PELHAM BAY LANDFILL
BRONX, NEW YORK

Operation and Maintenance Manual
Volume IIc

Prepared for.

City of New York
Department of Environmental Protection

WCC Project No. 92C4087

November 1996

Prepared by:



Woodward-Clyde Consultants, Inc.
363 Seventh Avenue, 11th Floor
New York, New York 10001

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OPERATING MANUAL

FOR

7' x 40' ZTOF

ENCLOSED GROUND FLARE SYSTEM

Location: Pelham Bay Landfill
Bronx, NY

WARNING

Do not attempt to operate flare without first familiarizing yourself with these operating instructions! Improper operation of the equipment may result in injury to persons, loss of life and damage to equipment.

Prepared for:

Purchasing Co.: Breco Mechanical
End User Co.: Pelham Bay Landfill
Purchase Order No.: 1304

Prepared by:

John Zink Company
11920 East Apache
Tulsa, Oklahoma 74116
Shop Order: BF-AO12224
Preparation Date: October 1995

For assistance contact John Zink Company as follows:

Service:	918-234-2751	Emergency: 918-234-1800
Spare Parts:	918-234-2751	Fax : 918-234-1986

Request field service and spare parts during our normal office hours from 8:00 a.m. to 4:30 p.m. (CST).

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Section Two

II. SAFETY SUMMARY

The following are general safety precautions for the operation and maintenance of the Enclosed Ground Flare system. Instructions contained in this Operating Manual are in addition to and do not replace the operating company's and owner's existing operating procedures and policies with regard to standard safety precautions for flare operation and maintenance.

WARNING

High voltages capable of causing death are used with this equipment. Use extreme caution when servicing the control rack. Any circuit on which work is being performed should be de-energized and the switch should be locked open. Ground the control rack with an adequate grounding rod or field prior to turning on the power.

WARNING

Flare systems may contain or produce toxic gases. Appropriate safety precautions must be taken whenever personnel may be exposed to flare gases. In particular, exposure may occur during close inspection of the flare tip or pilots and during removal or maintenance of equipment attached to the flare header.

WARNING

Exposure to refractory and insulation dust may cause life-threatening repertory disease. Refractory dust may contain crystalline silica which is believed to be a carcinogenic. Avoid breathing refractory dust if you work in any way with refractory of insulation by using NIOSH approved or better respirator for crystalline silica.

Section Three

III. INTRODUCTION

This manual was written to give the operator a complete overview of a John Zink Biogas Disposal System. A system may contain only a ZTOF Ground Flare or it may consist of a flare, a Control Panel with Rack, and a Blower Skid. All of the information required to safely operate and maintain the John Zink supplied items may be found within these instructions.

The John Zink Temperature Controlled Biogas Disposal System is automated and designed to safely break down typical organic compounds generated by solid waste and other biogas processes. The unit is governed by a Programmable Logic Controller (PLC) which receives and transmits signals with respect to operating conditions. If an unacceptable operating condition occurs, the system will stop the flow of waste gas or change the operating parameters to correct the problem. The Enclosed Flare includes a timed ignition sequence, pre-ignition purge, and fail safe controls for all hydrocarbon sources. A self checking flame scanner monitors the pilot and waste gas flame. High temperature indication and shutdown prevent damage to the equipment.

Take a moment to familiarize yourself with this manual. Contact John Zink Company if you have any questions or you require start up assistance.

Section Four

IV. RECEIPT AND INSTALLATIONS

Receipt

Upon delivery to the site and prior to installation, carefully examine the equipment for damage. Any damage that may be sustained in shipment will be reimbursed through the freight carrier and their insurance carrier. To assure prompt and accurate processing of any claims, John Zink Company recommends the following:

1. Inspect each item as it is unloaded or un-crated. Note any damage or shortages on the shipper's documentation before signing for deliver acceptance.

2. If the shipment cannot be inspected upon arrival, sign the delivery acceptance documents with the following qualifications:

   "Accepted subject to later inspection"

3. Inspect the delivery as soon as possible and in no case later than 10 days after delivery.

4. If damage or shortages are noted in action 1 or 2, notify the freight company immediately and provide them with an itemized damage or shortage list. In addition, notify the John Zink Company and replacement and repair procedure claims will be processed.

Installation

Reference Drawings

The following is a list of drawings that will be necessary for installation and are included in Section XIV of this manual.

B-F-AO12224- 150	Piping and Instrumentation Diagram
B-F-AO12224- 301	Enclosed Ground Flare Assembly
B-F-AO12224- 302	KE-1ST Pilot Assembly
B-F-AO12224- 303	360° Platform
B-F-AO12224- 304	Step Off Platform
B-F-AO12224- 401	Wiring Diagram for Enclosed Flare System
B-F-AO12224- 402	Wiring Diagram for Enclosed Flare System
B-F-AO12224- 403	Panel Rack Assembly
B-F-AO12224- 404	Panel Details
B-F-AO12224- 405	Interconnecting Diagram

General

1. Installation, connection and assembly of the stack, piping, electrical conduit, wiring, and touch-up painting are the responsibility of the customer.

2. The foundation should be level and be designed for the load that it will be subjected to by the equipment. Anchor bolt and support pad locations are shown on John Zink drawings.

3. Install 6 inches of pea sized gravel in the bottom of the flare to protect the foundation from radiant heat.

4. Cut off lifting lugs *before* start-up. Use after flare operation can be a safety hazard.

5. Insure that the system is adequately grounded as directed by local electric codes and soil conditions.

6. Refer to John Zink drawings for electrical and process piping connection to the system.

7. Do not run low voltage wires in the same conduit as high voltage wires. Do not run 4-20 mA Signal wires in the same conduit as electrical wires.

8. The ignition rod insulators on the pilot are fragile. Be sure that the ignition rod insulators are not damaged and that the rod, insulator bracket, and insulators are secure and tight.

9. The thermocouple assemblies have fragile ceramic parts. Be sure that the thermowells are not damaged.

10. Clean out flare system piping and remove sand, rocks, weld slag, and other debris immediately prior to assembly or installation. Use high pressure air to clear piping after assembly and installation.

11. If high winds are possible, it is recommended that a windscreen should be placed approximately six (6) feet in front of each damper.

Stack

1. Install the burner tips MK: D-ST-1243 with studs, nuts, and gaskets to the inlet manifold.

2. Bolt on all manual and automatic dampers using the nuts and bolts provided. Gaskets are not required. The actuator and bracket assembly should be located on the right as you face the damper.

3. Attach the purge air blower.

4. Thread the sight glass, CA-ST-0600, to the nozzle connection C3.

5. If applicable, mount the Flame Arrestor and Inlet Block Valve to their respective places in the waste gas line.

6. Verify that the drain plug, C2 is secure in the manifold.

7. Mount the pilot assemble to nozzle connection N4 and connect the fuel gas piping to C14.

8. Mount the Ignition Transformer box to the stack.

9. See the following table for thermocouple placement information:

Temperature Controlling Thermocouple

Flow Rate	Location
116 - 232	17'
233 - 463	27'
464 - 695	36'-6"

High Temperature Thermocouple

All Flow Rates	17'

NOTE
Do not install the thermocouple with the element forced to the end of the thermowell. Allow approximately 1/2" for thermal expansion.

10. Verify that the sample port covers are in place over connections C5 - C8.

Electrical

1. Connect power to the purge air blower and gas blowers if required
2. Connect 120 Vac to the flame scanner.
3. Connect ignition wire from the ignition panel to the pilot.
4. 120 Vac to the ignition panel.
5. Run the type K thermocouple wiring to all thermocouples.
6. 120 Vac and 4-20mA wiring to the damper actuator(s).
7. DPSL Purge Air Blower Press Switch (See Ref. Drawings 400 Series and P & ID)
8. Install the flow transmitter and run the low voltage wiring to the control panel.
9. Connect electrical wiring to the solenoid valve and limit switches located on the inlet block valve.

Customer Control Wiring

1. Connect wiring to customer remote contacts.
2. Connect wiring to any building circuits or modules (Optional).

Interconnecting Piping

1. Connect inlet, N1, to flare.
2. Connect inlet and outlet to K.O. drum (Optional).

Miscellaneous

1. Check all piping fittings for tightness.
2. Check all flanges for tightness.
3. Check all electrical conduit fittings for seals, if required, and tightness.
4. If applicable, do not pour electrical seals until the unit has been checked, started, and placed into service by a John Zink field service representative.
5. Verify that the external electrical control and power wiring is correctly sized and that the system has the correct overload protection.
6. Inspect the internal ceramic blanket refractory for any damage.
7. Verify that all electrical wiring connections are tight.
8. Install 6" of aggregate in the bottom of the ZTOF stack.

NOTE

Power to the control panel space heater should remain "On" at all times including storage to prevent internal corrosion.

Section Five

V. EQUIPMENT DESCRIPTION

Flare

The John Zink Enclosed ground flare provides a safe and effective method for the disposal of waste gases produced by solid waste or digester processes. The A-36 carbon steel shell provides the volume necessary to ensure a high destruction efficiency and is lined with 2 inches of ceramic fiber refractory anchored with inconel pins and keepers. High turn down and flame stability are provided by the " V-Mix™ " biogas anti-flashback burners. The burners tips are made of stainless steel to prevent corrosion. Bolted blade dampers are provided for air control.

Control Panel & Rack

The Flare Control Rack provides the control and operations logic for the entire system. The John Zink Control panel uses an Allen Bradley SLC-500 Programmable Logic Controller.

Blower Skid (Optional)

Our standard blower skid is of heavy construction and contains all equipment necessary to operate the unit within the skid boundaries. A typical skid has one or two blowers, and all valves required for isolation. The control panel and accessories are conveniently located and are pre-wired. A pneumatic block valve and condensate knock-out drum are provided.

Section Six

VI. DESIGN BASIS

Waste Gas

	Max.
Type:	Landfill
Methane:	50%
Carbon Dioxide:	50%
LHV:	454 Btu/hr
Temperature:	100 °F
Molecular Weight:	30
Max. Flow	1500 CFM
Max. Heat Release	41 MM Btu/hr

CAUTION

Flashback may occur if the landfill gas contains oxygen within the explosive limit.

Mechanical Design

Design Wind Speed:	100 mph
Ambient Temp:	-20 to 120 °F
Electrical Area:	Non-hazardous

Unit Design

Smokeless Flow	100%
P.D. @ Inlet Manifold	2 - 4 inches water column
Operating Temperature	1600 °F - 1800 °F
Retention Time	> 0.7 seconds

Utilities

Pilot Gas	22 SCFM of Propane @ 10 psig
Electrical	460 V / 3 ph / 60 Hz (with Integral Step-down Transformer) 120V/1 ph/60Hz (without Step-down Transformer)

Section Seven

VII. OPERATIONAL PHILOSOPHY

The following discussion is a guideline for meeting the minimum safety requirements while operating and enclosed flare.

Logic

The burner management system includes a flame safeguard package which monitors key parameters and shuts the unit down if an unsafe condition occurs. The key shutdown interlocks are as follows:

High Flare Temperature
Flame Failure
Low Purge Air Flow (in Purge Cycle)
Low Temperature (if applicable)

Start Up

A basic start up will typically consist of the following steps:

Stack Purge
Pilot Ignition
Initiate Waste Gas Flow
Heat Up to Operating Temperature (1600 °F - 1800 °F)

Stack Purge

Prior to lighting the pilot, the stack must be purged with fresh air to ensure that there are no potentially explosive gas/air mixtures inside. John Zink has included a purge air blower for this purpose. In order to ensure a safe atmosphere for igniting the pilot, the purge air blower should be left on for a minimum of 5 minutes to evacuate any gases which may have leaked in through the piping system.

Pilot Ignition

After the stack has been purged, the pilot should be immediately lit. Failure to light the pilot within 30 seconds will required that the vessel be purged again to ensure that a flammable mixture has not formed inside the vessel.

The pilot ignition sequence can be either an automatic or manual operation. Once the ignition button is depressed in the manual mode or the purge is completed in the automatic mode, the pilot solenoid valve should open and the ignition transformer will be energized.

Initiate Waste Gas Flow

Once the pilot is proven, the inlet block valve may be opened and the blower(s), if present, may be activated to initiate flow to the flare.

Heat Up to Operating Temperature

After the waste flow has been started, the temperature controller will begin closing the air damper(s) to heat the vessel to the required operating temperature.

Section Eight

VIII. PRE-STARTUP CHECKLIST

Initial start-up consists of the following steps:

√ Piping and Instrument Diagram Check
√ Mechanical Check
√ System Check
√ Stack Set-up

A qualified John Zink representative is recommended for initial start-up.

Piping and Instrument Diagram Check

John Zink will construct the waste gas enclosed flare in accordance with final drawings. Operating personnel should conduct a Piping and Instrument Diagram check to familiarize themselves with the equipment.

Mechanical Check

Operating personnel should verify that all of the equipment, including valves and the control system, are functional prior to start-up.

Before starting up the flare, checks should be made of the following items:

1. Verify that all the flare components are installed in accordance with the referenced drawings.

2. Verify that all electrical devices are connected to the proper power sources.

3. For the chromel-alumel type K thermocouples used, the red wire is negative (-) and the yellow wire is positive (+). Make sure that the thermocouple extension wire used is adequate for the radiation load and is proper for the thermocouple used. (i.e. KX wire for Type K thermocouples using a high temperature insulation).

NOTE

Cross connecting the red and yellow wires anywhere in the circuit will nullify the thermocouple output.

4. All system lines should be dry and free of dirt and foreign material. This should be done prior to connecting pilot gas lines at the pilots. Pilot gas lines should be confirmed as free and dry by removing the mixer orifice and strainer screen and blowing with clean dry air. Reinstall orifice and screen when clear flow is confirmed.

5. Check that all drain and vent valves are closed and that all drain and vent plugs are tightly secured.

6. All manual valves in the pilot gas and waste gas systems should be closed.
7. Verify that the main power disconnect is turned off.
8. Open the main control panel, PNL-101, and verify that all circuit breakers are turned off.
9. Turn the system power switch to the off position.
10. Turn the system selector switch to the off position.
11. Turn the Waste Inlet Valve switch to the off position.
12. Turn the Waste Gas Blower Switch to the off position.
13. Turn the Security Light switch to the off position.
14. Verify that the fuel pressure at PI-612 is approximately 10 psig. There will be no pressure here until Pilot Gas Solenoid Valve is open.
15. Verify that the hand valve at the nitrogen bottle is closed.
16. Check that all set points are properly adjusted.

1.	High Stack Temperature:	2000°F
2.	Temperature Indicating Controller:	1600°F
3.	Low Stack Temperature:	1400°F (Optional)
4.	Pressure Switch	
5.	Ammeters	
6.	Blower Overload Switches	
7.	Pressure Regulator PCV-608	10 psig for Propane 15 psig for Natural Gas

Note: Some items must be tested with the power on.

Section Nine

IX. SYSTEM OPERATION

Preparation for Start Up

1. Turn on the main disconnect switch.
2. Turn on all circuit breakers in control panel, PNL-101.
3. Turn on panel power.
4. Open the valve on the nitrogen bottle and set the pressure regulator to 100 psig.
5. Open the isolation valves to the blower that will be used.
6. Open HV-610 on the pilot gas train.
7. Turn the Waste Gas Blower switch to the Auto position.
8. Verify that the Unit Stop button is not depressed.
9. Set the manual damper at approximately 50% open.

Start Up

1. Place the Start Up Sequence Switch in the Auto position.

2. Place the Local Unit Control Switch in the Start/Run position. (If starting from a remote location, or when using a timer to run the system, the remote circuit must be in the stop position).

3. The purge blower, BL-202, will start and run for five minutes. During this time, the blue "Purging" light will illuminate to let the operator know what of the unit status. Once the purge cycle is completed, the Purge Complete Light will illuminate.

4. The pilot solenoid valve, FV-609, will open.

5. The ignition transformer will spark and the pilot will light.

6. The flame proved relay will verify that the pilot is lit.

7. After the Flame Proved light illuminates, the PLC will open the inlet waste gas valve, FCV-102, and activate the blower(s).

WARNING

All personnel should stay away from the damper openings during the start-up operations. It is possible for the landfill gas to flashback until the unit reaches design temperatures.

8. The pilot solenoid valve, FV-609, will close approximately 1 minute after the valve open limit is met.

9. As the unit comes up to temperature, the Controller, TIC-201, will send a signal to TCV-201 A/C and the controller will make adjustments to achieve the specified continuous operating temperature.

10. Once the vessel reaches operating temperature, slowly close the manual damper(s) to the same percentage open as the automatic damper(s).

Shut Down

Normal Shut Down

If for any reason the operator needs to shut the equipment down, the following steps are recommended for shut down.

1. Turn the Panel Power to the Off position
2. Turn the Waste Gas Blower switch to the Off position.
3. Turn the Waste Inlet Valve switch to the Closed position
4. Turn the Local Unit Control Switch to the Stop position.
5. Close pilot gas valve HV-601.
6. Close the blower isolation valves.
7. Close all manual valves.
8. Turn off the main disconnect.

NOTE
In order to restart the system after a failure cause has been corrected, the control system must be reset. This is done by either turning the local unit control switch to the STOP position and momentarily pressing the Reset push button, if provided, or by turning the Start Up Sequence switch to Manual and the back to Auto.

Emergency Shut Down

1. An Emergency Shutdown occurs when the Unit Stop button is depressed.
2. Once the Unit Stop button is depressed, the following occur:

   Electrical output from the PLC stops but the PLC remains energized.
   The Flame Proved Relay will de-energize.
   If the pilot is lit, the pilot gas solenoid valve, FV-609, is closed.
   The Waste Gas Valve, FCV-102, is closed.

3. To restart the system after an emergency shutdown:

Turn system selector switch to the off position.
Alleviate the reason for the shutdown.
Turn the system selector switch to the on position.
Refer to the Start Up section.

Power Failure

The following will occur during an electrical power failure:

If the pilot is lit, the pilot gas solenoid valve, FV-609, is closed.
The Waste Gas Valve, FCV-102, is closed.
The Flame Failure light will illuminate.

Once power is restored, the unit will start up automatically.

