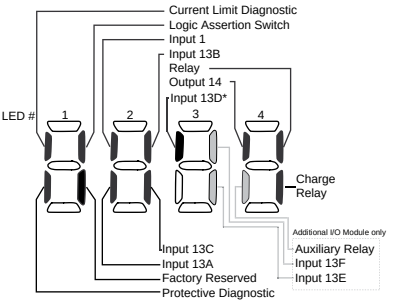
Code		Display Range (READ ONLY)			IMPORTANT
No.	Name				
P560	Sequencer: Currently Active Segment	0		17	
P561	Sequencer: Time since Start of Active Segment	0.0 0	{P708} {P708}	6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P562	Sequencer: Time Remaining in Active Segment	0.0 0	{P708} {P708}	6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P563	Sequencer: Number of cycles since start	0		65535	
P564	Sequencer: Number of cycles remaining	0		65535	
		NOTE: Parameters P560-P564 are visible only when P700 > 0 (i.e. the sequencer is enabled)			

4.5.7.1 Terminal & Protection Status Display

Parameter P530 allows monitoring of the control terminal points and common drive conditions:

An illuminated LED segment indicates:

- the protective circuit is active (LED 1)
- the Logic Assertion Switch is set to High (+)
- input terminal is asserted (LED 2)
- output terminal is energized (LED 4)
- the Charge Relay is not a terminal, this segment will be illuminated when the Charge Relay is energized (LED 4).



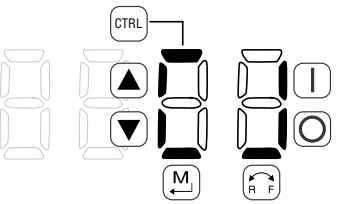
* Input 13D available on 15-30HP (11-22kW) models only

4.5.7.2 Keypad Status Display

Parameter P531 allows monitoring of the keypad pushbuttons:

An illuminated LED segment indicates when the button is depressed.

LED 1 and LED 2 are used to indicate pushbutton presses on a remote keypad that is attached to the drive. LED 3 and LED 4 indicate button presses on the local drive keypad.



4.5.8 Onboard Communications Parameters 15-60HP (11-45kW)

The P6xx Onboard Communication parameters are applicable to the 15HP (11kW) and higher models only.

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P600	Network Enable	0	0 Disabled 1 Remote Keypad 2 Modbus 7 Lecom	This parameter enables the onboard network communications.
			NOTE: Onboard Communications will be disabled if: - P600 = 0, or - P600 = 1 and P400 = 1, or - P600 = 2 and P400 = 2, 3, 4, 5, 6 or 7 - P600 = 7 and P400 = 2, 3, 4, 5, 6 or 7	If the onboard communications are disabled, the user will not have access to any of the other P6xx parameters.
P610	Network Address	1	1 - 247	Modbus
		1	1 - 99	Lecom
P611	Network Baud Rate	2	0 2400 bps 2 9600 bps 1 4800 bps 3 19200 bps	Modbus
		0	0 9600 bps 1 4800 bps 2 2400 bps 3 1200 bps 4 19200 bps	Lecom
P612	Network Data Format	0	0 8, N, 2 1 8, N, 1 2 8, E, 1 3 8, O, 1	Modbus Only
P620	Network Control Level	0	0 Monitor Only 1 Parameter Programming 2 Programming and Setpoint Control 3 Full Control	Lecom Only
P624	Network Powerup Start Status	0	0 Quick Stop 1 Controller Inhibit	Lecom Only
P625	Network Timeout	10.0	0.0 - 300.0 seconds	Modbus
		50	0 - 65000 milliseconds	Lecom
P626	Network Timeout Action	4	0 No action 1 Stop (P111) 2 Quick Stop 3 Controller Inhibit 4 Trip Fault, F.nF1	Modbus
		0	0 No action 1 Controller Inhibit 2 Quick Stop 3 Trip Fault, F.nF1	Lecom
P627	Network Messages Received		Read-Only: 0 - 9999	Valid network messages received
			NOTE: When the number of messages exceeds 9999, the counter resets and resumes counting from 0.	

4.5.9 Sequencer Parameters

The P700 Sequencer parameters are listed herein. Refer to section 4.5.7 for P56x Sequencer Diagnostic Parameters.

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P700	Sequencer Mode	0	0 Disabled 1 Enabled: transition on timer only 2 Enabled: transition on rising edge (P121, 122, 123 = 25 step sequence) 3 Enabled: transition on timer or rising edge			If P700 = 0 and no reference (P121, P101) points to any of the sequence segments, then P701-P799 will not be displayed on the local keypad.
P701	Sequencer: TB13A Trigger Segment	1	1 - 16 TB13A = lowest priority			Asserting TB13A with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P702	Sequencer: TB13B Trigger Segment	1	1 - 16 TB13B: higher priority than TB13A			Asserting TB13B with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P703	Sequencer: TB13C Trigger Segment	1	1 - 16 TB13C: higher priority thanTB13B, A			Asserting TB13C with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P704(2)	Sequencer: TB13D Trigger Segment	1	1 - 16 TB13D: higher priority than TB13C, B, A			Asserting TB13D with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P705	Sequencer: Action after Stop/Start transition or Fault Restart	0	0 Restart at beginning of sequence 1 Restart at beginning of current seg 2 Start at beginning of prior segment 3 Start at beginning of next segment			Pointed by TB13x
P707	Sequencer: Number of cycles	1	1		65535	1 = single scan; 65535 = continuous loop
P708	Sequencer: Time units/scaling	0	0 0.1	{sec}	6553.5	Setup units/scaling for all sequencer time related parameters
			1 1	{sec}	65535	
			2 1	{min}	65535	
			NOTE: P708 rescales the following sequencer related parameters: - Segment Times in current step: P712, P717, P722, P727, P732, P737, P742, P747, P752, P757, P762, P767, P772, P777, P782, P787, P792 - Sequence diagnostic/status: P561, P562			
	Segment #1					
P710	Segment #1 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P711	Segment #1 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P712	Segment #1 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P713	Segment #1 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P714	Segment #1 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
	Segment #2					
P7 15	Segment #2 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P7 16	Segment #2 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P7 17	Segment #2 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P7 18	Segment #2 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P7 19	Segment #2 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #3					
P720	Segment #3 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P72 1	Segment #3 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P722	Segment #3 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P723	Segment #3 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P724	Segment #3 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #4					
P725	Segment #4 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P726	Segment #4 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P727	Segment #4 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P728	Segment #4 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P729	Segment #4 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #5					
P730	Segment #5 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P73 1	Segment #5 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P732	Segment #5 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P733	Segment #5 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P734	Segment #5 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #6					
P735	Segment #6 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P736	Segment #6 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P737	Segment #6 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P738	Segment #6 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P739	Segment #6 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #7					
P740	Segment #7 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P741	Segment #7 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P742	Segment #7 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P743	Segment #7 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P744	Segment #7 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #8					
P745	Segment #8 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P746	Segment #8 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P747	Segment #8 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P748	Segment #8 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P749	Segment #8 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
	Segment #9					
P750	Segment #9 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P751	Segment #9 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P752	Segment #9 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P753	Segment #9 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P754	Segment #9 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #10					
P755	Segment #10 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P756	Segment #10 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P757	Segment #10 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P758	Segment #10 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P759	Segment #10 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #11					
P760	Segment #11 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P761	Segment #11 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P762	Segment #11 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P763	Segment #11 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P764	Segment #11 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #12					
P765	Segment #12 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P766	Segment #12 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P767	Segment #12 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0

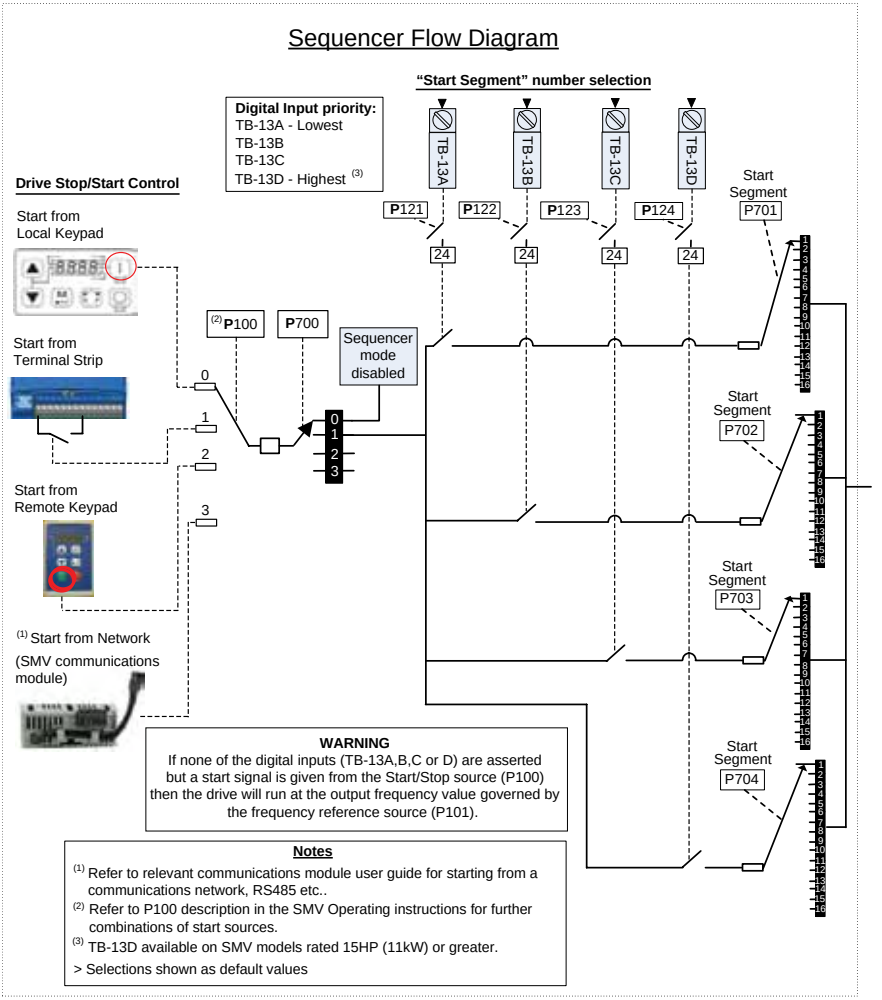
Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P168	Segment #12 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P169	Segment #12 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #13					
P170	Segment #13 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P171	Segment #13 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P172	Segment #13 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P173	Segment #13 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P174	Segment #13 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #14					
P175	Segment #14 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P176	Segment #14 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P177	Segment #14 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P178	Segment #14 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P179	Segment #14 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	Segment #15					
P180	Segment #15 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P181	Segment #15 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P182	Segment #15 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P183	Segment #15 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P184	Segment #15 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
	Segment #16					
P785	Segment #16 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P786	Segment #16 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P787	Segment #16 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P788	Segment #16 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P789	Segment #16 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
	End Segment					
P790	End Segment: Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction
P791	End Segment: Accel/Decel Time	5.0	0.0	{sec}	3600.0	
P792	End Segment: Delay before P793, 794 & 795 activation		0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708
P793	End Segment: Digital Output State		Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P794	End Segment: TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
P795	End Segment: Drive Action	0	0 Keep Running 1 Stop (based on P111) 2 Coast to Stop 3 Quick Stop 4 Coast with DC Brake 5 Ramp with DC Brake			Recovery: Toggling the START SEQUENCE will start the cycle from 'end segment Stop' or 'end segment DC Brake'.
		⚠	**WARNING!** If P795 = 0 then toggling the start sequence input will also restart the sequencer cycle but in the interim where TB13X is open the drive will ramp to the standard or specified alternate speed source depending on the drive configuration.			

⚠ **WARNING**

If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

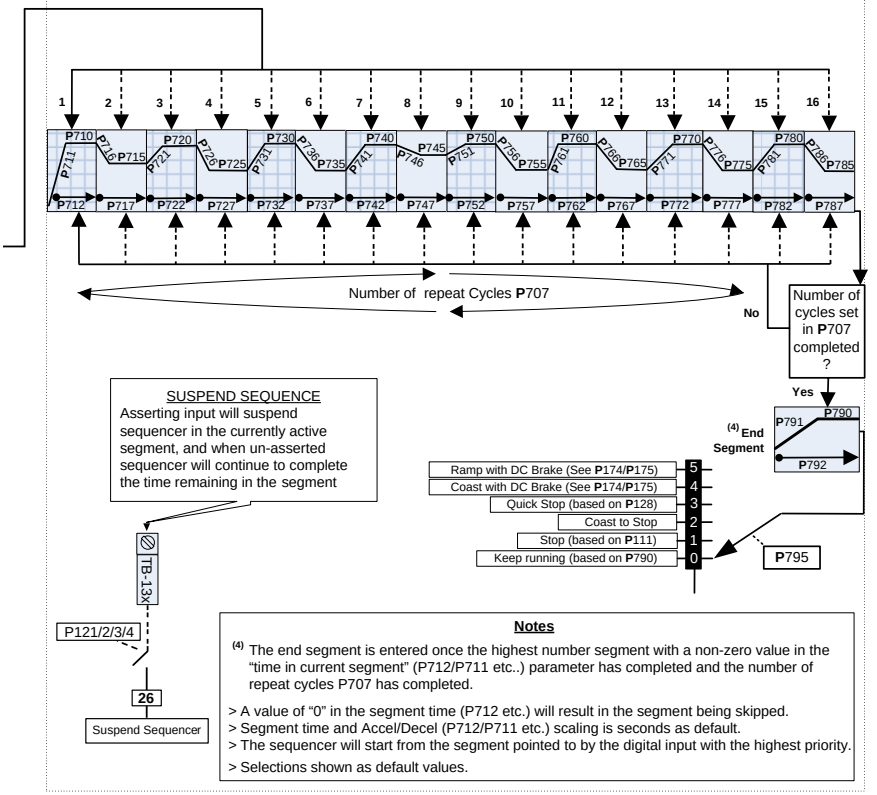
4.5.9.1 Sequencer Flow Diagram Left



WARNING
If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

4.5.9.2 Sequencer Flow Diagram Right

Action after Stop/Start (P100) transition/digital input (if setup for sequencer mode) transition or restart after trip.	
P706	**Action**
0	Restart at beginning of sequence (pointed by TB13x)
1	Restart at beginning of current segment
2	Start at beginning of prior segment
3	Start at beginning of next segment

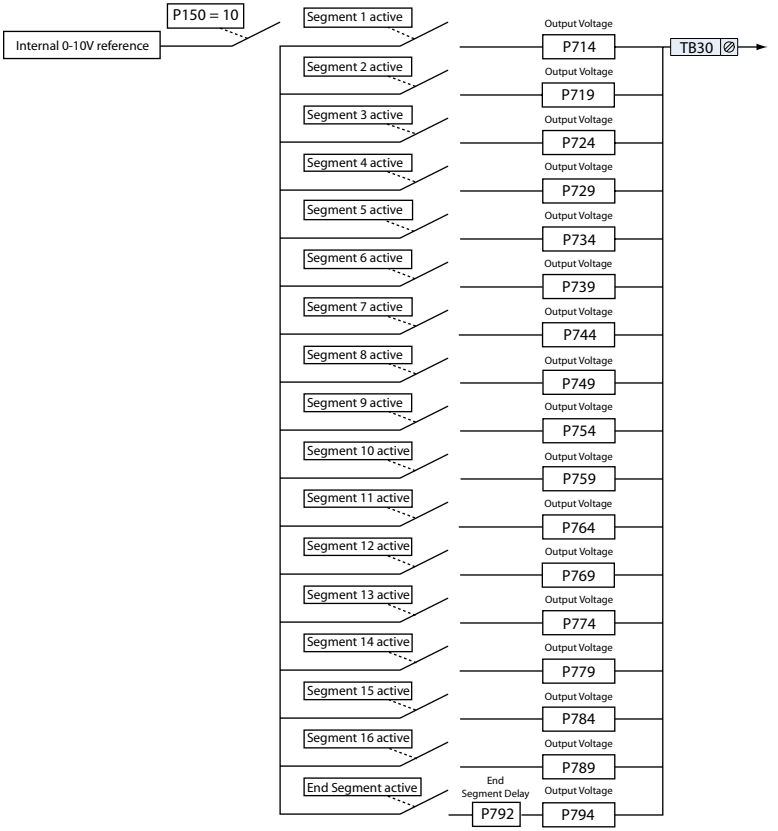


Notes

(4) The end segment is entered once the highest number segment with a non-zero value in the "time in current segment" (P712/P711 etc..) parameter has completed and the number of repeat cycles P707 has completed.

> A value of "0" in the segment time (P712 etc.) will result in the segment being skipped.
> Segment time and Accel/Decel (P712/P711 etc.) scaling is seconds as default.
> The sequencer will start from the segment pointed to by the digital input with the highest priority.
> Selections shown as default values.

4.5.9.3 Sequencer Status



NOTE

On the “End Segment”, the output voltage is not present until after the end segment delay P792 has expired. On the other segments the output voltage is present on entry to the segment. The same is true for the digital outputs.

5 Troubleshooting and Diagnostics

5.1 Status/Warning Messages

Status / Warning		Cause	Remedy
br	DC-injection brake active	DC-injection brake activated • activation of digital input (P121...P124 = 18) • automatically (P110 = 2, 4...6) • automatically (P111 = 1, 3)	Deactivate DC-injection brake • deactivate digital input • automatically after P175 time has expired
bF	Drive ID warning	The Drive ID (P502) stored on the EPM does not match the drive model.	• Verify motor data (P302…P306) and perform Auto Calibration. • Set drive mode (P300) to 0 or 1 • Reset the drive (P199 to 3 or 4) and reprogram.
CAL	Motor Auto-calibration active	Refer to P300, P399	Motor Auto-calibration is being performed
cE	An EPM that contains valid data from a previous software version has been installed	An attempt was made to change parameter settings	Parameter settings can only be changed after the EPM data is converted to the current version (P199 = 5)
CL	Current Limit (P171) reached	Motor overload	• Increase P171 • Verify drive/motor are proper size for application
dEC	Decel Override	The drive has stopped decelerating to avoid tripping into *HF* fault, due to excessive motor regen (2 sec max).	If drive trips into *HF* fault: • Increase P105, P126 • Install Dynamic Braking option
Err	Error	Invalid data was entered, or an invalid command was attempted	
FCL	Fast Current Limit	Overload	Verify drive/motor are proper size for application
FSt	Flying Restart Attempt after Fault	P110 = 5,6	
GE	OEM Settings Operation warning	An attempt was made to change parameter settings while the drive is operating in OEM Settings mode.	In OEM Settings mode (P199 = 1), making changes to parameters is not permitted.
GF	OEM Defaults data warning	An attempt was made to use (or reset to) the OEM default settings (P199 = 1 or 2) using an EPM without valid OEM data.	Install an EPM containing valid OEM Defaults data
LC	Fault Lockout	The drive attempted 5 restarts after a fault but all attempts were unsuccessful (P110 = 3...6)	• Drive requires manual reset • Check Fault History (P500) and correct fault condition
PdEC	PID Deceleration Status	PID setpoint has finished its ramp but the drive is still decelerating to a stop.	
PId	PID Mode Active	Drive has been put into PID Mode.	Refer to P200
SLP	Sleep Mode is active	Refer to P240...P242	
SP	Start Pending	The drive has tripped into a fault and will automatically restart (P110 = 3...6)	To disable Auto-Restart, set P110 = 0...2
SPd	PID Mode disabled.	Drive has been taken out of PID Mode. Refer to P200.	
StoP	Output frequency = 0 Hz (outputs U, V, W inhibited)	Stop has been commanded from the keypad, terminal strip, or network	Apply Start command (Start Control source depends on P100)

5.2 Drive Configuration Messages

When the Mode button is pressed and held, the drive's display will provide a 4-digit code that indicates how the drive is configured. If the drive is in a Stop state when this is done, the display will also indicate which control source commanded the drive to Stop (the two displays will alternate every second).

Configuration Display			
Format = x.y.zz	**x = Control Source:** L = Local Keypad t = Terminal Strip r = Remote Keypad n = Network	**y = Mode:** S = Speed mode P = PID mode t = Torque mode C = Sequencer mode	**zz = Reference:** CP = Keypad ▲ ▼ EU = 0-10 VDC (TB-5) E I = 4-20 mA (TB-25) JG = Jog nt = Network OP = MOP P 1 ... P7 = Preset 1...7 0 1 ... 16 = Sequencer Segment
	Example: • L_S_CP = Local Keypad Start control, Speed mode, Keypad speed reference • t_P_EU = Terminal Strip Start control, PID mode, 0-10 VDC setpoint reference • t_C_ 12 = Terminal Strip Start control, Sequencer Operation (Speed mode), Segment #12 • n_t_P2 = Network Start control, Vector Torque mode, Preset Torque #2 reference • n_S_03 = Network Start control, Speed mode, Speed reference from Sequencer segment #03		
Stop Source Display			
Format = x_StP	L_StP = Stop command came from Local Keypad t_StP = Stop command came from Terminal Strip r_StP = Stop command came from Remote Keypad n_StP = Stop command came from Network		

5.3 Fault Messages

The messages below show how they will appear on the display when the drive trips. When looking at the Fault History (P500), the F_ will not appear in the fault message.

Fault		Cause	Remedy (1)
F_AF	High Temperature fault	Drive is too hot inside	• Reduce drive load • Improve cooling
F_AL	Assertion Level fault	• Assertion Level switch is changed during operation • P120 is changed during operation • P100 or P121...P124 are set to a value other than 0 and P120 does not match the Assertion Level Switch.	• Make sure the Assertion Level switch and P120 are both set for the type of input devices being used, prior to setting P100 or P121... P124. Refer to 3.2.3 and P120.
F_bF	Personality fault	Drive Hardware	• Cycle Power • Power down and install EPM with valid data • Reset the drive back to defaults (P199 = 3, 4) and then re-program • If problem persists, contact factory technical support
F_CF	Control fault	An EPM has been installed that is either blank or corrupted	
F_cF	Incompatible EPM fault	An EPM has been installed that contains data from an incompatible parameter version	

(1) The drive can only be restarted if the error message has been reset.

Fault		Cause	Remedy [1]
F_dbF	Dynamic Braking fault	Dynamic braking resistors are overheating	• Increase active decel time (P105, P126, P127). • Check mains voltage and P107
F_EF	External fault	• P121…P124 = 21 and that digital input has been opened. • P121…P124 = 22 and that digital input has been closed.	• Correct the external fault condition • Make sure digital input is set properly for NC or NO circuit
F_F 1	EPM fault	EPM missing or defective	Power down and replace EPM
F_F2 … F_F 12	Internal faults		Contact factory technical support
F_Fnr	Control Configuration Fault	The drive is setup for REMOTE KEYPAD control (P100=2 or 5) but is not setup to communicate with a remote keypad	Set P400 = 1, or P600 = 1
		The drive is setup for NETWORK ONLY control (P100=3) but is not setup for network communications	Set P400 or P600 to a valid network communications protocol selection
F_FoL	Loss of 4-20 mA signal fault	4-20 mA signal (at TB-25) is below 2 mA (P163 = 1)	Check signal/signal wire
F_GF	OEM Defaults data fault	Drive is powered up with P199 =1 and OEM settings in the EPM are not valid.	Install an EPM containing valid OEM Defaults data or change P199 to 0.
F_HF	High DC Bus Voltage fault	Mains voltage is too high	Check mains voltage and P107
		Decel time is too short, or too much regen from motor	Increase active decel time (P105, P126, P127) or install Dynamic Braking option
F_ IL	Digital Input Configuration fault (P121... P124)	More than one digital input set for the same function	Each setting can only be used once (except settings 0 and 3)
		Only one digital input configured for MOP function (Up, Down)	One input must be set to MOP Up, another must be set to MOP Down
		PID mode is entered with setpoint reference and feedback source set to the same analog signal	Change PID setpoint reference (P121…P124) or feedback source (P201).
		One of the digital inputs (P121…P124) is set to 10 and another is set to 11…14.	Reconfigure digital inputs
		One of the digital inputs (P121…P124) is set to 11 or 12 and another is set to 13 or 14.	
		PID enabled in Vector Torque mode (P200 = 1 or 2 and P300 = 5)	PID cannot be used in Vector Torque mode
F_JF	Remote keypad fault	Remote keypad disconnected	Check remote keypad connections
F_LF	Low DC Bus Voltage fault	Mains voltage too low	Check mains voltage
F_n Id	No Motor ID fault	An attempt was made to start the drive in Vector or Enhanced V/Hz mode prior to performing the Motor Auto-calibration	See P300…P399 for Drive Mode setup and calibration.
F_nbF	Module communication fault	Communication failure between drive and Network Module.	Check module connections
F_nF 1 … F_nF9	Network Faults	Refer to the module documentation. for Causes and Remedies.	

(1) The drive can only be restarted if the error message has been reset.

Fault		Cause	Remedy [1]
F_0F	Output fault: Transistor fault	Output short circuit	Check motor/motor cable
		Acceleration time too short	Increase P104, P125
		Severe motor overload, due to: • Mechanical problem • Drive/motor too small for application	• Check machine / system • Verify drive/motor are proper size for application
		Boost values too high	Decrease P168, P169
		Excessive capacitive charging current of the motor cable	• Use shorter motor cables with lower charging current • Use low capacitance motor cables • Install reactor between motor and drive.
		Failed output transistor	Contact factory technical support
F_0F1	Output fault: Ground fault	Grounded motor phase	Check motor and motor cable
		Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current
F_PF	Motor Overload fault	Excessive motor load for too long	• Verify proper setting of P108 • Verify drive and motor are proper size for application
F_rF	Flying Restart fault	Controller was unable to synchronize with the motor during restart attempt; (P110 = 5 or 6)	Check motor / load
F_SF	Single-Phase fault	A mains phase has been lost	Check mains voltage
F_UF	Start fault	Start command was present when power was applied (P110 = 0 or 2).	• Must wait at least 2 seconds after power-up to apply Start command • Consider alternate starting method (P110).

(1) The drive can only be restarted if the error message has been reset.

Appendix A

A.1 Permissable Cable Lengths

The table herein lists the permissable cable lengths for use with an SMV inverter with an internal EMC filter.

NOTE
This table is intended as a reference guideline only; application results may vary. The values in this table are based on testing with commonly available low-capacitance shielded cable and commonly available AC induction motors. Testing is conducted at worst case speeds and loads.

Maximum Permissible Cable Lengths (Meters) for SMV Model with Internal EMC Filters									
Mains	**Model**	**4 kHz Carrier (P166 = 0)**		**6 kHz Carrier (P166 = 1)**		**8 kHz Carrier (P166 = 2)**		**10 kHz Carrier (P166 = 3)**	
		Class A	Class B	Class A	Class B	Class A	Class B	Class A	Class B
240 V, 1-phase (2/PE)	ESV251ⅆⅆ2SFⅆ	38	12	35	10	33	5	30	N/A
	ESV371ⅆⅆ2SFⅆ	38	12	35	10	33	5	30	N/A
	ESV751ⅆⅆ2SFⅆ	38	12	35	10	33	5	30	N/A
	ESV112ⅆⅆ2SFⅆ	38	12	35	10	33	5	30	N/A
	ESV152ⅆⅆ2SFⅆ	38	12	35	10	33	5	30	N/A
	ESV222ⅆⅆ2SFⅆ	38	12	35	10	33	5	30	N/A
400/480 V,3-phase (3/PE)	ESV371ⅆⅆ4TFⅆ	30	4	25	2	20	N/A	10	N/A
	ESV751ⅆⅆ4TFⅆ	30	4	25	2	20	N/A	10	N/A
	ESV112ⅆⅆ4TFⅆ	30	4	25	2	20	N/A	10	N/A
	ESV152ⅆⅆ4TFⅆ	30	4	25	2	20	N/A	10	N/A
	ESV222ⅆⅆ4TFⅆ	30	4	25	2	20	N/A	10	N/A
	ESV302ⅆⅆ4TFⅆ	30	4	25	2	20	N/A	10	N/A
	ESV402ⅆⅆ4TFⅆ	54	5	48	3	42	2	N/A	N/A
	ESV552ⅆⅆ4TFⅆ	54	5	48	3	42	2	N/A	N/A
	ESV752ⅆⅆ4TFⅆ	54	5	48	3	42	2	N/A	N/A

NOTE: The "ⅆⅆ" and "ⅆ" symbols are place holders in the Model part number that contain different information depending on the specific configuration of the model. Refer to the SMV Type Number Designation table in section 2.2 for more information.

APPENDIX D: EOS INPUT/OUTPUT LIST

NES JOB NAME: EAR / FARMINGDALE PLAZA CLEANERS (FARMINGDALE,NY)

NES JOB NUMBER: 11-177 DATE:7/25/11

PROCONTROL INPUT/OUTPUT LIST (TYPE B1)

	6 CHAR	**DIGITAL INPUTS (12)**				
NO.	**LABEL**	**DESCRIPTION**	**TYPE**	**NOTES**		
1	**RESET**	RESET BUTTON ON PANEL DOOR	DIGITAL	RESETS ALARMS,STARTS PUMP		
2	**MSLO**	MOISTURE SEP. LOW LEVEL		STOPS M/S EFFL. PUMP		
3	**MSEHI**	MOISTURE SEP. HIGH LEVEL		M/S HIGH LEVEL ALARM		
4	**SVETMR**	SVE TIMER		TIME OF DAY OPER. OF SVE		
5	**VFDFLT**	SVE VFD FAULT		VFD FAULT OCCURRED		
6	**VFDRUN**	SVE VFD RUNNING		SVE IS RUNNING		
7	**ESTOP**	EMERGENCY STOP ACTIVE		EMERGENCY STOP PRESSED		
8		SPARE				
9		SPARE				
10		SPARE				
11		SPARE				
12		SPARE				
		TERM. 13-16 NOT USED ON CONN.			**MN**	**MX**
		ANALOG INPUTS (8)			4mA	20mA
17	**FT101**	SVE INLET FLOW	4-20mA	ALLOWS INLET FLOW DISPLAY	0	TBD
18	**VT101**	SVE INLET VACUUM	4-20mA	ALLOWS VACUUM DISPLAY,WARN.	0	TBD
19	**FT102**	SVE DISCHARGE FLOW	4-20mA	ALLOWS DISCH. FLOW DISPLAY	0	TBD
20	**TT101**	SVE DISCHARGE TEMPERATURE	4-20mA	ALLOWS DISCH. TEMP. DISPLAY	0	TBD
21	**VFDHZ**	VFD OPERATING FREQUENCY	4-20mA	ALLOWS VFD OP. FREQ. DISPLAY	0	60
22		SPARE	4-20mA			
23		SPARE	4-20mA			
24		SPARE	4-20mA			
		DIGITAL OUTPUTS (14)				
33	**SVEBLR**	SVE BLOWER (VIA VFD)		CONTROLS SVE BLOWER		
34	**MSEPMP**	M/S EFFLUNT PUMP		CONTROLS M/S EFFLUENT PUMP		
35	**MSHLA**	MOISTURE SEP. HIGH LEVEL ALARM		STOPS SVE BLOWER		
36	**LOVACA**	LOW VACUUM WARNING		PROVIDES WARNING		
37	**HITMPA**	HIGH (DISCHARGE) TEMP. ALARM		STOPS SVE BLOWER		
38	**VFDFTA**	VFD FAULT ALARM		STOPS SVE BLOWER		
39		SPARE				
40	**ADCH1**	AUTODIALER CHANNEL1		INITIATES M/S HIGH LEVEL DIALOUT		
41	**ADCH2**	AUTODIALER CHANNEL2		INITIATES HIGH TEMPERATURE DIALOUT		
42	**ADCH3**	AUTODIALER CHANNEL3		INITIATES VFD FAULT DIALOUT		
43	**ADCH4**	AUTODIALER CHANNEL4		INITIATES LOW VACUUM DIALOUT		
44		SPARE				
45		SPARE				
46		SPARE				

	AUTODIALER INPUT ALLOCATION (SENSAPHONE 400)
CH	**DESCRIPTION**
1	M/S HIGH LEVEL ALARM
2	HIGH TEMPERATURE ALARM
3	VFD FAULT ALARM
4	LOW VACUUM WARNING

AUTODIALER OUTPUT NOT USED

NOTE: LIST IS PRELIMINARY

APPENDIX E: SVE COMPONENTS – PRODUCT DATA

MOISTURE SEPARATOR

GENERAL THEORY

The moisture separator removes liquids from the process stream in soil venting applications to help protect the blower from corrosion and mineral deposits caused by water.

DESIGN INFORMATION

NES moisture separators operate on the principles of cyclonic section aided by velocity reduction. The moisture separator inlet pipe is set tangential to the tank wall, a stringer pipe extends down past the separator inlet is placed in the center of the tank. The moisture laden air stream is forced into a cyclonic rotation. The centrifugal force produced throws the water droplets to the outer wall of the separator where they fall and collect at the bottom. Additional efficiency is produced when the velocity is reduced to values between 1500 fpm and 6000 fpm. For a separator of this type, moisture separation efficiency is typically 95% or greater for moisture droplets greater than 10 micron.

CONSTRUCTION

NES moisture separators are constructed of carbon steel with bronze drain valves, removable lid with EPDM gasket, mechanical ball and float assembly standard for drum style separators. Sight glass, emergency high-level switch and pump out switches are optional. Tank style separators are standard with carbon steel construction, bronze drain valves, flanged clean-out port, sight glass and emergency high level switch. Pump-out switches and mist eliminator are optional. All separators are primed and coated with a rust inhibitor to prevent corrosion.

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DRUM STYLE SEPARATOR

TANK STYLE SEPARATOR

NORMAL SERIES OF OPERATION FOR MOISTURE SEPARATOR LEVEL SWITCHES

1. Water level rises and actuates low level switch (wired normally open).
2. Switch closes and sends signal to controller.
3. Water level continues to rise and actuates high level switch (wired normally open).
4. Switch closes and sends signal to controller to activate moisture sepaator transfer pump.
5. Water level drops when pump activates.
6. De-energizes high switch.
7. Continues to drop.
8. De-energizes low switch.
9. Controller calls off pump.
10. Series repeats.