High Temperature

High temperature shutdown occurs when TE-101 senses a temperature above the set point of TISH-101. Correct the situation per the trouble shooting Section XI.

The High Temperature relay switch will de-energize and lock out the PLC output.
If the pilot is lit, the pilot gas solenoid valve, FV-609, is closed.
The Waste Gas Valve, FCV-102, is closed.
The High Temperature light will illuminate.

Once the condition has been corrected, the unit must be manually reset and started per Section IX.

Flame Failure

Flame failure can be caused by low flow or low methane content.

The Flame Safe Guard relay will de-energize and lock out the PLC output.
If the pilot is lit, the pilot gas solenoid valve, FV-609, is closed.
The Waste Gas Valve, FCV-102, is closed.
The Low Temperature light will illuminate if the controlling temperature drops below the set point.
The unit will attempt to re-light 3 times and if this fails, the unit will need to reset and started.

Once quality waste gas is available, the unit may be started per Section IX.

Low Temperature (Option)

A low temperature shutdown is caused by low flow, low methane content, or an incorrect thermocouple location.

The low temperature switch will send a signal to the PLC.
The PLC will begin a 10 minute time cycle.
If the temperature does not rise above the minimum temperature set point, the unit will be shut down.

Section Ten

X. SYSTEM TESTING

1. Purge Blower BL-202 and Purge Air Press Switch PDSL-203

   a. Turn the Start-Up Sequence "MAN-AUTO" switch to MAN.
   b. Turn the Local Unit Control "STOP-START/RUN" switch to RUN.
   c. Depress the "Purge Start" push button.
   d. After a few seconds the Blue "Purging Light" will come on.
   e. If the Purge Blower or the Purge Air Pressure Switch does not work, the Red "Low Purge Air" flow light will come on.

2. Flame Failure BS-103 and BE-103

   a. Open the Manual Valve on the Pilot Gas Line.
   b. Turn the Waste Inlet Valve "CLOSE-OPEN-AUTO" switch to CLOSE.
   c. After the Purge Complete light comes on depress the Ignition Start push button.
   d. The Red Flame Failure light should go out and the Green Flame Proved light should come on.
   e. Close the Manual valve on the Pilot Gas Line.
   f. The Green Flame Proved light should go out and the Red Flame Failure light should come on.

3. Emergency Shut-down

   a. Ignite the flare pilot.
   b. Depress the Unit Stop push button.
   c. The Green Flame Proved light should go out and the Red Flame Failure light should come on.
   d. Pull the Red "Unit Stop" push button out before unit can be started.

4. High Temperature

   a. Turn Panel Power "OFF-ON" switch to OFF.
   a. Disconnect thermocouple wires from terminals T-1 & T-2.
   c. Install the thermocouple simulator.
   d. Turn the Power switch ON.
   e. Raise thermocouple above 2000°F. The Red High Stack Temperature light will illuminate.
   f. Turn the Power switch OFF. Remove thermocouple simulator. Reconnect thermocouple wires to terminals T-1 & T-2.
   g. Turn the Power switch ON. Depress Reset push button.

5. Low Temperature

a. Turn the Power switch OFF. Disconnect the thermocouple wire from the temperature controller TIC-201.
b. Install the thermocouple simulator.
c. Turn the Power switch ON.
d. Raise thermocouple simulator above 1100°F. The Red Low Flare Temperature light will go out.
e. Turn the Power switch OFF. Disconnect the thermocouple simulator. Reconnect thermocouple wires to temperature controller TIC-201.

Section Eleven

XI. TROUBLESHOOTING

Problem: Power On light will not illuminate.

Possible Causes:

The main circuit breaker is turned off
The Power On switch is turned off.
The light bulb is burned out.
120 Vac power to the control panel is turned off. Check the voltage across terminals L1 and N1.
The main power circuit breaker is turned off.
There is a loose wire.

Problem: The system will not begin the purge cycle.

Possible Causes:

The waste gas valve closed limit switch is not set properly.
The purge air blower does not have power.
The motor starter contact did not close.
The motor starter holding coil is defective.
The motor starter overload relay has tripped. Depress the reset button.
The motor circuit breaker may be open.
There is a loose wire.

Problem: Purge blower failure.

Possible Causes:

The pressure switch is not wired or is wired incorrectly to the control panel.
The blower not connected.
The pressure switch is not making contact.

Problem: The pilot will not light.

Possible Causes:

The manual valve on the pilot train is closed.
The propane tank is out of fuel
The ignition rod is grounding out and not causing sufficient spark.
The pilot orifice is plugged.
The ignition wire is loose or broken.
The transformer is defective.
Pressure regulator needs adjusting.

Problem: The system does not show a proven flame when the pilot is lit.

Possible Causes:

The flame relay, BS-103, is not functioning properly.
The flame scanner is not sensing flame.
There is dirt on the scanner lens.
The flame amplifier is not functioning properly.
There is a loose wire.
Scanner not properly installed.
The scanner is not functioning properly.

Problem: The waste gas blower fails to start or trips out at attempt to start.

Possible Causes:

The waste gas blower does not have power.
The motor starter contact did not close.
The motor starter holding coil is defective.
The motor starter overload relay has tripped. Depress the reset button.
The motor starter circuit breaker may be open.
There is a loose wire.

Problem: The waste gas valve does not open.

Possible Causes:

Insufficient air or nitrogen supply.
The solenoid valve is not wired correctly to the waste gas valve.

Problem: The unit smokes when starting up.

Possible Causes:

The manual damper is not open enough.

Problem: The automatic damper does not operate correctly.

Possible Causes:

Loose or broken signal wire.
The temperature controller is not functioning properly.
The actuator is defective.
Bad thermocouple input to controller.

Problem: The unit shuts down on flame failure.

Possible Causes:

Low flow rate or low methane content.
Flame scanner failure.
Flame amplifier failure.
Automatic damper actuator failure.

Problem: The unit shuts down on high temperature.

Possible Causes:

The automatic damper actuator is not operating properly.
The high temperature switch set point is not set or operating correctly.
Thermocouple burn out.
Incorrect thermocouple lead wire.
High flow or high methane content.
Incorrect thermocouple elevation.
Incorrect control parameters in damper controller.

Problem: The unit shuts down on low temperature (Option).

Possible Causes:

The automatic damper actuator is not operating properly.
The low temperature set point is not properly set.
The thermocouple wiring is crossed.
Low flow rate or methane content.
Incorrect thermocouple elevation.

Section Twelve

XII. MAINTENANCE

1. The purge air blower BL-202 should be lubricated per the manufacturer's recommendations.
2. The waste gas blowers should be lubricated per the manufacturer's recommendations. The blower and motor alignment should be checked and the blower "bumped" to verify that the wiring is correct (Option).
3. The flame arrester should be cleaned every six months.
4. The demister pad in the knock out should be cleaned every six months. Visually inspect the internal surfaces of the knock out drum (Option).
5. Stroke the inlet waste gas valve and check the pressure in the nitrogen bottles (Option).
6. Check the pressure in the propane bottles (Option).
7. Test and verify all safety shutdown devices per Section X every three months.
8. Inspect the pilot assembly for damaged or loose wires, ignition rod, flame detector, spark plug and insulator damage once every 3 months. Repair if necessary.
9. Check the calibration and operation of all instruments in accordance with the vendor literature.
10. Refer to vendor literature for specific maintenance requirements of various components.
11. Inspect the flare tips for blockage or corrosion. Clean if necessary.
12. Inspect the internal insulation for overall integrity. Torn or worn insulation can cause damage to the equipment. Repair if necessary.
13. Inspect the external surface for signs of heat corrosion. Discoloration of the paint may indicate that there is some damage to the insulation.
14. Inspect all flanges and connections for signs of leakage. Remove and replace if necessary.
15. The control panel logic should be tested to insure that all shutdowns, inputs and outputs are operating correctly.
16. Inspect all of the auxiliary flare equipment for signs of deterioration.
17. Replace thermocouple assemblies at least once per year.

Note: The above maintenance summary is only designed as a guideline and does not include all areas that must be checked. A maintenance program must be developed based on existing company policy, operational experience, and vendor data requirements. This operating manual is to be used in conjunction with and does not replace any company policies.

XIII. SPECIFICATION SHEETS

JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION

CONTROL PANEL BILL OF MATERIALS

SPEC.NO. 1

S.O.NO. BF -A0012224

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	PNL 101	HOFFMAN #A-48H3612SSLP NEMA4X ENCLOSURE WITH #A-48P36 PANEL	900995
2	4	S-1,S-2,S-3,S-4	ALLEN BRADLEY #800H-HR2A SELECTOR SWITCH, 2-POS'N., NEMA 4,	010268
			1-N/O,1-N/C CONTACT	001208
4	1	S-5	ALLEN BRADLEY #800H-JR2KA7AXXX SELECTOR SWITCH, 3-POS'N., NEMA 4	300390
5	1	L-9	ALLEN BRADLEY #800H-PR16A AMBER PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
6	1	L-7	ALLEN BRADLEY #800H-PR16B BLUE PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	010232
				001598
7	3	L-2,L-4,L-5	ALLEN BRADLEY #800H-PR16G GREEN PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	010233
				001598
				010234
8	1	L-1	ALLEN BRADLEY #800H-PR16W WHITE PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
9	4	L-6,L-8,L-11,L-12	ALLEN BRADLEY #800H-PR16R RED PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	010235
				001598
				010104
11	3	PB-1,PB-3,PB-4	ALLEN BRADLEY #800H-R2A BLACK PUSHBUTTON, 1-N/O, 1N/C CONTACT, NEMA 4	001608
12	1	PB-2	ALLEN BRADLEY #800T-FX604 RED PUSHBUTTON (MAINTAINED)	022791
13	1	FB-1	GOULD #30313R FUSE BLOCK FOR MIDGET FUSES 3 POLE, 600VAC/30AMP RATING	402378
14	3	F-1,F-2,F-3	GOULD #TMR-3 FUSE, 250V/3 AMP RATING	402474
15	2	PDB-4,PDB-5	MARATHON 1431553-POLE POWER DISTRIBUTION BLOCK, 1 PRI./6 SEC.	404962
17	2	CB-9,CB-14	SQUARE D #QOU120 CIRCUIT BREAKER, 20 AMP/120VAC (1-POLE)	010225
18	1	CB-13	SQUARE D #QOU110 CIRCUIT BREAKER, 10 AMP/120VAC (1-POLE)	010223
19	1	RCPT-1	PERFECTLINE #T11 WEATHERPROOF BOX, LEVITON #6599 GFCI RECEPT, WGF100-CV COVER	030157

NOTES: ALL ITEMS TO BE U.L. LABELED

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE: 07/26/1995	APP: CL	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE: 07/06/1995	APP: CL	Shipment Promise Date: / /

JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION

CONTROL PANEL BILL OF MATERIALS

SPEC.NO. 1

S.O.NO. BF -A0012224

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
20	1	SL-1	APPLETON #LPSL-10150-G/MT 100 WATT, WHITE, HIGH PRESSURE SODIUM LIGHT WITH	030162
			INTERMATIC #K4221 PHOTOCELL	
	1	SL-2	APPLETON #LU 100HPS HIGH PRESSURE SODIUM LAMP	401504
21	1	H-1	WATLOW #020150C1-C-040-HOIT SILICONE RUBBER ENCLOSURE HEATER, 150 WATT/120VAC	030158
			(2" X 15"), WITH BUILT-IN THERMOSTAT (40° F SETTING).	
			HEATER BONDED TO ALUMINUM PLATE ON SIDE OPPOSITE FLANGE.	
22	1	W-1 △	NELSON # WD30202-2617-SS304 NEMA 4X WINDOW DOOR	405616
23	1	GFI-1	LEVITON #6599 GFI RECEPTACLE WITH COVER AND RACO #660 OR EQUAL OUTLET BOX	401112
26	4	CR-24,CR-68,CR-73,CR-81	POTTER-BRUMFIELD #KUP14A15, 120V/60HZ RELAY, 3PDT, WITH ALLEN BRADLEY	016478
			#700HN127 BASE	901[illegible]
27	100		JOHN ZINK #JZ16KX THERMOCOUPLE EXTENSION WIRE (100 FEET)	022[illegible]
			(SHIP LOOSE FOR CUSTOMER FIELD INSTALLATION)	
28	25'		DELCO #440 HIGH VOLTAGE IGNITION LEAD (25 FEET)	002167
			(SHIP LOOSE FOR CUSTOMER FIELD INSTALLATION)	
	1	HS-201	ALLEN-BRADLEY # 801H-HR2B SELECTOR SWITCH, 2 POS'N, NEMA 4	001521
			2-N/O & 2-N/C CONTACTS	001708
				001708

NOTES: ALL ITEMS TO HAVE U.L. LABEL

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /	
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:	
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No	
PROJ.APP.:	DATE: / /	REV △ DATE: 10/03/1995	APP: GG	Shipment Promise Date: / /	

JOHN ZINK COMPANY
A DIVISION OF KOCH ENGINEERING

SPECIFICATION
FLAME DETECTION SYSTEM

SPEC.NO. 2
S.O.NO. BF -A0012224
PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK
CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL
INQ.:
JZ.PO.NO:
CUST.PO.NO.:

FLAME SCANNER	Manufacturer	HONEYWELL	
	Model No.	#C7012E1112 SELF CHECKING FLAME SCANNER	JZ P/N
			026441
	Type	■ Ultra-Violet □ Infra-Red □ Flame Rod Other	
	Quantity	1	
	Power Requirement	120 VAC/60 HZ.	
	Lead Length		
	Mounting Connection	NEMA 4	
	Tag Number(s)	BE-103	
FLAME RELAY	Manufacturer	HONEYWELL	
	Model No.	#R4075C1005	
			001615
	Type	FLAME RELAY WITH SUB-BASE AND AMPLIFIER	
	Quantity	1	
	Power Requirement	120 VAC / 60 HZ.	
	Amplifier	R7247C1001	
	Wiring Base	Q295A-1039	001506
	F.F.R.T.	2 TO 4 SEC	001511
	Tag Number(s)	BS-103	

Notes: FLAME SCANNER BE-103 SHIP LOOSE, FLAME RELAY BS-103 MOUNTED IN PNL-101
ALL ITEMS TO BE U.L. LABELED

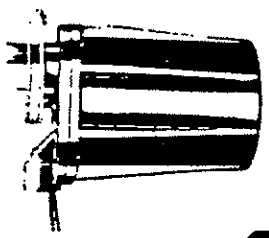
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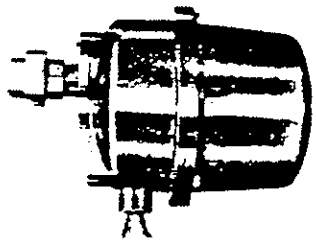
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C7012A,C,E,F,G Solid State Purple Peeper Ultraviolet Flame Detectors

The C7012A,C,E,F,G Flame Detectors are solid-state electronic devices for sensing the ultraviolet radiation emitted by the combustion of most carbon containing fuels such as natural gas, LP gases, and oil.



C7012A,E,G



C7012C,F

All models

- Solid-state electronic circuitry provides low power consumption and high reliability.
- Solid-state models directly replace previous models with vacuum electron tube circuitry.
- Detectors can be mounted horizontally, vertically or at any angle in between. The self-checking C7012E,F models require faceplate alignment and have integral locating reference points to assure proper operation of the shutter mechanism.
- Ultraviolet radiation sensing tube and quartz viewing window are field replaceable.
- Threaded conduit fitting and color-coded leadwires allow rapid electrical installation.
- Two flame detectors can be wired in parallel to reduce nuisance shutdowns in difficult flame sighting applications.
- A swivel mount is available to facilitate flame sighting.
- Models are available with a -40° F [-40° C] rating.

C7012A,C,G

- Designed for use with Honeywell Flame Safeguard Controls using Honeywell Rectification (R7247A, R7289A, R7747A, R7847A1017) and AMPLI-CHECK™ Rectification (R7247B, R7747B, R7847B1015) flame signal amplifiers.
- C7012G models available to meet BGC (British) and DIN (German) requirements.

C7012E,F

- Incorporate UV sensor tube checking feature; used with Honeywell dynamic self-check (R7247C, R7747C, R7847C) flame signal amplifiers.
- Oscillating shutter interrupts ultraviolet radiation reaching UV sensor between 60 and 120 times per minute (10 or 12 times per minute with R7747C and R7847C dynamic self-check amplifiers) to provide the UV sensor tube checking function. Amplifier circuitry components are checked from the microprocessor in the BCS 7700 or 7800 SERIES Control.
- C7012E is available to meet BGC (British) and DIN (Germany) requirements.

C7012A,E,G

- Housing meets NEMA 4 enclosure standards (indoor, outdoor protection: rain-tight, dust-tight, hose-directed water).
- Protective heat block built into the mounting flange.
- High pressure (50 psi [345 kPa]) quartz viewing window, focusing lens, and antivibration mounting accessories available.

C7012C,F

- Housing designed to be explosion-proof and Underwriters Laboratories Inc. listed for use in hazardous locations: Class 1, groups C and D; and Class 2, groups E, F, and G.
- Viewing window rated for 100 psi [690 kPa].

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Specifications

IMPORTANT: *The specifications in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the specifications listed. This product is tested and calibrated under closely controlled conditions, and minor differences in performance can be expected if those conditions are changed.*

MODELS:

C7012A Solid State Purple Peeper Ultraviolet Flame Detector: For use in rectification type flame safeguard systems.

C7012C Solid State Purple Peeper Ultraviolet Flame Detector: Same as C7012A except with explosion-proof housing for use in hazardous locations.

C7012E Self-Checking Solid State Purple Peeper Ultraviolet Flame Detector: For use with R7247C, R7747C, and R7847C Dynamic Self-Check Amplifiers.

C7012F Self-Checking Solid State Purple Peeper Ultraviolet Flame Detector: Same as C7012E except with explosion-proof housing for use in hazardous locations.

C7012G Solid State Purple Peeper Ultraviolet Flame Detector: Same as C7012A except designed to meet BGC (British) and DIN (German) requirements.