ACTIVATION OF EMERGENCY HIGH LEVEL SWITCH

1. Water level rises and actuates low level switch (wired normally open).
2. Switch closes and sends signal to controller.
3. Water level continues to rise and actuates high level switch (wired normally open).
4. Switch closes and sends signal to controller to activate moisture separator transfer pump.
5. Problem with pump, level switch or down stream process, water level does not drop.
6. Water level rises until emergency high switch (wired normally closed) is actuated.
7. Appropriate process equipment is de-energized (i.e. pump, SVE blower)

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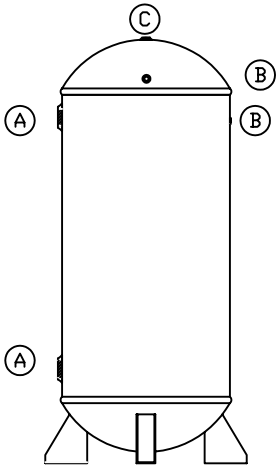
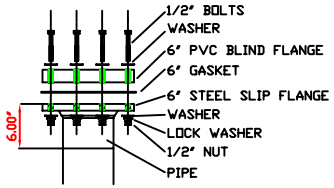
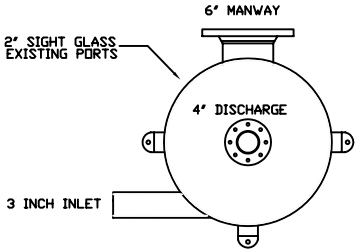
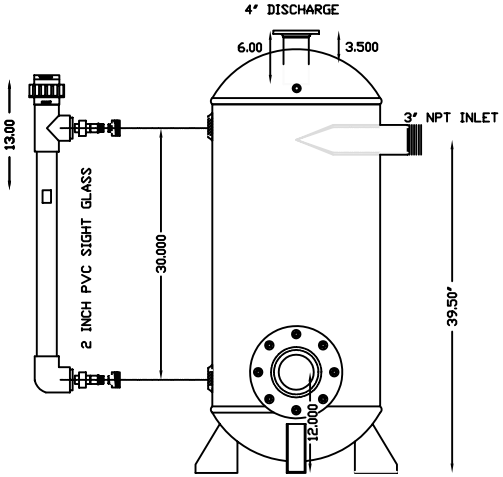
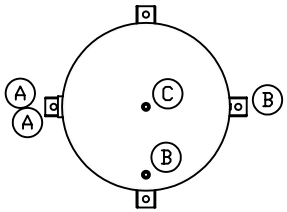
REVISIONS			
REV	DESCRIPTION	DATE	APPR











					LIQUID CAPACITY GALLONS +/-			
					LOW	HIGH	E HIGH	PUMP-OUT
					XX GLN	XX GLN	XX GLN	XX

					OPENINGS (NPT) IN INCHES						
P/N	PSI	GALLON	DIA	HEIGHT	A	B	C				
A10043	200	60	20	49	2.00"	0.25"	0.75"				

DRWN BY	DATE
CJJ	07-12-11
CHK BY	DATE
APPR BY	DATE

NES™
NATIONAL ENVIRONMENTAL SYSTEMS
84 Dunham Street – Attleboro, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)

TITLE: Moisture Separator
60 Gallon

Environmental Assessment & Remediations
NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners

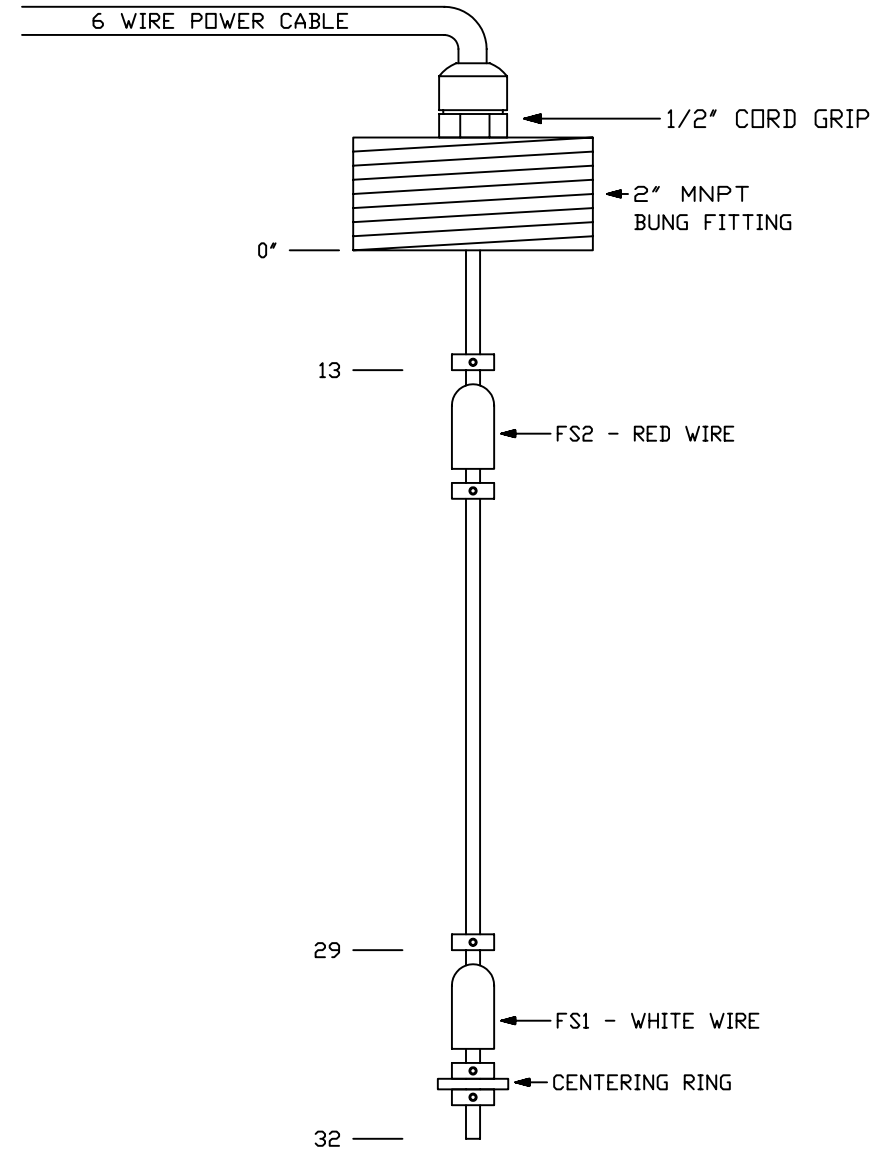
JOB NO.	SCALE	SIZE	DWG NO.	SHEET	REV
11-177	1"=10"	C	11-177-L2	1 OF 2	

REVISIONS			
REV 1	ADDED LOW LEVEL FLOAT	7-25-11	CJJ

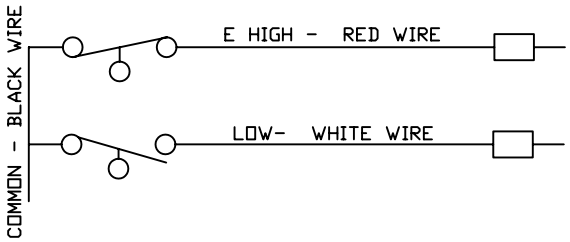
P500-010

CABLE LENGTH

10 FEET



BRASS CONSTRUCTION
WITH BUNA-N FLOATS



NES™ NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

DRWN BY CJJ DATE 10-25-10	TITLE MOISTURE SEPARATOR 1-POSITION FLOAT SWITCH					
CHK BY DATE	Environmental Assessment & Remediations NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners			JOB NO. 11-177		
APPR BY DATE	SCALE N/A	SIZE A	DWG NO. 11-177-L2-R1	SHEET 2 OF 2	REV. 1	

3 FLOAT SIGHT GLASS PROBE
NES P-500

Description:
The 3 float sight glass probe is designed to work in conjunction with a National Environmental Systems control panel to control the liquid level in a tank or sump. The brass float guide and buna floats provide long-term trouble free use and durability against corrosion. The probe is assembled with a standard length cable and a nipple (1/2" mnpt) for electrical junction box attachment.

Operation:
Each probe has three floats positioned with the brass collars at varying lengths from one to another. The top float is referred to as the "e-high", the middle is referred to as "high", and the bottom is referred to as "low", (in some custom applications an additional 1 or 2 floats can be added). The float is constructed to have a specific gravity less then water so it will float in water. As the float (with internal magnet) rises and falls within the stop collars, it opens and closes a small reed switch (electrical contacts) located within the stainless steel float guide. A typical arrangement has the lower float turning a discharge pump off, middle float turning a discharge pump on, and the top float signaling an alarm and turning a feed pump off.
Note: In some cases, if there is product within a tank (such as gasoline) it may not actuate the float because it has lower specific gravity than water.

Installation:
The probe should be installed within a sight glass or tank manufactured by National Environmental Systems. A junction box should also be provided within close proximity to the probe to allow it to be removed easily for repair or maintenance.

Maintenance:
Periodic inspection, cleaning, and testing are recommended to be performed at least once a week after the initial deployment of the probe. This schedule can be adjusted to more or less in frequency, depending upon site conditions.

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To clean the probe assembly, power to the control panel should be disconnected. The probe should be removed from the sight glass or tank, and all components cleaned with any type of cleaner compatible with the materials of construction (stainless steel and buna). Great care should be taken not to move the float collars, **they are not readily field adjustable. However collars can be repositioned if instructed properly by NES technical support staff.**

Test Procedures:

1. Disconnect probe wires from the nearest junction box, remove the probe from the sight glass, and move all the floats to the lowest point within the collars.
2. Connect an ohm meter to the red and black leads of the probe, meter should read approximately 0 to 1 ohm (switch closed).
3. Submerge the probe in the water, or manually move the e-high float to the highest point within the collars, the meter should now read infinite ohms or OL on some digital meters (switch open).
4. Connect the ohm meter to the green and black leads of the probe, meter should read infinity (switch open)..
5. Submerge the probe in water, or manually move the high float to the highest point within the collars, the meter should read approximately 0 to 1 ohm (switch closed).
6. Connect the ohm meter to the white and black leads of the probe, meter should read infinity (switch open).
7. Submerge the probe in water, or manually move the low float to the highest point within the collars, the meter should read approximately 0 to 1 ohm (switch closed).

Contact NES if your level sensor needs adjustment or replacement.

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ITT

Commercial Water

Goulds Pumps

G&L Series NPE

316L SS

NPE Series End Suction Centrifugal Pumps

Bombas Centrífugas de Succión Final Serie NPE

GOULDS PUMPS

Goulds Pumps is a brand of ITT Residential and Commercial Water.

Goulds Pumps es una marca de fábrica de ITT Agua Residencial y Comercial.

www.goulds.com

Engineered for life

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.

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.*

Model: 1ST1C5E4

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.

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*
[redacted]	Carbon	Silicon Carbide	[redacted]	316 SS	[redacted]
4			Viton		10K55
[redacted]	Silicon Carbide		[redacted]		[redacted]
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
[redacted]	[redacted]	[redacted]	[redacted]
E	4 7/16	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
[redacted]
5 = 3 PH, TEFC
[redacted]
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC
[redacted]

HP Rating, *HP Potencia*
C = ½ HP
[redacted]

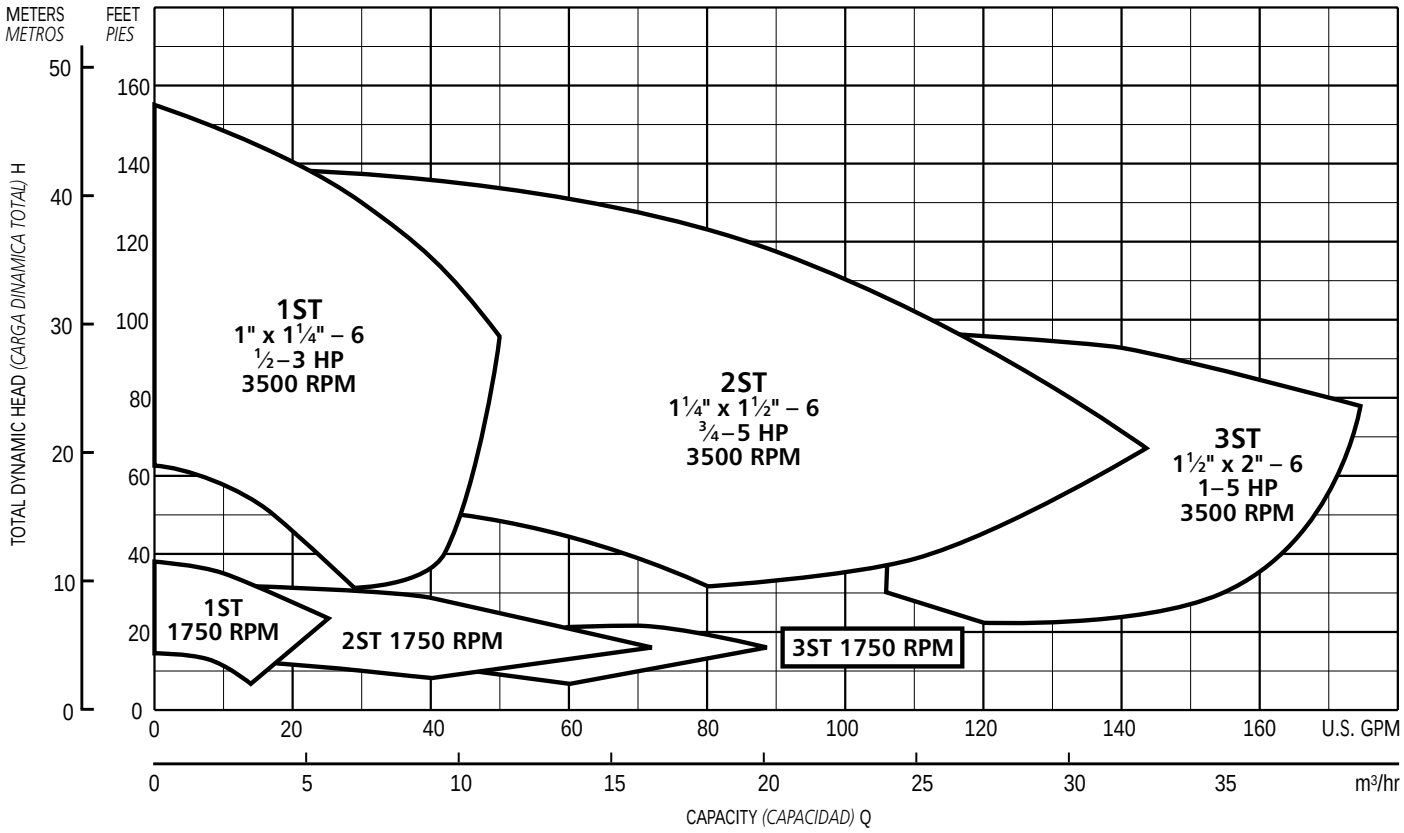
Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
[redacted]
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

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
[redacted]

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, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds check available service factor.

NOTAS:

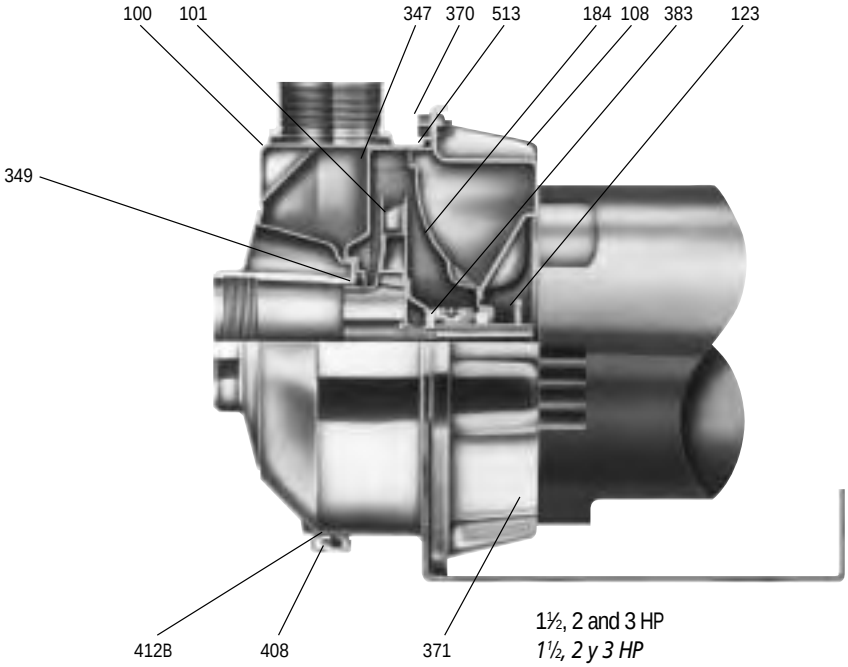
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

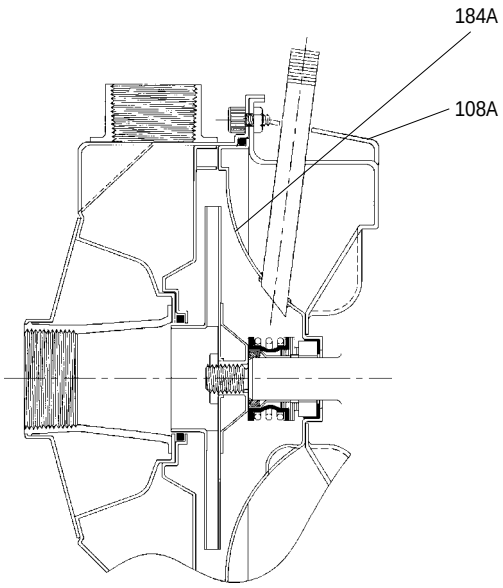
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds 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.

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

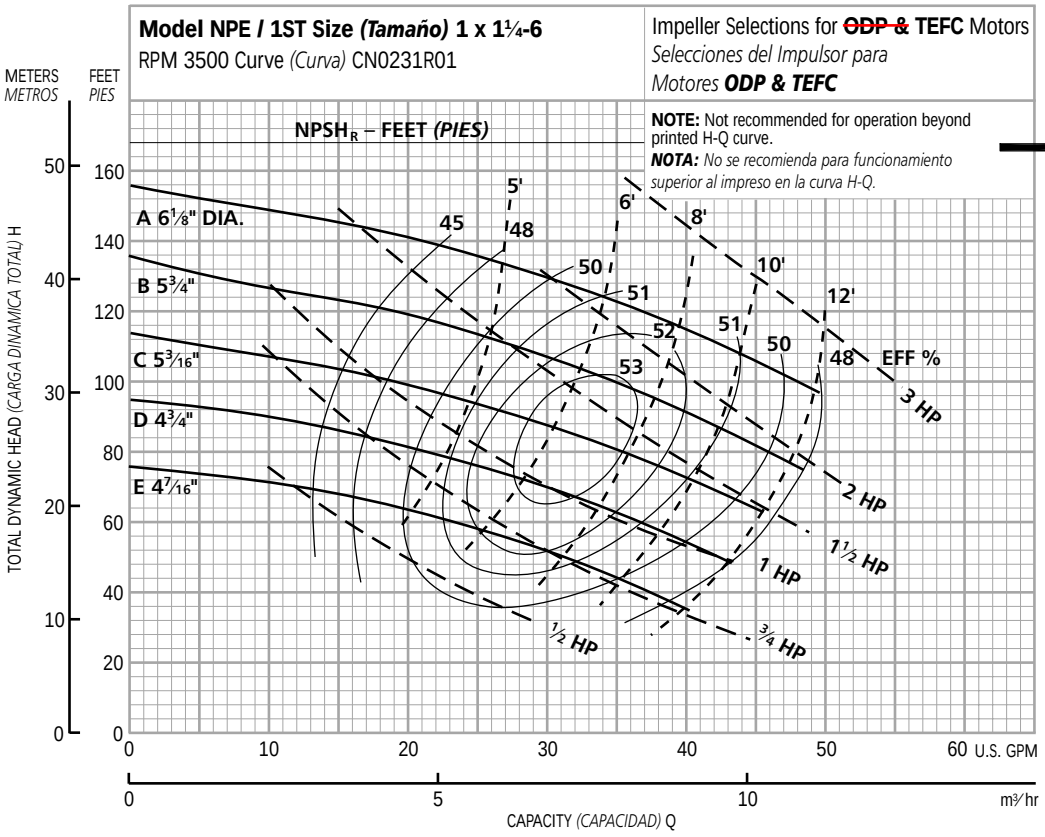
Item No., ***Parte No.***	**Description,** ***Descripción***	**Materials,** ***Materiales***
100	Casing, *Carcasa*	AISI 316L SS, *AISI 316L Acero inoxidable*
101	Impeller, *Impulsor*	
108	Motor adapter, *Adaptador del motor*	
108A	Motor adapter seal vent/flush, *Sello válvula/chorro del adaptador del 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
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 1750 RPM and 5 HP ODP and TEFC, all explosion proof see page 13.

Motor con pie para 1750 RPM, 5 HP ODP y TEFC, a prueba de explosiones en la página 13.

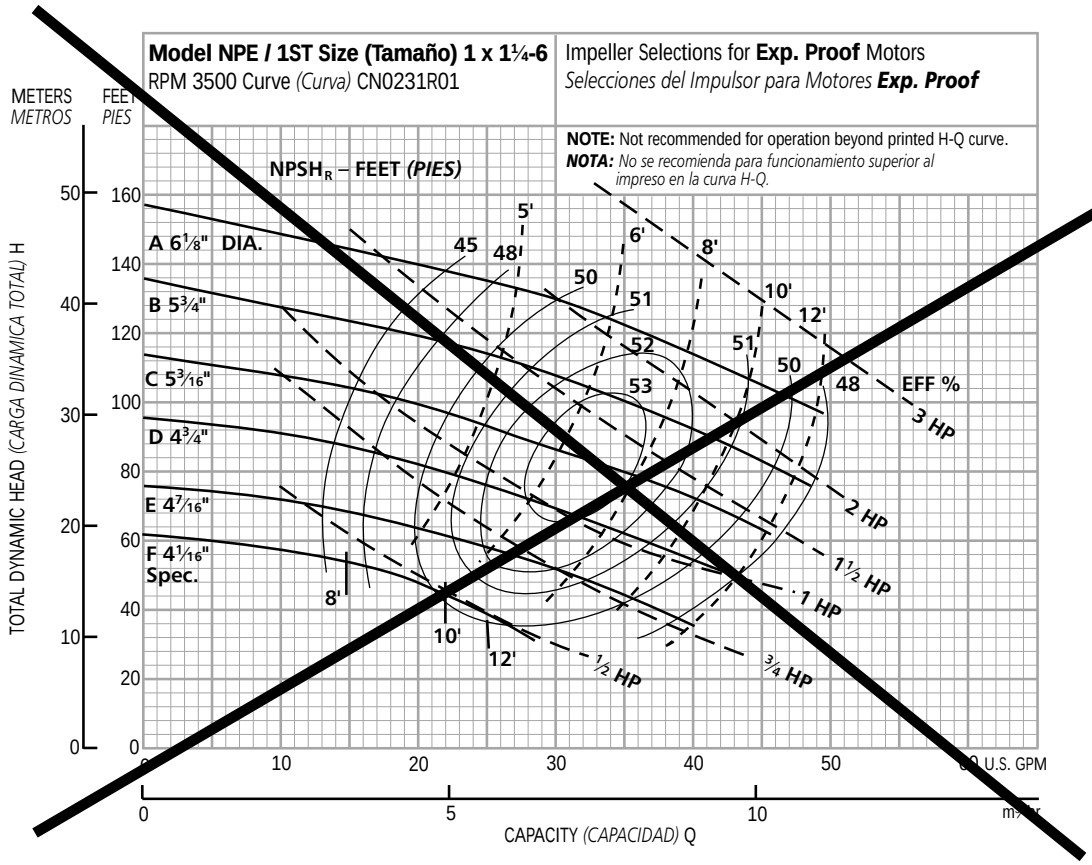
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5³⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ⅛" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ⅛".*



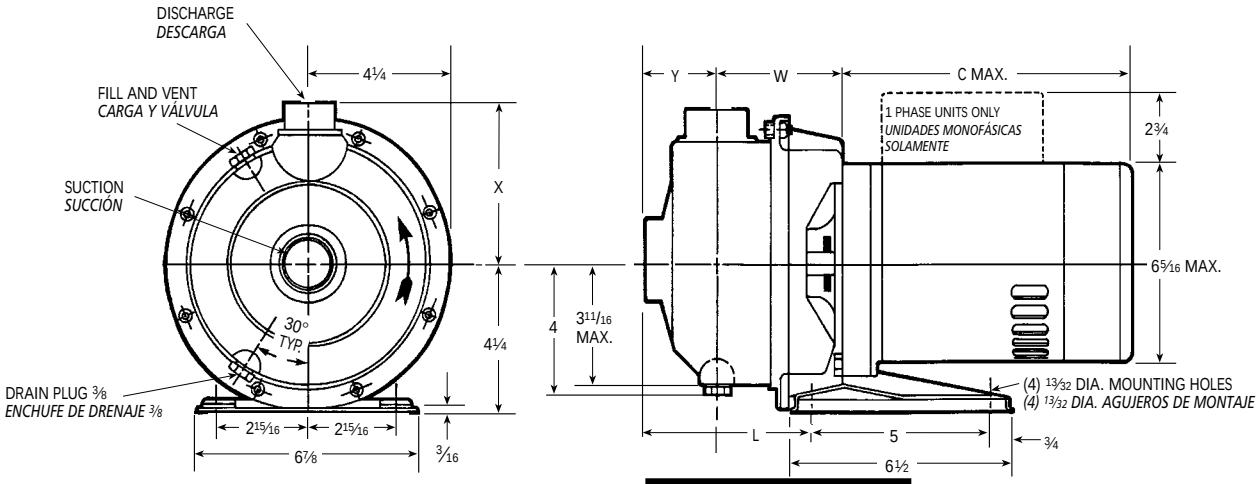
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄₁₆" spec.
E	¾	4⁷⁄₁₆
D	1	4¾
C	1½	5³⁄₁₆
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a ⅛" sphere.

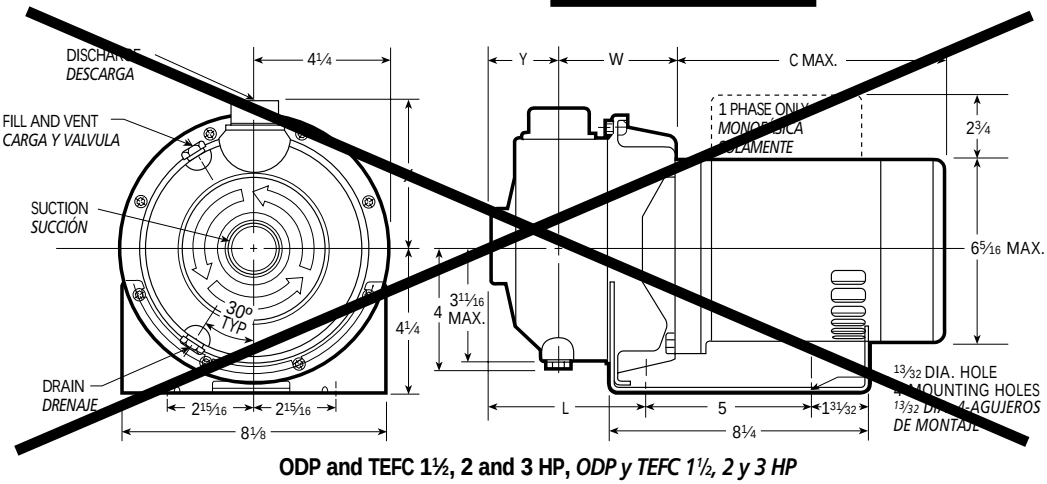
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ⅛".*

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, [redacted]



ODP and TEFC 1½, 2 and 3 HP, ***ODP y TEFC 1½, 2 y 3 HP***

Specifications
Especificaciones

Capacities to:
75 GPM (283L/min) at 1750 RPM
150 GPM (550L/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:
212°F (100°C) with standard seal or 250°F (121°C) with optional high temperature seal.

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 2 HP explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 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:
75 GPM (283L/min) a 1750 RPM
150 GPM (550L/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:
212°F (100°C) con sello estándar o 250°F (121°C) con sello opcional para alta temperatura.

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 de 2 HP. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 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.*

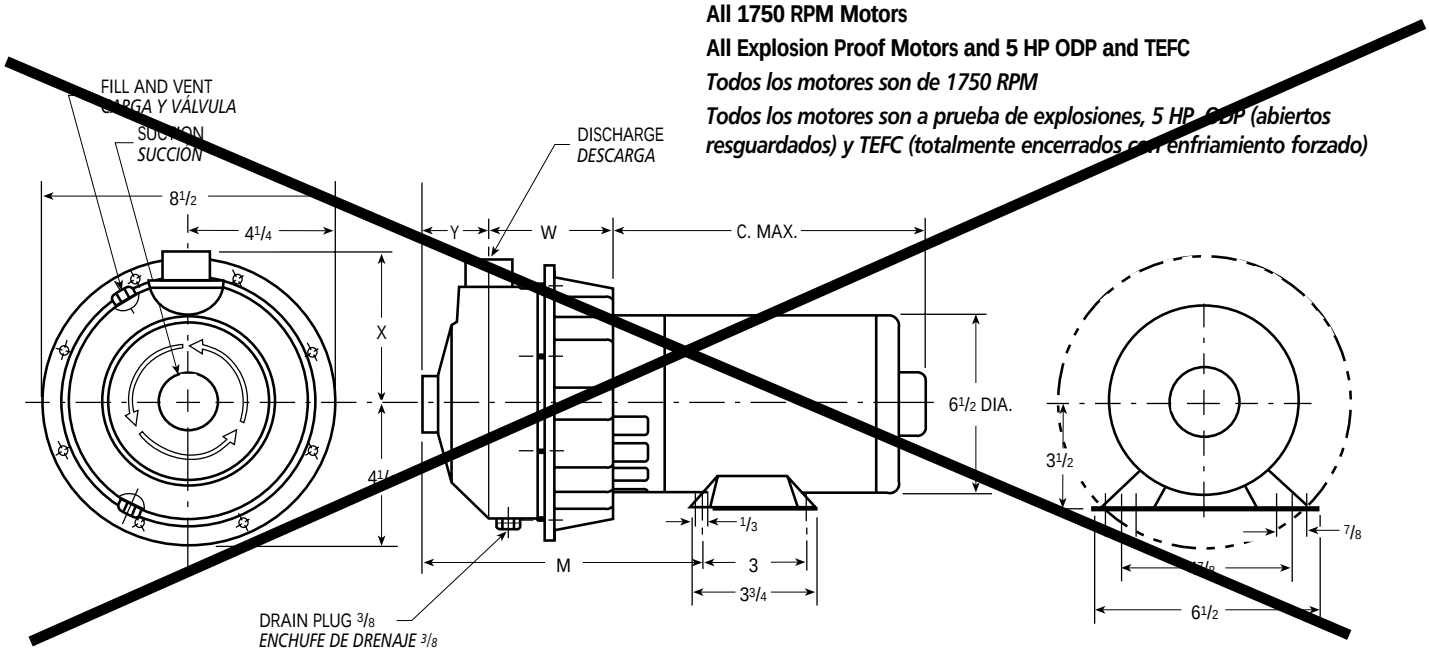
NPE Close Coupled with Footed Motor, 1750 RPM and Explosion-proof Motors
NPE Acople Cerrado con Motor con Patas, 1750 RPM y Motores a Prueba de Explosión

All 1750 RPM Motors

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son de 1750 RPM

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

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	[illegible]	[illegible]	[illegible]	[illegible]	18	[illegible]	9 15/16
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	22	26	49	23	21	30	11
1½	28	35	56	27	27	37	11 5/16
2	33	39	60	32	33	44	12 1/16
3	40	43	—	41	37	—	12 7/16
5	42	—	—	42	45	—	14¼

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.

ITT

Commercial Water

Goulds Pumps

G&L SERIES

MODEL NPE/NPE-F

Installation, Operation and
Maintainence Instructions

GOULDS PUMPS

Goulds Pumps is a brand of ITT Water Technology, Inc.
- a subsidiary of ITT Industries, Inc.

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:	212° F (100° C) with standard seal 250° F (120° C) with optional high temp seal
Pressure:	75 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 Figure1.

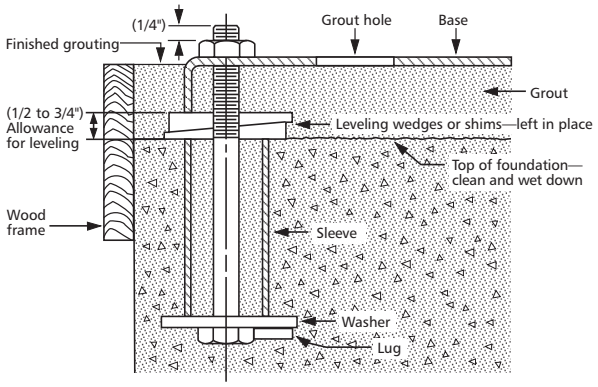


Figure 1

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.

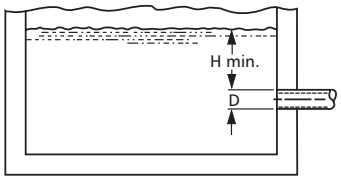


Figure 2

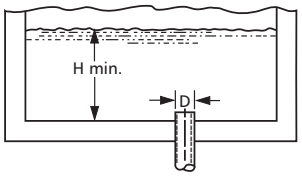


Figure 3

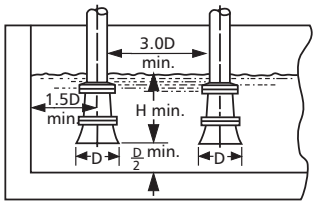


Figure 4

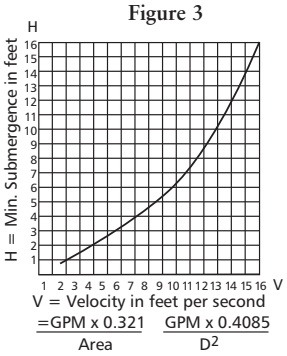


Figure 5

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.

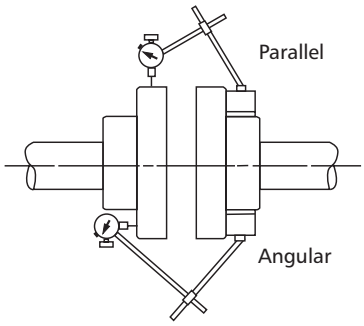


Figure 6

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

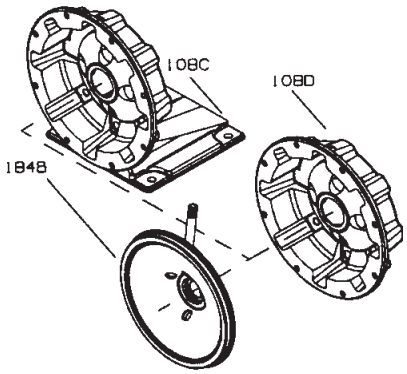
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	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

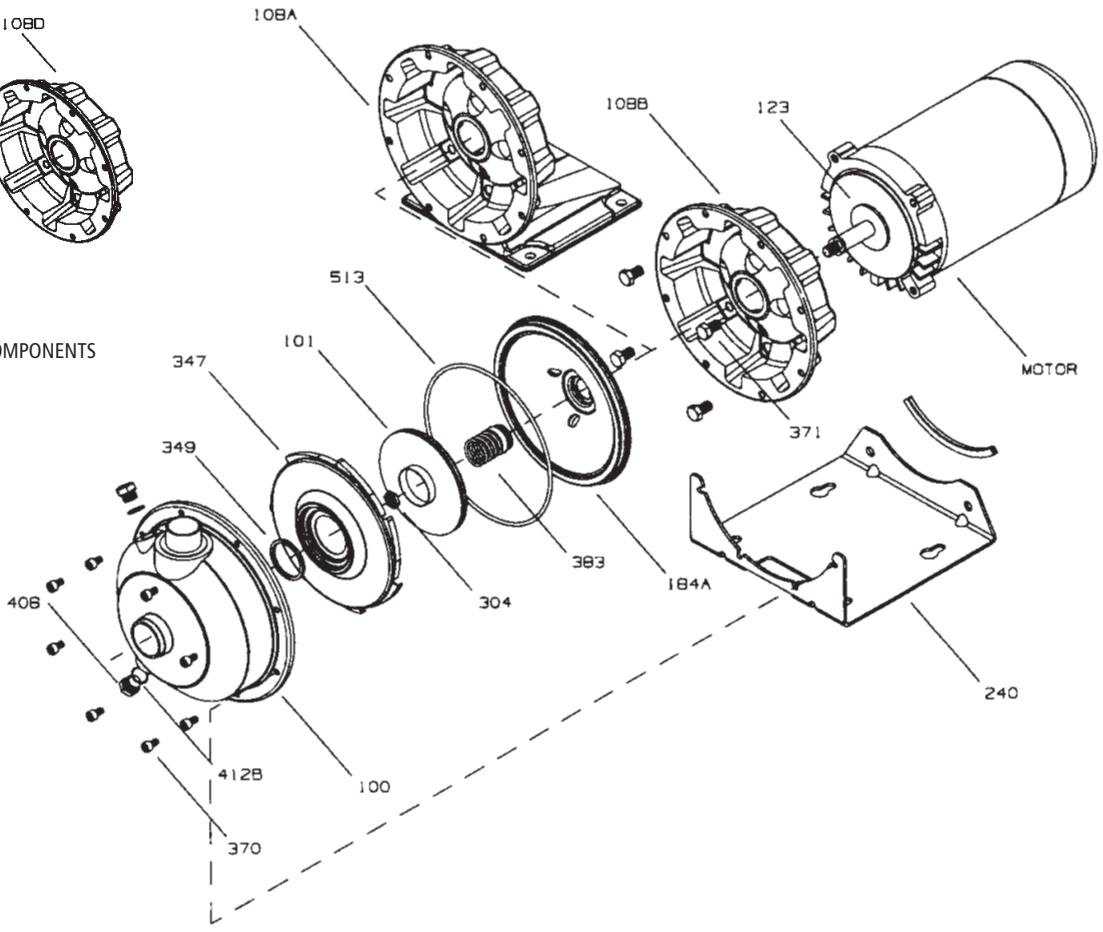
Item 383 Mechanical Seal (⅜" seal)				
Rotary	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

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



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

IM013R07 February, 2006

Engineered for life

GOULDS PUMPS

Repair Parts

MODEL

G&L Series NPE/NPE-F

Goulds Pumps

ITT Industries

Effective June, 2005
RNPE

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NPE END SUCTION

NOTE:
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS.