ELECTRICAL RATINGS:

Voltage and Frequency:

C7012A: Separate models for 100, 120, 208, or 240 Vac, all 50/60 Hz.

C7012E: Separate models for 100, 120, 208, or 240 Vac, all 50/60 Hz; also models for 110 or 220 volts, 50 Hz only.

C7012C and F: 120 Vac, 50/60 Hz.

C7012G: Models for 110, 220, or 240 volts, 50 Hz only.

Power consumption:

C7012A,C and G: 2.5 watts maximum.

C7012E and F: 7.0 watts maximum.

AMBIENT OPERATING TEMPERATURE RATINGS (outside the case):

C7012A,C and G: 25° F to 175° F [-4° C to 79° C].

C7012E and F: -20° F to 175° F [-29° C to 79° C].

C7012A1160 and C7012E1120: -40° F to 175° F [-40° C to 79° C].

STORAGE TEMPERATURE RATINGS: -60° F to 175° F [-51° C to 79° C].

HOUSING:

C7012A,E and G: Violet, cast-aluminum cover; mounting flange (with heat block) and faceplate are separate to provide heat insulation and sealoff. Meets NEMA 4 enclosure requirements (indoor, outdoor protection; rain-tight, dust-tight, hose-directed water). Optional water jacket available for the C7012A,E,G.

C7012C and F: Explosion-proof, two-piece, violet, cast aluminum.

PRESSURE RATING OF QUARTZ VIEWING WINDOW:

C7012A,E and G: 20 psi [138 kPa]. Focusing lens (20 psi [138 kPa] rating) or high pressure viewing window (50 psi [345 kPa] rating) available; see Accessories.

C7012C and F: 100 psi [690 kPa].

MOUNTING:

C7012A and E: Mounting flange with either 3/4 or 1 inch NPT internal threads (depending on model) for attaching to sight pipe.

C7012G: Mounting flange with 3/4 inch NPT internal threads for attaching to sight pipe.

C7012C and F: Pipe union with 1 inch NPT internal threads for attaching to sight pipe.

WIRING CONNECTIONS:

NEC Class 1 Color-coded Leadwires:

Length: 8 feet [2.4 meters].

Number of Leadwires:

C7012A and C: 4.

C7012E and F: 6.

C7012G: 5.

Ordering Information

When purchasing replacement and modernization products from your authorized flame safeguard distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number, or specify—

1. Model number.
2. Replacement parts, if required.
3. Accessories, if required.

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 Division Sales Office (check white pages of your phone directory).
2. Home and Building Control Division Customer Satisfaction
   Honeywell Inc., 1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386 (612) 951-1000

(In Canada—Honeywell Limited/Honeywell Limitee, 740 Ellesmere Road, Scarborough, Ontario M1P 2V9) International Sales Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

NOTE: Models designed to meet DIN (German) and BGC (British) requirements have an additional yellow/green leadwire that is used as a separate ground wire.

Threaded Leadwire Opening in Faceplate:
C7012A and E: 1/2-14 NPSM or 7/8-20 UNSM internal threads for attaching conduit.
C7012C and F: 1/2-14 NPT internal threads for attaching pipe.

DIMENSIONS: See Figs. 1 or 2.

WEIGHT:
C7012A,E and G: Approximately 4.25 pounds [1.9 kg].
C7012C and F: Approximately 14.5 pounds [6.6 kg].

SERVICEABILITY:
All Models: Field replaceable viewing window and ultraviolet sensing tube.
C7012E and F: Field replaceable self-checking coil and shutter assembly.

NOTE: The new 190971B Coil and Shutter Assembly can be used on existing C7012 Detectors with electron tubes, but the old 120625B Coil and Shutter Assembly *cannot* be used on *solid state* C7012 Flame Detectors.

INTERCHANGEABILITY:
Solid State C7012A,C,E,F and G Purple Peeper Ultraviolet Flame Detectors are interchangeable with similar models of earlier C7012 Flame Detectors.

APPROVALS:
Underwriters Laboratories Inc. Listed (120 volt models only):
C7012A and E (except C7012E1161): File No. MP268.
C7012C and F: For use in hazardous locations; Class 1, Groups C and D; Class 2, Groups E, F and G; File No. E34649.
Canadian Standards Association Certified (120 volt models only): C7012A and E: Master File LR95329-1.
Factory Mutual Approved: A,C,E and F models: 14740.01.
Industrial Risk Insurers Acceptable.
DIN: 220 volt models of European C7012E and G are designed to meet DIN requirements.
British Gas Corporation: 110 and 240 volt models of European C7012E and G are designed to meet British Gas Corporation requirements.

REPLACEMENT PARTS:
All Models:
113228 Ultraviolet Sensing Tube.
191286 Ultraviolet Sensing Tube for -40° F [-40° C] operation.
C7012A,E and G:
114372 Quartz Viewing Window; rated for 20 psi [138 kPa].
114465 Gasket, silicone rubber; for installing viewing window (three required).
120739 Gasket, asbestos-neoprene; heat insulation and seal-off for mounting flange.
C7012C and F: 122037 Quartz Viewing Window; rated for 100 psi [690 kPa].
C7012E and F: 190971B Coil and Shutter Assembly for all models except 220V/50 Hz.

Fig. 1—Dimensions of C7012A,E, and G in in. [mm].

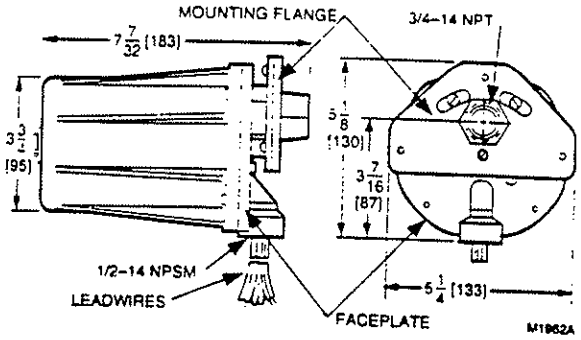
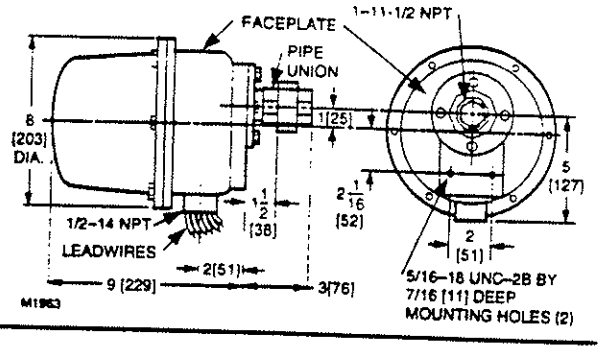


Fig. 2—Dimensions of C7012C and F in in. [mm].



ACCESSORIES:
All Models:
118369 Bushing, galvanized iron, with 3/4 inch NPT internal threads on one end and 1 inch NPT external threads on the other end. For adapting a detector with 1 inch NPT internal threads (for mounting) to a 3/4 inch sight pipe, or to the pipe nipple and tee for connecting an air supply.
W136A Test Meter (includes 196146 Meter Connector Plug).
117053 Meter Connector Plug (for older W136A models).
118367A Swivel Mount.
C7012A,E and G:
122748 Quartz Viewing Window, rated for 50 psi [345 kPa].
124204 Quartz Focusing Lens, rated for 20 psi [138 kPa]; for increasing the ultraviolet radiation sensed by the detector.
120934 Mounting Flange, aluminum, with 3/4 inch NPT internal threads for attaching to sight pipe.
124198 Mounting Flange, aluminum, with 1 inch NPT internal threads for attaching to sight pipe.
123539 Antivibration Mount.
C7012A,E and G: 190105 Water Jacket.

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 flame safeguard service technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ CAUTION

Ultraviolet sensing tubes have a life expectancy of 40,000 hours of continuous use within ambient temperature and voltage ratings. Worn out ultraviolet sensing tubes result in failure of the sensing tube to properly discriminate between flame conditions.

Appliances with burners that remain on continuously for 24 hours or longer should use the C7012E Flame Detector and the R7247C, R7747C, or R7847C Amplifiers with their associated controls.

⚠ CAUTION

1. Do not connect these detectors to non-Honeywell manufactured controls (primaries, programmers, multiburner systems, and burner management systems). Unsafe conditions could result.
2. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage. More than one disconnect may be involved.
3. All wiring must be NEC Class 1 (line voltage).
4. Voltage and frequency of the power supply connected to this detector must agree with the values marked on the detector.
5. The detector must be sighted so it will not respond to ignition spark.
6. On multiburner installations, each detector must respond only to the flame produced by the burner it is supervising.

IMPORTANT: *Do not connect more than two C7012 Flame Detectors in parallel.*

Proper flame detector installation is the basis of a safe and reliable flame safeguard installation. Refer to the burner manufacturer instructions and also to those included here. Carefully follow instructions to make the best possible flame detection application.

BASIC REQUIREMENTS

The combustion flames of most carbon-based fuels emit sufficient ultraviolet radiation to enable the C7012 Solid State Purple Peeper Ultraviolet Flame Detector to prove the presence of a flame in a combustion chamber. The detector is mounted outside the combustion chamber. Its mounting flange or union is threaded to one end of a sight pipe inserted through the wall of the combustion chamber. The ultraviolet sensing tube in the flame detector sights the flame through the pipe.

When a flame is present, the UV tube in the C7012 senses the ultraviolet radiation emitted. The C7012 produces a signal that is sent to the amplifier in the flame safeguard control. The amplified signal pulls in the flame relay in the control to allow proper operation of the system.

Because it is necessary for the UV sensing tube to actually *see* the flame, it is best to locate the detector as close to the flame as physical arrangement, temperature, and other restrictions permit. These restrictions are described in detail in the following paragraphs.

DETERMINE THE LOCATION

Before beginning the actual installation, determine the best location for mounting the detector. Carefully consider the factors discussed in this section before deciding on the location.

TEMPERATURE

Install the C7012 where the ambient temperature (outside the case) will stay within the ambient operating temperature ratings.

To keep the C7012 below its maximum rating, it may be necessary to add additional insulation between the wall of the combustion chamber and the detector. A shield or screen can be added to reflect radiated heat away from the detector. If the detector continues to get too hot, cooling is necessary. Refer to the Sight Pipe Ventilation section. A part no. 190105 Water Jacket is also available for cooling the C7012A,E,G Flame Detectors.

Because of the slower cycle rate of the shutter when using the R7747C or R7847C Amplifiers, additional heat is generated within the detector. Series 7 or later detectors are suggested for those applications.

VIBRATION

If the C7012 is subject to excessive vibration, use a special part no. 123539 Antivibration Mount, for the C7012A,E or G. If you use this mount, install it before you position and sight the detector.

CLEARANCE

Make sure there is enough room to easily mount the sight pipe, detector, and all required fittings, and to remove the detector for troubleshooting and servicing.

RADIATION SOURCES (Other than flame)

Examples of radiation sources (other than flame) that could actuate the detection system:

Ultraviolet sources:

Hot refractory above 2300° F [1260° C].

Spark:

- Ignition transformers.
- Welding arcs.
- Lightning.

Welding flames.

Bright incandescent or fluorescent artificial light.

Solar radiation.

Gas lasers.

Sun lamps.

Germicidal lamps.

Bright flashlight held close to the sensing tube.

Gamma ray and X-ray sources:

Diffraction analyzers.

Electron microscopes.

Radiographic X-ray machines.

High voltage vacuum switches.

High voltage condensers.

High voltage coronas.

Radioisotopes.

Except under unusual circumstances, none of these sources except hot refractory and ignition spark would be present in or near the combustion chamber.

The detector *may* respond to hot refractory above 2300° F [1260° C] if the refractory surface represents a significant percentage of the detector field of view. If the temperature of the hot refractory causes the flame relay (in the flame safeguard control) to pull in, ream the sight pipe so the detector views a cooler area of the refractory.

Ignition spark is an intense source of ultraviolet radiation. *When installing the detector, make sure it does not respond to ignition spark.*

SINGLE BURNER REQUIREMENTS

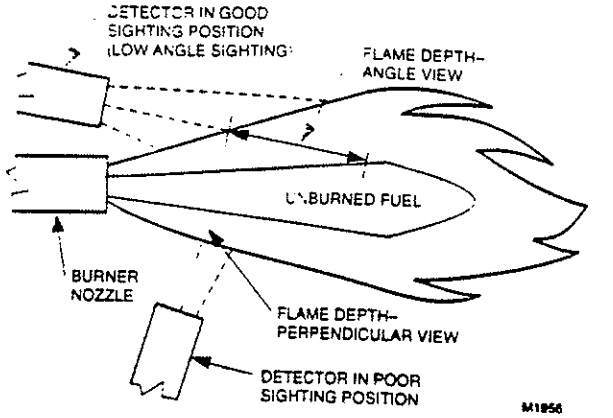
The detector must have an unobstructed view of a *steady* part of the flame it is supervising. This requires a proper sighting angle and minimized ultraviolet radiation attenuation effects. When supervising only one burner, sighting requirements are simplified.

SIGHTING ANGLE (Fig. 3)

The first 30 percent of a flame nearest the burner nozzle (the flame root) emits the most ultraviolet energy. Also, if the detector sights the flame at an angle instead of perpendicularly, it views more flame depth. Therefore, the best sighting angle is nearly parallel to the axis of the flame, permitting the detector to view a large portion of the first 30 percent of the flame nearest to the burner nozzle, as illustrated in Fig. 3.

Low angle sighting permits the detector to view a greater depth of flame, thus reducing the effects of instabilities in the flame pattern. Also, the environment near the burner nozzle is usually cleaner than at any other part of the combustion chamber. This provides a clearer line of sight and may keep the viewing window cleaner, thus reducing the maintenance required.

Fig. 3—Detector sighting angle.



NOTE: When possible, it is desirable to tilt the detector and sighting pipe *downward* to prevent the buildup of soot in the pipe or on the viewing window.

In most installations, the detector will need to respond to the pilot flame alone, then the pilot and main burner flame together, and finally the main burner flame alone. The detector must meet all sighting requirements that apply:

Pilot flame alone—the smallest pilot flame that can be detected must be capable of reliably igniting the main burner.

Pilot and main burner flame together—the detector must sight the junction of both flames.

Main burner flame alone—the detector must sight the most stable part of the flame for all firing rates.

PARALLEL FLAME DETECTORS

Shifting flame patterns, commonly encountered on burners with high turndown ratios, may require two parallel detectors to prove the flame at the highest and lowest firing rates and for modulation in between. In this case, one detector supervises the pilot (interrupted) and both detectors supervise the main burner flame. During the main burner run period, either detector is capable of maintaining system operation. A maximum of two C7012 Detectors can be connected in parallel.

In addition to assuring more reliable flame detection, parallel detectors facilitate maintenance during burner operation. Each detector can be removed, in turn, without shutting down the supervised burner. However, a flame simulating failure occurring in the flame signal amplifier or in either detector will cause a shutdown.

SCREENING EFFECTS

Smoke, oil mist, dirt and dust are masking agents that attenuate the ultraviolet radiation emitted by the flame. If they absorb too much radiation, the amount of ultraviolet radiation reaching the detector is reduced. The flame signal then can become too low to hold in the flame relay, resulting in burner shutdown.

The problem can be eliminated by diluting the contaminants. A strong flow of air through the sight pipe will clear a viewing path through the attenuating material. Refer to the Sight Pipe Ventilation section.

It is also desirable to sight the detector at an area containing fewer masking agents such as near the burner nozzle or near the entrance of the combustion air. Increasing the viewing area of the detector by shortening the sight pipe or by increasing the diameter of the sight pipe also reduces the attenuating effects of masking agents.

MULTIBURNER REQUIREMENTS (Flame discrimination)

In addition to meeting the requirements for a single burner, a multiburner installation requires discrimination between flames. *Flame discrimination* can be defined as locating all flame detectors so that each detector responds only to the flame produced by the burner it is supervising.

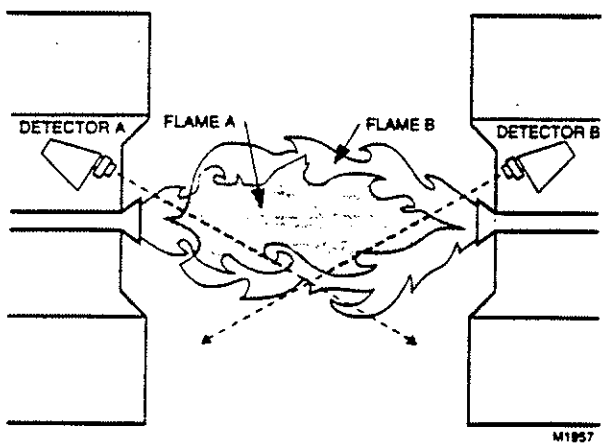
In multiple burner systems, not every detector can be positioned so its line-of-sight does not intercept flames from other burners. For example, this situation occurs in front-fired boiler-furnaces having more than one row of burners, or in multilevel opposed-fired furnaces where the burners face each other.

When planning such an installation, locate each flame detector so that it has the best possible view of the first 30 percent nearest the burner nozzle (the flame root) it is supervising, and the worst possible view of all other flames.

Fig. 4 illustrates a critical detector application problem that requires flame discrimination. Flame discrimination is accomplished for Detector A by repositioning it until the flame relay (in the flame safeguard control) does not respond to Flame B. Note that Detector A is aimed at the first 30 percent of Flame A where the ultraviolet radiation is most intense. It sights the *tip* of Flame B, but it is not aimed at the first 30 percent of Flame B where UV is intense. Detector A is repositioned to assure maximum response to Flame A while rejecting Flame B. Similarly, Detector B is positioned to assure maximum response to Flame B while rejecting Flame A.

If you reposition a detector and still cannot achieve flame discrimination, try reducing the viewing area by increasing the length or decreasing the diameter of the sight pipe, or adding an orifice plate.

Fig. 4—Example of flame discrimination problem (opposed burners).