(3) Mechanical Seal upgrades as noted on page 1.

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F

SEAL VENT/FLUSH OPTION

MECHANICAL SEAL and O-RING

4 = Pre-Engineered Standard

For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (⅝" seal)						
Seal Code	**Rotary**	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**	**Casing O-Ring**
2	Carbon	Sil-Carbide	EPR	316 SS	10K18*	EPR
4			Viton		10K55***	Viton
5	Sil-Carbide		EPR		10K81	EPR
6			Viton		10K62**	Viton

Note: *Replaces obsolete 10K56 **Replaces obsolete 10K29 ***Replaces obsolete 10K46 and 10K24

Impeller Option Code . . . No Adder Required

For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.

Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	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	

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

For critical application conditions, consult factory.

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

Note: Impeller diameter is measured at the vane. The overall diameter of the shroud may be greater.

DRIVER

1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

HP RATING

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

DRIVER: HERTZ/POLE/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

MATERIAL

ST = Stainless Steel

PUMP SIZE

1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

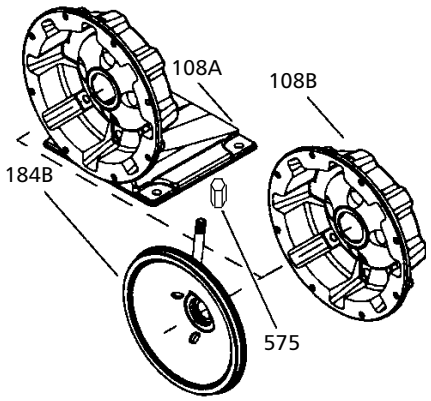
For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QTY.
100	Casing	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller		See Impeller chart on page 4			1
108A	Motor adapter with foot*		1L80			1
108B	Motor adapter less foot*		1L87			
123	Deflector	BUNA-N	5K7			1
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush		1L333			
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 1			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

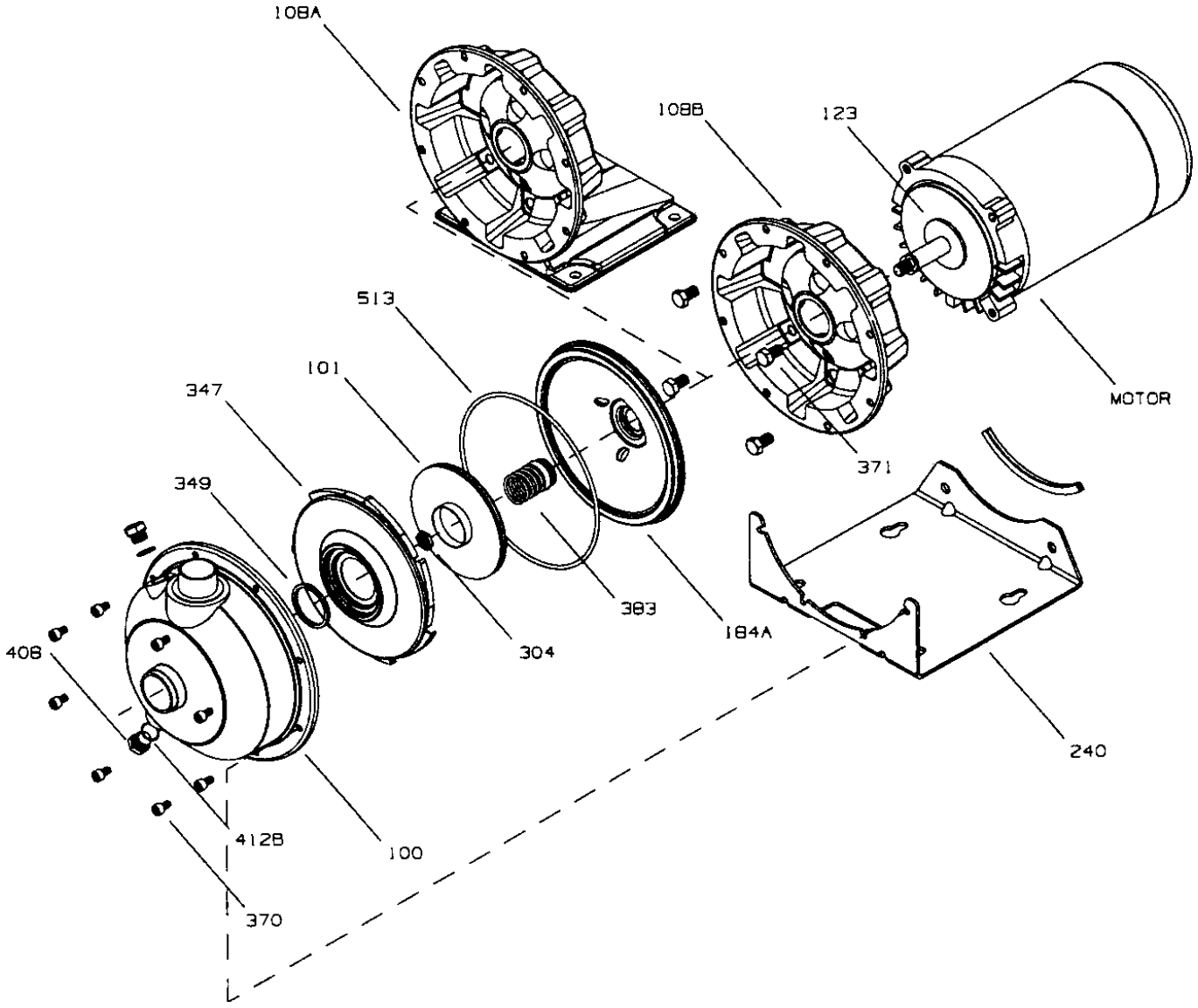
** Flush access hole provided.*

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS



NOTE:
Close-coupled units using motors ½ – 1 HP (TEFC and ODP) will use footed motor adapter as standard.
Close-coupled units using motors 1½ – 3 HP (TEFC and ODP) will use footless motor adapter as standard.
Close-coupled units using motors 5 HP and all X-Proof will have a foot attached to the 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.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x 1¼-6		1¼ x 1½-6		1½ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			6 1/8	2L885		
G			5 15/16	2L700	5 3/8	2L702
H			5 1/2	2L699	5	2L701
A	6 1/8	2L47	5 1/4	2L48	4 3/4	2L49
B	5 3/4	2L44	5 1/16	2L54	4 5/8	2L58
C	5 3/16	2L46	4 7/8	2L53	4 3/8	2L57
D	4 3/4	2L42	4 5/8	2L52	4 1/16	2L56
E	4 7/16	2L45	4 1/4	2L51	3 5/8	2L55
F	4 1/16	2L59	3 7/8	2L50		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST	2ST		3ST
			ODP/TEFC	ODP/TEFC		ODP/TEFC
½	C	Repair #	2L45			
		Dia.	4 7/16			
		Imp. Code	E			
¾	D	Repair #	2L42	2L50		
		Dia.	4 3/4	3 7/8		
		Imp. Code	D	F		
1	E	Repair #	2L46	2L51		2L55
		Dia.	5 3/16	4 1/4		3 5/8
		Imp.Code	C	E		E
1½	F	Repair #	2L44	2L52		2L56
		Dia.	5 3/4	4 5/8		4 1/16
		Imp. Code	B	D		D
2	G	Repair #	2L47	2L53		2L57
		Dia.	6 1/8	4 7/8		4 3/8
		Imp. Code	A	C		C
3	H	Repair #	2L47	2L48		2L49
		Dia.	6 1/8	5 1/4		4 3/4
		Imp. Code	A	A		A
5	J	Repair #		2L700	2L885	2L702
		Dia.		5 15/16	6 1/8	5 3/8
		Imp. Code		G	K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST		2ST			3ST	
			ODP	TEFC/EXP	ODP		TEFC/EXP	ODP	TEFC/EXP
½	C	Repair #	2L45	2L59					
		Dia.	4 7/16	4 1/16					
		Imp. Code	E	F					
¾	D	Repair #	2L42	2L45	2L50				
		Dia.	4 3/4	4 7/16	3 7/8				
		Imp. Code	D	E	F				
1	E	Repair #	2L46	2L42	2L51		2L50	2L55	
		Dia.	5 3/16	4 3/4	4 1/4		3 7/8	3 5/8	
		Imp. Code	C	D	E		F	E	
1½	F	Repair #	2L44	2L46	2L52		2L51	2L56	2L55
		Dia.	5 3/4	5 3/16	4 5/8		4 1/4	4 1/16	3 5/8
		Imp. Code	B	C	D		E	D	E
2	G	Repair #	2L47	2L44	2L53		2L52	2L57	2L56
		Dia.	6 1/8	5 3/4	4 7/8		4 5/8	4 3/8	4 1/16
		Imp. Code	A	B	C		D	C	D
3	H	Repair #	2L47	2L47	2L48		2L54	2L49	2L58
		Dia.	6 1/8	6 1/8	5 1/4		5 1/16	4 3/4	4 5/8
		Imp. Code	A	A	A		B	A	B
5	J	Repair #			2L700	2L885		2L702	
		Dia.			5 15/16	6 1/8		5 3/8	
		Imp. Code			G	K		G	

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854	26.8/13.4	36	E08821	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854	14.0	40	E09821	11.89	44			
5	E10754	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873	2.6/1.3	19	E04876	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873	3.4/1.7	19	E05876	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873	4.2/2.1	22	E06876	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878	5.8/2.9	25	E07876	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874	6.9/3.3	39	E08876	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874	7.2/3.6	31	E09876	7.6/3.8	37			
5	E10774	7.2/14.4	50	E10876	6.2/12.4	48			

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

GOULDS PUMPS

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Tel. (262) 268-0180
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E-mail usa@fpz.com

REGENERATIVE BLOWERS - **VACUUM**

SCL K07 K08 / K09 / K10 / K11 / K12

MS SERIES - MOR RANGE

TECHNICAL CHARACTERISTICS

- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - **cURus** motor

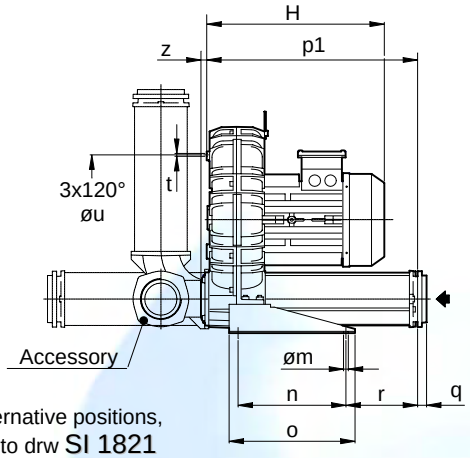
OPTIONS

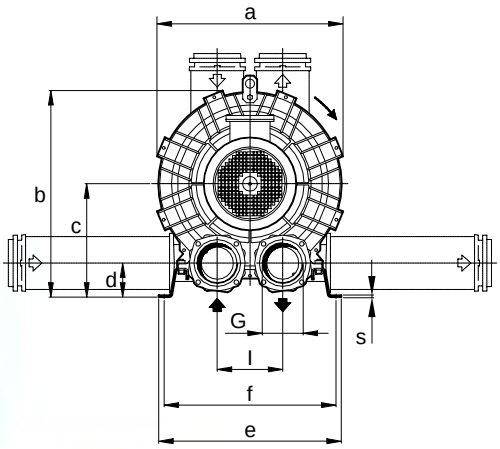
- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES

- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors

Dimensions in inches.
Dimension for reference only.





Possible alternative positions, please refer to drw SI 1821

Model	a	b	c	d	e	f	G	l	m	n	o	p1	q	r	s	t	u	z
K07-MS	16.69	18.84	10.59	3.23	18.43	17.24	3" NPT	6.10	0.51	11.81	13.78	20.16	0.98	5.39	0.20	M8	11.61	0.63
K08-MS	17.99	19.61	10.59	3.23	18.82	17.64	3" NPT	6.10	0.51	11.81	13.78	20.16	0.98	5.39	0.20	M8	12.2	0.63
K09-MS	19.37	22.09	12.40	3.78	20.00	18.82	4" NPT	7.17	0.51	11.81	13.78	23.07	0.98	7.83	0.20	M8	14.17	0.63
K10-MS	20.31	22.56	12.40	3.78	20.00	18.82	4" NPT	7.17	0.51	11.81	13.78	23.07	0.98	7.83	0.20	M8	14.17	0.63
K11-MS	21.34	23.74	13.07	3.58	21.26	20.00	4" NPT	7.87	0.51	11.81	13.78	23.46	0.98	8.03	0.20	M8	15.35	0.63
K12-MS	21.57	23.82	13.07	3.58	21.26	20.00	4" NPT	7.87	0.51	11.81	13.78	23.58	0.98	8.03	0.20	M8	15.35	0.51

Model	Maximum flow cfm		Installed power Hp		Maximum differential pressure Δp (In Hg)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	Inches	Lbs
K07-MS	294	*243*	4	*4*	3.7	*4.6*	77.7	*75.7*	15.45	103.00
			5 ½	*5 ½*	5.6	*6.3*	78.0	*76.0*	15.45	107.10
			7 ½	*7 ½*	9.6	*8.9*	78.3	*76.3*	18.37	145.70
			10	-	11.1	-	78.6	-	18.37	154.50
K08-MS	381	*316*	5 ½	*5 ½*	2.9	*3.8*	78.8	*76.8*	15.45	115.70
			10	*10*	8.5	*9.2*	79.4	*77.4*	18.37	163.10
K09-MS	471	*390*	7 ½	*7 ½*	3.7	*4.6*	79.3	*77.3*	18.84	166.50
			10	*10*	5.9	*7.0*	79.6	*77.6*	18.84	175.10
			15	*15*	10.3	*10.4*	80.1	*78.1*	19.63	196.20
			20	-	11.1	-	80.4	-	23.74	269.00
K10-MS	556	*460*	7 ½	*7 ½*	2.7	*3.8*	79.4	*77.4*	18.84	170.90
			10	*10*	4.7	*5.9*	79.7	*77.7*	18.84	179.50
			15	*15*	8.8	*9.9*	80.2	*78.2*	19.63	200.60
			20	-	11.1	-	80.5	-	23.74	273.40
K11-MS	650	*539*	10	*10*	2.9	*3.9*	82.0	*80.0*	19.04	194.90
			15	*15*	6.0	*7.1*	82.5	*80.5*	19.83	216.00
			20	*20*	9.2	*10.4*	83.0	*81.0*	23.94	288.80
			25	-	11.1	-	83.8	-	24.81	313.10
K12-MS	726	*602*	15	*15*	3.8	*6.6*	83.5	*81.5*	19.95	223.70
			20	*20*	6.3	*9.6*	84.3	*82.3*	24.06	296.50
			25	-	8.8	-	87.2	-	24.92	320.80

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

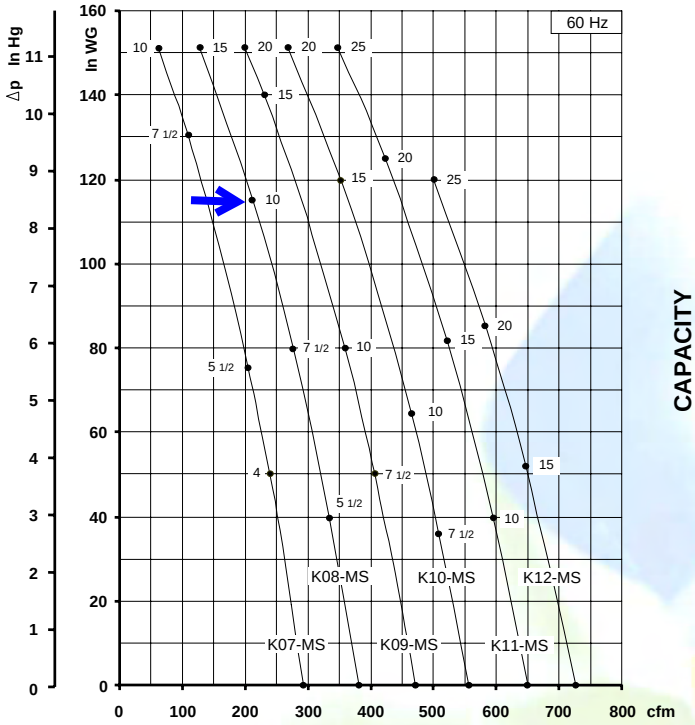
REGENERATIVE BLOWERS - **VACUUM**

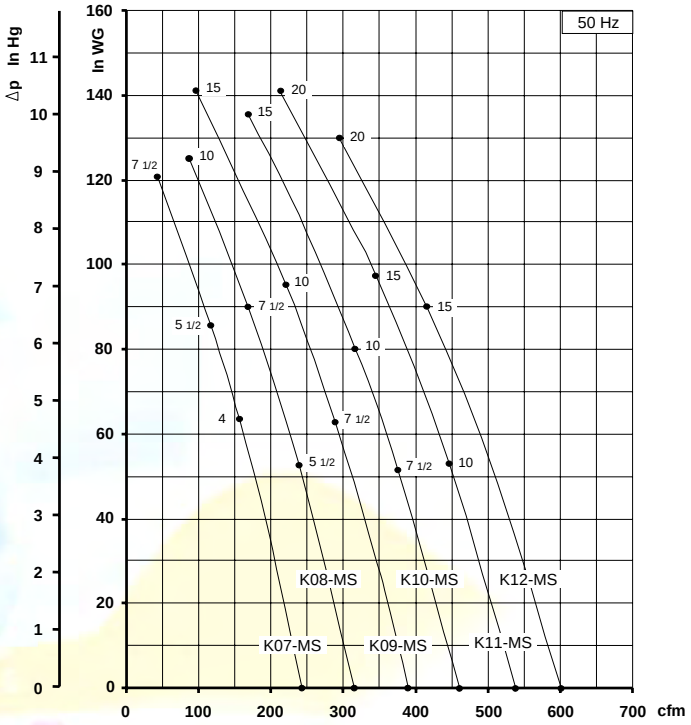
SCL K07 / K08 / K09 / K10 / K11 / K12

MS SERIES - MOR RANGE

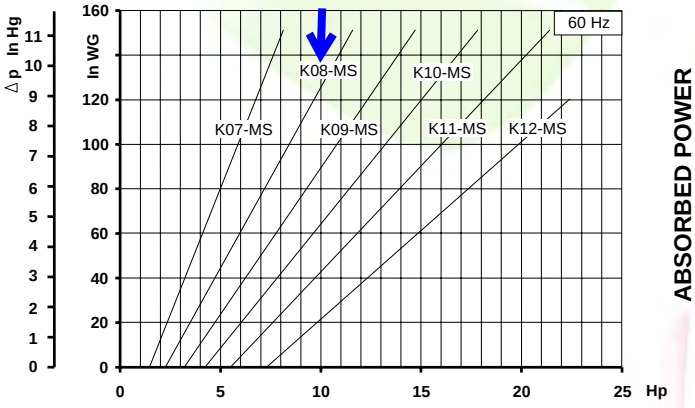
SN 1810-11 2/2

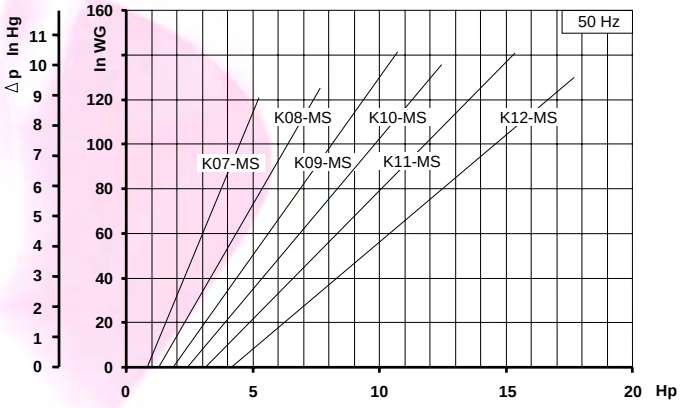
CAPACITY



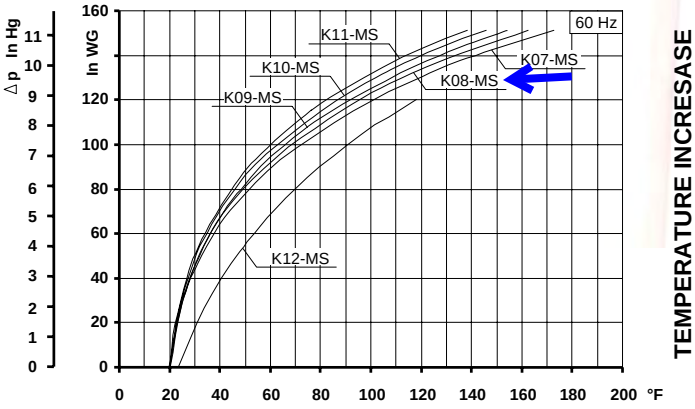


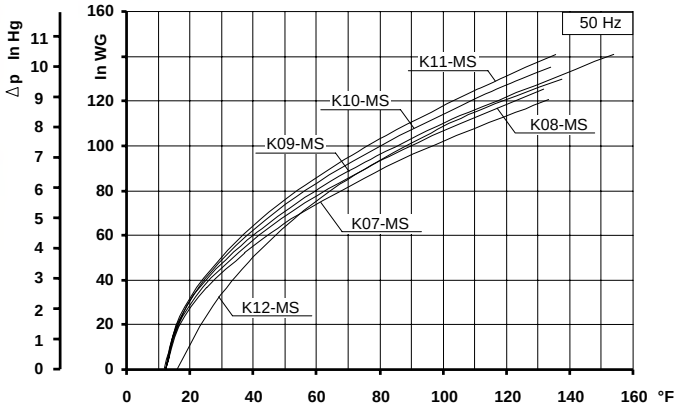
ABSORBED POWER





TEMPERATURE INCRESASE





Curves refer to air at 68° F temperature, measured at inlet port and 29.92 In Hg atmospheric backpressure (abs).
Values for flow, power consumption and temperature rise: +/-10% tolerance.
Data subject to change without notice.

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CE

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COMPRESSEURS - ASPIRATEURS A CANAL LATERAL 'SCL K-MS MOR'	**INSTRUCTIONS F**
SEITENKANALVERDICHTER - VAKUUMPUMPEN BAUREIHE 'SCL K-MS MOR'	**BETRIEBSANLEITUNG D**
COMPRESORES - ASPIRADORES DE CANAL LATERAL 'SCL K-MS MOR'	**INSTRUCCIONES E**

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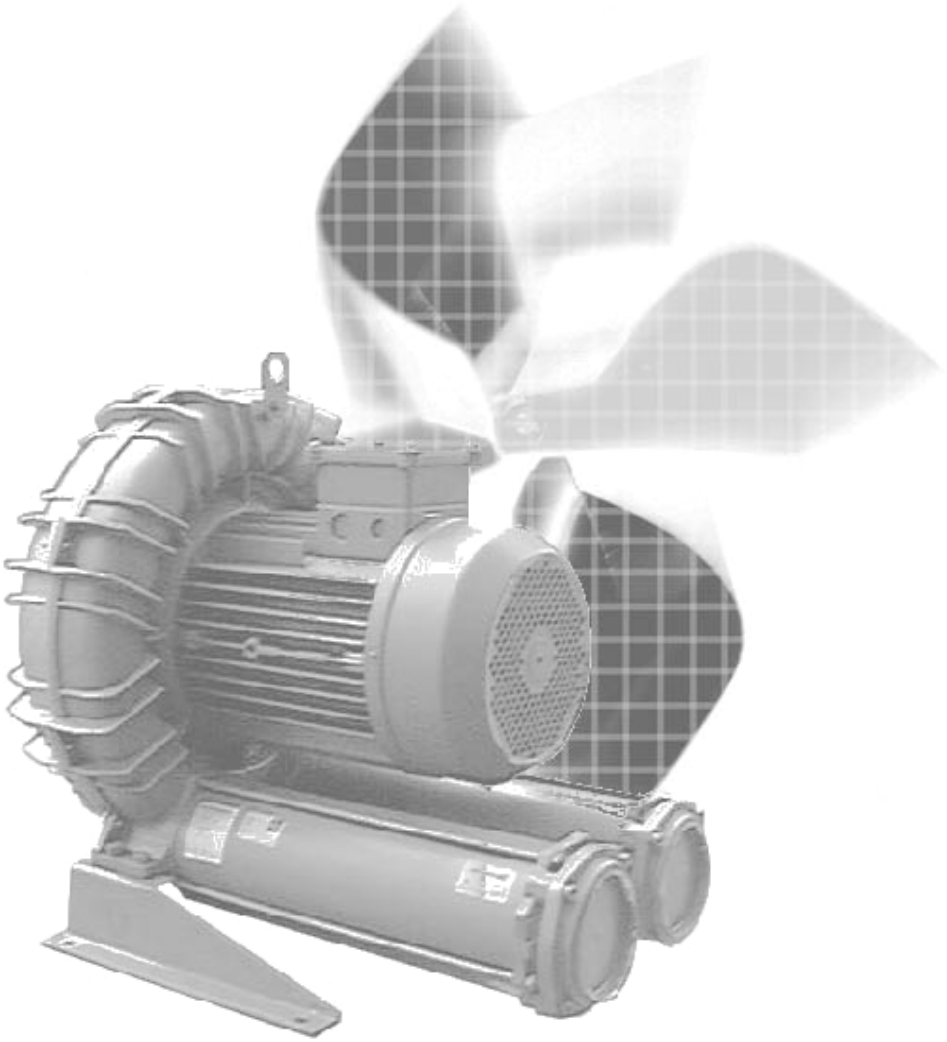
SN 1968-2

SCL K07 / K75 / K08 / K09 / K10 / K11



AZIENDA CON SISTEMA DI GESTIONE PER LA QUALITÀ CERTIFICATO DA DNV =UNI EN ISO 9001:2000=

effepizeta

CE

DICHIARAZIONE DI CONFORMITÁ ALLA DIRETTIVA MACCHINE
DECLARATION OF CONFORMITY TO THE MACHINERY DIRECTIVE

Unità tipo - *Unit type*

SCL K07-MS MOR - SCL K75-MS MOR - SCL K08-MS MOR
SCL K09-MS MOR - SCL K10-MS MOR - SCL K11-MS MOR

1. L'unità è in conformità con:
   - DIRETTIVA MACCHINE CE 98/37;
   - DIRETTIVA EMC CE 89/336 come modificata dalle Direttive CE 92/31 e CE 93/68;
   - DIRETTIVA BASSA TENSIONE CE 73/23 come modificata dalla Direttiva CE 93/68.

   È tuttavia vietata la messa in servizio prima che la macchina in cui sarà incorporata sia dichiarata conforme con le citate Direttive.

2. Sottoposta a collaudo funzionale è risultata conforme alle caratteristiche richieste.

1. *The unit conforms to the:*
   - *MACHINERY DIRECTIVE CE 98/37;*
   - *EMC DIRECTIVE CE 89/336 as ammended by the CE Directives 92/31 and 93/68;*
   - *LOW VOLTAGE DIRECTIVE CE 73/23 as ammended by the CE Directive 93/68.*

   Nevertheless it is forbidden to put the unit in service before the machine in which will be incorporated is declared in conformity with the above Directives.
2. *The unit has been tested and meets its operating performances.*

10.06

Amministratore Delegato
Managing Director

DATI CARATTERISTICI I
PERFORMANCE TABLE GB
CARACTÉRISTIQUES TECHNIQUES F
LEISTUNGDATEN D
DATOS CARACTERISTICOS E

SI - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	kW		**hPa** (mbar)		**Lp / Lw** (1) **dB (A)**		**Ps** max A	**M**
	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	**MPa** (bar)	**kg**
SCL K07-MS	**2.2**	***2.55***	**- 130 / + 130**	***- 100 / + 100***	**76.4**	***78.4***	**0.28 (2.8)**	**46.5**
	3.0	***3.45***	**- 200 / + 200**	***- 175 / + 175***	**76.7**	***78.7***	**0.28 (2.8)**	**47.5**
	4.0	***4.6***	**- 280 / + 280**	***- 250 / + 250***	**77.0**	***79.0***	**0.28 (2.8)**	**51.0**
	5.5	***6.3***	**- 325 / + 400**	***- 375 / + 375***	**77.3**	***79.3***	**0.28 (2.8)**	**61.5**
	-	***8.7***	**- / -**	***- / + 450***	**-**	***79.6***	**0.28 (2.8)**	**66.5**
SCL K75-MS	**4.0**	***4.6***	**- 150 / + 150**	***- 100 / + 100***	**77.4**	***79.4***	**0.28 (2.8)**	**51.5**
	5.5	**6.3**	**- 250 / + 250**	**- 200 / + 200**	**77.7**	***79.7***	**0.28 (2.8)**	**62.0**
	7.5	**8.7**	**- / + 325**	**- 300 / + 300**	**78.0**	***80.0***	**0.28 (2.8)**	**67.0**
	9.2	***10.6***	**- / -**	***- / + 400***	**-**	***80.3***	**0.28 (2.8)**	**76.5**
SCL K08-MS	**3.0**	***3.45***	**- 125 / + 125**	***- 100 / + 100***	**77.4**	***79.4***	**0.28 (2.8)**	**49.0**
	4.0	***4.6***	**- 180 / + 180**	***- 150 / + 150***	**77.7**	***79.7***	**0.28 (2.8)**	**52.5**
	5.5	***6.3***	**- 275 / + 275**	***- 250 / + 250***	**78.0**	***80.0***	**0.28 (2.8)**	**63.0**
	7.5	***8.7***	**- 350 / + 400**	***- 375 / + 375***	**78.3**	***80.3***	**0.28 (2.8)**	**68.0**
	9.2	***10.6***	**- / + 450**	***- / + 450***	**78.6**	***80.6***	**0.28 (2.8)**	**77.5**
SCL K09-MS	**4.0**	***4.6***	**- 130 / + 130**	***- 85 / + 85***	**78.0**	***80.0***	**0.28 (2.8)**	**62.0**
	5.5	***6.3***	**- 210 / + 210**	***- 150 / + 150***	**78.2**	***80.2***	**0.28 (2.8)**	**72.5**
	7.5	***8.7***	**- 290 / + 290**	***- 250 / + 250***	**78.5**	***80.5***	**0.28 (2.8)**	**77.5**
	9.2	***10.6***	**- 350 / + 350**	***- 325 / + 325***	**78.7**	***80.7***	**0.28 (2.8)**	**87.0**
	11	***12.7***	**- / + 450**	***- 375 / + 400***	**79.0**	***81.0***	**0.28 (2.8)**	**87.5**
	-	***17.4***	**- / -**	***- / + 500***	**-**	***81.3***	**0.28 (2.8)**	**92.5**
SCL K10-MS	**5.5**	***6.3***	**- 160 / + 160**	***- 115 / + 115***	**78.1**	***80.1***	**0.28 (2.8)**	**75.0**
	7.5	***8.7***	**- 250 / + 250**	***- 200 / + 200***	**78.5**	***80.5***	**0.28 (2.8)**	**80.0**
	9.2	***10.6***	**- 300 / + 300**	***- 270 / + 270***	**79.0**	***81.0***	**0.28 (2.8)**	**89.5**
	11	***12.7***	**- 350 / + 400**	***- 375 / + 375***	**79.4**	***81.4***	**0.28 (2.8)**	**90.0**
	15	***17.4***	**- / + 500**	***- / + 500***	**79.6**	***81.6***	**0.28 (2.8)**	**95.0**
SCL K11-MS	**5.5**	**-**	**- 100 / + 100**	***- / -***	**78.5**	**-**	**0.28 (2.8)**	**78.5**
	7.5	***8.7***	**- 175 / + 175**	***- 130 / + 130***	**80.0**	***82.0***	**0.28 (2.8)**	**83.5**
	9.2	***10.6***	**- 230 / + 230**	***- 175 / + 175***	**80.5**	***82.5***	**0.28 (2.8)**	**93.0**
	11	***12.7***	**- 300 / + 300**	***- 250 / + 250***	**81.0**	***83.0***	**0.28 (2.8)**	**93.5**
	15	***17.4***	**- 350 / + 400**	***- 350 / + 350***	**81.8**	***83.8***	**0.28 (2.8)**	**98.5**
	18.5	***21.5***	**- / + 500**	***- / + 500***	**83.6**	***85.6***	**0.28 (2.8)**	**128.5**

(1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, según la Normativa ISO 3744.

DATI CARATTERISTICI I
PERFORMANCE TABLE GB
CARACTÉRISTIQUES TECHNIQUES F
LEISTUNGDATEN D
DATOS CARACTERISTICOS E

US - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	Hp		**In Hg / In WG**		**Lp / Lw** (1) **dB (A)**		**Ps** max	**M**
	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	**In Hg**	**lbs**
SCL K07-MS	**4**	**4**	**- 3.7 / + 50**	***- 4.6 / + 63***	***78.7***	**76.7**	**82.7**	**104.50**
	5 ½	**5 ½**	**- 5.6 / + 75**	***- 6.3 / + 86***	***79.0***	**77.0**	**82.7**	**112.20**
	7 ½	**7 ½**	**- 9.6 / + 130**	***- 8.9 / + 138***	***79.3***	**77.3**	**82.7**	**135.20**
	10	**10**	**- 11.1 / + 181**	***- / + 161***	***79.6***	**77.6**	**82.7**	**146.30**
SCL K75-MS	**5 ½**	**5 ½**	**- 2.9 / + 40**	***- 4.8 / + 65***	***79.4***	**77.4**	**82.7**	**113.30**
	7 ½	**7 ½**	**- 4.8 / + 65**	***- 7.4 / + 100***	***79.7***	**77.7**	**82.7**	**136.30**
	10	**10**	**- 7.4 / + 100**	***- / + 130***	***80.0***	**78.0**	**82.7**	**147.40**
	15	**15**	**- 8.8 / + 160**	**- / -**	***80.3***	**78.3**	**82.7**	**168.40**
SCL K08-MS	**5 ½**	**5 ½**	**- 2.9 / + 40**	***- 3.8 / + 52***	***79.7***	**77.7**	**82.7**	**115.70**
	7 ½	**7 ½**	**- 5.9 / + 80**	***- 6.6 / + 90***	***80.0***	**78.0**	**82.7**	**138.90**
	10	**10**	**- 8.5 / + 115**	***- 9.2 / + 125***	***80.3***	**78.3**	**82.7**	**150.00**
	15	**15**	**- 11.1 / + 181**	***- / + 181***	***80.6***	**78.6**	**82.7**	**170.80**
SCL K09-MS	**7 ½**	**7 ½**	**- 3.7 / + 50**	***- 4.6 / + 63***	***80.2***	**78.2**	**82.7**	**159.80**
	10	**10**	**- 5.9 / + 80**	***- 7.0 / + 95***	***80.5***	**78.5**	**82.7**	**170.90**
	15	**15**	**- 10.3 / + 140**	***-10.4 / + 155***	***81.0***	**79.0**	**82.7**	**192.90**
	20	**20**	**- 11.1 / + 181**	***- / + 181***	***81.3***	**79.3**	**82.7**	**203.90**
SCL K10-MS	**7 ½**	**7 ½**	**- 2.7 / + 36**	***- 3.8 / + 51***	***80.1***	**78.1**	**82.7**	**165.30**
	10	**10**	**- 4.7 / + 64**	***- 5.9 / + 80***	***80.5***	**78.5**	**82.7**	**176.40**
	15	**15**	**- 8.8 / + 120**	***- 9.9 / + 135***	***81.0***	**79.0**	**82.7**	**198.40**
	20	**20**	**- 11.1 / + 167**	***- / + 191***	***81.4***	**79.4**	**82.7**	**253.00**
	25	**25**	**- / + 211**	***- / + 201***	***81.6***	**79.6**	**82.7**	**319.10**
SCL K11-MS	**10**	**10**	**- 2.9 / + 40**	***- 3.9 / + 53***	***82.0***	**80.0**	**82.7**	**184.10**
	15	**15**	**- 6.0 / + 82**	***- 7.1 / + 97***	***82.5***	**80.5**	**82.7**	**206.10**
	20	**20**	**- 9.2 / + 125**	***- 10.4 / + 141***	***83.0***	**81.0**	**82.7**	**217.20**
	25	**25**	**- 11.1 / + 162**	***- / + 162***	***85.6***	**83.6**	**82.7**	**283.30**

(1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, seg+ún la Normativa ISO 3744.

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1. GENERAL INSTRUCTIONS

CAUTION!

The 'SCL K' blowers - exhausters have been designed and manufactured for use in an industrial environment, operated by qualified personnel and as a unit to be incorporated in a machine, which conforms to the CE Machinery Directive.

The 'SCL K' blowers - exhausters, like all machinery and equipment with live and moving parts, can be a source of serious hazards unless properly used and protected.

The user is committed to ensure that:

All handling, assembly, installation, connection, maintenance and repair operations are undertaken by qualified personnel. Such people who by their background, training and experience as well as through their knowledge of statutory regulations, legislation, safety measures and operating conditions are able to carry out any necessary steps avoiding all possible risks to health and damage.

Such personnel should have received all the instructions and information, including any local legislation, and will follow them during the performance of any operation.

It shall be forbidden for unqualified personnel to carry out any operation, even indirectly, on the machines and equipment.

During the installation, all the prescribed working conditions, including any possible local requirements, shall be observed.

Additionally it is forbidden to put the unit in service before the machines of which they are a part are declared to conform to the CE Machinery Directive.

The user must be aware that in operation:

- **the surface temperatures can reach 160°C;**
- **the unit cannot contain high internal pressures, no greater than Ps max referred to in PERFORMANCE TABLE - page 3-4;**
- **there is small loss of the fluid handled;**
- **the level of noise may be unacceptable in certain applications.**

1.1 CONDITIONS OF USE

The 'SCL K' blowers - exhausters are designed for the continuous movement of air or non-explosive, non-hazardous and non-flammable gases and for service in non-explosive environments.

Solid particles, however small, including dirt can cause serious damage; therefore it is essential that such substances should be removed from the gas by suitable filters upstream of the inlet. (Units which do not have an adequate filter ARE NOT COVERED BY THE GUARANTEE).
The maximum driving pressure must never be exceeded (Maximum differential pressure of PERFORMANCE TABLE - page 3-4).

UNDER NO CIRCUMSTANCES OPERATE THE UNIT WITH THE GAS INLET OR OUTLET CLOSED. IN PARTICULAR THIS APPLIES TO THE UNITS WITH THE CAPACITY FOR HIGHER DRIVING PRESSURES.

Protect the units with an appropriate safety valve.

The performance characteristics are liable to variations due to the following factors:

- Differences of the suction or discharge pressures from the reference conditions (1013 mbar);
- Operation in a system with both a low suction pressure and a high back pressure;
- Operation with a gas at a different temperature or of a different specific gravity from the reference data (1.23 kg/m^3; 15 °C);
- Variations in the rotational velocity of the fan with respect to the reference value.

Both the gas inlet temperature and the ambient temperature must be in the range of -15°C to +40°C.
At the same time, ensure that the unit has good ambient ventilation, especially when subjected to severe operating conditions.
A unit subjected to frequent starting or to high ambient temperatures may be prone to overheating and in such cases further information should be requested.

Similarly, where flammable gases may be present, information must be requested for alternative models certified for the Ex. environment.

1.2 STORAGE AND SHIPPING

Store the unit in a dry place, preferably in original packaging.

Do not remove the protection plugs from the ports.

Avoid stacking anything on top of the packaging.

To move the packed boxes, use the largest pallet or support base possible to obtain the maximum stability.
On all occasions handle the units with care and avoid sudden impacts.

Lifting eyes are provided to unpack units weighting more than 25 kg.

(The weight of the unit is M in PERFORMANCE TABLE - page 3-4).

1.3 INSTALLATION

1.3.1 'SCL K' BLOWER - EXHAUSTER

It is important that the unit is installed in a well-ventilated environment where the temperature does not exceed 40°C.
If outside, protect the unit from direct sunlight and avoid the possibility of water collecting in the external crevices especially when installed with the axis vertical.

IMPORTANT!

Ingress of foreign matter, however small, will cause serious damage.
Such matter includes dust, sand, masonry debris, impurities in the tubes, cutting burrs or filings, welding or soldering slag and splatter, metal burrs and any residues from sealing and making the tube connections.

The unit can be mounted with the axis in any position.
As supplied, the unit is balanced and will not transmit vibrations, however it is recommended that it be mounted on vibration damping supports.

To connect the machine to the piping, remove the flanges and connect using flexible hoses. Do not use rigid connections as these may cause stress and harmful vibrations. Insert gaskets and tighten.

Remember to protect the inlet with suitable filters.
If it is necessary to regulate the flow, install a bypass valve (refer to section 1.5).

Only remove the plugs on the ports when making the final connections.

Select the tube size and the couplings to minimize the pressure drop, in particular:

- Do not use tubing of a smaller diameter than the ports of the unit; When installing units in parallel, size the manifold and main conduit accordingly;
- Utilise large radius bends and avoid using elbows;
- Avoid using valves which have a reduced orifice relative to the general system; Use swing check valves (utilising lightweight discs) which have the lowest pressure drop, rather than spring loaded check valves;
- For oxygenation select low loss diffusers (lowest pressure drop) and note that the pressure drop across plugs and porous membranes will increase over time due to progressive clogging.

A safety relief valve should be installed to avoid overloading the unit as a result of pressure differential variations.

Make the electrical connections to the motor and check the direction of rotation before connecting the conduit.

The 'SCL K' blowers - exhausters are already supplied as standard with silencers in the suction and exhaust ports (the noise levels Lp / Lw, with piped inlet and outlet flow, are detailed in PERFORMANCE TABLE - page 3-4).
For operation into free air (either suction or discharge) the free flow noise can be muffled with additional silencers.
In every situation avoid installing the unit on a structure, which can transmit or amplify any noise (tanks, sheet metal etc.).

Installation sketches - please refer to next page.

Further information should be requested regarding additional noise reduction by installing the unit in soundproof enclosures.

1.3.2 ELECTRIC MOTOR

WARNING

BEFORE UNDERTAKING ANY OPERATION ENSURE THAT THE UNIT IS DISCONNECTED FROM THE ELECTRICITY SUPPLY.

The electric motor has been selected for service in an ambient temperature between -15°C and +40°C at an altitude no higher than 1000 m. Ensure that the information on the nameplate is consistent with the supply voltage and frequency.
Variations in the supply voltage up to ± 10% are acceptable.
Outside the normal operating conditions the motor cannot deliver full power and problems can arise with starting, especially for single-phase motors.

Make the electrical connections referring to the wiring diagram in the terminal box, connecting an earth cable of adequate capacity to the earth terminal.
The fuses are designed only for short circuit protection and not to safeguard the motor. Therefore overload cut-outs (temperature or current) are essential to guard against the risk of overloads on the motor --- for example failure of one line in a three phase supply, an excessively high start up frequency, unacceptable variations in the supply voltage, stalled rotor, etc.
Set the overload cutouts at the nominal current specified on the nameplate.
The fuses should be rated for the peak currents or use "slow blow" fuses especially in applications of direct starting.

THE ENTIRE GUARANTEE SHALL CEASE TO APPLY WHEN INADEQUATE PROTECTION IS PROVIDED.

1.3.2.1 CURRENT MEASUREMENT

The current drawn refers to normal operating conditions.
Departures from the nominal operating conditions can result in variations of 10%.
There can be small differences in the measured value of each phase. These are tolerable up to a maximum deviation of 9% (ref. IEC 34-1).

1.4 COMMISSIONING

To commission the unit:

- Set the operating pressure or vacuum using a suitable gauge.
- Check the relieving pressure of the safety valve.
- Measure the current drawn by the motor and verify that it is within the limit stated on the name plate (refer to Para. 1.3.2.1).
- Adjust the overload cutouts accordingly.
- After one hour's operation, repeat the current measurements and verify that they are still within the stated limits.

1.5 OPERATING ADJUSTMENTS

The 'SCL K' blowers - exhausters will automatically generate the driving pressure required at the point of use.
Since the power absorbed and the operating temperature is primarily a function of the driving pressure, it is possible that these can exceed the permitted operating conditions for the unit.
Frequently the pressure losses of the tubing are overlooked as the major factor determining the driving pressure.

The driving pressure can be reduced by eliminating all possible obstructions and restrictions in the flow path.
If it is still too high, the flow can be reduced by installing a bypass valve.

Never choke the flow by throttling the suction or the discharge.

1.6 MAINTENANCE

After every 10-15 days of use clean the cartridge filter.
Replace the cartridge frequently in dusty environments.

A dirty filter will create a strong suction resistance and consequently a higher driving pressure, a higher operating temperature and an increase in the absorbed power.

Check that the driving pressure does not change over time.

It is important that a unit in service is subjected to periodic inspections by qualified personnel to insure against failures, which, directly or indirectly, could cause damage.

Departures from the normal operating conditions (e.g. a rise in the absorbed power, unusual operating noises, vibrations, etc.) are a sign of abnormal operation, which can lead to failure.

See paragraph 5 - TROUBLESHOOTING to be dealt with and/or avoiding possible breakage or faults.

Under normal working conditions (refers to PERFORMANCE TABLE - page 3-4) the machine's bearings should be replaced by qualified personnel after 25,000 working hours max or 4 years.

In the event of difficulties please contact F.P.Z. or the relevant sales agent.

Please note that repairs undertaken by a third party will invalidate the guarantee.

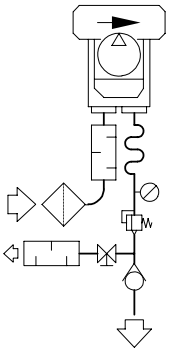
Periodically remove any surface deposits which otherwise can cause the operating temperature to rise.

Commitments, agreements or legal relationships are governed by the corresponding sales contract. The above items are in no way limited by the contents of this manual.
The quality of the materials and of the workmanship is guaranteed as set out by the standard conditions of sales.
The guarantee is not valid for the following: damage incurred during transport; inadequate storage; faulty installation; incorrect use; exceeding performance limits; electrical or mechanical miss-use.

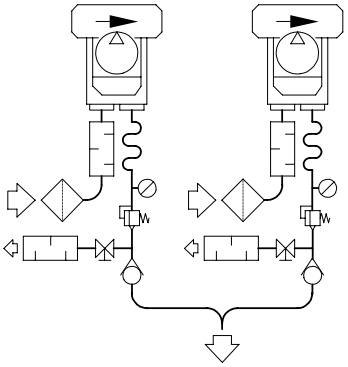
Store the packaging for possible future use.

2. INSTALLATION SKETCHES

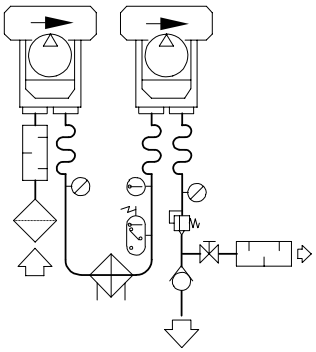
2.1 PRESSURE SERVICE



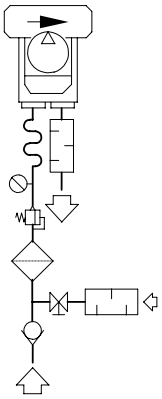
2.2 PARALLEL PRESSURE SERVICE



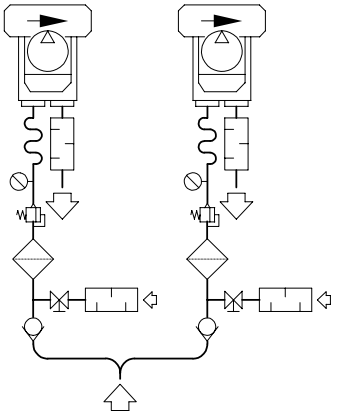
2.3 SERIES PRESSURE SERVICE



2.4 VACUUM SERVICE



2.5 PARALLEL VACUUM SERVICE



2.6 LIST ACCESSORIES

Item		Denomination	Item		Denomination
1		Filter – Inline filter	7		Valve
(2)		Silencer	(8)		Cooler
3		Flexible coupling	(9)		Thermometer
4		Pressure – Vacuum gauge	(10)		Temperature switch
5		Safety valve			
6		Non return valve	(x) IF NECESSARY		

3. INTERNAL CLEANING INSTRUCTIONS

CAUTION!

Internal deposit build up can cause:

- performance variations;
- alteration in clearances resulting in seizing;
- out of balance rotor.

3.1 CLEANING INSTRUCTIONS

In case it is necessary to clean the inside of the blower, proceed as follows:

1. Remove in order #915 and #902 screws placed on #162 cover.

2. Remove #162 cover by using the two threaded holes placed on cover itself.

3. Remove the #900 screw and #365 washer.

4. Remove the #360 bearing cover and extract the #321 bearing using a bearing puller.

N.B.: The #935 shims washers are included when necessary to accomodate the axial clearance. Be careful not to misplace.

5. Remove the #230 impeller, using a puller if necessary.

6. Clean and reassemble in reverse order.

If needed, reconstruct #423 seal using Loctite 598 or similar, after cleaning the sealing surfaces of any existing sealant.

3.2 REPLACEMENT SOUND-ABSORBING PANELS

If needed, replace the foam sound-absorbing panels, proceed as follows:

1. Remove #723 flange and related #426 O-Ring by removing #908 screws.

2. Remove #906 screws.

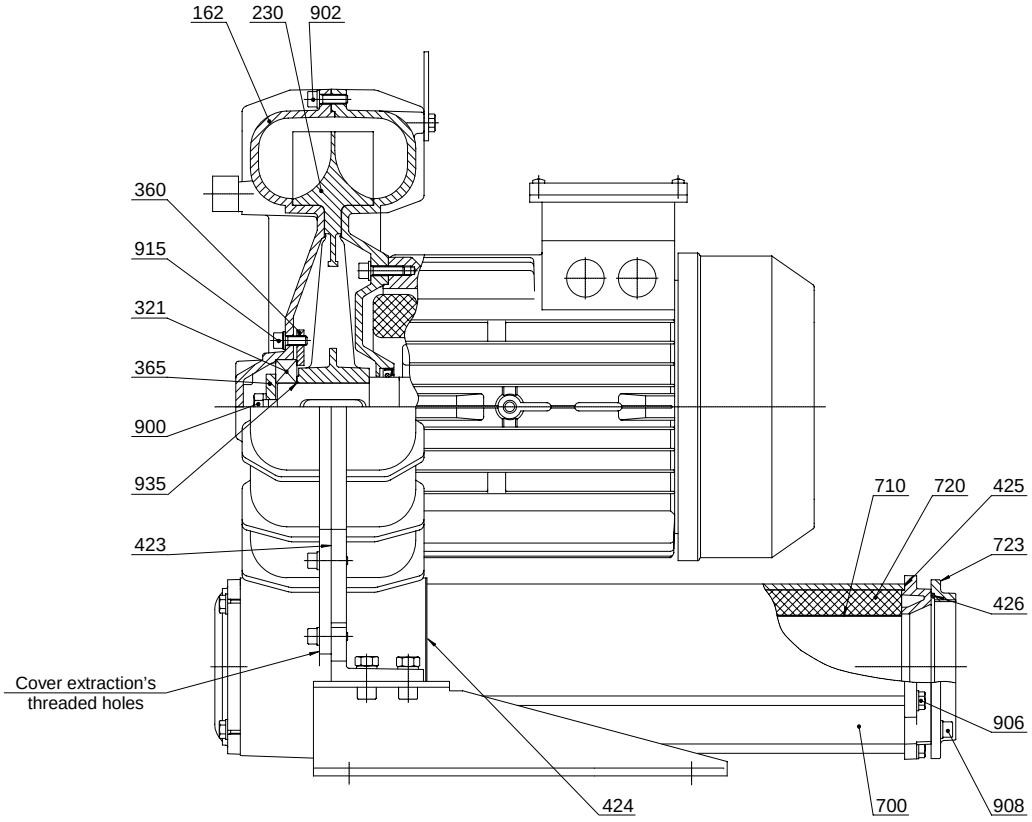
3. Take away the #700 silencers from the unit, being careful not to lose the #424 gaskets.

4. Extract the #720 panels from the silencer housings.

5. Clean up the #710 retaining screen.

6. Replace and reassemble proceeding in reverse order, remembering to include the #424 and #426 gaskets.

If needed, reconstruct #425 seal using Loctite 598 or similar, after cleaning the sealing surfaces of any existing sealant.



4. SILENCER HOUSING MOUNTING INSTRUCTIONS

The 'SCL K-MS' series was designed to provide maximum flexibility in the positioning of the silencer housings to meet various installation configurations.

The blower is supplied with the silencers configured as in Fig. 1

If this configuration needs to be modified, proceed as follows:

1. Identify the desired configuration (Fig. 2, Fig. 3, Fig. 4).

2. Disassembly of the silencer housing:

2.1 Remove #908 screws, taking away #723 flange with the #426 O-ring.

2.2 Remove the #906 screws.

2.3 Take away the #700 silencer from the unit along with the #424 gasket.

3. Disassembly of the #730 blind flange:

3.1 Remove the #909 screws, taking away the #730 flange along with the #427 gasket.

Reassemble in reverse order-do not forget the #424 #426 and #427 gaskets.

If needed, reconstruct #425 seal using Loctite 598 or similar, after cleaning the sealing surfaces of any existing sealant.

4.1 USING THE 90° MANIFOLD KIT TYPE CK (accessory)

The 90° manifold can only be installed on the #162 cover ports and as shown in the Figures below, there are multiple configurations.

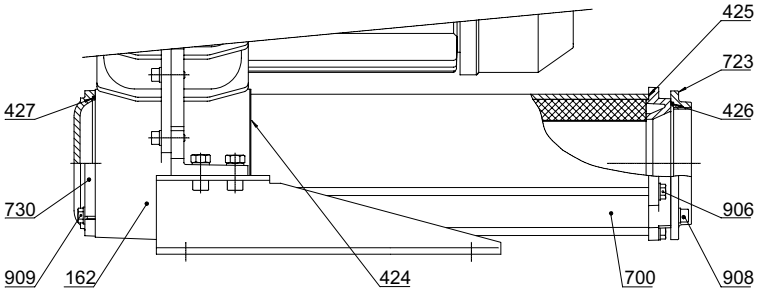
The 90° manifold kit type CK comes supplied with;

1 x manifold
1 x gasket and
4 x M8x25 UNI 5739 screws.

To mount the 90° manifold, proceed as follows:

1. Disassemble the silencer housing (see point 2)
2. Place the gasket between the #162 cover and the 90° manifold and seal with the M8x25 UNI 5739 screws.

Assemble the silencer housing in reverse order-do not forget the #424 and #426 gaskets.



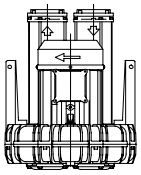


Fig.1

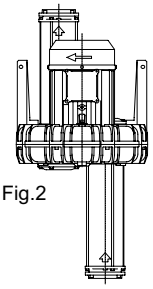


Fig.2

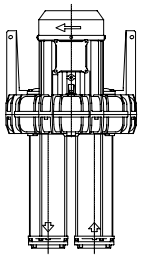


Fig.3

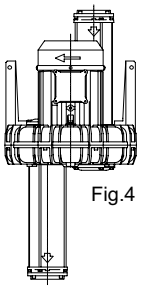


Fig.4

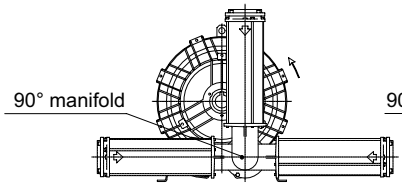


Fig. 2 with 90° manifold

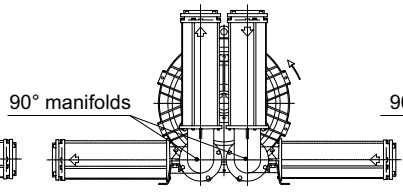


Fig.3 with two 90° manifolds

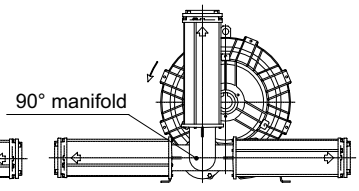


Fig.4 with 90° manifold

5. TROUBLESHOOTING

Problem	Cause	Solution
The unit does not start	The electric wiring is incorrect.	Check the electric wiring against the wiring diagram in the terminal board box.
	The power supply voltage is not suitable.	Check that the power supply voltage, measured at the motor's terminals, is within ± 5% of the nominal voltage.
	The impeller is stuck.	Get trained personnel to repair the machine.
Air flow rate zero or insufficient	Rotation direction incorrect.	Check that the direction of rotation is as indicated on the motor's fan cowling.
	Intake filter clogged.	Clean or replace the cartridge.
Power absorption exceeds the maximum allowed	Wiring incorrect.	Check the electric wiring against the wiring diagram in the terminal board box.
	Voltage drop on the power supply.	Return the power supply voltage at the terminals to within the values allowed.
	Intake filter clogged.	Clean or replace the cartridge.
	Deposits have built up inside the unit.	Get trained personnel to clean the machine internally.
	The unit is operating at a pressure and/or vacuum that exceeds that allowed.	Adjust the plant and/or the regulating valve to reduce the pressure differentials.
Delivery air temperature high	The unit is operating at a pressure / vacuum that exceeds that allowed.	Adjust the plant and/or the regulating valve to reduce the pressure differentials.
	Intake filter clogged.	Clean or replace the cartridge.
	Deposits have built up inside the unit.	Get trained personnel to clean the machine internally.
	Intake and/or delivery piping clogged.	Remove the obstructions.
	Air temperature at intake exceeds 40°C.	Use a heat exchanger to reduce the air temperature at the intake.
Excessive noise	The soundproofing fabric is damaged.	Replace the soundproofing fabric.
	The impeller is scraping against the chassis:	
	a. The unit is operating at a pressure / vacuum that exceeds that allowed.	Adjust the plant to reduce the pressure differentials.
	b. The play allowed during assembly has been reduced due to internal deposits (dust, impurities in the pipes, process residue, etc.).	Get trained personnel to clean the machine internally.
	Bearing worn.	Replace the bearing.
	Installation position of the unit not suitable.	Install the units on structures that cannot transmit or amplify the noise (tanks, steel plating, etc.).
Abnormal vibrations	The impeller is damaged.	Replace the impeller.
	Deposits have built up on the impeller.	Get trained personnel to clean the machine internally.
	The unit is fixed incorrectly.	Fix the unit on anti-vibration supports.

SOLBERG®

COMPACT "T" STYLE VACUUM FILTERS
"CT Series" 2" - 6" FPT

- **Compact Design**
- **Multi-Stage Filtration**
- **Quick Change Out**
- **Vacuum Tested**

BENEFITS

- **Compact** design for space restrictions; **Minimal** service area needed
- **Integrated Inlet Baffle**
- Inlet is above the element to **Extend** element life and maintenance intervals
- "T" style design **Minimizes** piping requirements
- "Drop-Down" housing for easy servicing and containment of particles
- Cast aluminum head **Resists** corrosion
- Pressure differential ports standard for monitoring
- Casting has 4 unthreaded tap holes for mounting bracket
- **Vacuum level**: Typically $1x10^{-3}$ mmHg ($1.3x10^{-3}$ mbar)
- Swing Bolts on 5" & 6" sizes for additional strength

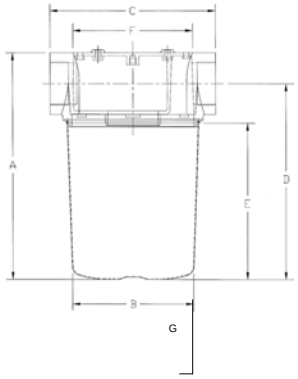
OPTIONS (Inquires Encouraged)

- Various media alternatives
- **See Through Bottom for Visual Inspection Now available for 3" and 4" housings!**
- Swing Bolts for 2" - 4" Sizes

CT-851/850
2" & 2 1/2" FPT

CT-235P/234P
3" & 4" FPT

CT-275P/274P
5" & 6" FPT



Dimension tolerance ± 1/4"

I = Industrial Duty S = Severe Duty E = Extreme Duty

	with Polyester Element	with Paper Element	FPT Inlet & Outlet	DIMENSIONS - inches A	B	C	D	E	Rated Flow SCFM Nominal Rating	Element Rating	Approx. Wt. lbs
I	CT-851-200C	CT-850-200C	2"	13	10 7/8	9	9	18	175	290	16
I	CT-851-250C	CT-850-250C	2-1/2"	13	10 7/8	9	9	18	210	290	15
I	CT-235P-300C	CT-234P-300C	3"	18 7/8	16 1/8	13 1/2	13	25	300	570	30
I	CT-235P-400C	CT-234P-400C	4"	18 7/8	16 1/8	13 1/2	13	25	520	570	26
S	CT-275P-500C	CT-274P-500C	5	18 1/4	14 3/8	19	9 7/8	20	800	1100	50
I	CT-275P-600C	CT-274P-600C	6"	18 1/4	14 3/8	19	9 7/8	20	1100	1100	45

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Solberg – Discover the Possibilities

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

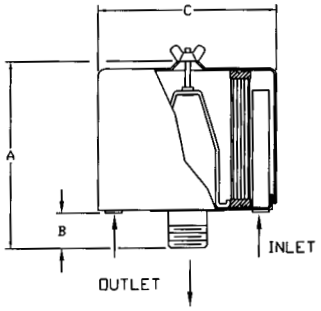
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tube is positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon 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)

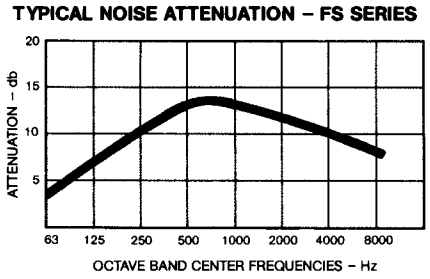
- 1/8" tap holes
- Pressure Drop Indicator
- Available in ***Stainless Steel***
- Epoxy coated housings
- Various media available
- Special connections, BSPT

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
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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E-mail: sales@solbergmfg.com ♦ Web Site: www.solbergmfg.com

SOLBERG

Inlet Vacuum Filters
Maintenance Manual

www.solbergmfg.com

Note: Please read the maintenance instructions given by the OEM for the machinery first. The OEM's manual should be adhered to in order to protect the equipment. Solberg Manufacturing, Inc has made every effort to make sure that these instructions are accurate but is not responsible for any typos, slight variations or for human errors that may occur.

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Maintenance Manual

SOLBERG Inlet Vacuum Filters

CONTENTS

**For Further Information Please Call: 630-773-1363*

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Rev: MMVF-407

Section A

INTRODUCTION

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet vacuum filters.

WARNING

This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the vacuum inlet filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will exceed your application requirements.

Section B

GENERAL INFORMATION

1. Identification of Solberg Vacuum Inlet Filters.

All Solberg inlet vacuum air filters should have an identification label/nameplate that gives the following information:

Assembly Model #
Replacement Element #

(The exception is OEM supplied units. In this case please enter the OEM part numbers below.)

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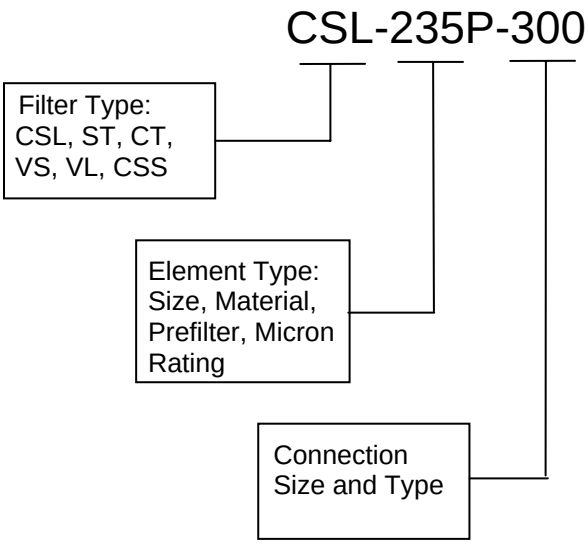
Fill in the actual nameplate data from your new Solberg inlet filter(s):

No.	Filter Model Number	Replacement Element
1		
2		
3		
4		
5		

Table 1

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'CSL' design filter with a 235 element with prefilter and 3" MPT connection size:



2. Filtration Rules of Thumb

General: For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter

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efficiency and, conversely, the lower the pressure drop. Therefore, the primary goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

Rule of Thumb #1: Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

Rule of Thumb #2: Always ask or specify a filter based on a micron rating **with** filtration efficiencies. As an example, stating a requirement for a 1-micron filter is misleading because no efficiency rating has been specified. A 1-micron filter at 95-% efficiency may be less efficient than a 5-micron filter at 99% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99% filtration efficiency at 5 microns is required.

Rule of Thumb #3: Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.

Filtration Efficiency Requirements (99+% efficiency)	**Environmental Conditions**	**Air to Media Ratio**	
Industrial Grade 2-micron **Paper**	Industrial Duty (clean, office/warehouse-like)	30 CFM/ft^2	(51m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	15 CFM/ft^2	(25.5m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	10 CFM/ft^2	(17m^3/h)/cm^2
Industrial Grade 5-micron **Polyester**	Industrial Duty (clean, office/warehouse-like)	50 CFM/ft^2	(85m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	40 CFM/ft^2	(68m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	25 CFM/ft^2	(42.5m^3/h)/cm^2
Industrial Grade 1-micron **Polyester**	Severe Duty (Foundry, Construction-like)	10 CFM/ft^2	(17m^3/h)/cm^2
Industrial Grade 0.3-micron **HEPA** Glass @ 99.97% efficiency	Industrial Duty (clean office/warehouse-like)	10 CFM/ft^2	(17m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	7 CFM/ft^2	(12m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	5 CFM/ft^2	(8.5m^3/h)/cm^2

Table 2

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Rule of Thumb #4: Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" / 250-380mm H_2O from the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200m^3/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Airflow	
1/4"	6 CFM	10m^3/h	1 ¼"	60 CFM	102m^3/h	6"	1,100 CFM	1870m^3/h
3/8"	8 CFM	14m^3/h	1 ½"	80 CFM	136m^3/h	8"	1,800 CFM	3060m^3/h
1/2"	10 CFM	17m^3/h	2"	135 CFM	230m^3/h	10"	3,300 CFM	5610m^3/h
3/4"	20 CFM	34m^3/h	2 ½"	195 CFM	332m^3/h	12"	4,700 CFM	7990m^3/h
1"	35 CFM	60m^3/h	3"	300 CFM	510m^3/h	14"	6,000 CFM	10200m^3/h
			4"	520 CFM	884m^3/h			
			5"	800 CFM	1360m^3/h			

Table 3 **Note: This information is for general use only. A qualified engineer must properly design each system.*

3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C
Filter Change-Out Differential: 10" to 15" / 250-380mm H_2O Over Initial Delta P

Media	Micron Rating
Standard Paper	99+% @ 2 micron
Standard Polyester	99+% @ 5 micron
"S" Series Wire Mesh	Epoxy Coated Wire Mesh
"Z" Series Polyester	99+% @ 1 micron
"HE" Series HEPA	99.97% @ 0.3 microns
"U" Series Polyester	99+% @ 25 micron
"W" Series Polyester	99+% @ 100 micron
"S2" Series	Stainless Steel Wire Mesh
"AC" & "ACP" Series	N/A
"Y" Series Polypropylene	99+% @ 5 micron

Table 4

Temperature Range: -15° to 385°F / -26° to 196°C
Filter Change-Out Differential: 10” to 15” / 250-380mm H_2O Over Initial Delta P

Media	Micron Rating
“MX” & “MXD” Series – Nomex Cloth	99+% @ 5 micron

Table 5

4. **Element Cleaning**

Some types of Solberg inlet filter elements can be cleaned and reused. However, damage can occur to an element during cleaning so it is imperative that care is taken during disassembly, cleaning and re-assembly. Damaged elements can allow particulate bypass, which will damage rotating equipment.

A. ***Polyester Element***: The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element should be dry before reinstallation.
B. ***Paper Element***: The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.
C. ***Polyurethane Prefilter***: The prefilter may be washed as a sponge or replaced to give the element a longer service life.
D. ***Epoxy Coated Wire Mesh and Stainless Steel Wire Mesh Elements***: Cleaning instructions similar to polyester, except mild solvents may be used.
E. ***Activated Carbon Element***: Not cleanable
F. ***Polypropylene Element***: Cleaning instructions similar to polyester
G. ***Nomex Cloth Element***: Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wingnuts and washers can be supplied upon request.

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Section C

PROCEDURES

1. Installation.

A. Maximum inlet gas stream temperature for most Solberg inlet vacuum filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers.

B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on inlet and outlet ports.

C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

2. Disconnecting canister top from canister base.

A. ST/CT/Small CSL: Release wire-form clips or loosen wing nut on “claw” bolts.

B. Large CSL: Loosen wing nut or hex head on T-bolts.

C. CSS: Twist upper housing to release.

D. VS/VL: Remove V-clamp by loosening Hex Nut or T-bolt and releasing.

E. Lift off canister top.

3. Removing element for service/maintenance.

A. Remove retaining hex head/wing-nut and washer carefully, and then remove element. Some elements will have a top plate that should also be removed.

B. Clean sealing surfaces of housing, top & base plates, and element endcaps so that they are free of dirt or any other particulate.

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WARNING

Failure to comply with these instructions may result in system or pump contamination.

4. Securing Element.

A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces.

B. Place top plate (if necessary) on element by centering on tap bolt.

C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: DO NOT over tighten!

WARNING

Defective installation may cause system or pump contamination. Use only genuine Solberg replacement parts.

5. Securing canister top to canister base.

A. Make sure all surfaces are free from dust and other particulate.

B. Hemisphere o-ring must rest evenly along canister/casting base o-ring groove.

C. ST/CT/Small CSL: Hold canister housing against o-ring or sealing ring on main filter head. Re-fasten wire-form clips or “claw” bolts.

D. Large CSL: Replace housing top plate. Feed T-bolts into corresponding slots and tighten evenly around perimeter. Note: Do NOT over tighten!

E. VS/VL: Secure V-clamp by disconnecting hex nut or T-bolt portion and placing V-clamp along the diameter of canister o-ring groove. Fasten T-bolt and secure tightly. V-CLAMP LEGS MUST REST UNIFORMLY ALONG ENTIRE O-RING GROOVE.

F. CSS: Reassemble top housing to bottom housing by aligning tabs and turning into place.

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Section D

MAINTENANCE RECOMMENDATIONS

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10” to 15” / 250-380mm H_2O higher pressure drop above the initial reading. Refer to page 4 for instructions.

2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change from Solberg specified parts!

3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.

4. Operate only when a proper seal exists.

5. VS/VL: Never operate without absolute assurance that V-clamp is secured correctly along entire diameter of canisters. Check along V-clamp for wear. Replace if any distortion occurs due to handling and usage.

SPARE PARTS LIST:

CSL/CT/VS/VL Series

		Housing						Element		
Parent Model Model-Element-Connection	Prefilter Model	Top Model No.	O-Ring Model No.	Gasket(s)/ Adapter Model No.	Wingnut(s) Model No.	Washer(s) Model No.	Clips/ Bolts Model No.	Top Plate Model No.	Wingnuts/ Bolt Model No.	Washer(s) Model No.
CSL-825/824-xxx	N/A	T824	OR337	BG224	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-843/842-xxx	PF842	T842	OR550	BG268	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-849/848-xxx	PF848	T848	OR675	BG281	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-851/850-xxx	PF850	T850	OR750	BG412	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-239/238-xxx	PF238	TD238	OR1250	N/A	N/A	N/A	CPWF	N/A	WN38X16	WR38X16
CSL-235/234-xxx	PF234	TC1400	OR1200	N/A	WN38X16	WR38X16	BT38163	T8000437	WN38X16	WR38X16
CSL-335/334-xxx	PF334	TC1400	OR1200	ADEX300	WN38X16	WR38X16	BT38163	T8000437	WN38X16	WR38X16
CSL-245/244-xxx	PF244	TC1850	OR1600	N/A	WN38X16	WR38X16	BT38163	T1000437	WN38X16	WR38X16
CSL-345/344-xxx	PF344	TC1850	OR1600	ADEX300	WN38X16	WR38X16	BT38163	T1000437	WN38X16	WR38X16
CSL-275/274-xxx	PF274	TC1850	OR1600	N/A	WN38X16	WR38X16	BT38163	T12000437	WN38X16	WR38X16
CSL-375/374-xxx	PF374	TC1850	OR1600	ADEX300	WN38X16	WR38X16	BT38163	T12000437	WN38X16	WR38X16
CSL-377/376-xxx	PF376	TC2250	OR2000	N/A	WN38X16	WR38X16	BT38163	T14750625	HN50X13	WR50X13
CSL-384(2)-xxx	PF384(2)	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CSL-685-xxx	PF684	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CSL-485(2)/484(2)-xxx	PF484(2)	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CT-851/850-xxx	PF850	N/A	OR725	BG412	N/A	N/A	CPWF	N/A	N/A	N/A
CT-235/234-xxx	PF234	N/A	GCT1100	ADCT234	N/A	N/A	CPWF	T8000437	BH38X16	WR38X88
CT-275/274-xxx	PF274	N/A	OR386	ADCT234	N/A	N/A	KITCT274	T12000437	BH38450	WR38X16
VS-275/274-xxx	PF274	N/A	OR386	N/A	N/A	N/A	N/A	T12000437	WN38X16	WR38X16
VL-275/274-xxx	PF274	N/A	OR386	N/A	N/A	N/A	N/A	T12000437	WN38X16	WR38X16

*Note: Spare parts are for standard products. See page 4 for replacement element.

Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA
Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Rev: MMVF-407

KUNKLE

Model 215V is Non-code Vacuum Relief.
Model 337 is ASME Section VIII Air/Gas "UV" National Board Certified Safety Valve.
Both are 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.
- Pivot between disc and spring corrects misalignment and compensates for spring side thrust.
- Each Kunkle valve is tested and inspected for pressure setting and leakage.

Model Descriptions

- **Model 337:** has "lift-pin" lift device for easy manual testing.
- All adjustments are factory sealed to help prevent tampering or disassembly.

Option

- Stainless Steel (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.

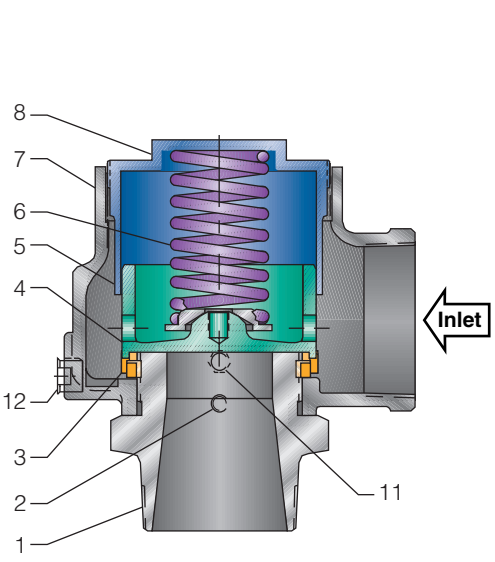
Vacuum Limits
Model 215V:
2" Hg to 29" Hg [67.7 to 982 mbarg]
-20° to 406°F [-29° to 208°C]

Pressure and Temperature Limits
Model 337:
1 to 60 psig [0.07 to 4.1 barg]
-20° to 406°F [-29° to 208°C]

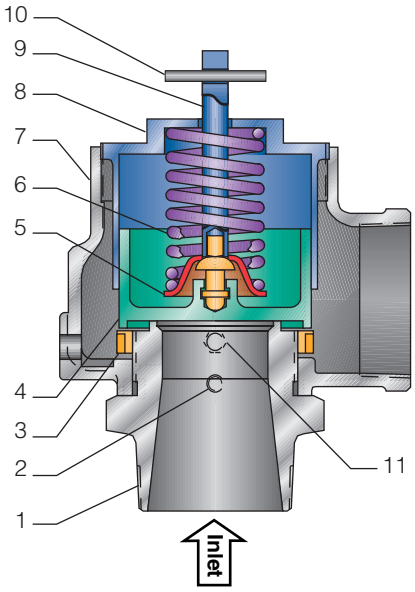
0337-H01ANE00004

tyco Flow Control

Parts and Materials



Model 215V



Model 337

Models 215V and 337

No.	Part Name	215V	337
1	Nozzle[1]	Bronze, SB62 or Brass B283-C48500	Bronze, SB62 or Brass B283-C48500
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

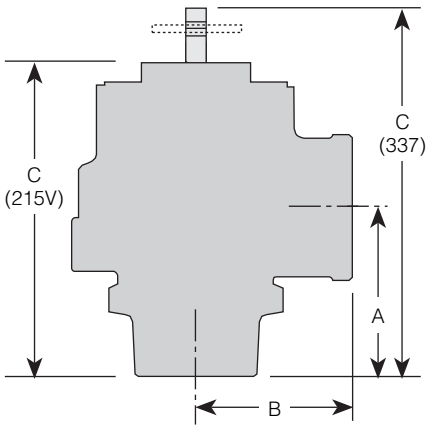
Notes

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 7/8 [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

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	2 1/2" Orifice Area, in² 2.79	3" Orifice Area, in² 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	2 1/2" Orifice Area, in² 2.79	3" Orifice Area, in² 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 Orifice Area [17.97 cm²]	7.62 cm Orifice Area [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.

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" [50.8 mm]
J - 2½" [63.5 mm]
K - 3" [76.2 mm]

Variation (01 to 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) to 60 psig [4.1 barg] (0060)
Model 215V, 2" Hg [68 mbarg] (0002) to 29" Hg [982 mbarg] (0029) vacuum

KUNKLE
953 Old U.S. Highway 70
Black Mountain, North Carolina 28711-2549
Customer Service Phone: 1-828-669-3700
www.kunklevalve.com

KUNKLE PRESSURE RELIEF VALVES

Installation and Operating Instructions

Pre-Installation Handling

This pressure relief valve is designed to protect equipment from overpressure. The valve should be handled with care, not subjected to heavy shock loads, and protected to prevent contamination from getting inside. It should be installed correctly per A.S.M.E. Boiler & Pressure Vessel Code requirements. Failure to do so could result in property damage or serious injury to personnel. When hoisting the valve into position for installation, care should be exercised so that lifting straps do not contact the valve lift lever.

Installation

Always wear proper safety equipment, including safety glasses and ear protection.

1. Mount the valve in a vertical position so that the valve body is self-draining. If a body drain port is provided, make sure it is open when required by the ASME code. Do not plug any bonnet vent openings. The inlet piping should be as short as possible, with no elbows, and equal to or greater than the size of the pressure relief valve inlet connection. This will help to limit the inlet pressure drop to 3% or less when the valve is relieving.

2. When discharge piping is connected to valve outlet, make sure it is self draining if a body drain port is not used. The valve should not be connected to any discharge pipe that contains pressure before the valve opens or to any pipe where the pressure build-up is greater than 10% of the set pressure when the valve is open and relieving.

   Discharge piping, other than a short tailpipe, must be supported. For steam service, a drip pan elbow or flexible connection between the valve and the pipe should be used to prevent excessive pipe stress, due to thermal expansion, from being imposed on the valve body.

3. For threaded valves, to prevent sealing compound from entering and damaging the valve, apply a small amount of pipe thread sealing compound to external threads only. Do not put any sealing compound on the first thread or on any internal threads. To do so may cause the sealing compound to enter the valve and cause seat leakage.

   Do not use the valve body or bonnet for installing the valve in threaded connections. Use the wrench flats provided to tighten the valve to the connecting pipe, and do not overtighten. To do so may cause valve leakage.

4. For flanged valves, use new gaskets and tighten the mounting studs evenly.

Operation

1. Maintain a system operating pressure at least 5 psig or 10% below the set pressure of the valve, whichever is greater. Operating too close to the valve set pressure will cause seat leakage and will shorten the time between valve maintenance.

2. Do not use the safety valve as a control valve to regulate system operating pressure. Excessive operation will cause the seat to leak and will require more frequent valve maintenance.

3. ASME Section I and VIII valves equipped with lift levers are designed to be operated only when the system pressure is 75% of set pressure or greater. ASME Section IV valves may be operated at any set pressure. When hand operating the valve, hold it open long enough to purge any foreign matter from the seat area. If a cable or wire is attached to the lift lever for remote actuation, make sure the direction of pull is the same as it would be if the lever were pulled directly by hand.

Maintenance

Maintenance should be performed on a regular basis. An initial inspection interval of 12 months is recommended. Depending on the service conditions and the condition of the valve, the inspection interval may be decreased or increased. Use only Kunkle parts for repair. Depending on the local jurisdictional requirements where the valve is installed, repairs may have to be made by a repair facility holding a VR stamp.

WARNING!

Removal of the seal wires or any attempt to adjust, repair or modify this product by non-qualified or non-authorized persons voids the product guarantee and may cause serious damage to equipment, personal injury, and death. Kunkle Valve is not liable for any damage resulting from misuse or misapplication of its products.

Kunkle Valve Division

Rev B 01/14/2002

Phone: 828-669-5515 953 Old US 70, Black Mountain, NC 28711 Fax: 828-669-4017

Procedure to Reset Kunkle Vacuum Relief Valves

To field reset a Kunkle vacuum relief valve, first turn off the vacuum pump that the valve serves. After the equipment completely stops, you can begin to work on the valve. Note that it is potentially dangerous to adjust the valve while the vacuum pump is in operation.

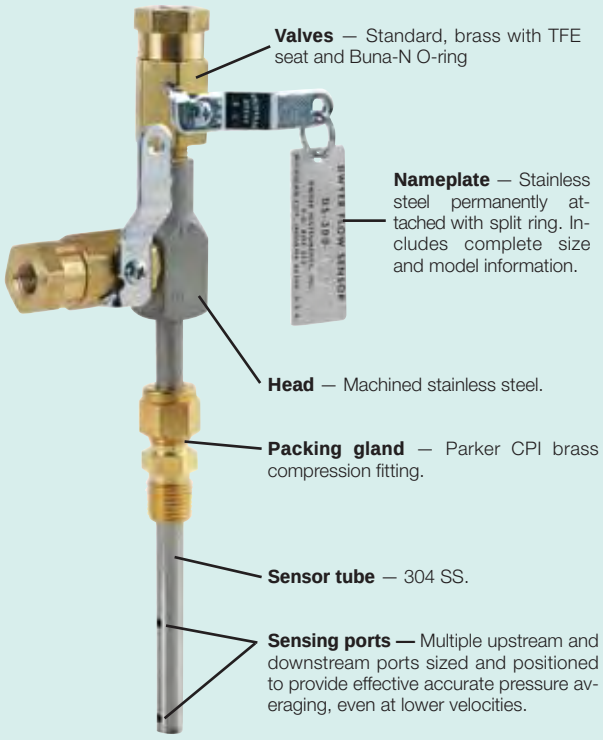
The valve setting is maintained by compressing a spring which is located within the valve body. This spring is compressed by turning the bronze valve cap clockwise until the necessary compression is obtained.

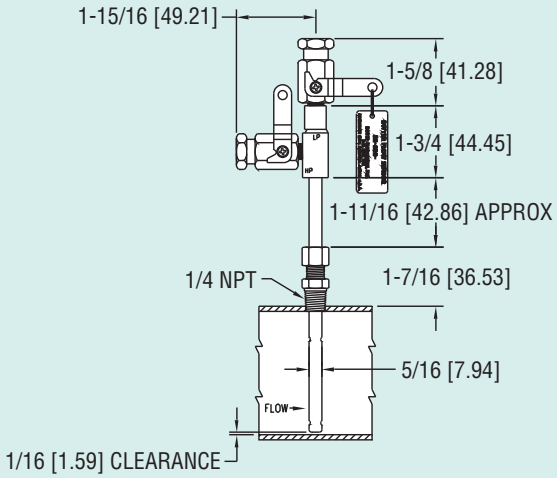
Begin by clipping the seal on the lock wire holding the two nameplate screws in place. Remove the nameplate screws. You must remove these screws in order to turn the valve body cap. Now rotate the valve body cap on full turn. Replace the nameplate screws. Clear all loose items away from the inlet of the valve. Turn on the vacuum pump and induce the desired relief valve setting vacuum level on the system. If the valve opens you have not sufficiently increased compression. Shut off the pump, remove the nameplate screws and turn the valve cap again one full turn. Follow the test procedure as above. Repeat until the desired set point is obtained. Once the final set point has been reached, replace the nameplate screws and reseal with a new lock wire seal.

In no case should the et point of the valve be increased in excess of the vacuum pumps maximum design capability or to the point that the motor exceeds its nameplate horse power rating (including service factor).

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

DS-300-1″
DS-300-1-1/4″
DS-300-1-1/2″
DS-300-2″
DS-300-2-1/2″
DS-300-3″
DS-300-4″
DS-300-6″
DS-300-8″
DS-300-10″

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

Options and Accessories

A-160 Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi

A-161 Brass Bushing, 1/4″ x 3/8″

DS-300 Less Valves. To order, add suffix **-LV**

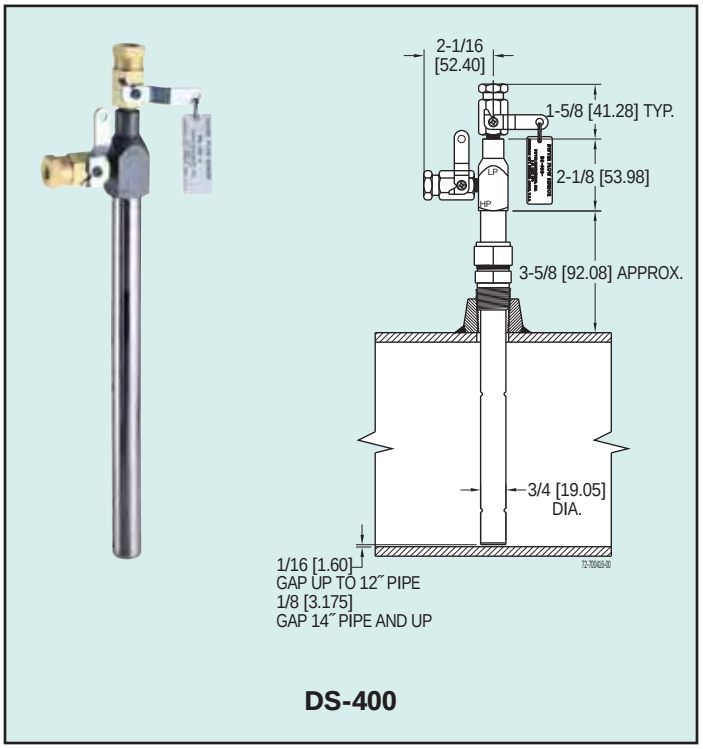
How To Order

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) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	4.8 19.0 50.0	8.3 33.0 90.5	11.5 42.0 120.0	20.5 65.0 210.0	30 113 325	49 183 510	86 330 920	205 760 2050	350 1340 3600	560 2130 6000
5	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	7.7 30.0 83.0	14.0 51.0 142.0	18.0 66.0 190.0	34.0 118.0 340.0	47 178 610	78 289 820	138 510 1600	320 1200 3300	560 2150 5700	890 3400 10000
10	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	11.0 41.0 120.0	19.0 72.0 205.0	25.5 93.0 275.0	45.5 163.0 470.0	67 250 740	110 410 1100	195 725 2000	450 1690 4600	800 3040 8100	1260 4860 15000
25	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	18.0 63.0 185.0	32.0 112.0 325.0	40.5 155.0 430.0	72.0 255.0 760.0	108 390 1200	173 640 1800	310 1130 3300	720 2630 7200	1250 4860 13000	2000 7700 22000
50	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	25.0 90.0 260.0	44.0 161.0 460.0	57.5 205.0 620.0	100.0 360.0 1050.0	152 560 1700	247 900 2600	435 1600 4600	1000 3700 0000	1800 6400 18500	
100	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	36.5 135.0 370.0	62.0 230.0 660.0	82.0 300.0 870.0	142.0 505.0 1500.0	220 800 2300	350 1290 3600	620 2290 6500	1500 5000 5000		

Model A-471 Portable Kit

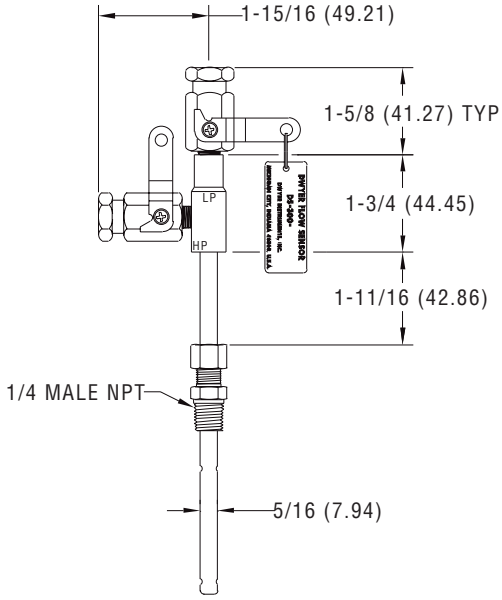
The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5˝ w.c. With accuracy of ±3% 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 8 and 9 for complete information on the Capsuhelic® gage.

CAPSUHELIC® GAGE SHOWN INSTALLED 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.**

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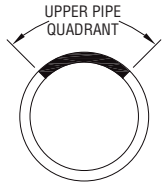
POSITION

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

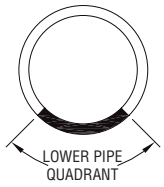
Install in upper quadrant of pipe



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

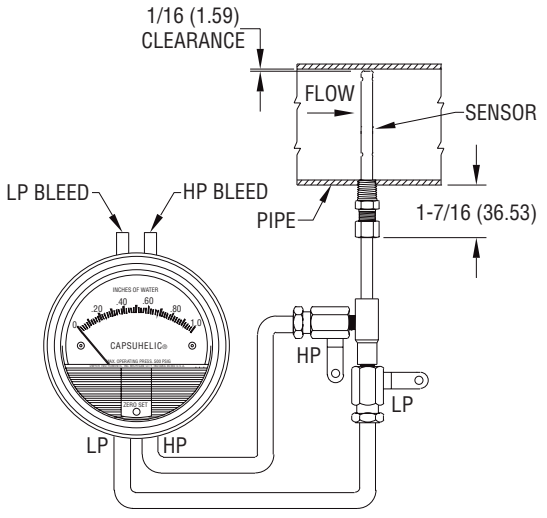
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

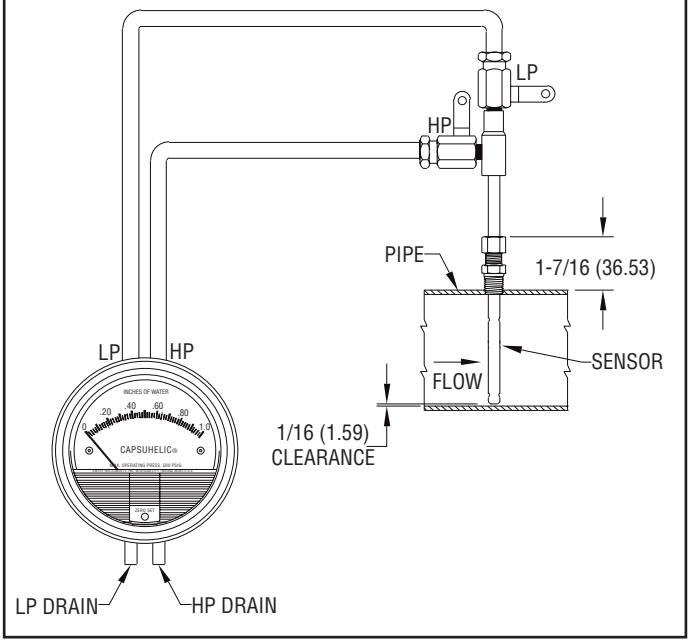
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

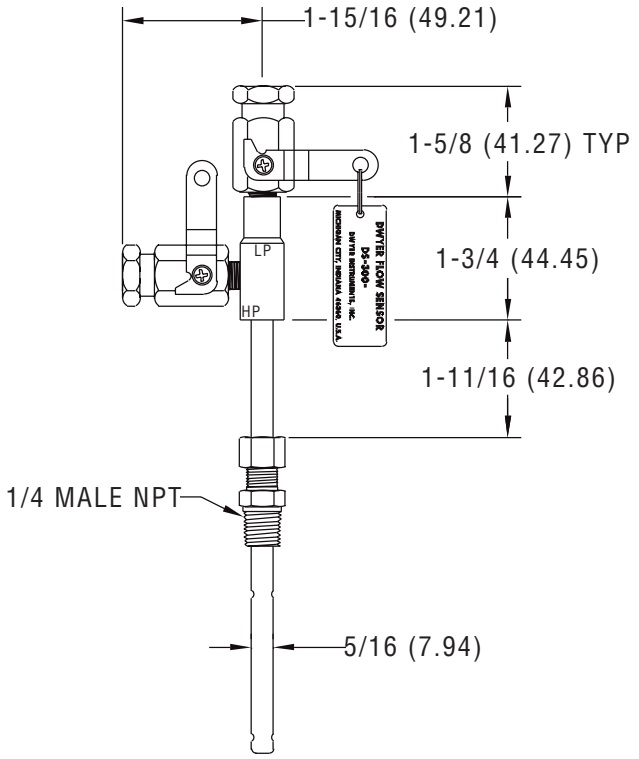
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

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.

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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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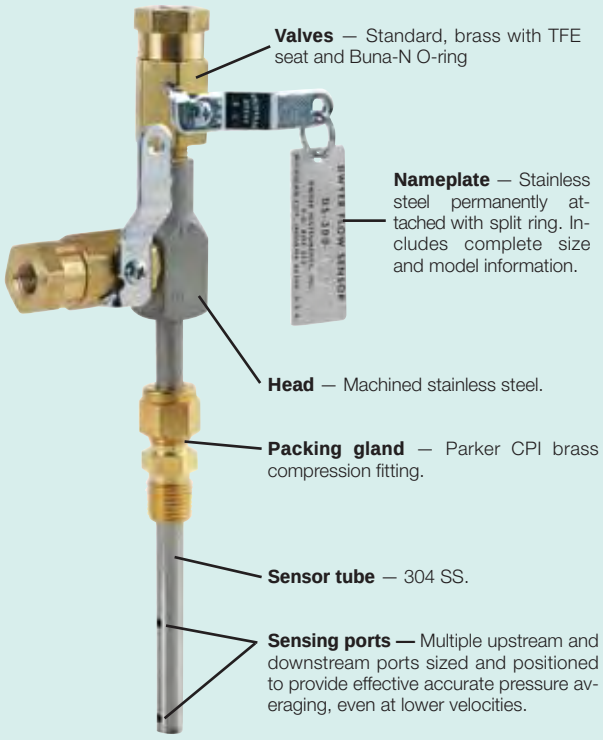
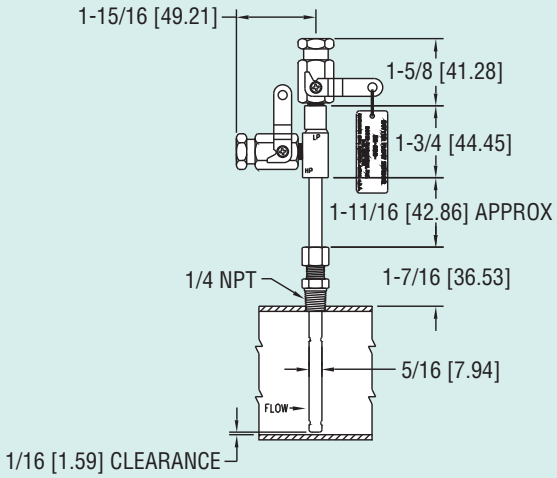
Series DS In-Line Flow Sensors

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

DS-300-1″
DS-300-1-1/4″
DS-300-1-1/2″
DS-300-2″
DS-300-2-1/2″
DS-300-3″
DS-300-4″
DS-300-6″
DS-300-8″
DS-300-10″

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

Options and Accessories

A-160 Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi

A-161 Brass Bushing, 1/4″ x 3/8″

DS-300 Less Valves. To order, add suffix **-LV**

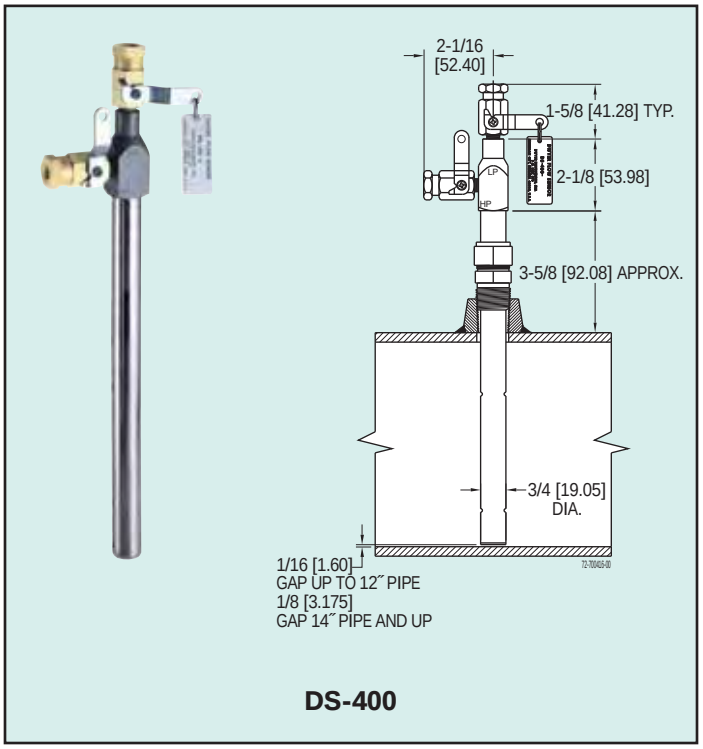
How To Order

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

Model A-471 Portable Kit

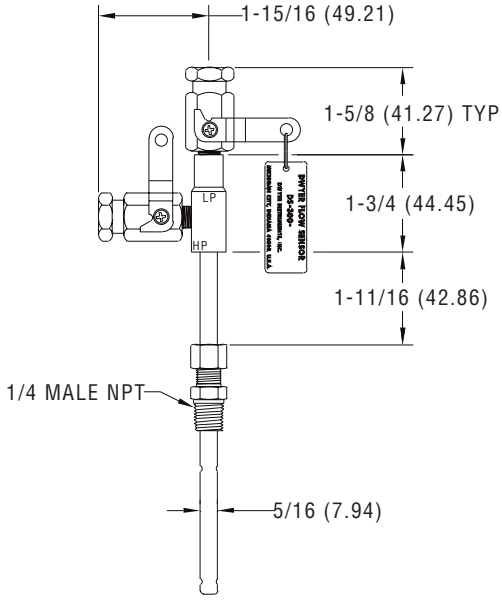
The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5˝ w.c. With accuracy of ±3% 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 8 and 9 for complete information on the Capsuhelic® gage.

CAPSUHELIC® GAGE SHOWN INSTALLED 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.

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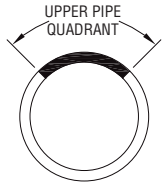
For Air or Gas Flow

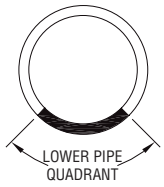
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

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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.

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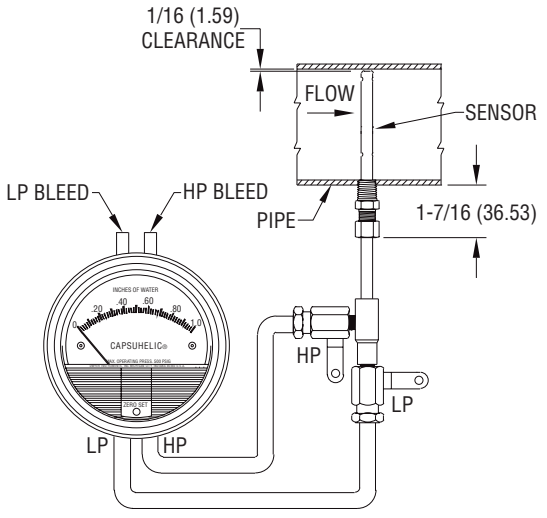
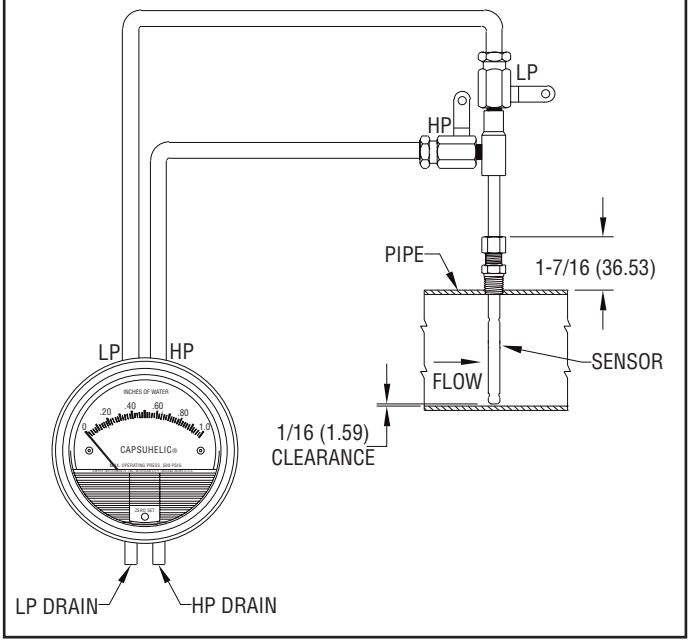
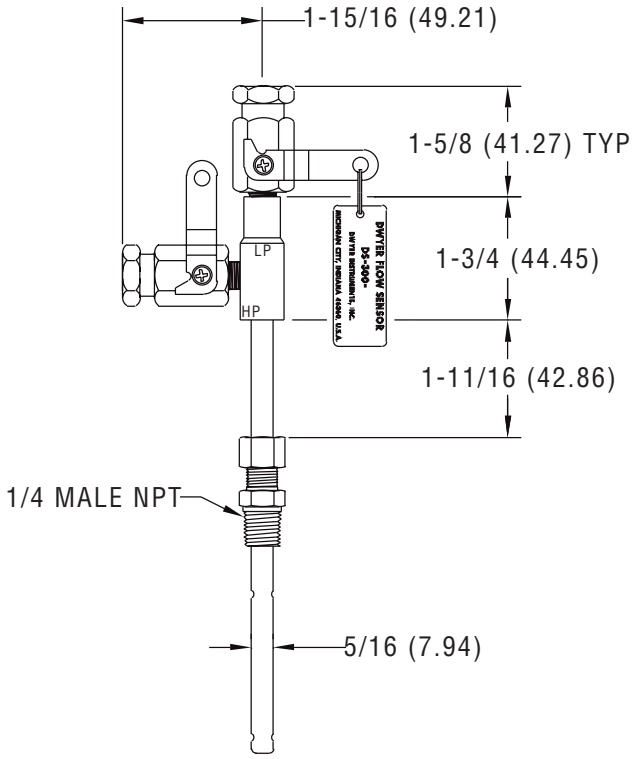


Air or Gas Flow





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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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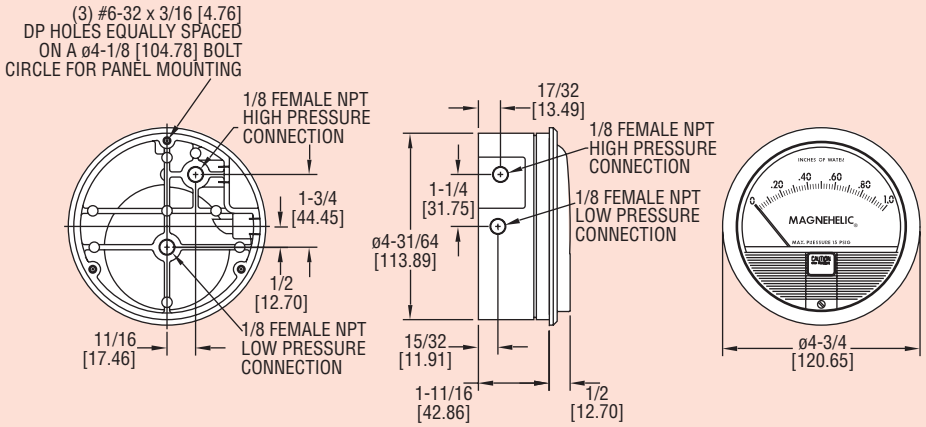
Series 2000

Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.
The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen. When ordering a Buna-N diaphragm pressures must be less than 35 psi.

Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional **A-610** Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1-1/4″ - 2″ pipe. Although calibrated for vertical position, many ranges above 1″ may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4-9/16″ hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

Flush...Surface... or Pipe Mounted

Vent Valves

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

High and Medium Pressure Models

Installation is similar to standard gages except that a 4-13/16″ hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20″ Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4″ (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable Signal Flag
Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

A-432 Portable Kit
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ I.D. rubber tubing, standhang bracket and terminal tube with holder.

A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

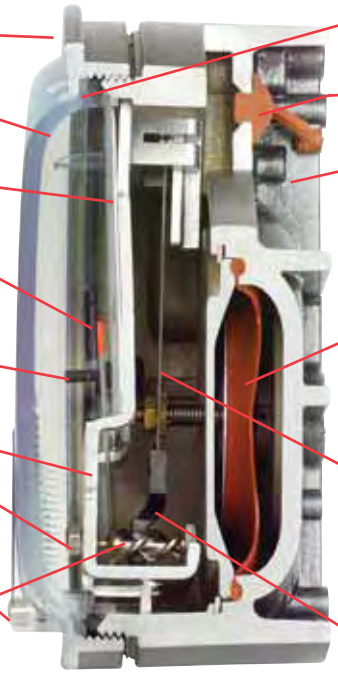
Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Series 2000 Magnehelic® Gage — Models and Ranges
Page V shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, square root scales for volumetric flow, etc., contact the factory.

Model	Range Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180	0-180
2250	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

Model	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

Model	Range MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10

Model	Range, Pa
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-100 x 10
Zero Center Ranges	
Model	Range, Pa
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

Model	Range in W.C./ Velocity F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2005AV	0-5.0/2000-8800
2010AV	0-10/2000-12500

Dual Scale English/Metric Models

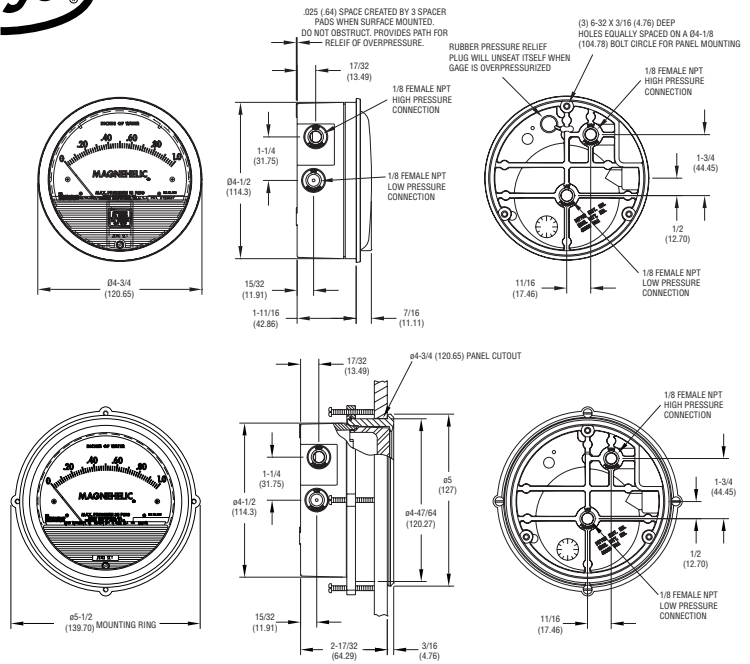
Model	Range, In. W.C.	Range, Pa or kPa
2000-OOD†••	0-.25	0-62 Pa
2000-OD†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

ACCESSORIES
A-299, Surface Mounting Bracket
A-300, Flat Flush Mounting Bracket
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-448, 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-605, Air Filter Kit
A-610, Pipe Mount Kit

OPTIONS — To order, add suffix: I.E. 2001-ASF
ASF, Adjustable Signal Flag
HP, High Pressure Option
LT, Low Temperatures to -20°F
MP, Med. Pressure Option
SP, Setpoint Indicator
Scale Overlays, Red, Green, Mirrored or Combination, Specify Locations

Bulletin A-27

Magnehelic® Differential Pressure Gage



**The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.*

STANDARD GAGE ACCESSORIES: Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapters and three flush mounting adapters with screws.