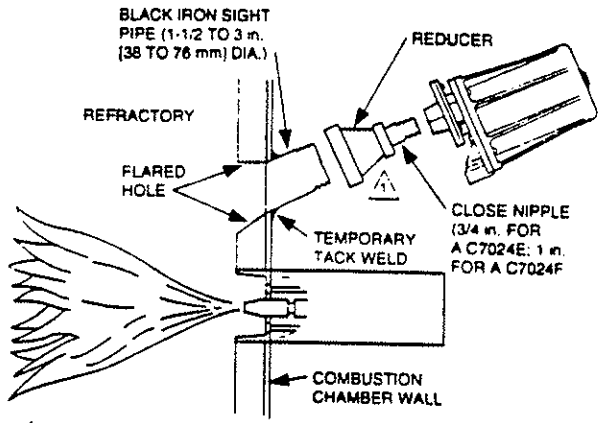


INSTALL THE SIGHT PIPE (Fig. 5)

After you have determined the location and sighting angle, select the sight pipe. A black iron pipe with a diameter of at least 1-1/2 in. [38.1 mm] is recommended. Do *not* use stainless steel or galvanized pipe because they reflect ultraviolet radiation internally and complicate aiming the pipe.

Sight pipes with diameters 2 to 3 in. [51 to 76 mm] produce better results for horizontal rotary burners, which require wide viewing angles. A wide viewing angle can also be obtained by using a short sight pipe.

Fig. 5—Typical mounting of C7012.



PREPARE HOLE IN WALL OF COMBUSTION CHAMBER

Cut or drill a hole of the proper diameter for the sight pipe in the wall of the combustion chamber at the selected location. Flare the hole to leave room for small adjustments of the sighting angle. The taper of the hole should be about 1 in. for every 3 in. [25 mm for every 76 mm] of wall thickness.

MOUNT SIGHTING PIPE

Thread one end of the pipe to fit the mounting flange, union, or required coupling. Cut the pipe to the desired length (as short as practicable) and at an angle so it fits flush with the wall of the combustion chamber. Tack weld the pipe to the wall in a trial position. ***Do not weld the sight pipe permanently in place until after completing the Adjustments and Checkout.***

NOTE: If you use part no. 118367A Swivel Mount and you are *positive* about the location and sighting angle, you can permanently weld the pipe.

INSTALL FITTINGS

In some cases, the sight pipe will not directly fit the C7012 mounting flange or union. Also, it may be desirable or necessary to ventilate the sight pipe. You may also want to use a swivel mount or an antivibration mount. Each of these cases may require additional fittings.

REDUCER

For sight pipes of larger diameter than the mounting flange connector or union, install a reducer as illustrated in Fig. 5. The reducer will require a close nipple with these external threads:

C7012A or E: 3/4 or 1 in. NPT (depending on model).
C7012C or F: 1 in. NPT.
C7012G: 3/4 in. NPT.

SIGHT PIPE VENTILATION

It may be necessary to ventilate the sight pipe to cool the detector or to clear a viewing path through UV radiation attenuating material.

For a negative pressure combustion chamber, drilling a few holes in the section of the sight pipe outside of the combustion chamber will allow air at atmospheric pressure to flow through the sight pipe and into the chamber. A perforated pipe nipple between the sight pipe and the detector can also be used.

For a positive pressure combustion chamber, connect a supply of pressurized air from the burner blower to flow through the sight pipe and into the chamber. The air pressure must be greater than the chamber pressure.

SWIVEL MOUNT

To facilitate proper flame sighting, a part no. 118367A Swivel Mount is available. The swivel mount will require a reducer of the proper size to mount it onto the sight pipe. It will also require a one-inch close nipple for mounting to a C7012 with a one inch connector. (For 118367A Swivel Mount mounting details, refer to form 60-0361.

ANTIVIBRATION MOUNT (C7012A,E, or G)

The detector will withstand normal burner vibration. If the vibration is excessive, part no. 123539 Antivibration Mount is available for a C7012A,E or G. (For mounting details, see form 60-0361.) If you use this mount, install it before positioning and sighting the detector.

MOUNT THE DETECTOR (Figs. 5-9)

Mount the detector onto the sight pipe, reducer, or other fitting (see Figs. 5, 6, 7, 8, 9).

The C7012A,C,G Flame Detectors do not have the oscillating shutter mechanism for checking the UV sensor so they can be mounted in any position if consideration is given to the temperature environment.

The C7012E,F Self-Checking Flame Detectors incorporate an oscillating shutter mechanism and, therefore, require special consideration for mounting positions other than vertically sighting downward or upward, as illustrated in Fig. 6. The C7012E has notch and arrow indicators (see Fig. 7) on the faceplate to facilitate mounting in positions other than those shown in Fig. 6. The notch and arrow must be vertically aligned with the notch in the up position and the arrow pointing downward (see Fig. 7). The C7012F must be mounted with the conduit opening located approximately 45 degrees below the horizontal (see Fig. 7).

Fig. 6—Vertical mounting of C7012E,F.

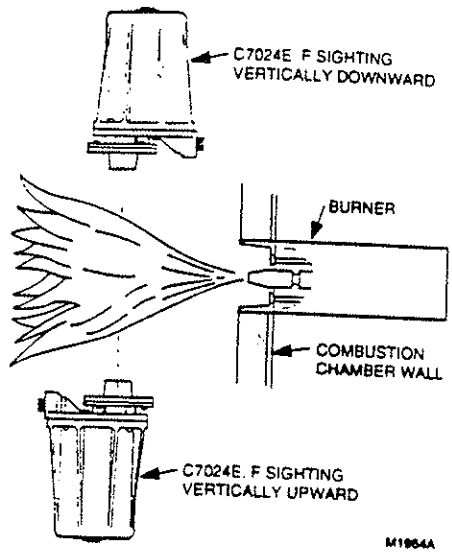
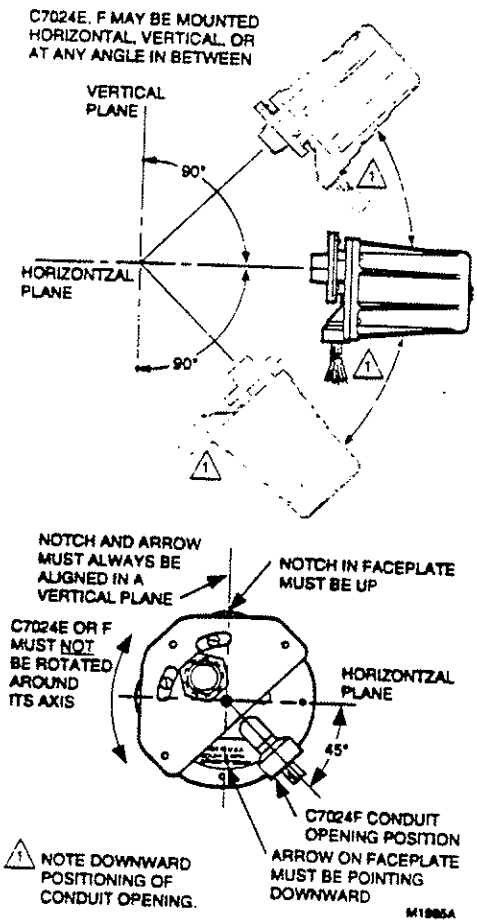


Fig. 7—C7012E,F mounting positions.



IMPORTANT: *The notch and arrow on the faceplate of the C7012E must be aligned in a vertical plane with the notch up and the arrow pointing downward.*

The C7012F housing must be mounted with the conduit opening approximately 45° below horizontal (see Fig. 7).

To mount a C7012A, E or G (Fig. 8):

1. The mounting flange is in two pieces. Loosen (but *do not* remove) the three screws holding the flange together.
2. Slightly rotate the detector so the slots in the back section of the mounting flange clear the screws in the front section; then separate the two sections.
3. Screw the front section of the mounting flange onto the sight pipe, reducer, or other fitting.

Fig. 8—Mounting C7012A, E, or G Detector.

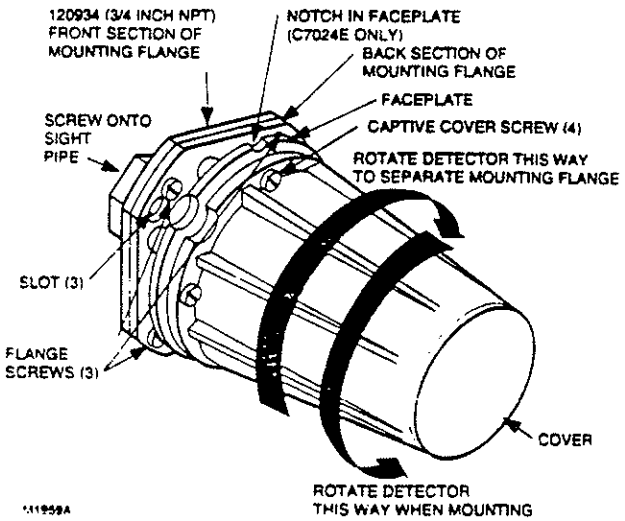
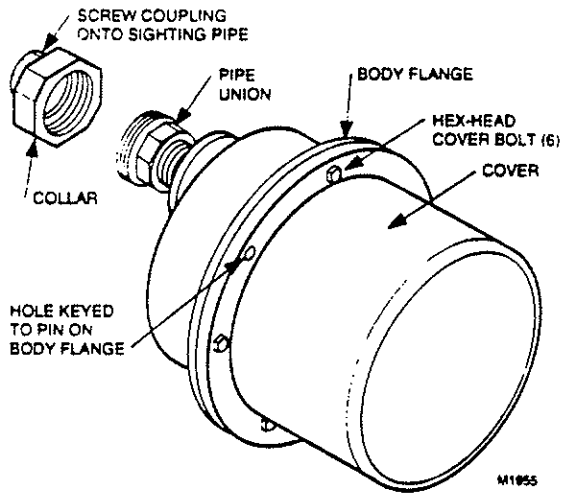


Fig. 9—Mounting C7012C or F Detector.



4. Fit the slots in the back section of the mounting flange (with the detector) over the three screws in the front section, and rotate the detector so the screws hold the flange together.
5. Tighten the screws securely.

To mount a C7012C or F with explosion-proof housing (Fig. 9):

1. Unscrew the collar on the pipe union and remove the coupling section. The collar and coupling are in two pieces: *do not separate them.*
2. Screw the coupling onto the sight pipe, reducer, or other fitting.
3. Mount the rest of the pipe union (with the detector) on the coupling and securely tighten the collar.

WIRING (Figs. 10-16)

⚠ *CAUTION*

When using a C7012E or F with a R7247C, R7747C, R7847C Dynamic Self-Check Amplifier, be careful not to short the *white* shutter leadwires together (by wiring incorrectly, leaving an incorrect jumper wire, or stripping the insulation too much so the bare leadwires can touch). If the shutter leadwires are shorted during the operation, the amplifier will be permanently damaged and be nonoperative.

IMPORTANT: *Certain C7012E and all G models are designed to meet DIN and BGC requirements. They have an additional yellow/green grounding leadwire; connect this wire to a separate ground terminal on the wiring subbase.*

1. All wiring must comply with applicable local electrical codes, ordinances, and regulations. Use NEC Class 1 wiring.
2. *Keep the flame signal leadwires as short as possible from the flame detector to the terminal strip or wiring subbase.* Capacitance increases with leadwire length, reducing the signal strength. The maximum permissible leadwire length depends on the type of leadwire and conduit type and diameter. *The ultimate limiting factor in flame signal leadwire length is the signal current.* Refer to Table 1.
3. The detector has color-coded plastic-insulated, no. 18 leadwires, 8 ft [2.4m] long, rated for 221° F [105° C]. These wires *must be run in a conduit.*
4. If the leadwires are not long enough to reach the terminal strip or wiring subbase, make the required splices in a junction box.
5. If splicing is necessary, use moisture-resistant no. 14 wire suitable for at least 167° F [75° C] if the detector is used with a flame safeguard *primary* control, or at least 194° F [90° C] if used with a flame safeguard *programming* control.
6. *For high temperature installations,* use Honeywell specification no. R1298020 wire or equivalent for the "F" leadwire. (This wire is rated up to 400° F [204° C] for

continuous duty. It is tested for operation up to 600 volts and for breakdown up to 7500 volts.) For the other leadwires, use moisture-resistant no. 14 wire selected for a temperature rating above the maximum operating temperature.

7. Refer to Figs. 10 through 16 for wiring connections.

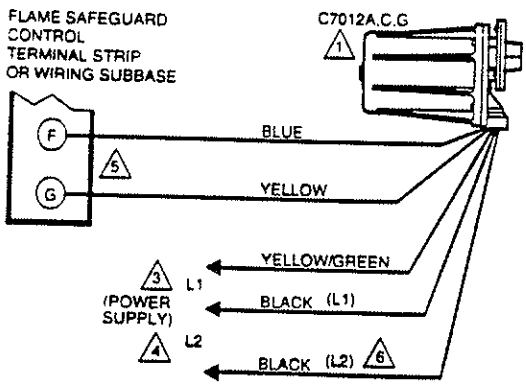
IMPORTANT: *Do not run the flame detector wiring in the same conduit with high voltage ignition transformer wires.*

CONNECTING DETECTORS IN PARALLEL

For a flame that is difficult to sight, using two parallel C7012 Flame Detectors reduces nuisance shutdowns. If only one of the parallel detectors loses the flame signal, the other will indicate the presence of the flame and will keep the burner running. *If two parallel C7012E or F Detectors (with self-checking shutters) are used, a flame-simulating failure in either detector will cause the burner to shut down.* Two C7012E or F Detectors may be connected in parallel to the same terminals on 120 volt flame safeguard controls. To avoid exceeding the rating of the solid-state shutter switch in the R7247C, R7747C, R7847C Flame Signal Amplifier, *do not connect more than two C7012E or F Detectors in parallel.*

IMPORTANT: *Voltage and frequency rating of the C7012 must match the power supply of the flame safeguard control.*

Fig. 10—Wiring diagram for C7012A,C, or G Detectors with rectification type, flame safeguard primary and programming controls.



1 TWO C7012A,C, OR G DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS.

2 THE ADDITIONAL YELLOW/GREEN LEADWIRE IS ONLY ON C7012G MODELS DESIGNED TO MEET DIN OR BGC REQUIREMENTS. CONNECT THIS WIRE TO A SEPARATE GROUND TERMINAL ON THE WIRING SUBBASE.

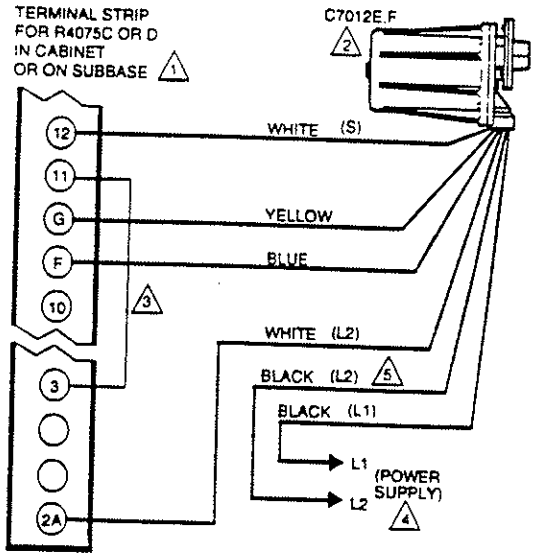
3 VOLTAGE AND FREQUENCY RATING OF THE C7012A,C, OR G MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.

4 ON THE BCS7700 CONTROL, THE BLUE WIRE CONNECTS TO TERMINAL 31, THE YELLOW LEADWIRE TO TERMINAL 29.

5 ( ) IDENTIFICATION LABEL ON LEADWIRES.

M8371

Fig. 11—Wiring diagram for C7012E or F Detectors with R4075C or D Flame Safeguard controls.



1 AN R7247C DYNAMIC SELF CHECK AMPLIFIER MUST BE USED WITH AN R4075C OR D.

2 TWO C7012E OR F DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS ON 120 VOLT CONTROLS ONLY.

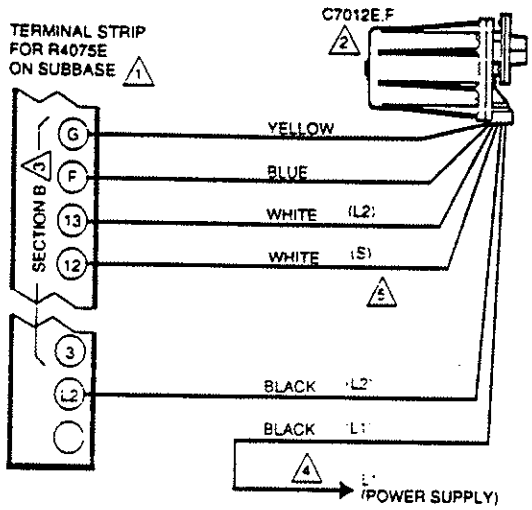
3 REMOVE THE JUMPERS BETWEEN TERMINALS 12 AND F AND BETWEEN TERMINALS 11 AND 10 (IF THERE ARE JUMPERS), AND INSTALL A JUMPER BETWEEN TERMINALS 11 AND 3.

4 VOLTAGE AND FREQUENCY RATING OF THE C7012E OR F MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.

5 ( ) IDENTIFICATION LABEL ON LEADWIRES.

M8372

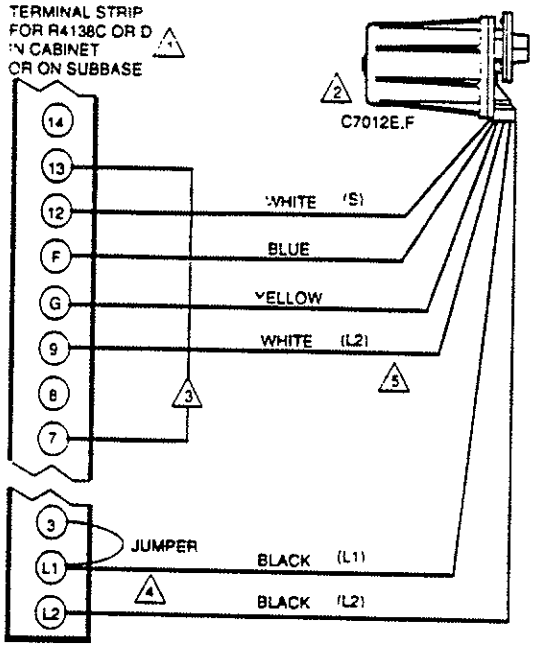
Fig. 12—Wiring diagram for C7012E or F Detectors with R4075E Flame Safeguard control.