MP AND HP GAGE ACCESSORIES: Mounting ring and snap ring retainer substituted for 3 adaptors, 1/4" compression fittings replace 1/8" pipe thread to rubber tubing adaptors.

OVERPRESSURE PROTECTION: Standard Magnehelic® Differential Pressure Gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (excludes MP and HP models). To provide a free path for pressure relief, there are four spacer pads which maintain .023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

SPECIFICATIONS

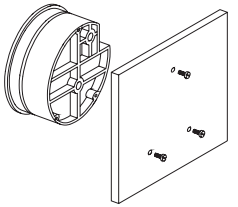
Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. (MP model has polycarbonate cover).
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on -00, - 00N, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20″ Hg to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
Temperature Limits: 20 to 140°F (-6.67 to 60°C). *Low temperature models available as special option.
Size: 4″ (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).

†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.
Note: May be used with hydrogen when ordering Buna-N diaphragm. Pressure must be less than 35 psi.

INSTALLATION

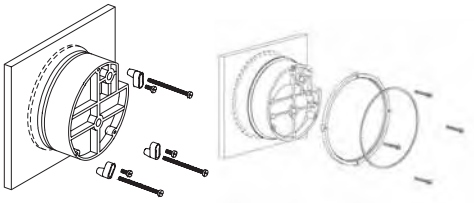
Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.
All standard Magnehelic® Differential Pressure Gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range models of 0.5" w.c. plus 0.25" w.c. and metric equivalents must be used in the vertical position only.

SURFACE MOUNTING



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

FLUSH MOUNTING



Provide a 4-9/16" dia. (116 mm) opening in panel. Provide a 4-3/4" dia. (120 mm) opening for MP and HP models. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place.

PIPE MOUNTING

To mount gage on 1-1/4" - 2" pipe, order optional A-610 pipe mounting kit.

TO ZERO GAGE AFTER INSTALLATION

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

OPERATION

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.
Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.
Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.
When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with flexible rubber or vinyl tubing.
B. For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended.

MAINTENANCE

No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves should be used in permanent installations. The Series 2000 is not field serviceable 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.

WARNING

Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended.

TROUBLE SHOOTING TIPS

Gage won't indicate or is sluggish.

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.

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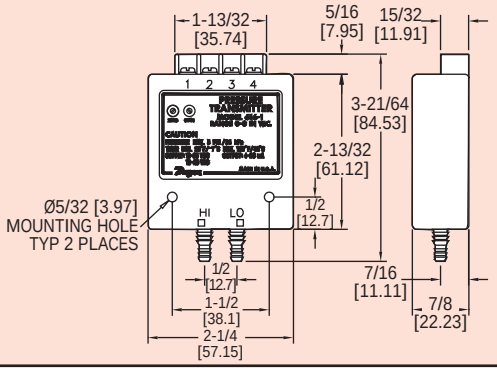
Series 616

Differential Pressure Transmitter

Ranges from 0-1 in. w.c. to 0-100 psid, Accuracy ±0.25%



Series 616 Transmitter features an exceptional ±0.25% accuracy in several factory calibrated ranges. Choose the one just right for your application. Span and Zero controls included for fine tuning and minor re-calibration in the field.

Series 616, models 0.25% accuracy

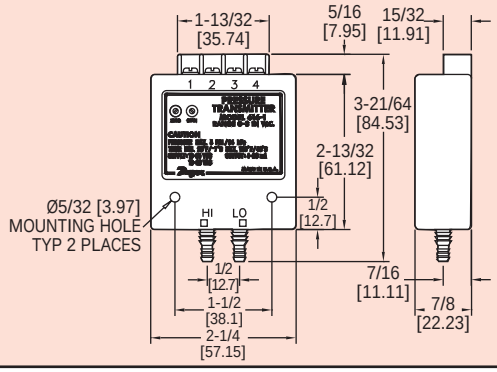
Model	Range	Max. Press.	Model	Range	Max. Press.
616-00	0-1 in w.c.	2 psig	**616-8**	0-10 psid	29 psig
616-0	0-2 in w.c.	2 psig	**616-9**	0-20 psid	58 psig
616-1	0-3 in w.c.	2 psig	**616-10**	0-30 psid	58 psig
616-2	0-6 in w.c.	5 psig	**616-11**	0-50 psid	150 psig
616-3	0-10 in w.c.	5 psig	**616-12**	0-100 psid	150 psig
616-4	0-20 in w.c.	11 psig	**616-3B**	1.5-0-1.5 in w.c.	2 psig
616-5	0-40 in w.c.	11 psig	**616-6B**	3-0-3 in w.c.	5 psig
616-6	0-100 in w.c.	29 psig	**616-10B**	5-0-5 in w.c.	5 psig
616-7	0-200 in w.c.	29 psig	**616-20B**	10-0-10 in w.c.	11 psig

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±0.25% F.S.
Stability: ±1% F.S./yr.
Temperature Limits: 0 to 140°F (-17.8 to 60°C).
Compensated Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Pressure Limits: See chart.
Thermal Effect: ±0.02% F.S./°F (±0.0012% F.S./°C).
Power Requirements: 10-35 VDC (2-wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Potentiometers for zero and span.
Loop Resistance: DC; 0-1250 ohms maximum.
Current Consumption: DC; 38 mA maximum.
Electrical Connections: Screw-type terminal block.
Process Connections: Barbed, dual size to fit 1/8″ and 3/16″ (3.12 mm and 4.76 mm) I.D. rubber or vinyl tubing.
Weight: 1.8 oz (51 g).
Agency Approvals: CE.

Series 616C

Differential Pressure Transmitter

Ranges from 0-1 in. w.c. to 0-100 psid, Accuracy 1% F.S.



Series 616C Transmitter features an exceptional 1% accuracy in several factory calibrated ranges. Choose the one just right for your application. Span and Zero controls included for fine tuning and minor re-calibration in the field.

Series 616C, models 1% accuracy

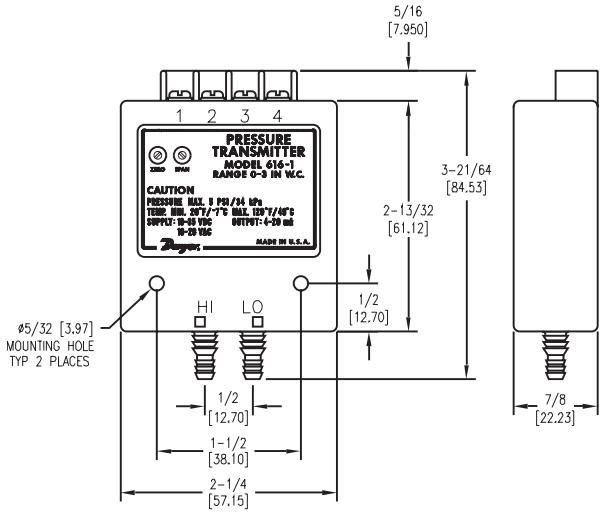
Model	Range	Max. Press.	Model	Range	Max. Press.
616C-1	0-3 in w.c.	2 psig	**616C-8**	0-10 psid	29 psig
616C-2	0-6 in w.c.	5 psig	**616C-9**	0-20 psid	58 psig
616C-3	0-10 in w.c.	5 psig	**616C-10**	0-30 psid	58 psig
616C-4	0-20 in w.c.	11 psig	**616C-11**	0-50 psid	150 psig
616C-5	0-40 in w.c.	11 psig	**616C-12**	0-100 psid	150 psig
616C-6	0-100 in w.c.	29 psig	**616C-3B**	1.5-0-1.5 in w.c.	2 psig
616C-7	0-200 in w.c.	29 psig	**616C-6B**	3-0-3 in w.c.	5 psig
			616C-10B	5-0-5 in w.c.	5 psig
			616C-20B	10-0-10 in w.c.	11 psig

Note: 0-1 in w.c. and 0-2 in w.c. only available in 616 series.

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±1% F.S.
Stability: ±1% F.S./yr.
Temperature Limits: 0 to 140°F (-17.8 to 60°C).
Compensated Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Pressure Limits: See chart.
Thermal Effect: ±0.02% F.S./°F (±0.0012% F.S./°C).
Power Requirements: 10-35 VDC (2-wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Potentiometers for zero and span.
Loop Resistance: DC; 0-1250 ohms maximum.
Current Consumption: DC; 38 mA maximum.
Electrical Connections: Screw-type terminal block.
Process Connections: Barbed, dual size to fit 1/8″ and 3/16″ (3.12 mm and 4.76 mm) I.D. rubber or vinyl tubing.
Weight: 1.8 oz (51 g).

Series 616 Differential Pressure Transmitter

Specifications – Installation and Operating Instructions



The Dwyer Series 616 Differential Pressure Transmitter senses the pressure of air and compatible gases and sends a standard 4-20 mA output signal. A wide range of models are available factory calibrated to specific ranges as listed in the chart below. The span and zero controls are for use when checking calibration. They are not intended for re-ranging to a significantly different span. Versatile circuit design enables operation in 2, 3 or 4-wire current loops.

For applications requiring direct pressure readings or percent of full span output, the optional Model A-701 Digital Readout makes an ideal companion device. It provides a bright red 0.6˝ high, 3-1/2 digit LED display while supplying power to the Series 616 transmitter. For additional information on these and other Dwyer Transmitting instruments, see the Dwyer Full Line catalog.

Series 616 Transmitter Models and Ranges*

Model No.	Range	Max. Press.	Model No.	Range	Max. Press.
616-00	0-1 in. w.c.	5 psig	**616-8**	0-10 psid	58 psig
616-0	0-2 in. w.c.	5 psig	**616-9**	0-20 psid	58 psig
616-1	0-3 in. w.c.	5 psig	**616-10**	0-30 psid	58 psig
616-2	0-6 in. w.c.	5 psig	**616-11**	0-50 psid	150 psig
616-3	0-10 in. w.c.	5 psig	**616-12**	0-100 psid	150 psig
616-4	0-20 in. w.c.	11 psig	**616-3B**	1.5-0-1.5 in. w.c.	5 psig
616-5	0-40 in. w.c.	11 psig	**616-6B**	3-0-3 in. w.c.	5 psig
616-6	0-100 in. w.c.	29 psig	**616-10B**	5-0-5 in. w.c.	5 psig
616-7	0-200 in. w.c.	29 psig	**616-20B**	10-0-10 in. w.c.	11 psig

***All models available with 0.25% F.S. Accuracy.**
Models available with 1.0% F.S. Accuracy include 616-1 through 616-20B.

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult Factory.
Accuracy: 616: ±0.25% F.S.; 616C: ±1.0% F.S.
Stability: ± 1% F.S./yr.
Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Pressure Limits: See Chart.
Thermal Effect: 616: ±0.055% F.S./°F (0.099% F.S./°C); 616C: ±0.070% F.S./°F (0.125% F.S./°C).
Power Requirements: 10-35 VDC (2, 3 or 4 wire); 16-26 VAC (4 wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Potentiometers for zero and span.
Loop Resistance: DC: 0-1250 ohms maximum.
AC: 0-1200 ohms maximum.
Current Consumption: DC: 38 mA maximum.
AC: 76mA maximum.
Electrical Connections: Screw-type terminal block.
Process Connections: Barbed, dual size to fit 1/8˝ and 3/16˝ (3.12 mm and 4.76 mm) I.D. rubber or vinyl tubing.
Mounting Orientation: Vertical, consult factory for other position orientations.
Weight: 1.8 oz. (51 grams).

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e-mail: lit@dwyer-inst.com

Installation

1.0 Location

Select a clean, dry mounting location free from excess vibration where the temperature will remain between 20 and 120˚F (-6.7 and 48.9˚C). Distance from the receiver is limited only by total loop resistance. See Electrical Connections below. The tubing supplying pressure to the instrument can be practically any length required, but long lengths will increase response time slightly.

2. Position

A vertical position, with pressure connections pointing down, is recommended. That is the position in which all standard models are spanned and zeroed at the factory. They can be used at other angles, but final spanning and zeroing must be done while transmitter is in that alternate position.

Pressure Connections

Two integral barbed tubing connections are provided. They are dual-sized to fit both 1/8˝ and 3/16˝ (3.12 and 4.76 mm) I.D. tubing. Be sure the pressure rating of the tubing exceeds that of the operating ranges. On ranges over 20 psi, we recommend use of a suitable hose clamp to assure the integrity of the connection.

Electrical Connections

CAUTION: Do not exceed specified supply voltage ratings. Permanent damage not covered by warranty will result. This unit is not designed for 120 or 240 volts AC line operation.

Electrical connections are made to the terminal block located on the top of the transmitter. Terminals are marked 1, 2, 3 and 4 *(see Fig. B below)*. Determine which of the following circuit drawings applies to your application and wire accordingly.

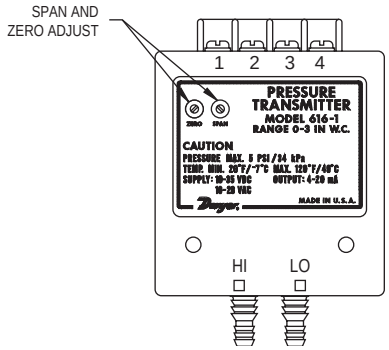

Figure B

Wire Length

The maximum length of wire connecting 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 size and cost of connecting leads. Where wiring length is under 100 feet, hook-up wire as small as 22 AWG can be used.

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.* Note the jumper between terminals 3 and 4. The range of appropriate receiver load resistance (R_L) for the DC power supply voltage available is expressed by the formula and graph in *Fig. F.* Shielded two wire cable is recommended for control loop wiring. If grounding is required, use the negative side of the control loop after the receiver. Otherwise, in 2-wire operation it is not necessary to observe polarity of control loop connections.

2-Wire Connections

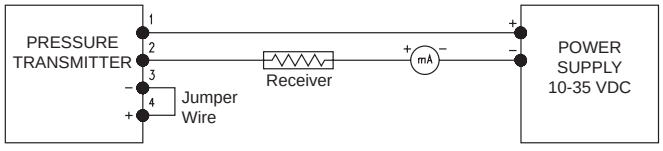

Figure C

3-Wire Operation

An external power supply delivering 10-35 VDC with minimum current capability of 40 mA DC (per transmitter) is required. *See Fig. D for connection of power supply, transmitter and receiver.* The range of appropriate receiver load resistance (R_L) for the DC power supply available is expressed by the formula and graph in *Fig. F.* Shielded cable is recommended for control loop wiring. Do not employ a separate ground in 3-wire operation. Unit will not function properly and/or damage could result. Control loop polarity must be observed in the following respect. Although power supply terminals 1 and 2 are not polarized, the receiver must be connected between terminal 3 of transmitter and negative side of power supply.

3-Wire Connections

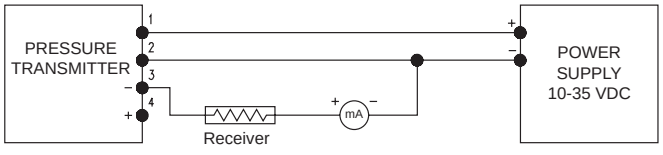

Figure D

4-Wire Operation

An external power supply delivering 10-35 VDC with a minimum current capability of 40 mA DC (per transmitter) or 16-26 VAC with a minimum current capability of 80 mA AC (per transmitter) is required. *See Fig. E for connection of power supply, transmitter and receiver.* The range of appropriate load resistance (R_L) for the DC or AC power supply available is expressed by the formulas and graphs in *Fig's. F and G.*

Shielded cable is recommended for control loop wiring. Do not employ a separate ground in 4-wire operation. Unit will not function properly and/or damage could result. Control loop polarity must be observed; terminal 3 is negative and terminal 4 is positive.

4-Wire Connections

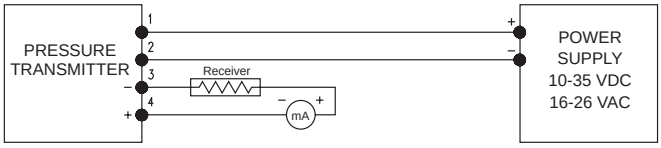

Figure E

Power Supply Voltage – VDC (2, 3 or 4-wire)

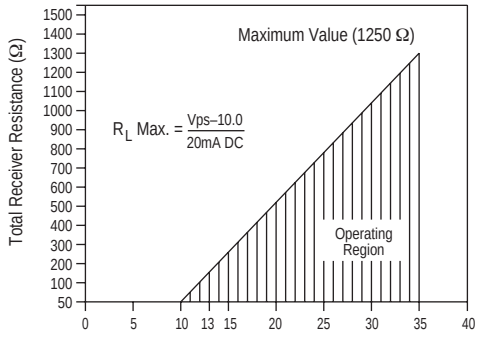

Figure F

Power Supply Voltage – VAC (4-Wire)

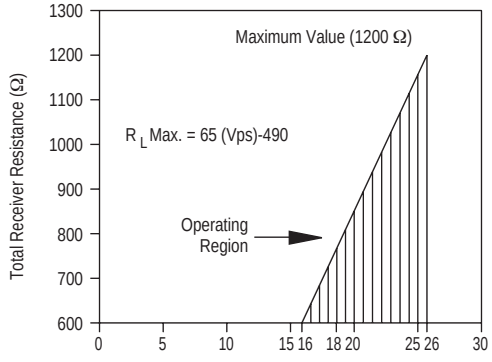

Figure G

Calibration Check

Each Series 616 Transmitter is factory calibrated to the range given in the model chart. To check calibration and adjust if necessary, the following procedure should be used. For purposes of clarification in these instructions, range is defined as that pressure which, applied to the transmitter, produces 20 milliamps of current in the loop. Zero pressure is always assumed to be 4 milliamps.

1. With the transmitter connected to the companion receiver, insert an accurate milliameter in series with the current loop. Full scale range should be approximately 30 mA.

2. Connect a controllable pressure source to one leg of a tee with the other two legs connected to the high pressure port of the transmitter and the third leg to an accurate test gage or manometer, in an appropriate range. The low pressure port should be vented to atmosphere. Calibration must be performed with the unit in the same position in which it will be mounted.

3. Apply electrical power to the unit and allow it to stabilize for 10 minutes.

4. With no pressure applied to the transmitter, adjust ZERO control so that loop current is 4 mA.

5. Apply full range pressure and adjust loop current to 20 mA using SPAN control.

6. Relieve pressure and allow transmitter to stabilize for 2 minutes.

7. Zero and span controls are slightly interactive, so repeat steps 4 through 6 until zero and full range pressures consistently produce currents of 4 and 20 mA respectively.

8. Remove the milliameter from the current loop and proceed with final installation of the transmitter and receiver.

Voltage Input

Series 616 Transmitters can be easily adapted for receivers requiring 1-5 or 2-10 VDC inputs. Insert a 249 ohm, 1/2 watt (1-5 VDC) or 499 ohm (2-10 VDC) resistor in series with the current loop but in parallel with the receiver input. Locate this resistor as close as possible to the input. Because resistor accuracy directly influences output signal accuracy, we recommend use of a precision ±0.1% tolerance resistor to minimize this effect. See Fig. H and J below.

3-Wire Connection (1-5 or 2-10 VDC Output)

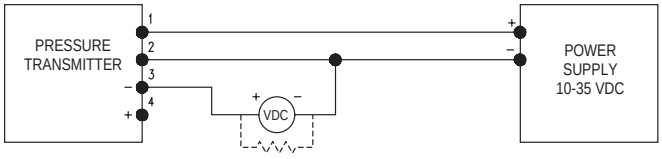

Figure H

4-Wire Connection (1-5 or 2-10 VDC Output)

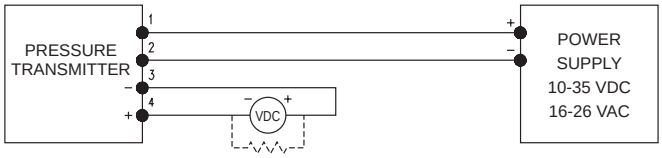

Figure J

Multiple Receiver Installation

An advantage of the standard 4-20 mA DC output signal produced by the Series 616 Transmitter is that any number of receivers can be connected in series in the current loop. Thus, an A-701 Digital Readout, an analog panel meter, a chart recorder, process controlling equipment or any combination of these devices can be operated simultaneously. The only requirement is that each component be equipped for a standard 4-20 mA input and the proper polarity of the input connections be observed when inserting the device in the current loop. If any of the units display a negative or downscale reading, the signal input leads are reversed.

Maintenance

Upon final installation of the Series 616 Differential Pressure Transmitter and the companion receiver, including the A-701 Digital Readout, no routine maintenance is required. A periodic check of the system calibration is recommended following the procedures explained on page 3 under *Calibration Check.* The Series 616 Transmitter is not field serviceable and should be returned, freight prepaid, to the factory if repair is required. Please enclose a description of the problems encountered plus any available application information. The A-701 should be returned directly to its manufacturer for service. See the A-701 instructions for address.

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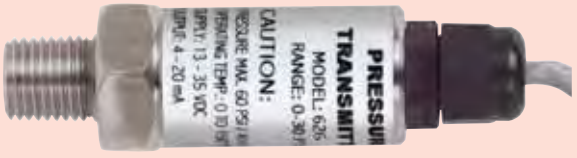
Series 626 & 628

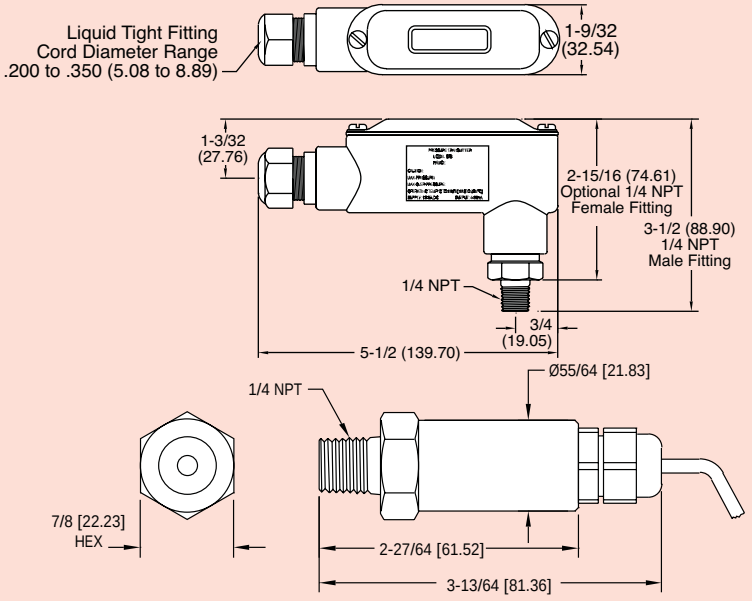
Industrial Pressure Transmitter

Complete Offering of Ranges, Connections and Outputs

Conduit Housing (-CH)



General Purpose Housing (-GH)



The Series 626 Pressure Transmitters possess a highly precise 0.25% piezo-resistive sensor contained in a compact, rugged, NEMA 4X 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 highly corrosive 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

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Type 316 SS, 316L SS.
Accuracy: 626: 0.25% full scale. 628: 1% full scale (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: 626: ±0.02% FS/°F. 628: ±0.04% FS/°F (includes zero and span).
Pressure Limits: See table.
Power Requirements: 13 to 30 VDC.
Output Signal: 4 to 20 mA. Optional 0-5, 1-5, 0-10, 1-6 or 2-10.
Response Time: 50 msec.
Loop Resistance: 0 - 1300 ohms maximum for current. For voltage outputs, minimum load resistance: 2000 ohms.
Current Consumption: 38 mA (maximum).
Electrical Connections: Conduit Housing (-CH): terminal block, 1/2˝ female NPT conduit. General Purpose Housing (-GH): cable, DIN connector or 4 pin M-12.
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 (psig)	Maximum Pressure (psig)	Over Pressure (psig)	Range Number	Pressure Range (psig)	Maximum Pressure (psig)	Over Pressure (psig)
00	30˝ Hg-0	30	150	11	0-150	300	750
01	30-0-15	30	150	12	0-200	400	1000
02	30-0-30	60	300	13	0-300	600	1500
03	30-0-45	100	300	14	0-500	1000	2500
04	30-0-60	200	500	15	0-1000	2000	5000
05	30-0-100	200	500	16	0-1500	3000	5000
06	0-5	10	50	17	0-2000	4000	5000
07	0-15	30	150	18	0-3000	6000	7500
08	0-30	60	300	19	0-5000	7500	10000
09	0-50	100	300	26	0-8000	10000	12000
10	0-100	200	500				

MODEL ORDERING CHART

Accuracy	626 628						0.25% Full Scale Accuracy 1.0% Full Scale Accuracy
Range		-00 -01 -02 -03 -04 -05 -06 -07 -08 -09 -10 -11 -12 -13 -14 -15 -16 -17 -18 -19 -26					0-30˝ Hg Vacuum 30-0-15 psi 30-0-30 psi 30-0-45 psi 30-0-60 psi 30-0-100 psi 0-5 psi 0-15 psi 0-30 psi 0-50 psi 0-100 psi 0-150 psi 0-200 psi 0-300 psi 0-500 psi 0-1000 psi 0-1500 psi 0-2000 psi 0-3000 psi 0-5000 psi 0-8000 psi
Housing			-CH -GH				Conduit Housing General Purpose Housing
Process Connection				-P1 -P2 -P3 -P4 -P5			1/4˝ male NPT 1/4˝ female NPT 1/4˝ male BSPT 1/4˝ female BSPT Refrigerant Valve Depressor
Electrical Connection					-E1 -E2 -E3 -E4 -E5 -E6		Cable Gland with 3' of Prewired Cable Cable Gland with 6' of Prewired Cable Cable Gland with 9' of Prewired Cable DIN Connector Available with -GH Housing Only 1/2˝ female NPT Conduit Available with -CH Housing Only M-12 4 Pin Connector
Signal Output						-S1 -S2 -S3 -S4 -S5 -S6	4-20 mA 1-5 Volt 2-10 Volt 0-5 Volt 0-10 Volt 1-6 Volt
Options							-AT -NIST -LED	Aluminum Tag NIST Traceable Certificate Bright Red LED display. Available with -CH housing only

626 with LED Display (CH housing only)

Note: LED option is not NEMA 4X rated.

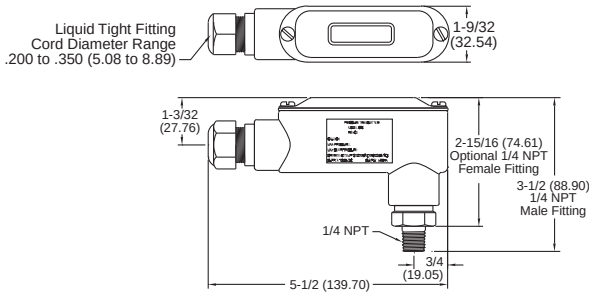
Optional -E4 DIN Connector (GH housing only)

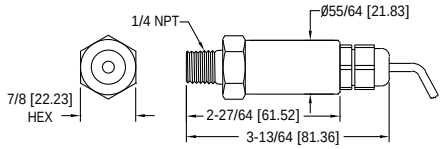
Series 626 & 628 Pressure Transmitters

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 (psig)	**Maximum Pressure (psig)**	**Over Pressure (psig)**
30″ Hg-0	30	45
30-0-15	60	90
30-0-30	90	130
30-0-45	120	180
30-0-60	150	225
30-0-100	200	300
0-5	10	50
0-15	30	150
0-30	60	300
0-50	100	300
0-100	200	500
0-150	300	750
0-200	400	1000
0-300	600	1500
0-500	1000	2500
0-1000	2000	5000
0-1500	3000	5000
0-2000	4000	5000
0-3000	6000	7500
0-5000	7500	10000
0-8000	10000	12000
0-30″ Hg (vacuum)	30	150

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Type 316L SS; Ceramic Ranges: Type 316 SS, ceramic, fluoroelastomer.
Accuracy: 626: 0.25% full scale;
626 ceramic ranges: 0.5% full scale;
628: 1% full scale.
(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: 626: ±0.02% FS/°F. 628: ±0.04% FS/°F (includes zero and span).
Pressure Limits: See table.
Power Requirements: 13 to 30 VDC.
Output Signal: 4 to 20 mA. Optional 0-5, 1-5, 0-10, 1-6 or 2-10.
Response Time: 50 msec.
Loop Resistance: 0 - 1300 ohms maximum for current.
For voltage outputs, minimum load resistance: 2000 ohms.
Current Consumption: 38 mA (maximum).
Electrical Connections: Conduit Housing (-CH): terminal block, 1/2″ female NPT conduit. General Purpose Housing (-GH): cable or DIN connector.
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.
*Note: Transmitters with ceramic sensor are not CE approved.

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.

CURRENT (4-20 mA) OUTPUT OPERATION

An external power supply delivering 13-30 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:

$$R_L \text{ Max} = \frac{Vps - 13}{20 \text{ mA DC}}$$

Shielded cable is recommended for control loop wiring.

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Current Output

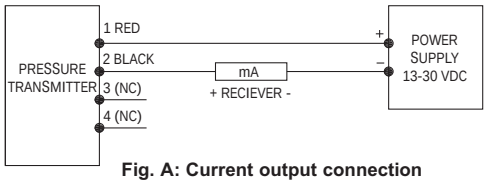

Fig. A: Current output connection

4a. 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. 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 (+).

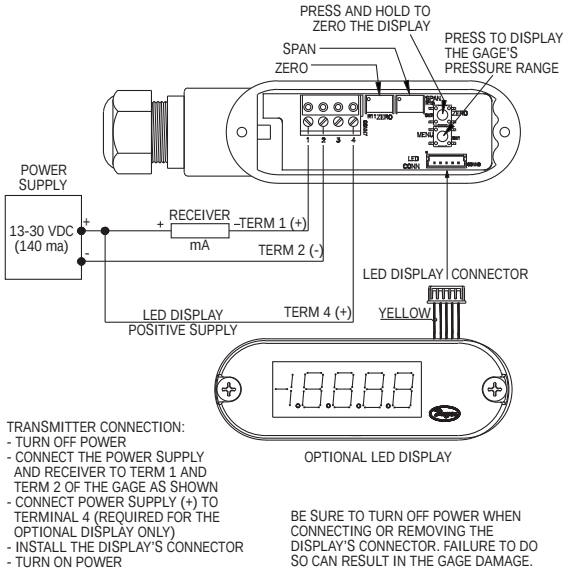

Fig. B: Current output with optional LED display connection

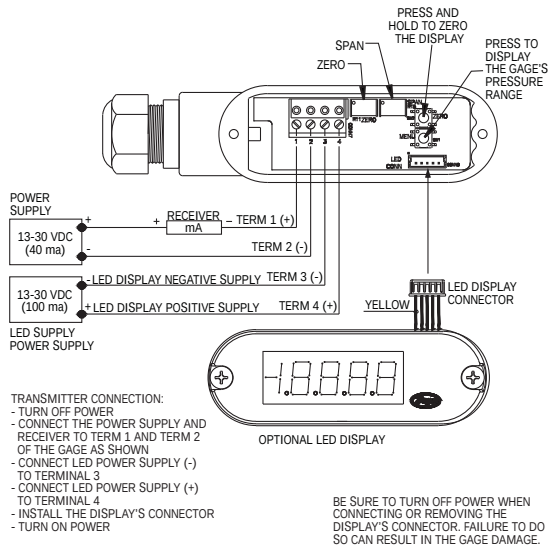

Fig. C: Current output with optional LED display using two power supplies

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.

4b. General Purpose Housing (-GH) 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.

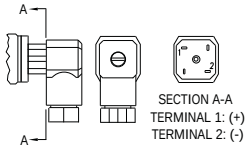

Fig. D

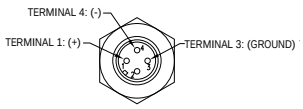

Fig. E

VOLTAGE (0-5, 1-5, 0-10, 1-6 or 2-10 Volt) OUTPUT OPERATION
(Other outputs contact the factory) See Fig. F for connection of the power supply, transmitter and receiver.

Voltage Output

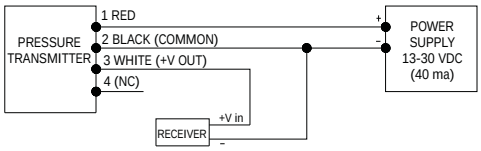

Fig. F: Voltage output connection

4c. 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.

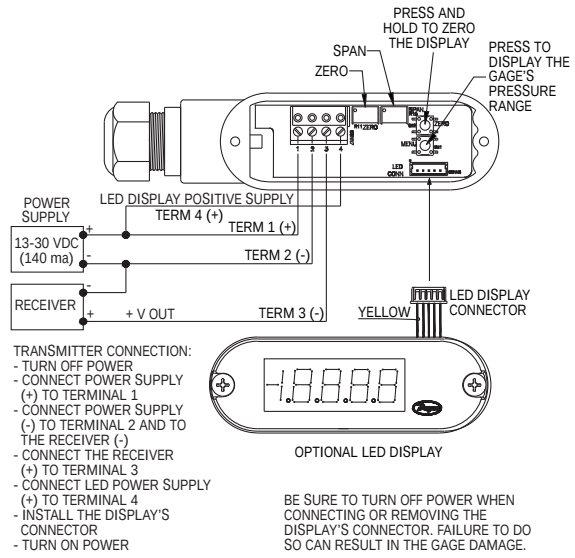

Fig. G: Voltage output with optional LED display connection

4d. General Purpose Housing (-GH) 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.

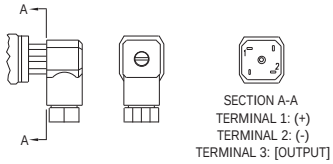

Fig. H

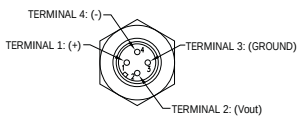

Fig. I

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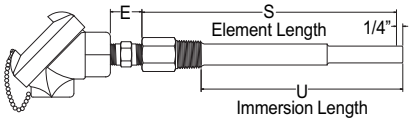
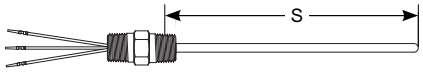
Sensors with Connection Heads

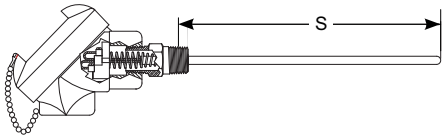
Configuration Code GP03

Spring-Loaded RTD/Thermowell Assemblies with General Purpose Connection Heads

Spring-Loaded RTD Thermowell Assemblies with General Purpose Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the RTD assembly below, the thermowell from the thermowell section of this catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. They are supplied with a 316 stainless steel sheath and are available in various initial accuracies and temperature ranges as noted in the tables below. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed postition. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.







ORDER CODES

Example Order Number:

1-0	1-1	1-2		2-0		3-0		4-0	4-1	4-2	
R1T185L	48	3	-	Select Thermowell Part # or Insert 3 Digit Length Code	-	SL	-	8HN	31,	T-	Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements

α = 0.003 85 ºC^{-1}

CODE		INITIAL ELEMENT ACCURACY 0 ºC
LOW RANGE WIRE WOUND (-200 to 204) ºC		
SINGLE	***DUPLEX***	
R1T185L	R1T285L	± 0.1%
R5T185L	R5T285L	± 0.01%
LOW RANGE THIN FILM (-40 to 204) ºC		
RBF185L	RBF285L	± 0.12%
RAF185L	RAF285L	± 0.06%
HIGH RANGE WIRE WOUND (-200 to 600) ºC		
R1T185H	R1T285H	± 0.1%

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

1-2 Element Connection

CODE	DESCRIPTION
2	2 wire
3	3 wire
4[1]	4 wire
[1] Not available in duplex or with 440 Series Transmitter	

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
SN	Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max.
[1] Not available with option 35T-642A	

4-0 Head Mounting Fittings

CODE	DESCRIPTION	CODE	DESCRIPTION
STEEL FITTINGS		*316SS FITTINGS*	
6HN	1/2" x 1/2" NPT hex nipple 1" length	8HN	1/2" x 1/2" NPT hex nipple 1" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)	8PN_	1/2" NPT pipe nipple (specify "E" length in inches)
6PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)	8PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
[1] 4" Minimum length required			

4-1 Head and Sheath Terminations

CODE	DESCRIPTION
22	3" Individual Teflon® leads with terminal pins
31	Aluminum screw cover head
34	Cast iron screw cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general purpose housing
49	Flip-top aluminum head
53	Grey Delrin® screw cover head
62	White DIN form B polypropylene head
63	White polypropylene head
91	316 L stainless steel screw cover head
92	DIN form B 316 stainless steel screw cover head
4-2	**Options**
W[1]	Epoxy Coating
GS	Ground screw
I	Stainless tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-440[2]	(4 to 20) mA head mounted RTD transmitter
T-441[3]	(4 to 20) mA Isolated head mounted transmitter
T-442[3]	(4 to 20) mA Isolated Hart® head mounted transmitter
See transmitter ordering information in back of section.	
[1] Available with option 31 only. [2] Available with option 31, 34, 49, 53, 63, 91 only. [3] Available with option 31, 49, 62, 92 only.	

Series 440 Installation and Operating Instructions

1 SAFETY NOTES

Safe and secure operation of the head transmitter can only be guaranteed if the operating instructions and all safety notes contained are understood and followed.

1.1 Correct Use

The unit is a universal, presettable temperature transmitter for resistance thermometer (RTD). The unit is constructed for mounting in a connection head and a field housing. The manufacturer cannot be held responsible for damage caused by misuse of the unit.

1.2 Installation, commissioning and operation

The unit is constructed using the most up-to-date production equipment and complies with the safety requirements of the EU guidelines. If it is installed incorrectly or is misused, certain application dangers can occur. Trained personnel must do installation, wiring, and maintenance of the unit. These personnel must have read and understood these instructions and must follow them to the letter.

2 FUNCTION AND SYSTEM CONSTRUCTION

2.1 Function

Provides electronic monitoring of input signals into an analog output signal in industrial temperature measurement. The head transmitter is mounted in a connection head or separated from the sensor in a field housing. Setting up of the head transmitter is done using PC and configuration software. The configuration kit is required for setting up the head transmitter.

2.2 Measurement system

Transforming the following input signals:
• Resistance thermometers (RTD) (in 2 or 3 wire connection systems)

Fault monitoring of:
• Measurement range override or undercut
• Sensor breakage and short circuit

3 INSTALLATION

3.1 Installation conditions

Ambient temperature: (-40 to 85) °C [-40 to 185] °F
Installation area: Field housing; connection head
Installation angle: No limit

Safety notes: The unit must only be powered by a power supply that operates using an IEC 61010-1 compliant energy limited circuit.

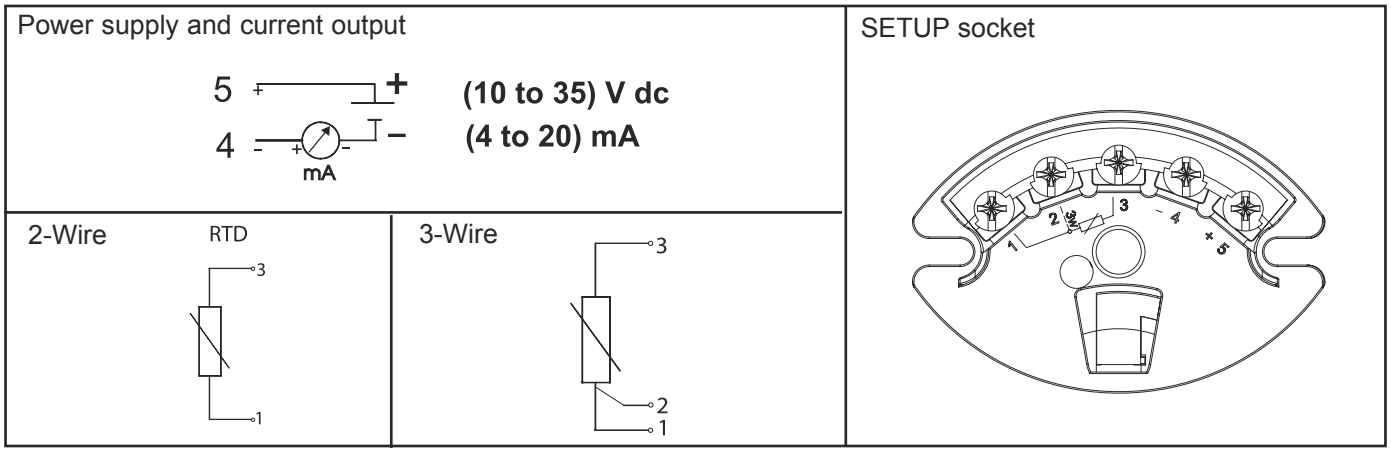
3.2 Installation

• Feed the sensor leadwires through the central hole in the head transmitter
• Position the head transmitter in the connection head
• Feed the installation screws through the slots in the head transmitter.
• Screw the head transmitter into the field housing using a screwdriver while not over tightening.

4 WIRING

4.1 Overview

Terminal layout



4.2 Measurement unit connection

Attention: Switch off power supply before opening the housing cover. Do not install or connect the unit to mains power. If this is not followed parts of the electronic circuit will be damaged.

• Sensors:
Connect the sensor leads to the respective head transmitter terminals (Terminals 1 to 3) by following the wiring diagram (see figure 4.1).

• Output signal and power supply:
Open the PG cable gland on the head transmitter or field housing. Feed the cable through the opening in the PG cable gland and then connect the cable cores to terminals 4 and 5 according to the wiring diagram (see figure 4.1).

• PC configuration (SETUP socket):
Open the flap on the SETUP socket (Figure 4.1) and connect the SETUP connection cable.

Hint: The screws on the terminals must be screwed tightly. Head transmitter configuration during measurement operation is possible. There is no need to disconnect leads.

Potential leveling
Please take note when installing the head transmitter remotely in a field housing. The screen on the (4 to 20) mA signal output must have the same potential as the screen at the sensor connections. When using earthed thermocouples, screening of the output (4 to 20) mA cable is recommended. In plants with strong electromagnetic fields, screening of all cables with a low ohm connection to the transmitter housing is recommended.

5 OPERATION

5.1 Short form instructions (SETUP)

PRESETTABLE PARAMETERS	
Standard settings	• Sensor type • Connection mode (2 or 3 wire connection) • Units (°C or °F) • Measurement range start (depends on sensor) • Measurement range end (depends on sensor)
Expanded settings	• Compensation resistance (0 to 20) Ω on 2 wire connection • Fault condition reaction (≤ 3.6 mA or ≥ 21.0 mA) • Output (analog standard/inverse) • Damping (0 to 8) s • Offset (-9.9 to +9.9) ˚C [-17.8 to +17.8] ˚F • Measurement point identification/TAG Service functions
Service functions	• Simulation (on/off)

For detailed TransComm operating instructions, please read the online documentation contained in the software.

5.2 Communication

The head transmitter must be set up using a PC and configuration kit. The following points must be taken into account if trouble free setting up is to be achieved:
• Configuration software installation.
• Connect the head transmitter to the PC using the connection cable from the configuration kit.

CONFIGURATION SOFTWARE INSTALLATION	
System conditions	• IBM PC or compatible computer (minimum Pentium 166 MHz) • Windows 95/98/ME/NT4.0/2000 • 64 MB RAM • Minimum 30 MB free memory on hard drive • CD-ROM drive • Screen resolution 800 x 600 Pixel • Free serial interface
Recommended minimum configuration	• Pentium 400 MHz • 128 MB main RAM • 120 MB free hard drive memory • Screen resolution 1024 x 768 Pixel
Installation start	Start Windows 1. Place installations-CD in the respective drive 2. Start “Setup.exe” and follow the installation instructions 3. If required, the help/operating manual can be printed once the software has been successfully installed.

Connecting the head transmitter to the PC using the configuration kit connection cable

1. Connect the SETUP connector of the interface cable to the SETUP socket in the head transmitter (see figure 4.1).

2. Connect the RS232C connector to a free serial interface socket on the PC. In order to achieve optimum connection, tighten the RS232C connector screws to the PC.

Note: Configuration of the head transmitter can be done with or without power applied.

6 COMMISSIONING

6.1 Installation check

Monitor all connections making sure they are tight. In order to guarantee fault free operation, the terminal screws must be tight onto the connection cables. The unit is now ready for operation.

6.2 Commissioning

Once the power supply has been connected the head transmitter is operational.

Set up using the PC configuration software

The head transmitter left the factory with a default parameter configuration. If no customer specific configuration was mentioned on the order the default parameter configuration is constructed as follows:

Sensor	Pt100 (RTD)
Connection mode	3-wire
Measurement range and units	(0 to 100) °C

Hint: If a change has been made to the measurement point the head transmitter can be re-configured. In order to re-configure the parameters follow these instructions:

- Install the configuration software and make connection to the PC (see Chapter 5, Operation).
- For detailed operating instructions for the PC configuration software, please read the online documentation contained in the software.

Interactive setting up of the temperature transmitter

Customer specific linearization and sensor matching is done using the TransComm configuration software. The program calculates the linearization coefficients X0 to X4, that need to be entered into the PC configuration software.

6.3 Function check

Measuring the analogue (4 to 20) mA output signal or following failure signals:

Measurement range undercut	Linear fall to 3.8 mA
Measurement range excess	Linear rise to 20.5 mA
Sensor break; sensor short circuit	≤ 3.6 mA or ≥ 21.0 mA selectable

7 MAINTENANCE

The head transmitter is maintenance free.

8 FAULT FINDING

8.1 Repair concept and disposal

Due to its construction, the head transmitter cannot be repaired. When disposing of the head transmitter please take note of local disposal regulations.

8.2 Faultfinding and repairs

Trouble shooting in general

FAULT	CAUSE	ACTION/CURE
No communication	2 wire connection incorrect	Re-connect correctly (see connection diagram)
	No power supply to the 2 wire connection	Check the current loop
	Power supply too low (< 10 V dc)	Check power supply
	Interface cable defective	Check the interface cable
	PC-interface defective	Check the interface of your PC
	Head transmitter defective	Replace head transmitter

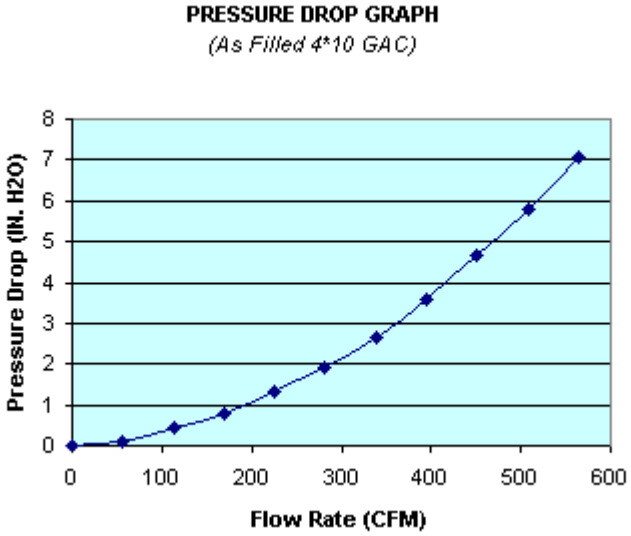
Trouble shooting on RTDs (Pt100)

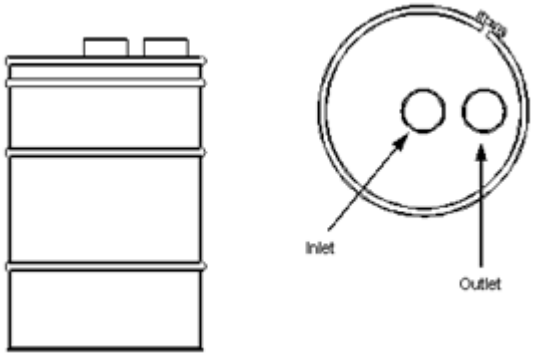
FAULT	CAUSE	ACTION/CURE
Current (≤ 3.6 or ≥ 21.0) mA	Sensor defective	Check sensor
	Incorrect RTD connection	Connect the cables correctly (see connection diagram)
	Incorrect 2 wire connection	Connect the cables correctly (see connection diagram)(Polarity)
	No power supply on the 2 wire connection	Check the current loop; the supply should be > 10 V dc
	Incorrect transmitter programming (number of wires)	Change parameter ‘connection mode’ (see chap. Operation)
	Programming	Thermocouple set up (see chap. Operation). Change to RTD
	Head transmitter defective	Replace head transmitter
Incorrect or inaccurate measured value	Sensor is incorrectly installed	Reinstall sensor correctly
	Heat dissipation via sensor	Monitor sensor installation positioning
	Incorrect transmitter programming (number of wires)	Change parameter ‘connection mode’
	Transmitter programming faulty (scale)	Change scale
	Wrong RTD set up	Change parameter ‘sensor type’
	Sensor connection (2 wire)	Monitor sensor connection
	Sensor cable resistance not compensated (2 wire)	Compensate cable resistance
	Offset incorrectly set up	Monitor offset

APPENDIX F: GRANULAR ACTIVATED CARBON SYSTEM – PRODUCT DATA

VR-140

High Flow Radial Design Vapor Phase Filter





VR-140 SPECIFICATIONS			
Overall Height	3'2"	Vessel/Internal Piping Materials	CS/ SCH 40 PVC
Diameter	23"	Internal Coating	Polyamide Epoxy Resin
Inlet / Outlet (FNPT)	4"	External Coating	Urethane Enamel
Drain / Vent (FNPT)	OPT	Maximum Pressure / Temp	6 PSIG / 150° F
GAC Fill (lbs)	140	Cross Sectional Bed Area	5.6 FT^2
Shipping / Operational Weight (lbs)	200/225	Bed Depth/Volume	7.25 IN / 5 FT^3

Operation & Maintenance Manual

VFD ● VFV ● VF ● VR SERIES

Tetrasolv Filtration Vapor Filters

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

CONTENTS

1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat vapor. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

The most common application utilizes activated carbon as the adsorption media. Typically vapor which contains low levels of organic contaminants flows upward through the column of activated carbon where the larger organic molecules adhere to the porous structure of the activated carbon granules. This adsorption begins at the bottom of the “bed” and continues upward as the original adsorptive area becomes saturated.

Complete saturation of the carbon is dependent upon many factors such as contaminant levels, temperature, compounds being adsorbed, humidity, etc. Typically a carbon isotherm has been run on the influent stream to determine the expected rate of consumption of the activated carbon media. When monitoring has determined discharge air no longer meets discharge requirements the carbon will have to be removed and replaced ***(refer to section 5.0)***.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system. If you have any questions please contact Tetrasolv Filtration at the number listed below or support@tetrasolv.com.

- ***WARNING: Where system pressure may exceed design pressure we strongly recommend the use of a relief device. Exceeding the maximum pressure of the filter could result in catastrophic failure***

of the vessel.

- Always adhere to “lockout/tagout” procedures when servicing the system.

- Wear appropriate safety equipment when operating system.

♦ ***WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.***

♦ ***WARNING: High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehydes, organic acids and sulphur may cause severe temperature rises.***

- Understand the potential hazards of the stream being treated by the system. The activated carbon may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the carbon may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

♦ ***WARNING: Failure to follow the procedures outlined below can result in catastrophic damage to the system.***

Crane Lift - If a crane lift is to be used we recommend the following method. A “spreader” equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

3.3 Inspection

Perform the following inspections after un-loading the system. Note any discrepancies and contact TetraSolv immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.

- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.

- If the filters are shipped without carbon visually inspect the interior of the vessel for damaged internals.

- Inspect the carbon discharge, drain and vent valves for damage

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it’s maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped

loose with the system.

The outlet piping if connected to a stack or vent should be designed to prevent the introduction of water or debris into the adsorber piping. Discharge piping should be sized equal to or greater than the diameter of the system piping or back pressure could occur creating excess pressure drop on the system.

Flowrates greater than 60 cfm / sq ft can produce bed fluidization in vapor phase filters. When this occurs carbon granules can be lifted and propelled out of the carbon bed in up-flow applications. In extreme cases large amounts of carbon can be expelled. If the system will be operating near or greater than the amount stated above please contact Tetrasolv for recommendations.

Carbon filters can be manifold in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

Vapor conditions such as high humidity and high temperature (> 125º F) can cause inefficient adsorbtion to occur. If these conditions exist contact Tetrasolv for support. Also, any free water or product and debris should be eliminated with a knockout filter prior to the vapor stream entering the system. Many other vapor issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

4.0 OPERATION

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.

4.3 Monitoring

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate media breakdown or presence of high moisture. Rapid increase in pressure drop could indicate adsorber failure.

Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

5.0 ADSORBER SERVICING

The Adsorber may be serviced on-site using a vacuum removal method. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber be checked thoroughly and any minor maintenance conducted.

5.1 Carbon Loading - Bulk Bag

- ***WARNING - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.***

Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasping it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

5.2 Carbon Loading - Vacuum Method

In this method dry-activated carbon will be loaded into to the adsorbers using a vacuum rig. To add the carbon to the filters use the following method:

WARNING: Due to the low vacuum rating of the VF series adsorbers (< 60" H_20) only experienced change-out personnel should attempt this method of re-filling. Exceeding the recommend vacuum rating could lead to failure of the superstructure of the vessel.

1. Connect a 3" vacuum source to the auxiliary connection of the adsorber to be filled.

2. Install a 16" bolted transfer lid onto the manway opening of the adsorber to be filled.

3. Turn on the vacuum and check for good flow of air through the adsorber. Connect the fill line to the transfer lid and lead enough hose to reach the fresh carbon source (Note: This should be as short of a distance as possible).

4. Begin vacuuming carbon into the adsorber. It is important to note that the loading method is actually conveying and not true vacuum. The hose should contain 1/3 air with the carbon. Closely view the adsorber being filled. If the adsorber is collasping in excessively take less carbon and more air. This is something from experience and cannot be adequately explained here.

5. When transfer is complete the transfer lid should be removed and the carbon in the adsorber should be leveled out to insure even pressure drop across the bed.

6. Close the manway and turn the adsorber back on.

> ***Note: When the system if first started up small amounts of fines may be present in the discharge stream. This is normal and should discontinue within a short period of time.***

6.0 MAINTENANCE

6.1 Extended Shutdown

If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

Monitor the system closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

TETRASOLV

VAPOR PHASE FILTRATION MEDIA : 4x10 RE-ACTIVATED CARBON

GENERAL DESCRIPTION

Select Re-Activated carbon from domestic sources is quality screened during our purchasing process for activity, density and fines. The use of re-activated carbon is recommended as a lower cost alternative for most sites where drinking water quality is not necessary. In many cases our re-activated carbon meets and exceeds imported virgin carbon. In addition all carbon either sold by itself or installed in our filtration units is traced by lot number to the installation or sale.

4*10 (Vapor Phase) Standard Specifications:	**Standard**	**Value**
Carbon Tetrachloride Activity Level	ASTM D-3467	40 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	4x10 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

Packaging:		
50 Pound Bags	50 Pound Drums	Bulk Tanker
1,000 Pound Bulk Sacks	200 Pound Drums	

APPENDIX G: INSPECTION CHECKLIST

DEC-FARMINGDALE480 **Date:**
Farmingdale Plaza Cleaners **Technician:**

SVE SYSTEM STARTUP INSPECTION CHECKLIST

Visual Inspection

_____ Check container exterior for damage/penetrations
_____ Check process piping and piping/equipment connections
_____ Check process piping mounting assemblies
_____ Check Valves (open & close valves to ensure proper operation)
_____ Check gauges (all in place? Labeled?)
_____ Check instrumentation (all in place? Labeled?)
_____ Check equipment (Damage? Defects? Labeled?)
_____ Inlet filter installed?

Electrical Inspection

_____ Main power off, locked, and tagged? (if no, do not proceed)
Check control panel interior & exterior
_____ Free of dirt/debris/water?
_____ Mounting hardware ok?
_____ Free of defects?
Check wiring and connections
_____ Wiring insulation ok?
_____ VFD connections ok?
_____ Telephone line connections and jacks ok?
_____ Control panel connections ok?
_____ EOS and autodialer connections ok?
_____ Data loggingequipment connections ok?

Equipment Testing

_____ SVE-1, SVE-3 & SVE-5 header lines disconnected from manifold
_____ Dilution valve open 50%

SVE Blower
record readings-

Aux. line vac (VI-102):	System influent vac (VI-104):
SVE Blower vac (VI-106):	System Influent airflow (FI-101):
System eff. airflow (FI-102):	Blower eff. pressure (PI-101):

Moisture Separator Transfer Pump
_____ Powered on ok?
_____ Pump turns ok?

DEC-FARMINGDALE480 **Date:**
Farmingdale Plaza Cleaners **Technician:**

SVE SYSTEM STARTUP INSPECTION CHECKLIST

System Testing

_____ SVE-1, SVE-3 & SVE-5 header lines disconnected from manifold
_____ Dilution valve open 50%

W/ System operating-
_____ Control panel lights working?
Check Gauges
_____ VI-102
_____ VI-104
_____ VI-105
_____ VI-106
_____ PI-101
_____ TI-101
_____ TI-102
_____ PI-102
_____ FI-101
_____ FI-102

APPENDIX H: DEFICIENCY REPORT FORM

DEFICIENCY REPORT

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

E.A.R. Site ID: DEC-Farmingdale480
Site Location:

Farmingdale Plaza Cleaners
450 Main Street
Farmingdale, NY

Report Date:

Reported By:

Approved By:

Control No.:

Project Name: Farmingdale Plaza Cleaners
Site No: 130107

Ref.	Item/Component	Deficiency Description

Recommended Corrective Actions

Copies To: File NYSDEC
AECOM

Environmental Assessment & Remediations
Phone: (631) 447-6400

225 Atlantic Avenue, Patchogue, NY 11772
Fax: (631) 447-6497

APPENDIX I: SITE DATA INFORMATION SHEET

FARMINGDALE PLAZA CLEANERS
450-480 Main Street
Farmingdale, NY
Site No. 130107
EAR ID: DEC-Farmingdale480

DATE:
TECHNICIAN:

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

PARAMETER	LOCATION		UNITS	BEFORE ADJUSTMENTS	AFTER ADJUSTMENTS	COMMENTS
Vacuum	SVE-1 Influent (Manifold)	VI-101	Inches of Water			
	SVE-3 Influent (Manifold)		Inches of Water			
	SVE-5 Influent (Manifold)	VI-102	Inches of Water			
	System Influent	VI-104	Inches of Water			
	Moisture Separator	VI-105	Inches of Water			
	SVE Blower	VI-106	Inches of Water			
Pressure	SVE Blower Effluent	PI-101	Inches of Water			
		PI-102	Inches of Water			
Air Flow	System Influent (ΔP)	FI-101	Inches of Water			
	SVE Blower Effluent (ΔP)	FI-102	Inches of Water			
	SVE-1 Influent (Manifold)	Instr	FPM			
	SVE-3 Influent (Manifold)	Instr	FPM			
	SVE-5 Influent (Manifold)	Instr	FPM			
Temperature	Pre Moisture Separator	TI-101	°F			
	SVE Blower Effluent	TI-102	°F			
	SVE-1 Influent (Manifold)	Instr	°F			
	SVE-3 Influent (Manifold)	Instr	°F			
	SVE-5 Influent (Manifold)	Instr	°F			
Concentrations	SVE-1 Influent (Manifold)	Instr	ppm			
	SVE-3 Influent (Manifold)	Instr	ppm			
	SVE-5 Influent (Manifold)	Instr	ppm			
	Moisture Separator	Instr	ppm			
	Pre-Carbon	Instr	ppm			
	Mid Carbon	Instr	ppm			
	Post Carbon	Instr	ppm			
Level	Moisture Separator Liquid Level	T-101	Inches			
	Condensate Storage Drum		% Full			
Misc	Dilution Valve		% Open			
	Heater		On/Off			
	Ventilation		On/Off			
	VFD		Hz			
				TIME	HR METER READING	
Runtime	Control Power Hour Meter		Hours			
	SVE Blower Hour Meter		Hours			

Notes:

APPENDIX J: INSPECTION, MAINTENANCE & LUBRICATION SCHEDULE

FARMINGDALE PLAZA CLEANERS
450-480 Main Street
Farmingdale, NY
Site No. 130107
EAR ID: DEC-Farmingdale480

DATE:
TECHNICIAN:

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Inspection, Maintenance & Lubrication Schedule

Maintenance Item		Frequency	Completed (yes/no)	Date Last Conducted	Comments
Dilution Air Filter					
-Inspect		bi-weekly			
Blower Inlet Filter					
-Inspect		bi-weekly			
-Replace		as required			
SVE Blower	**B-101**				
-Inspect		bi-weekly			
-Replace Bearings		Every 25,000 working hours			
Moisture Separator					
-Inspect		bi-weekly			
-Test LSHH Switch		monthly			
-Pumped Out		as required			
Transfer Pump	**TP-101**				
-Inspect		monthly			
-Lubricate		close-coupled - no lubrication necessary			
GAC Vessel #1	**VGAC-201**				
-Inspect		bi-weekly			
-Note lead, lag, or bypassed		bi-weekly			
GAC Vessel #2	**VGAC-202**				
-Inspect		bi-weekly			
-Note lead, lag, or bypassed		bi-weekly			
Alarms		quarterly			
Heater		as required			
Ventilation		as required			
Lighting		monthly			
Piping		bi-weekly			
Gauges		bi-weekly			
Container		bi-weekly			
Fenced Enclosure		bi-weekly			
Manholes		bi-weekly			
Well Caps/Plugs		monthly			

Notes:

APPENDIX K: LAB ANALYTICAL REPORT – CONDENSATE SAMPLE

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 460-35505-1

Job Description: 130107 DEC Farmingdale 480

For:
Long Island Environmental Assessment
dba Env Assessment & Remediation
225 Atlantic Avenue
Patchogue, NY 11772

Attention: Mr. Ian Hofmann

Approved for release.
Larry Decker
Project Manager I
1/17/2012 1:49 PM

Larry Decker
Project Manager I
larry.decker@testamericainc.com
01/17/2012

TestAmerica Edison Certifications and Approvals: Connecticut: CTDOH #PH-0200, New Jersey: NJDEP (NELAP) #12028, New York: NYDOH (NELAP) #11452, NYDOH (ELAP) #11452, Pennsylvania: PADEP (NELAP) 68-00522 and Rhode Island: RIDOH LAO00132

Table of Contents

CASE NARRATIVE

Client: Long Island Environmental Assessment

Project: 130107 DEC Farmingdale 480

Report Number: 460-35505-1

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

It should be noted that samples with elevated Reporting Limits (RLs) as a result of a dilution may not be able to satisfy customer reporting limits in some cases. Such increases in the RLs are unavoidable but acceptable consequence of sample dilution that enables quantification of target analytes or interferences which exceed the calibration range of the instrument.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 01/07/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 2.1 C.

Note: All samples which require thermal preservation are considered acceptable if the arrival temperature is within 2C of the required temperature or method specified range. For samples with a specified temperature of 4C, samples with a temperature ranging from just above freezing temperature of water to 6C shall be acceptable. Samples that are hand delivered immediately following collection may not meet these criteria, however they will be deemed acceptable according to NELAC standards, if there is evidence that the chilling process has begun, such as arrival on ice, etc.

IGNITABILITY
Sample 460-35505-1 was analyzed for Ignitability in accordance with EPA SW-846 Method 1020A. The samples were analyzed on 01/13/2012.

No difficulties were encountered during the Ignitability analysis.

All quality control parameters were within the acceptance limits.

TOTAL METALS
Sample 460-35505-1 was analyzed for total metals in accordance with EPA SW-846 Method 6010B. The samples were prepared on 01/11/2012 and analyzed on 01/12/2012.

No difficulties were encountered during the metals analysis.

All quality control parameters were within the acceptance limits.

TOTAL MERCURY
Sample 460-35505-1 was analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared and analyzed on 01/11/2012.

No difficulties were encountered during the mercury analysis.

All quality control parameters were within the acceptance limits.

VOLATILE ORGANIC COMPOUNDS (GC-MS)
Sample 460-35505-1 was analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 01/12/2012.

No difficulties were encountered during the volatiles analysis.

All quality control parameters were within the acceptance limits.

SEMIVOLATILE ORGANIC COMPOUNDS (GC-MS)

Sample 460-35505-1 was analyzed for semivolatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8270C. The samples were prepared on 01/11/2012 and analyzed on 01/12/2012.

Atrazine failed the recovery criteria low for LCS 460-98698/2-A. Benzaldehyde and Benzo[a]pyrene failed the recovery criteria high. Atrazine failed the recovery criteria low for LCSD 460-98698/3-A. Benzaldehyde and Benzo[a]pyrene failed the recovery criteria high. Refer to the QC report for details.

No other difficulties were encountered during the semivolatiles analysis.

All other quality control parameters were within the acceptance limits.

TOTAL ORGANIC HALIDES

Sample 460-35505-1 was analyzed for total organic halides in accordance with EPA SW-846 Method 9020B. The samples were prepared and analyzed on 01/12/2012.

No difficulties were encountered during the TOX analysis.

All quality control parameters were within the acceptance limits.

EXECUTIVE SUMMARY - Detections

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Sample ID Analyte	Client Sample ID	Result	Qualifier	Reporting Limit	Units	Method
460-35505-1	**CONDENSATE**					
Acetone		12		5.0	ug/L	8260B
2-Butanone		5.8		5.0	ug/L	8260B
Barium		223		200	ug/L	6010B
Ignitability		>160			Degrees F	1020A

METHOD SUMMARY

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Description	Lab Location	Method	Preparation Method
Matrix: Water			
Volatile Organic Compounds (GC/MS)	TAL EDI	SW846 8260B	
Purge and Trap	TAL EDI		SW846 5030B
Semivolatile Organic Compounds (GC/MS)	TAL EDI	SW846 8270C	
Liquid-Liquid Extraction (Separatory Funnel)			SW846 3510C
Metals (ICP)	TAL EDI	SW846 6010B	
Preparation, Total Metals			SW846 3010A
Mercury (CVAA)	TAL EDI	SW846 7470A	
Preparation, Mercury			SW846 7470A
Ignitability, Setaflash Closed-Cup Method	TAL EDI	SW846 1020A	
Organic Halides, Total (TOX)	TAL SAV	SW846 9020B	
Carbon Trap Preparation			EPA-17 Carbon Trap

Lab References:

TAL EDI = TestAmerica Edison

TAL SAV = TestAmerica Savannah

Method References:

EPA-17 = "Method 1650, Revision A, Adsorbable Organic Halides By Adsorption And Colormetric Titration," EPA, February 1992

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

METHOD / ANALYST SUMMARY

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method	Analyst	Analyst ID
SW846 8260B	Desai, Saurab	SD
SW846 8270C	Crocco, Michael	MC
SW846 6010B	Chang, Churn Der	CDC
SW846 7470A	Sheikh, Razia B	RBS
SW846 1020A	Carlone, John	JC
SW846 9020B	Nelson, Christopher	CN

SAMPLE SUMMARY

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
460-35505-1	Condensate	Water	01/05/2012 1130	01/07/2012 1722

SAMPLE RESULTS

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Client Sample ID: Condensate

Lab Sample ID: 460-35505-1 Date Sampled: 01/05/2012 1130
Client Matrix: Water Date Received: 01/07/2012 1722

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	c64478.d
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 1547			Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 1547				

Analyte	Result (ug/L)	Qualifier	MDL	RL
Dichlorodifluoromethane	1.0	U	0.29	1.0
Chloromethane	1.0	U	0.21	1.0
Bromomethane	1.0	U	0.31	1.0
Vinyl chloride	1.0	U	0.13	1.0
Chloroethane	1.0	U	0.45	1.0
Trichlorofluoromethane	1.0	U	0.16	1.0
Freon TF	1.0	U	0.28	1.0
Methylene Chloride	1.0	U	0.19	1.0
Acetone	12		2.5	5.0
Carbon disulfide	1.0	U	0.15	1.0
Methyl acetate	2.0	U	0.33	2.0
1,1-Dichloroethene	1.0	U	0.14	1.0
1,1-Dichloroethane	1.0	U	0.10	1.0
cis-1,2-Dichloroethene	1.0	U	0.20	1.0
trans-1,2-Dichloroethene	1.0	U	0.14	1.0
MTBE	1.0	U	0.18	1.0
Chloroform	1.0	U	0.15	1.0
1,2-Dichloroethane	1.0	U	0.24	1.0
2-Butanone	5.8		0.82	5.0
1,1,1-Trichloroethane	1.0	U	0.25	1.0
Cyclohexane	1.0	U	0.13	1.0
Carbon tetrachloride	1.0	U	0.19	1.0
Bromodichloromethane	1.0	U	0.093	1.0
1,2-Dichloropropane	1.0	U	0.090	1.0
cis-1,3-Dichloropropene	1.0	U	0.11	1.0
Trichloroethene	1.0	U	0.18	1.0
Methylcyclohexane	1.0	U	0.090	1.0
Dibromochloromethane	1.0	U	0.11	1.0
1,1,2-Trichloroethane	1.0	U	0.10	1.0
Benzene	1.0	U	0.13	1.0
trans-1,3-Dichloropropene	1.0	U	0.12	1.0
Bromoform	1.0	U	0.10	1.0
Isopropylbenzene	1.0	U	0.21	1.0
4-Methyl-2-pentanone	5.0	U	0.68	5.0
2-Hexanone	5.0	U	0.55	5.0
Tetrachloroethene	1.0	U	0.20	1.0
Toluene	1.0	U	0.090	1.0
1,1,2,2-Tetrachloroethane	1.0	U	0.090	1.0
Chlorobenzene	1.0	U	0.16	1.0
Ethylbenzene	1.0	U	0.25	1.0
Xylenes, Total	3.0	U	0.43	3.0
Styrene	1.0	U	0.13	1.0
1,2-Dibromo-3-Chloropropane	1.0	U	0.15	1.0
1,3-Dichlorobenzene	1.0	U	0.22	1.0
1,4-Dichlorobenzene	1.0	U	0.15	1.0
1,2-Dichlorobenzene	1.0	U	0.16	1.0

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Client Sample ID: Condensate

Lab Sample ID: 460-35505-1 Date Sampled: 01/05/2012 1130
Client Matrix: Water Date Received: 01/07/2012 1722

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	c64478.d
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 1547			Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 1547				

Analyte	Result (ug/L)	Qualifier	MDL	RL
1,2,4-Trichlorobenzene	1.0	U	0.44	1.0
1,2-Dibromoethane	1.0	U	0.090	1.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	115		70 - 122
Toluene-d8 (Surr)	97		69 - 125
Bromofluorobenzene	102		69 - 135

Client Sample ID: **Condensate**

Lab Sample ID: 460-35505-1 Date Sampled: 01/05/2012 1130
Client Matrix: Water Date Received: 01/07/2012 1722

8270C Semivolatile Organic Compounds (GC/MS)

Analysis Method:	8270C	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Prep Method:	3510C	Prep Batch:	460-98698	Lab File ID:	z13279.d
Dilution:	1.0			Initial Weight/Volume:	980 mL
Analysis Date:	01/12/2012 0438			Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Benzaldehyde	10	U *	2.0	10
Phenol	10	U	0.83	10
Bis(2-chloroethyl)ether	1.0	U	0.29	1.0
2-Chlorophenol	10	U	2.2	10
2-Methylphenol	10	U	1.8	10
Acetophenone	10	U	2.8	10
N-Nitrosodi-n-propylamine	1.0	U	0.26	1.0
Hexachloroethane	1.0	U	0.26	1.0
Nitrobenzene	1.0	U	0.31	1.0
Isophorone	10	U	2.8	10
2-Nitrophenol	10	U	2.4	10
2,4-Dimethylphenol	10	U	3.5	10
Bis(2-chloroethoxy)methane	10	U	2.7	10
2,4-Dichlorophenol	10	U	2.7	10
Naphthalene	10	U	2.8	10
4-Chloroaniline	10	U	2.0	10
Hexachlorobutadiene	2.0	U	0.58	2.0
Caprolactam	10	U	2.6	10
4-Chloro-3-methylphenol	10	U	2.6	10
2-Methylnaphthalene	10	U	3.1	10
Hexachlorocyclopentadiene	10	U	1.7	10
2,4,6-Trichlorophenol	10	U	2.4	10
2,4,5-Trichlorophenol	10	U	2.7	10
2-Chloronaphthalene	10	U	2.8	10
2-Nitroaniline	20	U	5.0	20
Dimethyl phthalate	10	U	2.9	10
Acenaphthylene	10	U	2.8	10
2,6-Dinitrotoluene	2.0	U	0.62	2.0
3-Nitroaniline	20	U	5.1	20
Acenaphthene	10	U	2.8	10
2,4-Dinitrophenol	31	U	5.5	31
4-Nitrophenol	31	U	6.8	31
Dibenzofuran	10	U	2.9	10
2,4-Dinitrotoluene	2.0	U	0.48	2.0
Diethyl phthalate	10	U	3.0	10
4-Chlorophenyl phenyl ether	10	U	2.6	10
Fluorene	10	U	2.9	10
4-Nitroaniline	20	U	5.9	20
4,6-Dinitro-2-methylphenol	31	U	4.8	31
N-Nitrosodiphenylamine	10	U	3.0	10
4-Bromophenyl phenyl ether	10	U	2.6	10
Hexachlorobenzene	1.0	U	0.30	1.0
Atrazine	10	U *	3.1	10
Pentachlorophenol	31	U	5.4	31
Phenanthrene	10	U	3.2	10
Anthracene	10	U	2.9	10