1. AN R7247C DYNAMIC SELF CHECK AMPLIFIER MUST BE USED WITH AN R4075E.
2. TWO C7012E OR F DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS ON 120 VOLT CONTROLS ONLY.
3. WIRING IS SHOWN FOR SECTION B. CONNECT ANOTHER DETECTOR TO THE IDENTICAL TERMINALS IN SECTION A. TERMINAL L2 IS USED FOR BOTH SECTIONS.
4. VOLTAGE AND FREQUENCY RATING OF THE C7012E OR F MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.
5. ( ) IDENTIFICATION LABEL ON LEADWIRES

M9373

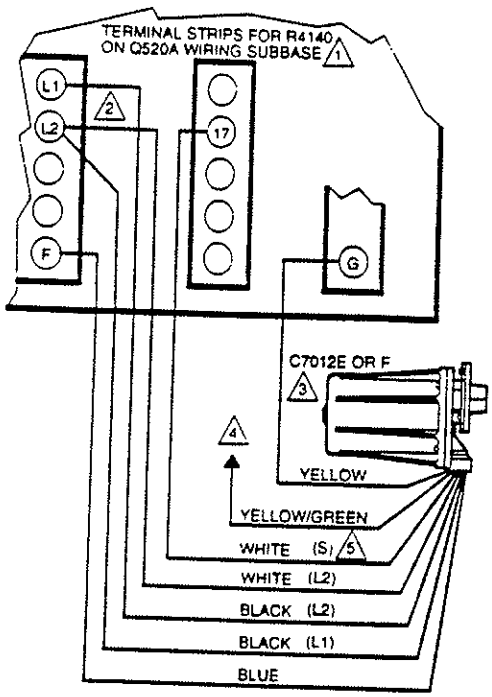
Fig. 13—Wiring diagram for C7012E or F Detectors with R4138C,D Flame Safeguard controls.



1. AN R7247C DYNAMIC SELF CHECK AMPLIFIER MUST BE USED WITH AN R4138C OR D.
2. TWO C7012E OR F DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS ON 120 VOLT CONTROLS ONLY.
3. REMOVE THE JUMPERS BETWEEN TERMINALS 14 AND 13 AND BETWEEN TERMINALS 12 AND F (IF THERE ARE JUMPERS). AND INSTALL A JUMPER BETWEEN TERMINALS 13 AND 7
4. VOLTAGE AND FREQUENCY RATING OF THE C7012E OR F MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.
5. ( ) IDENTIFICATION LABEL ON LEADWIRES.

M9374

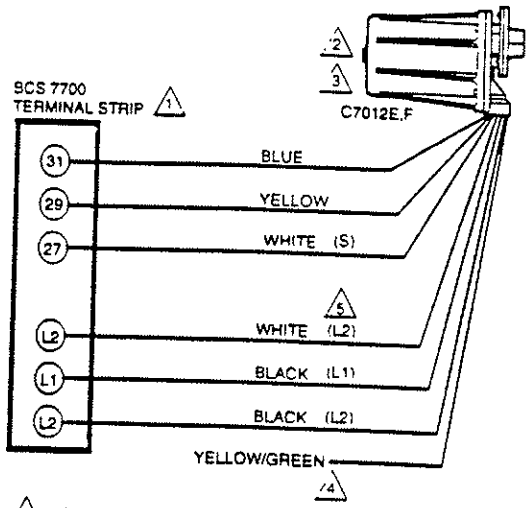
Fig. 14—Wiring diagram for C7012E or F Detectors with R4140 and BC7000 Flame Safeguard controls.



1. AN R7247C DYNAMIC SELF CHECK AMPLIFIER MUST BE USED WITH AN R4140, BC7000.
2. VOLTAGE AND FREQUENCY RATING OF THE C7012E OR F MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.
3. TWO C7012E OR F DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS ON 120 VOLT CONTROLS ONLY.
4. THE ADDITIONAL YELLOW/GREEN LEADWIRE IS ONLY ON C7012E MODELS DESIGNED TO MEET DIN OR BGC REQUIREMENTS. CONNECT THIS WIRE TO A SEPARATE GROUND TERMINAL ON THE WIRING SUBBASE.
5. ( ) IDENTIFICATION LABEL ON LEADWIRES.

M9375

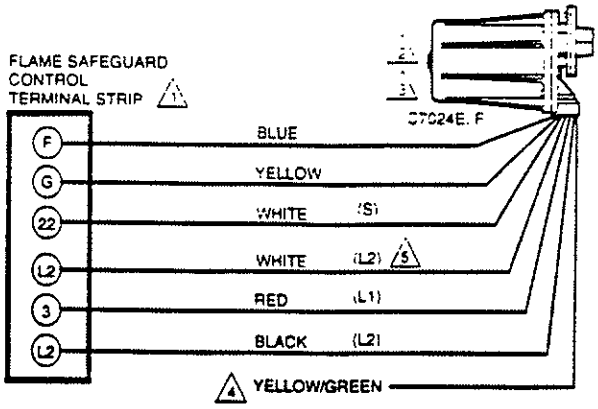
Fig. 15—Wiring diagram for C7012E.F Detectors with BCS 7700 Flame Safeguard controls.



1. A R7747C DYNAMIC SELF-CHECK AMPLIFIER MUST BE USED WITH THE C7012E.F/BCS 7700 COMBINATION. SHUTTER CYCLE RATE IS 12 TIMES PER MINUTE. SUGGEST USING SERIES 7 OR GREATER FOR THESE APPLICATIONS
2. VOLTAGE AND FREQUENCY RATING OF THE C7012E.F MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.
3. TWO C7012E.F DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS ON 120 VOLT CONTROLS ONLY.
4. THE ADDITIONAL YELLOW/GREEN LEADWIRE IS ONLY ON C7012E MODELS WHICH MEET BGC OR DIN REQUIREMENTS. CONNECT YELLOW/GREEN WIRE TO A SEPARATE GROUND TERMINAL ON THE WIRING SUBBASE.
5. ( ) IDENTIFICATION LABEL ON LEADWIRES.

M9376

Fig. 16—Wiring diagram for C7012E.F Detectors with 7800 SERIES Flame Safeguard controls with shutter drive circuitry.



1 A R7824C DYNAMIC SELF-CHECK AMPLIFIER MUST BE USED WITH A RM7824 FLAME SAFEGUARD CONTROL INCORPORATING THE SHUTTER DRIVE CIRCUIT. SHUTTER CYCLE RATE IS 10 TO 12 PER MINUTE. SUGGEST USING SERIES 7 OR GREATER FOR THESE APPLICATIONS.

2 VOLTAGE AND FREQUENCY RATING OF THE C7024E, F MUST MATCH THE POWER SUPPLY OF THE FLAME SAFEGUARD CONTROL.

3 TWO C7024E, F DETECTORS MAY BE CONNECTED IN PARALLEL TO THE SAME TERMINALS ON 24 Vdc CONTROLS ONLY.

4 THE ADDITIONAL YELLOW/GREEN LEADWIRE IS ONLY ON C7024E MODELS WHICH MEET BGC OR DIN REQUIREMENTS: CONNECT YELLOW/GREEN WIRE TO SEPARATE GROUND TERMINAL ON THE WIRING SUBBASE.

5 ( ) IDENTIFICATION LABEL ON LEADWIRES

M9377

Adjustments and Checkout

UV SENSOR TUBE TEST

For initial burner lightoff, consult the burner manufacturer instructions or the instructions for the flame safeguard control.

If the system does not start during the initial burner lightoff, check the UV sensor tube in the flame detector. If a reddish glow appears when there is no flame present, replace the UV sensing tube. When performing this test, make sure there are no extraneous sources of ultraviolet radiation in the test area (see Radiation Sources section).

ADJUST DETECTOR SIGHTING

With the flame detector installed and the burner running, adjust the sighting position of the detector for optimum flame signal.

Most existing Honeywell flame safeguard controls incorporate a flame current jack on the control flame amplifier or on the control itself. Measure the flame signal with a volt-ohmmeter such as the Honeywell W136A Volt-ohmmeter. (see Fig. 17). To measure the flame current (signal), part number 196146 Cable Connector, included with W136A, must be used in conjunction with the meter. With the W136A (or equivalent) positioned to the zero to 25 microampere scale, connect the meter probes to the two ends of the cable connector plug (red to red, black to black). Insert the plug end of the connector plug directly into the flame jack of the control or control amplifier (see Fig. 17). The flame signal in microamperes is then read directly by the W136A Meter. Refer to Table 1 for minimum acceptable flame currents.

The R7747C and R7847C Amplifiers used with the BCS 7700 and 7800 SERIES Flame Safeguard controls, respectively, have a dc voltage flame signal output. For the R7747C Amplifiers, a volt-ohm meter with a minimum sensitivity of 20,000 ohm/volt with a zero to five or ten Vdc scale is recommended. It is suggested that a volt-ohm meter with a minimum sensitivity of one megohm/volt and a zero to five or ten Vdc scale be used for R7847C amplifier flame signal measurements. Measure the flame signal as illustrated in Figs. 18 and 19. Be careful to make the proper connections of positive (red) meter lead to positive (+) control jack and negative (black) meter lead to negative (-) or (-Com) jack with 7800 SERIES controls. If the BCS 7700 and 7800 SERIES controls have the Keyboard Display Module, a zero to five Vdc voltage will be displayed on the module.

NOTES:

1. If using an R7247B AMPLI-CHECK™ or C Dynamic Self-Check Amplifier, set the selector switch on the W136A Meter to the SPL (damped) position. Allow a few seconds for the current to stabilize. The red flame indicating lamp on the amplifier should blink about one to four times a second (from bright to dim). If the lamp is ON or OFF continuously while reading the flame signal, replace the amplifier.
2. If using an RA890H or J Self-Checking Flame Safeguard control, press the TEST button (on the control) to stabilize the current reading while taking a measurement. (The green flame indicating-lamp on the RA890H or J should be ON continuously while reading the flame signal.)
3. For a C7012E or F, the shutter operation causes fluctuations in the current reading. Read the average stable current, disregarding the peaks.
4. The flame signal must be steady (or stable as described in note 3).

Move the detector and sight pipe around to sight the flame from various positions and angles. Try to get a maximum steady (or stable) reading on the meter. The signal must be above the minimum acceptable current listed in Table 1.

Measure the flame signal for the pilot alone, the main burner flame alone, and both together (unless monitoring only the pilot flame when using an intermittent pilot, or only the main burner flame when using direct spark ignition). With the detector in its final position, all required flame signals must be steady (or stable) and as specified in Table 1. If you cannot obtain the proper signal, refer to the Troubleshooting section.

Fig. 17—Measuring microamp flame signal.

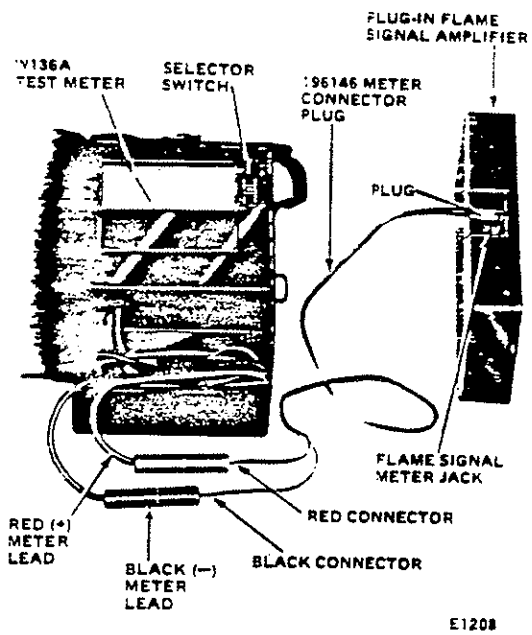


Fig. 18—Measuring voltage flame signal with BCS 7700 controls.

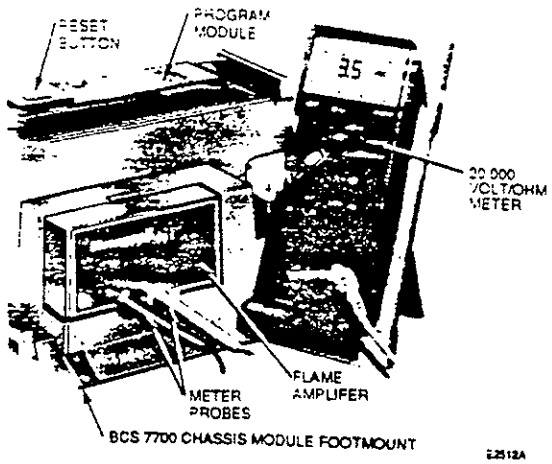
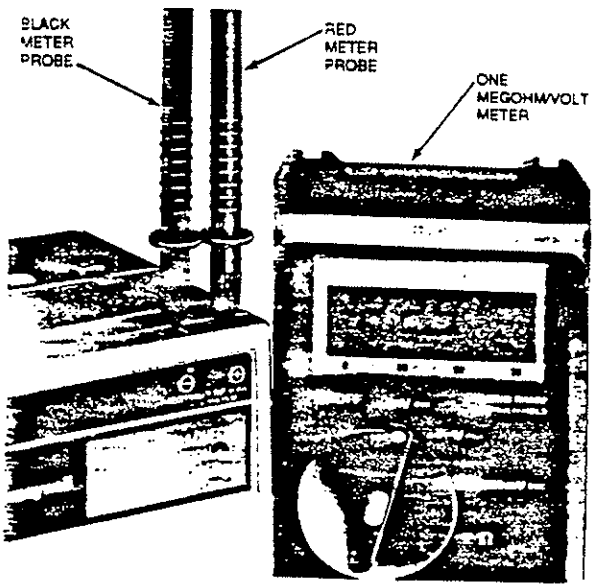


Fig. 19—Measuring voltage flame signal with 7800 SERIES controls.



PILOT TURNDOWN TEST

If the detector is used to prove a pilot flame before the main fuel valve(s) can be opened, perform a Pilot Turndown Test before welding the sight pipe into position. Follow the procedures in the flame safeguard control instructions and in the burner manufacturer instructions.

ULTRAVIOLET RESPONSE TESTS

IGNITION SPARK RESPONSE TEST

Test to make certain that ignition spark is not actuating the flame relay (usually 2K) in the flame safeguard control.

1. Close the pilot and main burner manual shutoff valves.
2. Start the burner and run through the Ignition period. Ignition spark should occur, but the flame relay must not pull in. The flame signal should not be greater than

0.25 microamp for most Honeywell controls and not greater than 1.0 Vdc for BCS 7700 controls nor larger than 0.25 Vdc for 7800 SERIES controls.

3. If the flame relay does pull in, reposition the detector farther from the spark, or relocate/resight the detector to eliminate/reduce the detector response to reflected UV radiation. It may be necessary to construct a barrier to block the ignition spark from the detector view. Continue adjustments until the flame signal due to ignition spark is less than the flame signal values indicated in step 2.

TABLE 1—FLAME SIGNAL.

Flame Detector	Plug-in Flame Signal Amplifier	Flame Safeguard Control(s)	Minimum[a] Acceptable Steady Current (microamps)	Maximum Expected Current (microamps)	Minimum[a] Acceptable Steady Voltage (Vdc)	Maximum Expected Voltage (Vdc)
C7012A,C	R7247A	R4075C,D,E; R4138C,D; R4140G,L,M; BC7000L	2.0	6.0		
	R7247B[b] Ampli-Check™	R4075C,D,E; R4138C,D; R4140G,L,M; BC7000L	2.0	4.0		
	R7289A	R4795A,D	2.0	6.0		
	None	R485B; R7023B; R7795B,D,F,H; RA890E,F; RA890H,J[c,b]	2.0	5.0		
	R7847A	RM7800E,G,L,M; RM7823A; RM7838A,B; RM7840E,G,L,M; RM7890A,B; RM7895A,B,C,D			1.25	5.0
	R7847B[b] Ampli-Check™	RM7800E,G,L,M; RM7823A; RM7838A,B; RM7840E,G,L,M; RM7890A,B; RM7895A,B,C,D			1.25	5.0
C7012E,F[f]	R7247C[d] Dynamic Self-Check	R4075C,D,E; R4138C,D; R4140G,L,M	2.0	7.0		
	R7747C[e] Dynamic Self-Check	BCS 7700			2.2	4.98
	R7847C[g] Dynamic Self-Check	RM7800E,G,L,M; RM7823A; RM7838A,B; RM7840E,G,L,M; RM7890B; RM7895A,B,C,D			1.25	5.0
C7012G	R7321A,B	R4140J,K	2.0	6.0		

[a] This minimum or greater signal should be obtained if the detector is correctly installed and positioned to properly sense flame. This current or voltage must be obtained before completing the Checkout.
[b] The circuitry tests *ONLY the flame signal amplifier* during burner operation and shuts down the burner *if the amplifier fails*.
[c] Depress TEST button while reading current.
[d] Set selector switch on W136A Volt-ohm meter to SPL (damped) position to read current.
[e] Shutter operates ten cycles per minute.
[f] Shutter operation of the C7012E,F causes fluctuations in the current reading. Read the average stable current or voltage, disregarding the peaks.
[g] Shutter operates 12 cycles per minute.

RESPONSE TO OTHER ULTRAVIOLET RADIATION SOURCES

Some sources of artificial light produce small amounts of ultraviolet radiation. Under certain conditions, an ultraviolet detector will respond to them as if it is sensing a flame. DO NOT USE AN ARTIFICIAL LIGHT SOURCE TO CHECK THE RESPONSE OF AN ULTRAVIOLET FLAME DETECTOR. To check for proper detector operation, conduct flame failure response tests under all operating conditions.

WELD THE SIGHT PIPE

When the flame signal is acceptable after all adjustments are made, remove the detector and weld the sight pipe in its final position. (If you are using a swivel mount, the pipe may already be welded.) Then reinstall the detector.