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Client Sample ID: **Condensate**

Lab Sample ID: 460-35505-1 | Date Sampled: 01/05/2012 1130
Client Matrix: Water | Date Received: 01/07/2012 1722

8270C Semivolatile Organic Compounds (GC/MS)

Analysis Method:	8270C	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Prep Method:	3510C	Prep Batch:	460-98698	Lab File ID:	z13279.d
Dilution:	1.0			Initial Weight/Volume:	980 mL
Analysis Date:	01/12/2012 0438			Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Carbazole	10	U	3.3	10
Di-n-butyl phthalate	10	U	3.0	10
Fluoranthene	10	U	3.3	10
Pyrene	10	U	3.0	10
Butyl benzyl phthalate	10	U	2.6	10
3,3'-Dichlorobenzidine	20	U	5.0	20
Benzo[a]anthracene	1.0	U	0.28	1.0
Chrysene	10	U	3.2	10
Bis(2-ethylhexyl) phthalate	10	U	2.0	10
Di-n-octyl phthalate	10	U	1.5	10
Benzo[b]fluoranthene	1.0	U	0.27	1.0
Benzo[k]fluoranthene	1.0	U	0.27	1.0
Benzo[a]pyrene	1.0	U *	0.14	1.0
Indeno[1,2,3-cd]pyrene	1.0	U	0.15	1.0
Dibenz(a,h)anthracene	1.0	U	0.092	1.0
Benzo[g,h,i]perylene	10	U	2.0	10
Diphenyl	10	U	2.9	10
4-Methylphenol	10	U	1.6	10
bis (2-chloroisopropyl) ether	10	U	2.0	10

Surrogate	%Rec	Qualifier	Acceptance Limits
2-Fluorophenol	58		10 - 65
2-Fluorobiphenyl	90		53 - 108
Phenol-d5	38		10 - 48
Nitrobenzene-d5	93		56 - 112
2,4,6-Tribromophenol	82		46 - 122
Terphenyl-d14	102		50 - 122

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Client Sample ID: **Condensate**

Lab Sample ID: 460-35505-1 | Date Sampled: 01/05/2012 1130
Client Matrix: Water | Date Received: 01/07/2012 1722

6010B Metals (ICP)

Analysis Method:	6010B	Analysis Batch:	460-98806	Instrument ID:	ICP4
Prep Method:	3010A	Prep Batch:	460-98614	Lab File ID:	01122012.asc
Dilution:	1.0			Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 1437			Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				

Analyte	Result (ug/L)	Qualifier	MDL	RL
Arsenic	5.0	U	3.7	5.0
Barium	223		5.9	200
Cadmium	5.0	U	0.82	5.0
Chromium	10.0	U	4.5	10.0
Lead	5.0	U	4.0	5.0
Selenium	10.0	U	5.8	10.0
Silver	10.0	U	1.3	10.0

7470A Mercury (CVAA)

Analysis Method:	7470A	Analysis Batch:	460-98677	Instrument ID:	LEEMAN3
Prep Method:	7470A	Prep Batch:	460-98621	Lab File ID:	98620hg1.PRN
Dilution:	1.0			Initial Weight/Volume:	30 mL
Analysis Date:	01/11/2012 1636			Final Weight/Volume:	30 mL
Prep Date:	01/11/2012 1117				

Analyte	Result (ug/L)	Qualifier	MDL	RL
Mercury	0.20	U	0.16	0.20

General Chemistry

Client Sample ID: **Condensate**

Lab Sample ID: 460-35505-1 Date Sampled: 01/05/2012 1130
Client Matrix: Water Date Received: 01/07/2012 1722

Analyte	Result	Qual	Units	MDL	RL	Dil	Method
Halogens, Total Organic	0.020	U	mg/L	0.0070	0.020	2.0	9020B
Analysis Batch: 680-226034	Analysis Date: 01/12/2012 1723						
Prep Batch: 680-226032	Prep Date: 01/12/2012 0730						
TOX Result 1	0.020	U	mg/L	0.0070	0.020	2.0	9020B
Analysis Batch: 680-226034	Analysis Date: 01/12/2012 1723						
Prep Batch: 680-226032	Prep Date: 01/12/2012 0730						
TOX Result 2	0.020	U	mg/L	0.0070	0.020	2.0	9020B
Analysis Batch: 680-226034	Analysis Date: 01/12/2012 1723						
Prep Batch: 680-226032	Prep Date: 01/12/2012 0730						

Analyte	Result	Qual	Units	Dil	Method
Ignitability	>160		Degrees F	1.0	1020A
Analysis Batch: 460-98956	Analysis Date: 01/13/2012 1740				

DATA REPORTING QUALIFIERS

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Section	Qualifier	Description
GC/MS VOA		
	U	Analyzed for but not detected.
GC/MS Semi VOA		
	U	Analyzed for but not detected.
	*	LCS or LCSD exceeds the control limits
Metals		
	U	Indicates analyzed for but not detected.
General Chemistry		
	U	Indicates analyzed for but not detected.

QUALITY CONTROL RESULTS

Client: Long Island Environmental Assessment Job Number: 460-35505-1

QC Association Summary

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
GC/MS VOA					
Analysis Batch:460-98737					
LCS 460-98737/3	Lab Control Sample	T	Water	8260B	
MB 460-98737/4	Method Blank	T	Water	8260B	
460-35505-1	Condensate	T	Water	8260B	
GC/MS Semi VOA					
Prep Batch: 460-98698					
LCS 460-98698/2-A	Lab Control Sample	T	Water	3510C	
LCSD 460-98698/3-A	Lab Control Sample Duplicate	T	Water	3510C	
MB 460-98698/1-A	Method Blank	T	Water	3510C	
460-35505-1	Condensate	T	Water	3510C	
Analysis Batch:460-98777					
LCS 460-98698/2-A	Lab Control Sample	T	Water	8270C	460-98698
LCSD 460-98698/3-A	Lab Control Sample Duplicate	T	Water	8270C	460-98698
MB 460-98698/1-A	Method Blank	T	Water	8270C	460-98698
460-35505-1	Condensate	T	Water	8270C	460-98698

Report Basis
T = Total

Report Basis
T = Total

Client: Long Island Environmental Assessment Job Number: 460-35505-1

QC Association Summary

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
Metals					
Prep Batch: 460-98614					
LCS 460-98614/2-A	Lab Control Sample	T	Water	3010A	
MB 460-98614/1-A	Method Blank	T	Water	3010A	
460-35505-1	Condensate	T	Water	3010A	
Prep Batch: 460-98621					
LCS 460-98621/2-A	Lab Control Sample	T	Water	7470A	
MB 460-98621/1-A	Method Blank	T	Water	7470A	
460-35505-1	Condensate	T	Water	7470A	
Analysis Batch:460-98677					
LCS 460-98621/2-A	Lab Control Sample	T	Water	7470A	460-98621
MB 460-98621/1-A	Method Blank	T	Water	7470A	460-98621
460-35505-1	Condensate	T	Water	7470A	460-98621
Analysis Batch:460-98806					
LCS 460-98614/2-A	Lab Control Sample	T	Water	6010B	460-98614
MB 460-98614/1-A	Method Blank	T	Water	6010B	460-98614
460-35505-1	Condensate	T	Water	6010B	460-98614
Analysis Batch:460-98855					
MB 460-98614/1-A	Method Blank	T	Water	6010B	460-98614

Report Basis
T = Total

General Chemistry

Analysis Batch:460-98956					
460-35505-1	Condensate	T	Water	1020A	
460-35505-1DU	Duplicate	T	Water	1020A	
Prep Batch: 680-226032					
460-35505-1	Condensate	T	Water	Carbon Trap	
460-35505-1MS	Matrix Spike	T	Water	Carbon Trap	
460-35505-1MSD	Matrix Spike Duplicate	T	Water	Carbon Trap	
Analysis Batch:680-226034					
460-35505-1	Condensate	T	Water	9020B	680-226032
460-35505-1MS	Matrix Spike	T	Water	9020B	680-226032
460-35505-1MSD	Matrix Spike Duplicate	T	Water	9020B	680-226032

Report Basis
T = Total

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Surrogate Recovery Report

8260B Volatile Organic Compounds (GC/MS)

Client Matrix: Water

Lab Sample ID	Client Sample ID	DCA %Rec	TOL %Rec	BFB %Rec
460-35505-1	Condensate	115	97	102
MB 460-98737/4		115	97	105
LCS 460-98737/3		107	100	102

Surrogate	Acceptance Limits
DCA = 1,2-Dichloroethane-d4 (Surr)	70-122
TOL = Toluene-d8 (Surr)	69-125
BFB = Bromofluorobenzene	69-135

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Surrogate Recovery Report

8270C Semivolatile Organic Compounds (GC/MS)

Client Matrix: Water

Lab Sample ID	Client Sample ID	2FP %Rec	FBP %Rec	PHL %Rec	NBZ %Rec	TBP %Rec	TPH %Rec
460-35505-1	Condensate	58	90	38	93	82	102
MB 460-98698/1-A		57	91	38	93	94	96
LCS 460-98698/2-A		56	87	37	87	82	94
LCSD 460-98698/3-A		54	87	35	86	83	94

Surrogate	Acceptance Limits
2FP = 2-Fluorophenol	10-65
FBP = 2-Fluorobiphenyl	53-108
PHL = Phenol-d5	10-48
NBZ = Nitrobenzene-d5	56-112
TBP = 2,4,6-Tribromophenol	46-122
TPH = Terphenyl-d14	50-122

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Method Blank - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	MB 460-98737/4	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64461.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0921	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0921				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Dichlorodifluoromethane	1.0	U	0.29	1.0
Chloromethane	1.0	U	0.21	1.0
Bromomethane	1.0	U	0.31	1.0
Vinyl chloride	1.0	U	0.13	1.0
Chloroethane	1.0	U	0.45	1.0
Trichlorofluoromethane	1.0	U	0.16	1.0
Freon TF	1.0	U	0.28	1.0
Methylene Chloride	1.0	U	0.19	1.0
Acetone	5.0	U	2.5	5.0
Carbon disulfide	1.0	U	0.15	1.0
Methyl acetate	2.0	U	0.33	2.0
1,1-Dichloroethene	1.0	U	0.14	1.0
1,1-Dichloroethane	1.0	U	0.10	1.0
cis-1,2-Dichloroethene	1.0	U	0.20	1.0
trans-1,2-Dichloroethene	1.0	U	0.14	1.0
MTBE	1.0	U	0.18	1.0
Chloroform	1.0	U	0.15	1.0
1,2-Dichloroethane	1.0	U	0.24	1.0
2-Butanone	5.0	U	0.82	5.0
1,1,1-Trichloroethane	1.0	U	0.25	1.0
Cyclohexane	1.0	U	0.13	1.0
Carbon tetrachloride	1.0	U	0.19	1.0
Bromodichloromethane	1.0	U	0.093	1.0
1,2-Dichloropropane	1.0	U	0.090	1.0
cis-1,3-Dichloropropene	1.0	U	0.11	1.0
Trichloroethene	1.0	U	0.18	1.0
Methylcyclohexane	1.0	U	0.090	1.0
Dibromochloromethane	1.0	U	0.11	1.0
1,1,2-Trichloroethane	1.0	U	0.10	1.0
Benzene	1.0	U	0.13	1.0
trans-1,3-Dichloropropene	1.0	U	0.12	1.0
Bromoform	1.0	U	0.10	1.0
Isopropylbenzene	1.0	U	0.21	1.0
4-Methyl-2-pentanone	5.0	U	0.68	5.0
2-Hexanone	5.0	U	0.55	5.0
Tetrachloroethene	1.0	U	0.20	1.0
Toluene	1.0	U	0.090	1.0
1,1,2,2-Tetrachloroethane	1.0	U	0.090	1.0
Chlorobenzene	1.0	U	0.16	1.0
Ethylbenzene	1.0	U	0.25	1.0
Xylenes, Total	3.0	U	0.43	3.0
Styrene	1.0	U	0.13	1.0
1,2-Dibromo-3-Chloropropane	1.0	U	0.15	1.0
1,3-Dichlorobenzene	1.0	U	0.22	1.0
1,4-Dichlorobenzene	1.0	U	0.15	1.0

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Method Blank - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	MB 460-98737/4	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64461.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0921	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0921				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
1,2-Dichlorobenzene	1.0	U	0.16	1.0
1,2,4-Trichlorobenzene	1.0	U	0.44	1.0
1,2-Dibromoethane	1.0	U	0.090	1.0

Surrogate	% Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	115	70 - 122
Toluene-d8 (Surr)	97	69 - 125
Bromofluorobenzene	105	69 - 135

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Lab Control Sample - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	LCS 460-98737/3	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64459.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0831	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0831				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Dichlorodifluoromethane	20.0	14.9	75	46 - 145	
Chloromethane	20.0	19.3	97	58 - 146	
Bromomethane	20.0	14.6	73	55 - 153	
Vinyl chloride	20.0	16.6	83	61 - 144	
Chloroethane	20.0	17.4	87	69 - 145	
Trichlorofluoromethane	20.0	17.3	87	69 - 147	
Freon TF	20.0	21.3	106	47 - 139	
Methylene Chloride	20.0	20.2	101	79 - 119	
Acetone	20.0	17.2	86	45 - 156	
Carbon disulfide	20.0	18.2	91	58 - 139	
Methyl acetate	20.0	17.9	89	50 - 151	
1,1-Dichloroethene	20.0	18.8	94	56 - 139	
1,1-Dichloroethane	20.0	19.3	97	78 - 122	
cis-1,2-Dichloroethene	20.0	18.4	92	80 - 120	
trans-1,2-Dichloroethene	20.0	19.0	95	75 - 122	
MTBE	20.0	20.3	101	71 - 115	
Chloroform	20.0	19.7	98	82 - 123	
1,2-Dichloroethane	20.0	20.6	103	74 - 118	
2-Butanone	20.0	16.5	82	65 - 114	
1,1,1-Trichloroethane	20.0	17.9	90	74 - 128	
Cyclohexane	20.0	17.2	86	58 - 133	
Carbon tetrachloride	20.0	18.2	91	73 - 120	
Bromodichloromethane	20.0	18.5	92	79 - 119	
1,2-Dichloropropane	20.0	17.9	89	80 - 120	
cis-1,3-Dichloropropene	20.0	19.8	99	80 - 120	
Trichloroethene	20.0	17.4	87	78 - 119	
Methylcyclohexane	20.0	18.1	90	61 - 129	
Dibromochloromethane	20.0	18.7	94	80 - 120	
1,1,2-Trichloroethane	20.0	18.7	93	79 - 119	
Benzene	20.0	18.8	94	83 - 124	
trans-1,3-Dichloropropene	20.0	19.4	97	78 - 118	
Bromoform	20.0	16.5	82	73 - 123	
Isopropylbenzene	20.0	17.8	89	80 - 125	
4-Methyl-2-pentanone	20.0	17.8	89	53 - 120	
2-Hexanone	20.0	16.7	84	53 - 121	
Tetrachloroethene	20.0	18.0	90	68 - 139	
Toluene	20.0	18.3	91	80 - 120	
1,1,2,2-Tetrachloroethane	20.0	19.7	98	74 - 126	
Chlorobenzene	20.0	19.0	95	81 - 121	
Ethylbenzene	20.0	18.2	91	79 - 126	
Xylenes, Total	60.0	56.7	94	76 - 121	

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Lab Control Sample - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	LCS 460-98737/3	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64459.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0831	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0831				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Styrene	20.0	19.4	97	69 - 112	
1,2-Dibromo-3-Chloropropane	20.0	19.2	96	70 - 116	
1,3-Dichlorobenzene	20.0	19.2	96	81 - 126	
1,4-Dichlorobenzene	20.0	18.7	93	83 - 123	
1,2-Dichlorobenzene	20.0	18.7	94	82 - 122	
1,2,4-Trichlorobenzene	20.0	16.6	83	66 - 120	
1,2-Dibromoethane	20.0	18.5	93	78 - 118	

Surrogate	% Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	107	70 - 122
Toluene-d8 (Surr)	100	69 - 125
Bromofluorobenzene	102	69 - 135

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method Blank - Batch: 460-98698

Method: 8270C
Preparation: 3510C

Lab Sample ID:	MB 460-98698/1-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13274.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0239	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Benzaldehyde	10	U	2.0	10
Phenol	10	U	0.81	10
Bis(2-chloroethyl)ether	1.0	U	0.28	1.0
2-Chlorophenol	10	U	2.2	10
2-Methylphenol	10	U	1.8	10
Acetophenone	10	U	2.7	10
N-Nitrosodi-n-propylamine	1.0	U	0.25	1.0
Hexachloroethane	1.0	U	0.25	1.0
Nitrobenzene	1.0	U	0.30	1.0
Isophorone	10	U	2.7	10
2-Nitrophenol	10	U	2.4	10
2,4-Dimethylphenol	10	U	3.4	10
Bis(2-chloroethoxy)methane	10	U	2.6	10
2,4-Dichlorophenol	10	U	2.6	10
Naphthalene	10	U	2.7	10
4-Chloroaniline	10	U	2.0	10
Hexachlorobutadiene	2.0	U	0.57	2.0
Caprolactam	10	U	2.5	10
4-Chloro-3-methylphenol	10	U	2.5	10
2-Methylnaphthalene	10	U	3.0	10
Hexachlorocyclopentadiene	10	U	1.7	10
2,4,6-Trichlorophenol	10	U	2.4	10
2,4,5-Trichlorophenol	10	U	2.6	10
2-Chloronaphthalene	10	U	2.7	10
2-Nitroaniline	20	U	4.9	20
Dimethyl phthalate	10	U	2.8	10
Acenaphthylene	10	U	2.7	10
2,6-Dinitrotoluene	2.0	U	0.61	2.0
3-Nitroaniline	20	U	5.0	20
Acenaphthene	10	U	2.7	10
2,4-Dinitrophenol	30	U	5.4	30
4-Nitrophenol	30	U	6.7	30
Dibenzofuran	10	U	2.8	10
2,4-Dinitrotoluene	2.0	U	0.47	2.0
Diethyl phthalate	10	U	2.9	10
4-Chlorophenyl phenyl ether	10	U	2.5	10
Fluorene	10	U	2.8	10
4-Nitroaniline	20	U	5.8	20
4,6-Dinitro-2-methylphenol	30	U	4.7	30
N-Nitrosodiphenylamine	10	U	2.9	10
4-Bromophenyl phenyl ether	10	U	2.5	10
Hexachlorobenzene	1.0	U	0.29	1.0
Atrazine	10	U	3.0	10
Pentachlorophenol	30	U	5.3	30
Phenanthrene	10	U	3.1	10

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Method Blank - Batch: 460-98698

Method: 8270C
Preparation: 3510C

Lab Sample ID:	MB 460-98698/1-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13274.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0239	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Anthracene	10	U	2.8	10
Carbazole	10	U	3.2	10
Di-n-butyl phthalate	10	U	2.9	10
Fluoranthene	10	U	3.2	10
Pyrene	10	U	2.9	10
Butyl benzyl phthalate	10	U	2.5	10
3,3'-Dichlorobenzidine	20	U	4.9	20
Benzo[a]anthracene	1.0	U	0.27	1.0
Chrysene	10	U	3.1	10
Bis(2-ethylhexyl) phthalate	10	U	2.0	10
Di-n-octyl phthalate	10	U	1.5	10
Benzo[b]fluoranthene	1.0	U	0.26	1.0
Benzo[k]fluoranthene	1.0	U	0.26	1.0
Benzo[a]pyrene	1.0	U	0.14	1.0
Indeno[1,2,3-cd]pyrene	1.0	U	0.15	1.0
Dibenz(a,h)anthracene	1.0	U	0.090	1.0
Benzo[g,h,i]perylene	10	U	2.0	10
Diphenyl	10	U	2.8	10
4-Methylphenol	10	U	1.6	10
bis (2-chloroisopropyl) ether	10	U	2.0	10

Surrogate	% Rec	Acceptance Limits
2-Fluorophenol	57	10 - 65
2-Fluorobiphenyl	91	53 - 108
Phenol-d5	38	10 - 48
Nitrobenzene-d5	93	56 - 112
2,4,6-Tribromophenol	94	46 - 122
Terphenyl-d14	96	50 - 122

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 460-98698

Method: 8270C
Preparation: 3510C

LCS Lab Sample ID:	LCS 460-98698/2-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13291.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0926	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

LCSD Lab Sample ID:	LCSD 460-98698/3-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13292.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0949	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

	% Rec.						
Analyte	LCS	LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Benzaldehyde	205	202	52 - 150	2	30	*	*
Phenol	43	41	12 - 44	4	30		
Bis(2-chloroethyl)ether	80	78	62 - 108	3	30		
2-Chlorophenol	93	90	53 - 101	3	30		
2-Methylphenol	85	82	40 - 90	3	30		
Acetophenone	73	72	68 - 109	2	30		
N-Nitrosodi-n-propylamine	87	84	70 - 109	4	30		
Hexachloroethane	83	79	50 - 99	4	30		
Nitrobenzene	87	85	66 - 106	3	30		
Isophorone	81	80	68 - 108	2	30		
2-Nitrophenol	94	93	65 - 107	1	30		
2,4-Dimethylphenol	94	94	55 - 100	0	30		
Bis(2-chloroethoxy)methane	92	90	69 - 108	2	30		
2,4-Dichlorophenol	97	95	64 - 107	2	30		
Naphthalene	86	84	63 - 101	3	30		
4-Chloroaniline	86	85	58 - 105	1	30		
Hexachlorobutadiene	85	84	52 - 99	1	30		
Caprolactam	26	26	10 - 30	2	30		
4-Chloro-3-methylphenol	96	95	57 - 106	1	30		
2-Methylnaphthalene	84	83	66 - 102	1	30		
Hexachlorocyclopentadiene	72	69	40 - 105	4	30		
2,4,6-Trichlorophenol	96	96	67 - 111	0	30		
2,4,5-Trichlorophenol	97	96	67 - 114	0	30		
2-Chloronaphthalene	93	91	65 - 107	3	30		
2-Nitroaniline	89	87	73 - 116	2	30		
Dimethyl phthalate	98	96	69 - 111	2	30		
Acenaphthylene	90	88	67 - 107	2	30		
2,6-Dinitrotoluene	98	96	68 - 114	1	30		
3-Nitroaniline	103	101	59 - 108	2	30		
Acenaphthene	92	89	66 - 108	3	30		
2,4-Dinitrophenol	36	36	19 - 113	2	30		
4-Nitrophenol	36	34	10 - 44	4	30		
Dibenzofuran	91	89	68 - 105	2	30		
2,4-Dinitrotoluene	98	94	65 - 113	3	30		
Diethyl phthalate	97	95	66 - 109	3	30		

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 460-98698

Method: 8270C
Preparation: 3510C

LCS Lab Sample ID:	LCS 460-98698/2-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13291.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0926	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

LCSD Lab Sample ID:	LCSD 460-98698/3-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13292.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0949	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

Analyte	% Rec. LCS	% Rec. LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
4-Chlorophenyl phenyl ether	93	91	68 - 105	2	30		
Fluorene	91	90	68 - 105	1	30		
4-Nitroaniline	107	105	49 - 119	2	30		
4,6-Dinitro-2-methylphenol	59	62	58 - 115	5	30		
N-Nitrosodiphenylamine	103	102	71 - 121	1	30		
4-Bromophenyl phenyl ether	98	97	66 - 110	0	30		
Hexachlorobenzene	95	94	65 - 107	1	30		
Atrazine	49	49	56 - 116	1	30	*	*
Pentachlorophenol	63	64	55 - 116	0	30		
Phenanthrene	93	93	68 - 110	0	30		
Anthracene	92	91	68 - 108	1	30		
Carbazole	92	91	67 - 110	1	30		
Di-n-butyl phthalate	97	95	68 - 111	2	30		
Fluoranthene	86	84	68 - 108	3	30		
Pyrene	100	98	61 - 110	2	30		
Butyl benzyl phthalate	103	100	66 - 115	3	30		
3,3'-Dichlorobenzidine	99	99	69 - 129	0	30		
Benzo[a]anthracene	90	88	65 - 106	2	30		
Chrysene	97	93	68 - 112	4	30		
Bis(2-ethylhexyl) phthalate	103	100	66 - 114	3	30		
Di-n-octyl phthalate	89	88	51 - 115	1	30		
Benzo[b]fluoranthene	101	96	65 - 111	5	30		
Benzo[k]fluoranthene	102	98	66 - 114	4	30		
Benzo[a]pyrene	106	102	58 - 101	4	30	*	*
Indeno[1,2,3-cd]pyrene	119	113	68 - 121	5	30		
Dibenz(a,h)anthracene	123	118	67 - 124	4	30		
Benzo[g,h,i]perylene	132	126	65 - 134	5	30		
Diphenyl	78	76	66 - 112	2	30		
bis (2-chloroisopropyl) ether	84	80	68 - 107	4	30		

Surrogate	LCS % Rec	LCSD % Rec	Acceptance Limits
2-Fluorophenol	56	54	10 - 65
2-Fluorobiphenyl	87	87	53 - 108
Phenol-d5	37	35	10 - 48
Nitrobenzene-d5	87	86	56 - 112
2,4,6-Tribromophenol	82	83	46 - 122

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Surrogate	LCS % Rec	LCSD % Rec	Acceptance Limits
Terphenyl-d14	94	94	50 - 122

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method Blank - Batch: 460-98614

Method: 6010B
Preparation: 3010A

Lab Sample ID:	MB 460-98614/1-A	Analysis Batch:	460-98806	Instrument ID:	ICP4
Client Matrix:	Water	Prep Batch:	460-98614	Lab File ID:	01122012.asc
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 1451	Units:	ug/L	Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Barium	200	U	5.9	200
Cadmium	5.0	U	0.82	5.0
Chromium	10.0	U	4.5	10.0
Lead	5.0	U	4.0	5.0
Selenium	10.0	U	5.8	10.0
Silver	10.0	U	1.3	10.0

Method Blank - Batch: 460-98614

Method: 6010B
Preparation: 3010A

Lab Sample ID:	MB 460-98614/1-A	Analysis Batch:	460-98855	Instrument ID:	ICP4
Client Matrix:	Water	Prep Batch:	460-98614	Lab File ID:	01122012A.asc
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 2354	Units:	ug/L	Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Arsenic	5.0	U	3.7	5.0

Lab Control Sample - Batch: 460-98614

Method: 6010B
Preparation: 3010A

Lab Sample ID:	LCS 460-98614/2-A	Analysis Batch:	460-98806	Instrument ID:	ICP4
Client Matrix:	Water	Prep Batch:	460-98614	Lab File ID:	01122012.asc
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 1441	Units:	ug/L	Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Arsenic	2000	1898	95	80 - 120	
Barium	2000	2000	100	80 - 120	
Cadmium	50.0	50.13	100	80 - 120	
Chromium	200	200.8	100	80 - 120	
Lead	500	512.6	103	80 - 120	
Selenium	2000	1858	93	80 - 120	
Silver	50.0	48.58	97	80 - 120	

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method Blank - Batch: 460-98621

Method: 7470A
Preparation: 7470A

Lab Sample ID:	MB 460-98621/1-A	Analysis Batch:	460-98677	Instrument ID:	LEEMAN3
Client Matrix:	Water	Prep Batch:	460-98621	Lab File ID:	98620hg1.PRN
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	30 mL
Analysis Date:	01/11/2012 1643	Units:	ug/L	Final Weight/Volume:	30 mL
Prep Date:	01/11/2012 1117				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Mercury	0.20	U	0.16	0.20

Lab Control Sample - Batch: 460-98621

Method: 7470A
Preparation: 7470A

Lab Sample ID:	LCS 460-98621/2-A	Analysis Batch:	460-98677	Instrument ID:	LEEMAN3
Client Matrix:	Water	Prep Batch:	460-98621	Lab File ID:	98620hg1.PRN
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	30 mL
Analysis Date:	01/11/2012 1628	Units:	ug/L	Final Weight/Volume:	30 mL
Prep Date:	01/11/2012 1117				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Mercury	1.00	0.942	94	80 - 120	

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Duplicate - Batch: 460-98956

Method: 1020A
Preparation: N/A

Lab Sample ID:	460-35505-1	Analysis Batch:	460-98956	Instrument ID:	No Equipment
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	
Analysis Date:	01/13/2012 1746	Units:	Degrees F	Final Weight/Volume:	1.0 mL
Prep Date:	N/A				
Leach Date:	N/A				

Analyte	Sample Result/Qual	Result	RPD	Limit	Qual
Ignitability	>160	>160	NC	10	

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Matrix Spike/
Matrix Spike Duplicate Recovery Report - Batch: 680-226032

Method: 9020B
Preparation: Carbon Trap

MS Lab Sample ID:	460-35505-1	Analysis Batch:	680-226034	Instrument ID:	TOX1
Client Matrix:	Water	Prep Batch:	680-226032	Lab File ID:	N/A
Dilution:	2.0	Leach Batch:	N/A	Initial Weight/Volume:	50 mL
Analysis Date:	01/12/2012 1723			Final Weight/Volume:	50 mL
Prep Date:	01/12/2012 0730				
Leach Date:	N/A				

MSD Lab Sample ID:	460-35505-1	Analysis Batch:	680-226034	Instrument ID:	TOX1
Client Matrix:	Water	Prep Batch:	680-226032	Lab File ID:	N/A
Dilution:	2.0	Leach Batch:	N/A	Initial Weight/Volume:	50 mL
Analysis Date:	01/12/2012 1723			Final Weight/Volume:	50 mL
Prep Date:	01/12/2012 0730				
Leach Date:	N/A				

	% Rec.						
Analyte	MS	MSD	Limit	RPD	RPD Limit	MS Qual	MSD Qual
TOX Result 1	86	102	60 - 140	17	40		
TOX Result 2	86	102	60 - 140	17	40		

TestAmerica Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Phone (203) 929-8140 Fax (203) 929-8142

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact: Ian Hofman	Field Sampler: EAR / ES	TAT Required (business days): Standard 10-Day	Lab PM/Contact:
Company: E.A.R.	Mobile/Field Number:		Lab Job Number (Lab Use Only):
Address: 225 Atlantic Ave.	E-Mail:	Deliverable Type (Report/EDD):	Passed Rad Screen (Lab Use Only): [✓] Yes [ ] No
City, State, Zip: Patchogue, NY, 11772	PO #:	Sample Disposal: [ ] Return to Client [ ] Disposal by Lab [ ] Archive for __ Months (A fee may be assessed if samples are retained for longer than 1 month)	Cooler Temperatures (Lab Use Only):
Phone: (631) 447-6400	WO #:		
Email:	Project #:		
Project Name/Site Location (State): DEC-Farmingdale 480 (NY)	SSOW#:	State Regulatory QC Criteria Requirements:	

COC Number: 21802
Page ___ of ___
Carrier Tracking
Notes: 35505

Samples submitted for analysis will be subject to TestAmerica Terms and Conditions

TA #	Field Sample Identification (Containers for each sample may be combined on one line)	Collection Date	Collection Time (24-Hour Clock)	Matrix Aq=Aqueous, S=Solid, W=Waste/Oil, O=Other	MS/ MSD (Yes or No)	Unpreserved	H2SO4	HNO3	HCL	NaOH	ZnAc/NaOH	Other	6010B RCRA8 Analyte ~~RCRA~~ 9470A Merc.	8260B (OLM04.2 Comp list)	1020A (Ignitability)	8270C (OLM04.2 Compound List)	9020B (Regular TOX (in duplicate))				Comments
	Condensate	1-5-12	1130	Aq		3	1	1	3				X	X	X	X	X				Category A Deliverables

Relinquished by: [signature]	Date/Time: 1-5-12 / 1300	Company: EAR	Received by: EAR Fridge	Date/Time: 1-5-12 / 1300	Company: EAR
Relinquished by: EAR Sample Fridge	Date/Time: 1-6-12 / 1340	Company: EAR	Received by: William A Vigliotta	Date/Time: 1-6-12 1340	Company: EAR
Relinquished by: William A Vigliotta	Date/Time: 1-6-12 / 1340	Company: EAR	Received by: [signature]	Date/Time: 1/6/12 1340	Company: TAct

Comments: [signature] 1/6/12 1639 TACt Relinquished Jennifer Cyr 1/6/12 17:22

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy
Field Sampling / Shipping Instructions and Laboratory Sample Receipt Policy included on Reverse Side of COC

TAL-0015 (0609) Fedex

Fedex 1/7/12 C Hall 1/7/12 1155 TA. 2.1 °C #50

TestAmerica Edison
Sample pH Receipt Log

Job No. 35505

page ___ of ___

Sample No.	Ammonia (pH<2)	COD (pH<2)	Metals (pH<2)	Nitrate Nitrite (pH<2)	O & G (pH<2)	Pest (pH 5-9)	PHC (pH<2)	Phenols (pH<2)	Sulfide (pH>9)	TKN (pH<2)	TOC (pH<2)	Total Cyanide (pH>12)	Total Phos (pH<2)	Other TOX
1			LZ											KZ

Initials: [signature]

Date: 1/7/12

EDS-WI-038, Rev 1, 11/21/07

Login Sample Receipt Checklist

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Login Number: 35505
List Number: 1
Creator: Hall, Alonzo

List Source: TestAmerica Edison

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	Not present
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	2.1° C IR 50
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Login Number: 35505
List Number: 1
Creator: Barnett, Eddie T

List Source: TestAmerica Savannah
List Creation: 01/11/12 01:19 PM

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX L: WARRANTY

WARRANTY

All products not manufactured by RapidTech LLC d/b/a National Environmental Systems, carry the original manufacturer's warranty. Copies are available on request.

RapidTech LLC d/b/a National Environmental Systems, warrants its packaged and manufactured equipment against any defect in material or workmanship, under normal use and storage for a period of twelve (12) months from date of manufacture and invoice, regardless of system start-up date. In the event that products are found to be defective within the warranty period, RapidTech LLC d/b/a National Environmental Systems, sole obligation and remedy shall be the furnishing of replacements for any defective parts, and such replacement parts shall be furnished but not installed by RapidTech LLC d/b/a National Environmental Systems RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, WILL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES IN ANY CLAIM SUIT OR PROCEEDINGS ARISING UNDER WARRANTY, NOR WILL RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, ACCEPT ANY LIABILITY FOR CLAIMS FOR LABOR, LOSS OR PROFIT, REPAIRS OR OTHER EXPENSES INCIDENTAL TO REPLACEMENT.

The warranty requires that the purchaser complete all operations and maintenance as detailed in each section of the Operation & Maintenance Manual supplied with the purchased system. In addition installation must comply with nationally recognized electrical and mechanical standards as well as best engineering practices in effect at the time of purchase.

The product warranty expressed above is our only warranty and may not be verbally changed or modified by any representative of RapidTech LLC d/b/a National Environmental Systems All freight costs incurred in shipping parts to or from RapidTech LLC d/b/a National Environmental Systems, or to the manufacturer if necessary are at the expense of the customer.

RapidTech LLC dba National Environmental Systems, will invoice the cost of any replacement parts. These parts will be credited upon certification the original part was defective and the defective part was returned within one week of notifying RapidTech LLC d/b/a National Environmental Systems, of the malfunction. If the part is found to have been misused no credit will be issued. In order for RapidTech LLC d/b/a National Environmental Systems, to ship a replacement part on account, all outstanding invoices must be current.

RapidTech LLC d/b/a National Environmental Systems, expressly disclaims any warranties, expressed or implied, including any warranty of merchantability or fit for particular purpose or any warranty arising from a course of dealing or usage of trade. Except to the extent required by applicable law. RapidTech LLC d/b/a National Environmental Systems, shall not be liable, in tort, contract or otherwise, for any loss or damage, whether direct, consequential or incidental, of any person or entity arising in connections with the equipment.