FINAL CHECKOUT

Before putting the burner into service, check out the installation using the Checkout procedures in the Instructions for the appropriate flame safeguard control. After completing the Checkout, run the burner through at least one complete cycle to verify correct operation.

⚠ CAUTION

Do not put the system into operation until all Checkout tests in the Instructions for the appropriate flame safeguard control and any others specified in the burner installation instructions have been completed satisfactorily.

Troubleshooting

⚠ CAUTION

1. Be extremely careful while troubleshooting the detector; line voltage is present on some of the terminals when power is on.
2. Open the master switch to disconnect power before removing or installing the detector or its cover. More than one disconnect may be involved.

EQUIPMENT REQUIRED

1. Use Honeywell W136A Volt-ohm meter with a zero to 25 microamp scale to check out most Honeywell flame safeguard controls.
2. Use part no. 196146 Meter Connector Plug provided with the W136A.
3. To measure the flame signal of the BCS 7700 control, a volt-ohm meter with a minimum sensitivity of 20,000 ohms/volts and a zero to five Vdc or zero to ten Vdc scale is recommended. When the Keyboard Display Module is included with the control, flame signal will be displayed on the module.
4. For 7800 SERIES controls, a volt-ohm meter with a minimum sensitivity of one megohm/volt and a zero to five or ten Vdc scale is suggested. When the Keyboard Display Module is included with the control, a flame signal will be displayed on the module.
5. For replacement parts, see Specifications section.

UV SENSOR TUBE TEST

See UV Sensor Tube Test section.

UNSATISFACTORY FLAME SIGNAL

If a satisfactory flame signal (see Table 1) cannot be obtained while adjusting the sighting position of the detector, follow these procedures. If you encounter other problems in the system, refer to the Troubleshooting section in the instructions for the appropriate flame safeguard control.

NOTE: For instructions for replacing the viewing window, sensing tube, and coil and shutter assembly, see the Service section.

TROUBLESHOOTING PROCEDURES

First perform the Preliminary Inspection. Then follow the applicable procedures for either a low reading or a zero reading on the meter. After reinstalling the detector or replacing its cover, recheck the meter reading. To try to obtain the proper flame signal, adjust the position of the detector. If you complete all of the procedures and still cannot obtain a proper flame signal, replace the detector.

PRELIMINARY INSPECTION

1. Check for the proper line voltage. Make sure the master switch is closed, connections are correct, and power supply is of the correct voltage and frequency.
2. Check the detector wiring for defects:
   - Incorrect connections.
   - Wrong type or size of wire.
   - Deteriorated wire.
   - Open circuits.
   - Short circuits.
   - Leakage paths caused by moisture, soot, or dirt.
3. With the burner running, check the temperature at the detector. If it exceeds 175° F [79° C]:
   - Add additional insulation between the wall of the combustion chamber and the detector.
   - Add a shield or screen to reflect radiated heat away from the detector, or
   - Add cooling (refer to Sight Pipe Ventilation and Accessories sections).

REMOVING THE DETECTOR FROM THE SIGHT PIPE

C7012A,E or G (refer to Fig. 8): Loosen the three screws holding the mounting flange together; rotate the detector slightly so the screws clear the slots in the back section of the flange; separate the flange; and pull off the back section (with the UV sensor).

C7012C or F (refer to Fig. 9): Unscrew the collar from the pipe union and remove the detector.

NOTE: The detector will be free as soon as the collar is unscrewed; *don't drop it.*

PROCEDURES FOR A ZERO METER READING

1. Replace the plug-in amplifier (if there is one). Then recheck the flame signal.
2. Replace the ultraviolet sensing tube (see Service section). Then recheck the flame signal.
3. For a C7012E or F, replace the coil and shutter assembly (see Service below). Then recheck the flame signal.
4. If you still cannot obtain a meter reading, replace the detector.

IMPORTANT: *At the completion of Troubleshooting, be sure to perform the Adjustments and Checkout procedures.*

Service

⚠ CAUTION

Open the master switch to disconnect power before removing or installing the detector or its cover. More than one disconnect may be involved.

PERIODIC MAINTENANCE

1. Clean the viewing window (or focusing lens) when necessary. Remove the detector (see Troubleshooting section) and use a clean cloth over the eraser end of a pencil. Do not remove the window (or lens) to clean it. If it is broken or damaged or it is coated with a substance that cannot be cleaned off, replace it (see Fig. 24).
2. Keep the flame detection system adjusted for the smoothest, most reliable operation as recommended by the burner manufacturer.
3. Replace the sensing tube, coil and shutter assembly, or viewing window only when necessary to obtain proper operation.

REMOVING THE DETECTOR COVER

ALL MODELS: *Open the master switch.*

C7012A,E OR G: Unscrew the four captive cover screws (Fig. 8) and carefully slide off the cover.

C7012C OR F: Unscrew the six hex-head cover bolts (Fig. 9) and carefully pull off the cover.

NOTE: These bolts are removable. Put them in a safe place so you do not lose them.

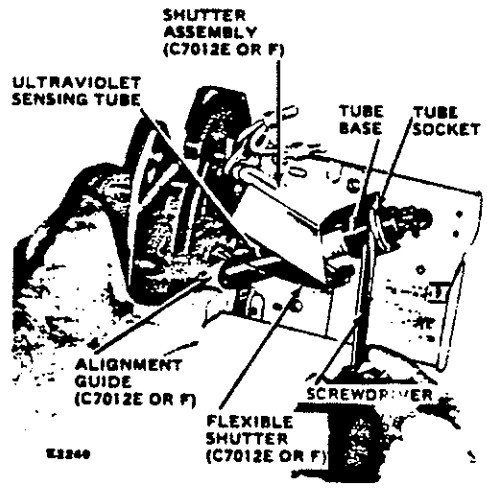
REPLACING THE ULTRAVIOLET SENSING TUBE, ALL MODELS (Fig. 20)

1. *Open the master switch* and remove the cover from the detector (see instructions above).
2. Locate the UV sensing tube.

IMPORTANT: *On a C7012E or F, be very careful not to kink or otherwise damage the flexible shutter.*

3. On a C7012E or F, gently bend the alignment guide just enough to free the tip of the tube.
4. Insert a screwdriver between the tube base and socket, and gently pry the tube out of its socket.
5. Pull the tube out of its socket (and out of the shutter assembly on a C7012E or F).
6. On a C7012E or F, insert the new tube through the openings in the shutter assembly.
7. Align the three pins on the new tube with the holes in the socket.
8. Carefully push the new tube firmly into the socket. (On a C7012E or F, the alignment guide will snap into place around the tip of the tube.)
9. Make sure the new UV sensor tube is seated securely.
10. Replace the detector cover.

Fig. 20—Replacing ultraviolet radiation sensing tube.



NOTE: The cover for a C7012C or F has a small hole that is keyed to a pin on the body flange (Fig. 9).

REPLACING THE COIL AND SHUTTER ASSEMBLY, C7012E,F ONLY (Fig. 21)

NOTE: Use *only* a 190971B Coil and Shutter Assembly. This assembly can also be used on existing C7012 Detectors with electronic tubes. The actual operating voltage of the coil will be either 110V or 120V, depending on the primary control used in the system.

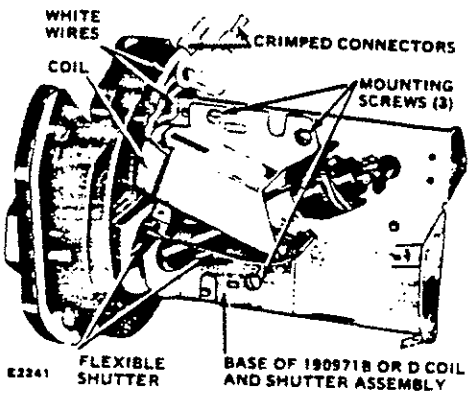
1. *Open the master switch* and remove the detector cover (see Removing the Detector Cover section).
2. Remove the ultraviolet sensing tube (steps 1 through 5 of Replacing the Ultraviolet Sensing Tube section).
3. Cut the white wires as close as possible to the crimped connectors, and remove the crimped connectors.
4. Remove the three mounting screws from the base of the coil and shutter assembly. Put the screws in a safe place.
5. Remove the coil and shutter assembly.
6. Put the new coil and shutter assembly into place.

IMPORTANT: *Be very careful not to kink or otherwise damage the flexible shutter.*

7. Insert the three mounting screws into the base of the coil and shutter assembly and tighten securely.
8. Remove sufficient insulation from each of the two white leadwires remaining on the detector, and also from each of the two white leadwires on the new coil.
9. Using solderless connectors, connect one of the coil wires to one of the remaining white leadwires. Connect the other coil wire to the other remaining white leadwire.
10. Reinstall the sensing tube (steps 6 through 9 of Replacing the Ultraviolet Sensing Tube section).
11. Replace the detector cover.

NOTE: The cover for a C7012F has a small hole that is keyed to a pin on the body flange (Fig. 9).

Fig. 21—Replacing coil and shutter assembly on C7012E,F.



REPLACING THE QUARTZ VIEWING WINDOW (or Focusing Lens)

IMPORTANT: *A quartz window or lens must be used. Ordinary glass absorbs or filters out ultraviolet radiation.*

C7012A,E,G (Fig. 22)

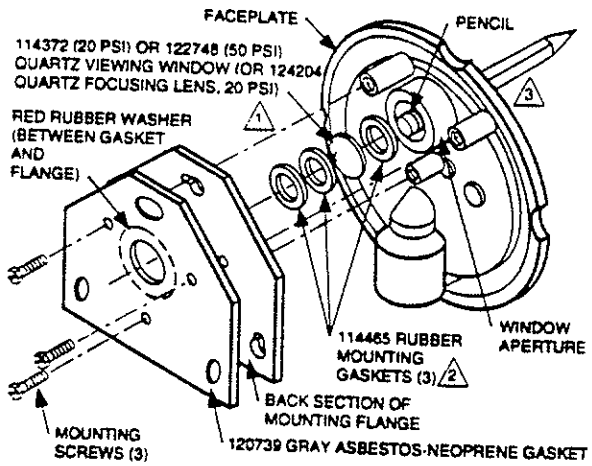
1. *Open the master switch*; remove the detector from the sight pipe and remove the detector cover. (See appropriate sections.)
2. Remove the ultraviolet sensing tube (steps 1 through 5 of Replacing the Ultraviolet Sensing Tube section).
3. Loosen the three screws holding the back section of the mounting flange to the faceplate. Carefully remove and *keep together the three screws, the gray asbestos-neoprene gasket, the red rubber washer, and the back section of the mounting flange.*

NOTE: If the viewing window (with its rubber mounting gaskets) is stuck to the mounting flange, skip step 4.

IMPORTANT: *On a C7012E, be very careful not to kink or otherwise damage the flexible shutter.*

4. Using the eraser end of a pencil, push out the viewing window (with its rubber mounting gaskets) from the inside of the faceplate.
5. Insert one rubber mounting gasket into the window aperture in the faceplate.
6. Insert the new quartz viewing window (or focusing lens) into the window aperture with either side toward the flame.

Fig. 22—Replacing quartz viewing window or focusing lens on C7012A,E,G.



1 VIEWING WINDOW CAN BE REPLACED WITH EITHER SIDE TOWARD THE FLAME.

2 ONLY 1 GASKET ON EACH SIDE OF A FOCUSING LENS.

3 ON A C7024, REMOVE THE 3 MOUNTING SCREWS AND MOVE THE COIL AND SHUTTER ASSEMBLY OUT OF THE WAY TO PUSH OUT THE VIEWING WINDOW.

M1061A

7. Insert two rubber mounting gaskets (only one gasket when replacing a focusing lens) into the aperture.

8. Put the back section of the mounting flange, rubber washer, and asbestos-neoprene gasket into place on the faceplate, and securely tighten the three mounting screws.

NOTE: Make sure the red rubber washer between the gray asbestos-neoprene gasket and the back section of the mounting flange does not protrude over the window aperture or otherwise obscure the line-of-sight of the detector.

9. Clean the viewing window (or focusing lens) on both sides using a clean cloth placed over the eraser end of a pencil.

10. Reinstall the sensing tube (steps 6 through 9 of Replacing the Ultraviolet Sensing Tube section).

11. Replace the detector cover and reinstall the detector on the sight pipe.

C7012C OR F (Fig. 23)

1. *Open the master switch* and remove the detector from the sight pipe (see appropriate section).

2. Unscrew the four hex-head bolts holding the seal-off flange to the faceplate, and remove the flange. Put the bolts in a safe place.

3. Unscrew the retaining ring (with its rubber O-ring seal) from the seal-off flange.

4. Tip the flange and let the viewing window fall into your hand.

5. Insert either side of the new 122037 Quartz Viewing Window into the window aperture.

6. Screw the retaining ring (with its O-ring seal) into the seal-off flange and tighten securely.

7. Clean the viewing window on both sides with a clean cloth over the eraser end of a pencil.

8. Put the seal-off flange back into place on the faceplate, and securely tighten the four hex-head bolts.

9. Reinstall the detector on the sight pipe.

Fig. 23—Replacing quartz viewing window on C7012C,F.

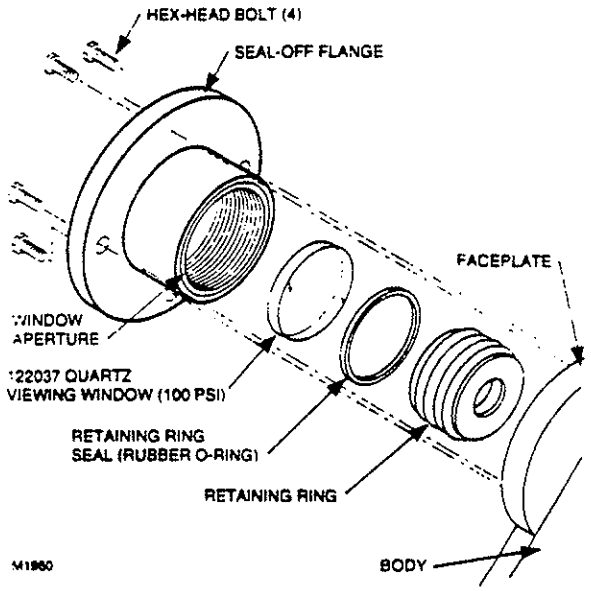


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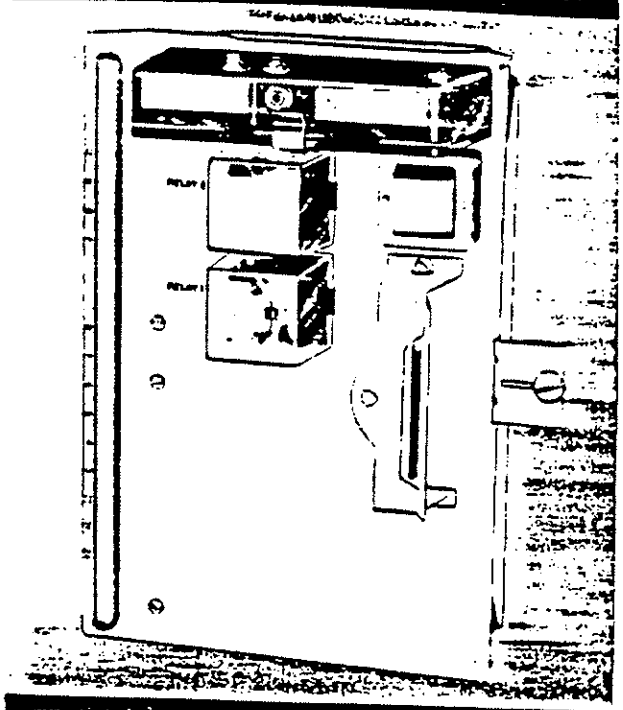
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INDUSTRIAL FLAME SAFEGUARD CONTROLS



R4075C, D

Form Number 60-2367—3

THE R4075C OR D INDUSTRIAL FLAME SAFEGUARD CONTROL IS A PRIMARY CONTROL FOR SUPERVISION OF A LARGE, SEMIAUTOMATIC, CONSTANT-FIRED, INDUSTRIAL BURNER USING GAS, OIL, COAL, OR A COMBINATION OF FUELS. ITS BASIC FUNCTION IS TO DELAY ADMISSION OF FUEL TO THE COMBUSTION CHAMBER UNTIL THE PILOT FLAME HAS BEEN PROVEN, AND THEN TO MONITOR THE FLAME THROUGH THE RUN PERIOD.

- Approvals (120V models only): Underwriters Laboratories Inc. component recognized, Canadian Standards Association certified, and Factory Mutual approved.
- R4075D has override on momentary power interruptions (up to 1 second) to eliminate nuisance shutdowns during power line switchovers.
- Separate models of the R4075C are available for operation at 120, 208, or 240 volts: 50/60 Hz. The R4075D is available only in a 120 volt, 50/60 Hz model. An international R4075C model (220 volts, 50 Hz) is also available.
- Solid state, color-coded, plug-in flame signal amplifier capability includes 3 standard models plus 3 Dynamic Self Check models and 1 Dynamic Ampli-Check model.
- Dynamic Self Check amplifier, when used with a rectifying flame rod, a C7012E or F Purple Peeper Ultraviolet Flame Detector, or a C7076A Adjustable Sensitivity Ultraviolet Flame Detector, tests all electronic components in the flame detection system (amplifier and detector) 60 to 240 times a minute during burner operation and shuts down the burner if the detection system fails.
- Dynamic Ampli-Check amplifier, when used with a C7015A Infrared (lead sulfide) Flame Detector, tests the flame signal amplifier during burner operation and shuts down the burner if the amplifier fails.
- Safety shutdown will occur on (1) failure to ignite the pilot, (2) loss of flame while the main burner is firing, or (3) failure of the flame detection system (if a self-checking system is used).
- Alarm terminal is available to operate an external line voltage alarm on safety shutdown.
- R4075 directly replaces most older models to meet the latest requirements: no change in terminal functions or numbering. No rewiring required for direct replacement.

J.B.
REV. 6-78 (.25)

SEE BACK COVER FOR TABLE OF CONTENTS

SPECIFICATIONS

IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. 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.

MODELS:

R4075C Industrial Flame Safeguard Control. For supervision of large, semiautomatic, constant-fired burners.

R4075D Industrial Flame Safeguard Control. Same as R4075C but with power failure override to prevent shutdown during very short power outages (power line switching–approximately 1 second or less).

NOTE: The pilot valve (or 1st stage oil valve) must stay open and the flame must stay on for the duration of the outage.

International model of the R4075C (220V, 50 Hz).

ELECTRICAL RATINGS:

Voltage and Frequency–

R4075C: separate models for 120V, 50/60 Hz; 208V, 50/60 Hz; 220V, 50 Hz; and 240V, 50/60 Hz.

R4075D: 120V, 50/60 Hz only.

Maximum Power Consumption–

120V models at 60 Hz:
9 watts running or 3 watts standby.

208V and 240V models at 60 Hz:
10 watts running or 4 watts standby.

220V models at 50 Hz:
10 watts running or 4 watts standby.

Maximum Terminal Ratings–

TERMINAL	TYPICAL LOAD	PILOT DUTY RATING	VOLTAGE
8	Alarm	125 VA	120 to 240V
8	Alarm	50 VA	up to 30V
3	Pilot Valve	125 VA	120 to 240V
5	Main Fuel Valve(s)	250 VA	120 to 240V

NOTE: Allowable inrush can be up to 10 times the pilot duty rating.

Example–Pilot duty rating = 125 VA.
At 120V, running current is
$\frac{125}{120}$ = 1.04 amp.
Maximum allowable inrush is
10 times 1.04 = 10.4 amp.

Limit Ratings–Limits must be able to carry and break current to the ignition transformer, pilot valve, and main fuel valve(s) simultaneously.

SAFETY FEATURES:

Safe Start Check–for the presence of flame, or a condition simulating a flame, provided at startup. If the flame relay 2K is pulled in before the START button is pressed, 2K2 is open, preventing the load relay 1K from pulling in. The system cannot be started until the condition is corrected and 2K drops out.

(continued on page 3)

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. **Model number.**
2. **Voltage and frequency.**

ORDER SEPARATELY–

1. **Flame detection system (amplifier and matching flame detector). See Table I.**
2. **Q294A or Q442A Cabinet, or Q295A Subbase.**
3. **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 RESIDENTIAL DIVISION SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).**
2. **RESIDENTIAL DIVISION CUSTOMER SERVICE**
   HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
   MINNEAPOLIS, MINNESOTA 55422 (612) 542-7500

(IN CANADA–HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9)
INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

NOTE: If using a C7012E or F Purple Peeper Ultraviolet Flame Detector (with a self-checking shutter), a Safe Start Check will not be provided with the jumper between terminals 11 and 3 (see Fig. 1, 2, or 3). However, self-checking action will shut down the system if there is a flame-simulating component failure in the flame detection system.

Safety Shutdown—pilot and main fuel valve(s) are de-energized. If used, the external alarm is energized. The START button must be *manually* pressed to restart the system.

Safety Shutdown occurs on—

1. failure to ignite the pilot (or 1st stage oil burner if using direct spark ignition of oil).
2. loss of flame during the run period.
3. failure in the flame detection system (if a self-checking system is used—see Table I).

Flame Failure Response Time—2 to 4 seconds.

AMBIENT OPERATING TEMPERATURE RATINGS:
Minimum—minus 20 F [minus 29 C].
Maximum—
60 Hz: plus 130 F [plus 54 C].
50 Hz: plus 125 F [plus 52 C].

MOUNTING (order separately):
Q294A Cabinet for surface mounting.
Q442A Cabinet for flush mounting.
Q295A Subbase for mounting in customer's cabinet.

MOUNTING DIMENSIONS: See Figs. 4, 5, and 6 (pages 11 and 12).

WEIGHT (without plug-in flame signal amplifier):
120 volt models: 5 lb [2.27 kg].
208, 220, and 240 volt models: 5 lb. 10 oz [2.55 kg].

FLAME DETECTION SYSTEM (order separately): Plug-in Flame Signal Amplifier and matching Flame Detector: see Table I.

APPROVALS (120V models only):
UNDERWRITERS LABORATORIES INC. COMPONENT RECOGNIZED: File No. MP268; Guide No. MCCZ2.
CANADIAN STANDARDS ASSOCIATION CERTIFIED: File No. LR1620; Guide No. 140-A-2 and 300-1-0.2.
FACTORY MUTUAL APPROVED: Report Nos. 24313 and 24117.01.

ACCESSORIES:
1. S445A START-STOP Station; for remote operation.
2. W136A Test Meter (includes 117053 Meter Connector Plug).
3. 117053 Meter Connector Plug (for older W136A models).
4. 123514A Flame Simulator (for use with R7247A Rectification Amplifiers).
5. 123514B Flame Simulator (for use with R7249A Ultraviolet Amplifiers).
6. 130716A Autotransformer—120V primary, 135V secondary. Provides extra power for operation of the shutter on a C7012E or F Purple Peeper Ultraviolet Flame Detector with electron (vacuum) tubes when the detector is mounted vertically, or within 45 degrees of vertical.
7. R4155A Alarm Silencing Relay (available only in 120V, 60 Hz models).
8. Q624A Solid State Spark Generator: prevents detection of ignition spark when properly applied with flame detection systems using C7027, C7035, or C7044 Minipeeper Ultraviolet Flame Detectors. For use only with gas pilots.

TABLE I—FLAME DETECTION SYSTEMS

PLUG-IN FLAME SIGNAL AMPLIFIERS					APPLICABLE FLAME DETECTORS		
TYPE	COLOR	SELF CHECKING	MODEL	FLAME FAILURE RESPONSE TIME	FUEL	TYPE	MODELS
RECTIFICATION	GREEN	NO	R7247A	2 TO 4 SEC	GAS	RECTIFYING FLAME RODS	HOLDERS[c]: C7004, C7007, C7011. COMPLETE ASSEMBLIES: C7005, C7008, C7009, Q179
			R7247A, R7247B[a]	2 TO 4 SEC	OIL	RECTIFYING PHOTOCELL[b]	C7003, C7010, C7013, C7014
					GAS, OIL, COAL	ULTRAVIOLET (PURPLE PEEPER)	C7012A OR C.
		DYNAMIC SELF CHECK[a]	R7247B	2 TO 4 SEC	GAS	RECTIFYING FLAME RODS	HOLDERS[c]: C7004, C7007, C7011. COMPLETE ASSEMBLIES: C7005, C7008, C7009, Q179
			R7247C	2 TO 4 SEC	GAS, OIL, COAL	ULTRAVIOLET (PURPLE PEEPER)	C7012E OR F.
INFRARED	RED	NO	R7248A	2 TO 4 SEC	GAS, OIL, COAL	INFRARED (LEAD SULFIDE)	C7015.
		DYNAMIC AMPLI-CHECK[a]	R7248B	2 TO 4 SEC			
ULTRAVIOLET	PURPLE	NO	R7249A	2 TO 4 SEC	GAS, OIL	ULTRAVIOLET (MINIPEEPER)	C7027, C7035, C7044.
	BLUE	DYNAMIC SELF CHECK[a]	R7476A	2 TO 4 SEC	GAS, OIL, COAL	ULTRAVIOLET (ADJUSTABLE SENSITIVITY)	C7076

[a] DYNAMIC SELF CHECK CIRCUITRY TESTS ALL ELECTRONIC COMPONENTS IN THE FLAME DETECTION SYSTEM (AMPLIFIER AND DETECTOR) 60 TO 240 TIMES A MINUTE DURING BURNER OPERATION AND SHUTS DOWN THE BURNER IF THE DETECTION SYSTEM FAILS.

[b] CIRCUITRY TESTS ONLY THE FLAME SIGNAL AMPLIFIER DURING BURNER OPERATION AND SHUTS DOWN THE BURNER IF THE AMPLIFIER FAILS.

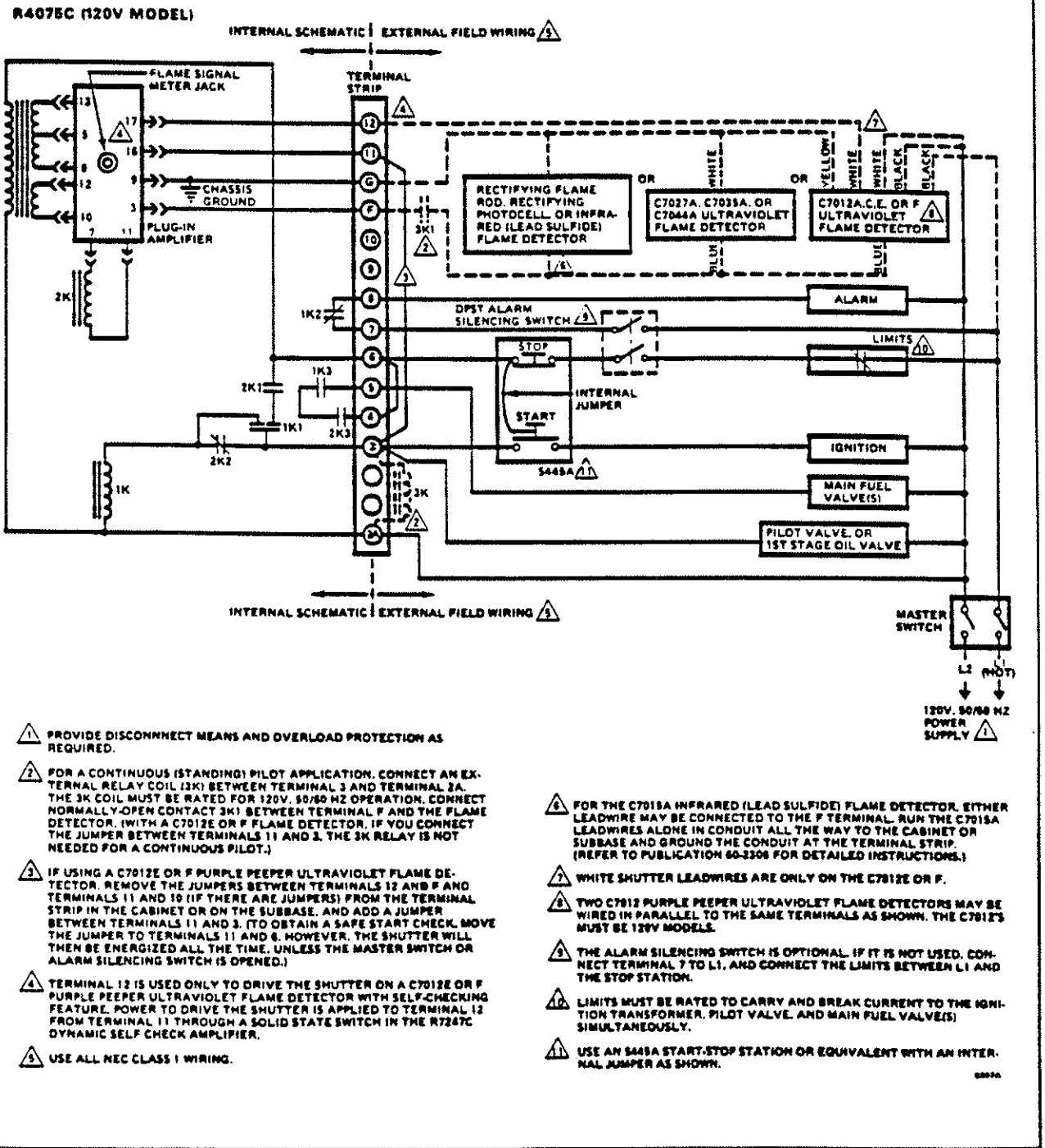
[c] ORDER FLAME ROD SEPARATELY: SEE INSTRUCTION SHEET FOR THE HOLDER.

[d] USE HONEYWELL PHOTOCELL PART NO. 36316, ONLY.

OPERATION

R4075C (120V MODEL)

The internal schematic diagram and sample block diagram of field wiring for the 120V model of the R4075C is shown below. (The 208V, 220V, and 240V models are the same except that they have an additional transformer which provides the 120V required to drive the shutters on C7012E or F Purple Peeper Ultraviolet Flame Detectors. See the schematic on page 7.) The schematic shows all relay contacts in the de-energized position. Refer to the Sequence of Operation on the next 2 pages.



1. PROVIDE DISCONNNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. FOR A CONTINUOUS (STANDING) PILOT APPLICATION, CONNECT AN EXTERNAL RELAY COIL (3K) BETWEEN TERMINAL 3 AND TERMINAL 2A. THE 3K COIL MUST BE RATED FOR 120V, 50/60 HZ OPERATION. CONNECT NORMALLY-OPEN CONTACT 3K1 BETWEEN TERMINAL F AND THE FLAME DETECTOR. (WITH A C7012E OR F FLAME DETECTOR, IF YOU CONNECT THE JUMPER BETWEEN TERMINALS 11 AND 3, THE 3K RELAY IS NOT NEEDED FOR A CONTINUOUS PILOT.)
3. IF USING A C7012E OR F PURPLE PEEPER ULTRAVIOLET FLAME DETECTOR, REMOVE THE JUMPERS BETWEEN TERMINALS 12 AND F AND TERMINALS 11 AND 10 (IF THERE ARE JUMPERS) FROM THE TERMINAL STRIP IN THE CABINET OR ON THE SUBBASE, AND ADD A JUMPER BETWEEN TERMINALS 11 AND 3. (TO OBTAIN A SAFE START CHECK, MOVE THE JUMPER TO TERMINALS 11 AND 6. HOWEVER, THE SHUTTER WILL THEN BE ENERGIZED ALL THE TIME, UNLESS THE MASTER SWITCH OR ALARM SILENCING SWITCH IS OPENED.)
4. TERMINAL 12 IS USED ONLY TO DRIVE THE SHUTTER ON A C7012E OR F PURPLE PEEPER ULTRAVIOLET FLAME DETECTOR WITH SELF-CHECKING FEATURE. POWER TO DRIVE THE SHUTTER IS APPLIED TO TERMINAL 12 FROM TERMINAL 11 THROUGH A SOLID STATE SWITCH IN THE R7247C DYNAMIC SELF CHECK AMPLIFIER.
5. USE ALL NEC CLASS 1 WIRING.
6. FOR THE C7015A INFRARED (LEAD SULFIDE) FLAME DETECTOR, EITHER LEADWIRE MAY BE CONNECTED TO THE F TERMINAL. RUN THE C7015A LEADWIRES ALONE IN CONDUIT ALL THE WAY TO THE CABINET OR SUBBASE AND GROUND THE CONDUIT AT THE TERMINAL STRIP. (REFER TO PUBLICATION 60-2306 FOR DETAILED INSTRUCTIONS.)
7. WHITE SHUTTER LEADWIRES ARE ONLY ON THE C7012E OR F.
8. TWO C7012 PURPLE PEEPER ULTRAVIOLET FLAME DETECTORS MAY BE WIRED IN PARALLEL TO THE SAME TERMINALS AS SHOWN. THE C7012'S MUST BE 120V MODELS.
9. THE ALARM SILENCING SWITCH IS OPTIONAL. IF IT IS NOT USED, CONNECT TERMINAL 7 TO L1, AND CONNECT THE LIMITS BETWEEN L1 AND THE STOP STATION.
10. LIMITS MUST BE RATED TO CARRY AND BREAK CURRENT TO THE IGNITION TRANSFORMER, PILOT VALVE, AND MAIN FUEL VALVE(S) SIMULTANEOUSLY.
11. USE AN S48A START-STOP STATION OR EQUIVALENT WITH AN INTERNAL JUMPER AS SHOWN.

FIG. 1—SIMPLIFIED SCHEMATIC DIAGRAM AND SAMPLE BLOCK DIAGRAM OF FIELD WIRING FOR THE 120V MODEL OF THE R4075C.

SEQUENCE OF OPERATION FOR THE R4075C

NOTE: Italics denote special applications.

NORMAL OPERATION

OPERATOR ACTION	R4075C OPERATION	SYSTEM OPERATION
TO START:		
1. Reset all limits. Close the master switch and the alarm silencing switch (if used).	1. a. Power is applied to terminal 6 through the limits, alarm silencing switch, and STOP station; the plug-in amplifier is energized.	1. a. Standby to start.
CAUTION Do not push in the START button before the master switch is completely closed.	b. Power is applied to terminal 7 (through the alarm silencing switch), and to terminal 8 (through 1K2).	b. The alarm is energized.
2. Push in the START button on the S445A and hold it in.	2. a. Power is applied to the ignition transformer and to terminal 3 through the limits, alarm silencing switch, STOP station, internal jumper in the S445A, and START station.	2. a. The ignition transformer and pilot valve (or 1st stage oil valve) are energized. The pilot valve opens and the pilot is ignited. The flame detector detects the pilot flame. *For a continuous pilot application, external relay 3K pulls in. Contact 3K1 closes to complete the flame detection circuit to the amplifier.*
	b. Relay 1K pulls in through 2K2 (safe start contact). Contact 1K1 closes, bypassing 2K2; 1K2 opens and 1K3 closes.	b. The alarm is de-energized.
	c. *If an R7247C Dynamic Self Check Amplifier is used, power is applied from terminal 3 through the jumper to terminal 11, through the solid state switch in the amplifier (between amplifier terminals 16 and 17), to terminal 12.*	c. *If a C7012E or F Purple Peeper Ultraviolet Flame Detector (with self-checking feature) is used, the shutter is energized.*
	d. When the pilot flame is detected, relay 2K pulls in. Contact 2K1 closes, bypassing the START station from terminal 6, through 2K1 and 1K1, to terminal 3. Contact 2K2 opens. Contact 2K3 closes; power is applied from terminal 6 through the jumper to terminal 4, and then through 2K3 and 1K3 to terminal 5.	d. The automatic main fuel valve(s) is energized. The valve(s) opens and the main burner is ignited. The system is in the run condition. *(If a manually opened valve is used, the main burner will not be ignited until step 4 is completed.)*
3. Release the START button.	3. Normal operation, including self-checking of the flame detection system (if a self-checking system is used).	3. The ignition transformer is de-energized.
4. *Open manual main fuel valve(s) (if used).*	4. Normal operation.	4. *The main burner is ignited. The system is in the run condition.*
TO STOP:		
5. Push in the STOP button on the S445A and hold it in until the alarm is energized.	5. a. Power is removed from terminal 6. This removes power from terminals 3, 4, 5, and 11. The plug-in amplifier is de-energized and relay 2K drops out.	5. a. The pilot valve (or 1st stage oil valve) and the main fuel valve(s) are de-energized. The valves close and the pilot and main burner flames go out.
	b. Relay 1K drops out; 1K2 closes.	b. The alarm is energized.
	c. All relay contacts are reset for the next startup.	c. None.
6. Open the alarm silencing switch (if used).	6. Power is removed from terminals 7 and 8.	6. The alarm is de-energized.
7. Open the master switch.	7. None.	7. The system is de-energized.

SAFETY OPERATION		
ABNORMAL CONDITION	R4075C OPERATION	SYSTEM OPERATION
Safe Start Check—A flame, or a condition simulating a flame, is present before the START button is pressed. NOTE: *This check does not apply if using a continuous (standing) pilot, or if using a C7012E or F Flame Detector with the jumper connected between terminals 11 and 3.*	Relay 2K pulls in when the flame (or flame-simulating condition) is detected. Contact 2K2 opens, preventing relay 1K from pulling in when the START button is pressed. • Contact 1K1 stays open; the START station is not bypassed. Power is removed from terminal 3 when the START button is released.. • Contact 1K2 remains closed. • Contact 1K3 remains open.	The pilot (or 1st stage oil burner) is ignited when the START button is pressed, but the system will shut down when the START button is released. • When the START button is released, the ignition transformer and the pilot valve (or 1st stage oil valve) are de-energized. The valve closes and the pilot flame goes out. • The alarm remains energized. • The automatic main fuel valve(s) cannot be energized.
The pilot (or 1st stage oil burner) is not ignited.	Relay 2K does not pull in. • Contact 2K1 stays open; the START station is not bypassed. When the START button is released, power is removed from terminal 3 and relay 1K drops out. • Contact 2K3 stays open; power cannot be applied to terminal 5. • Contact 1K2 closes.	System cannot be started. • When the START button is released, the ignition transformer and the pilot valve (or 1st stage oil valve) are de-energized. The pilot valve closes. • The automatic main fuel valve(s) cannot be energized. • The alarm is energized.
The flame goes out during the run period.	Relay 2K drops out. • Contact 2K1 opens; power is removed from terminal 3 and relay 1K drops out. • Contact 2K3 opens; power is removed from terminal 5. • Contact 1K2 closes.	Safety shutdown occurs. • The pilot valve (or 1st stage oil oil valve) is de-energized and the valve closes. • The main fuel valve(s) is de-energized and the valve(s) closes. • The alarm is energized.
Momentary power failure.	All relays drop out.	Safety shutdown occurs, but the alarm is not energized until power is restored.
IF USING A SELF-CHECKING FLAME DETECTION SYSTEM: The flame detection system fails while the system is turned off.	Relay 2K cannot pull in when the system is started—same operation as if the pilot is not ignited.	Safety shutdown occurs.
The flame detection system fails during the run period with the burner firing.	Relay 2K drops out—same operation as if the flame goes out.	Safety shutdown occurs.

R4075C (208V, 220V, AND 240V MODELS)

The internal schematic diagram and sample block diagram of field wiring for the 208V, 220V, and 240V models of the R4075C is shown below. The schematic shows all relay contacts in the de-energized position.

Operation is the same as for the 120V model of the R4075C (except for operation of the ALARM on a 220V, 50 Hz model). Refer to the Sequence of Operation on pages 5 and 6.

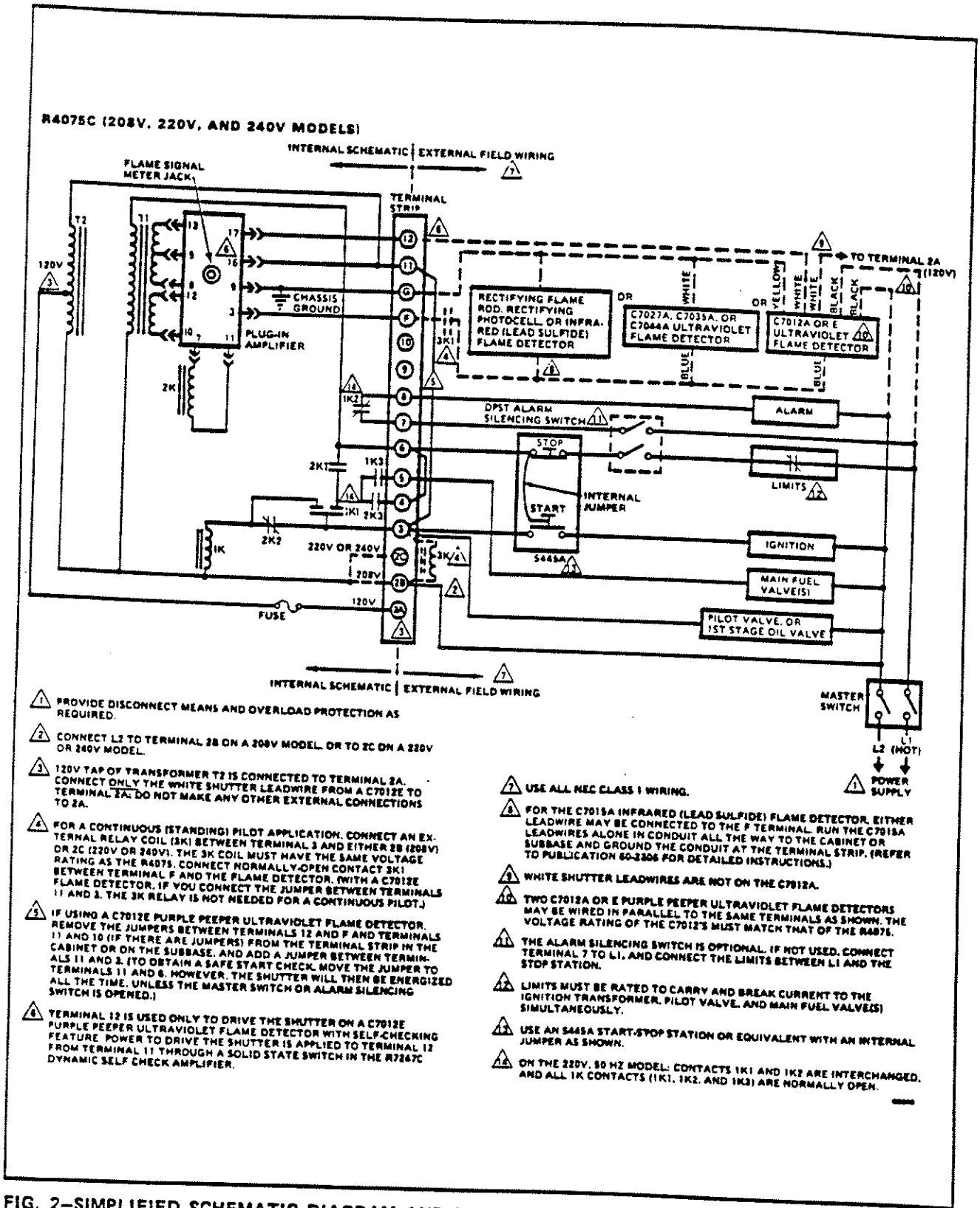
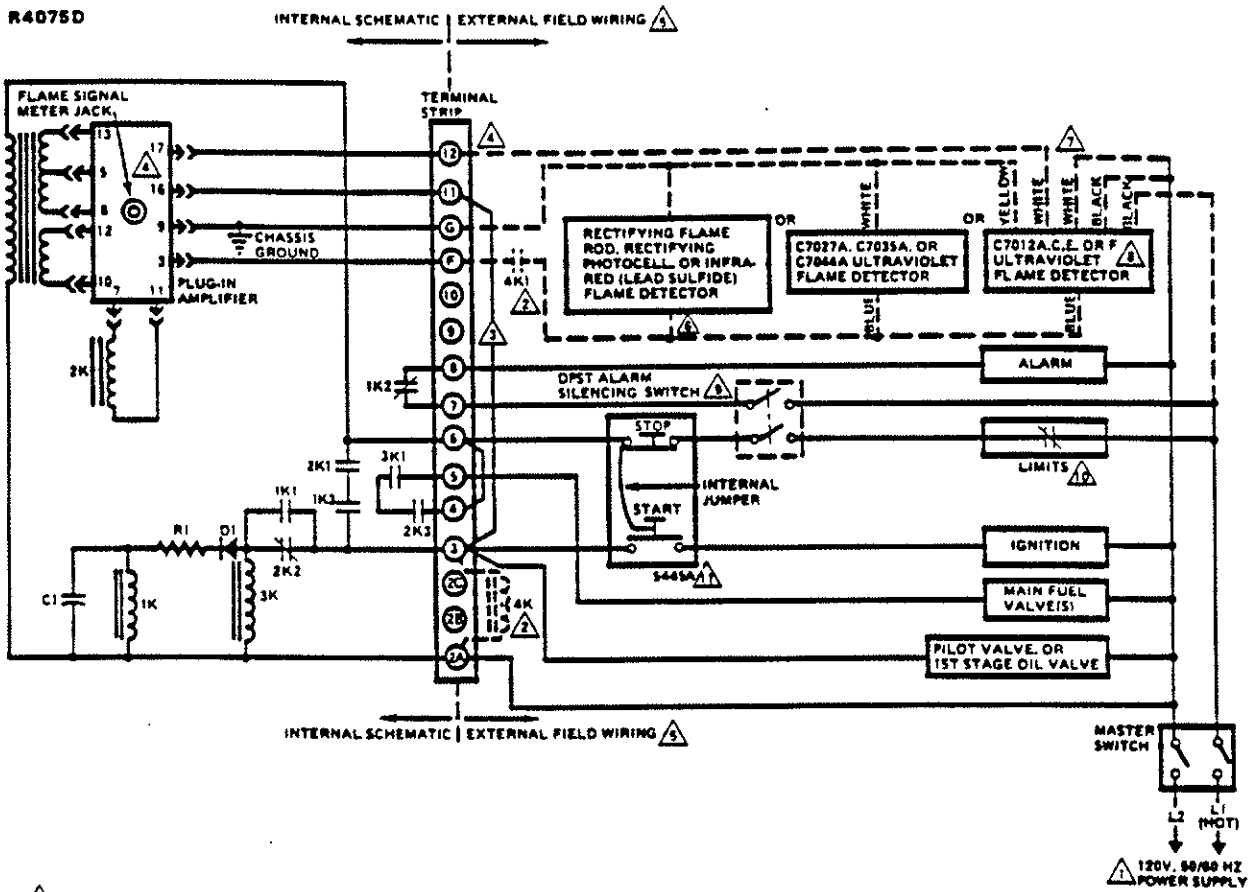


FIG. 2–SIMPLIFIED SCHEMATIC DIAGRAM AND SAMPLE BLOCK DIAGRAM OF FIELD WIRING FOR THE 208V, 220V, AND 240V MODELS OF THE R4075C.

The internal schematic diagram and sample block diagram of field wiring for the R4075D is shown below.

The schematic shows all relay contacts in the de-energized position. Refer to the Sequence of Operation on the next 2 pages.



1. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. FOR A CONTINUOUS (STANDING) PILOT APPLICATION, CONNECT AN EXTERNAL RELAY COIL (4K) BETWEEN TERMINAL 3 AND TERMINAL 2A. THE 4K COIL MUST BE RATED FOR 120V, 50/60 HZ OPERATION. CONNECT NORMALLY OPEN CONTACT 4K1 BETWEEN TERMINAL F AND THE FLAME DETECTOR. (WITH A C7012E OR F FLAME DETECTOR, IF YOU CONNECT THE JUMPER BETWEEN TERMINALS 11 AND 3, THE 4K RELAY IS NOT NEEDED FOR A CONTINUOUS PILOT.)
3. (IF USING A C7012E OR F PURPLE PEEPER ULTRAVIOLET FLAME DETECTOR, REMOVE THE JUMPERS BETWEEN TERMINALS 12 AND F AND TERMINALS 11 AND 10 (IF THERE ARE JUMPERS) FROM THE TERMINAL STRIP IN THE CABINET OR ON THE SUBBASE, AND ADD A JUMPER BETWEEN TERMINALS 11 AND 3. (TO OBTAIN A SAFE START CHECK, MOVE THE JUMPER TO TERMINALS 11 AND 6. HOWEVER, THE SHUTTER WILL THEN BE ENERGIZED ALL THE TIME, UNLESS THE MASTER SWITCH OR ALARM SILENCING SWITCH IS OPENED.)
4. TERMINAL 12 IS USED ONLY TO DRIVE THE SHUTTER ON A C7012E OR F PURPLE PEEPER ULTRAVIOLET FLAME DETECTOR WITH SELF-CHECKING FEATURE. POWER TO DRIVE THE SHUTTER IS APPLIED TO TERMINAL 12 FROM TERMINAL 11 THROUGH A SOLID STATE SWITCH IN THE R7247C DYNAMIC SELF CHECK AMPLIFIER.
5. USE ALL NEC CLASS 1 WIRING.
6. FOR THE C7015A INFRARED (LEAD SULFIDE) FLAME DETECTOR, EITHER LEADWIRE MAY BE CONNECTED TO THE F TERMINAL. RUN THE C7015A LEADWIRES ALONE IN CONDUIT ALL THE WAY TO THE CABINET OR SUBBASE AND GROUND THE CONDUIT AT THE TERMINAL STRIP. (REFER TO PUBLICATION 68-2306 FOR DETAILED INSTRUCTIONS.)
7. WHITE SHUTTER LEADWIRES ARE ONLY ON THE C7012E OR F.
8. TWO C7012 PURPLE PEEPER ULTRAVIOLET FLAME DETECTORS MAY BE WIRED IN PARALLEL TO THE SAME TERMINALS AS SHOWN. THE C7012'S MUST BE 120V MODELS.
9. THE ALARM SILENCING SWITCH IS OPTIONAL. IF IT IS NOT USED, CONNECT TERMINAL 7 TO L1, AND CONNECT THE LIMITS BETWEEN L1 AND THE STOP STATION.
10. LIMITS MUST BE RATED TO CARRY AND BREAK CURRENT TO THE IGNITION TRANSFORMER, PILOT VALVE, AND MAIN FUEL VALVE(S) SIMULTANEOUSLY.
11. USE AN S46SA START-STOP STATION OR EQUIVALENT WITH AN INTERNAL JUMPER AS SHOWN.

FIG. 3–SIMPLIFIED SCHEMATIC DIAGRAM AND SAMPLE BLOCK DIAGRAM OF FIELD WIRING FOR THE R4075D.

SEQUENCE OF OPERATION FOR THE R4075D

NOTE: Italics denote special applications.

NORMAL OPERATION

OPERATOR ACTION	R4075D OPERATION	SYSTEM OPERATION
TO START:		
1. Reset all limits. Close the master switch and the alarm silencing switch (if used). **CAUTION** Do not push in the START button before the master switch is completely closed.	1. a. Power is applied to terminal 6 through the limits, alarm silencing switch, and STOP station; the plug-in amplifier is energized.	1. a. Standby to start.
	b. Power is applied to terminal 7 (through the alarm silencing switch), and to terminal 8 (through 1K2).	b. The alarm is energized.
2. Push in the START button on the S445A and hold it in.	2. a. Power is applied to the ignition transformer and to terminal 3 through the limits, alarm silencing switch, STOP station, internal jumper in the S445A and START station.	2. a. The ignition transformer and pilot valve (or 1st stage oil valve) are energized. The pilot valve opens and the pilot is ignited. The flame detector detects the pilot flame. *For a continuous pilot application, external relay 4K pulls in. Contact 4K1 closes to complete the flame detection circuit to the amplifier.*
	b. Relay 3K pulls in through 2K2 and 3K1 closes.	b. None.
	c. Relay 1K pulls in through 2K2 (safe start contact), diode D1, and resistor R1. Contact 1K1 closes, bypassing 2K2; 1K2 opens and 1K3 closes. Capacitor C1 charges.	c. The alarm is de-energized.
	d. *If an R7247C Dynamic Self Check Amplifier is used, power is applied from terminal 3 through the jumper to terminal 11, through the solid state switch in the amplifier (between amplifier terminals 16 and 17), to terminal 12.*	d. *If a C7012E or F Purple Peeper Ultraviolet Flame Detector (with self-checking feature) is used, the shutter is energized.*
	e. When the pilot flame is detected, relay 2K pulls in. Contact 2K1 closes, bypassing the START station from terminal 6, through 2K1 and 1K3, to terminal 3. Contact 2K2 opens. Contact 2K3 closes; power is applied from terminal 6 through the jumper to terminal 4, and then through 2K3 and 3K1 to terminal 5.	e. The automatic main fuel valve(s) is energized. The valve(s) opens and the main burner is ignited. The system is in the run condition. *(If a manually opened valve is used, the main burner will not be ignited until step 4 is completed.)*
3. Release the START button.	3. Normal operation, including self-checking of the flame detection system (if a self-checking system is used).	3. The ignition transformer is de-energized.
4. *Open manual main fuel valve(s) (if used).*	4. Normal operation.	4. *The main burner is ignited. The system is in the run condition.*
TO STOP:		
5. Push in the STOP button on the S445A and hold it in until the alarm is energized.	5. a. Power is removed from terminal 6. This removes power from terminals 3, 4, 5, and 11. The plug-in amplifier is de-energized and relay 2K drops out.	5. a. The pilot valve (or 1st stage oil valve) and the main fuel valve(s) are de-energized. The valves close and the pilot and main burner flames go out.
	b. Relays 1K and 3K drop out; 1K2 closes.	b. The alarm is energized.
	c. All relay contacts are reset for the next startup.	c. None.
6. Open the alarm silencing switch (if used).	6. Power is removed from terminals 7 and 8.	6. The alarm is de-energized.
7. Open the master switch.	7. None.	7. The system is de-energized.

SAFETY OPERATION		
ABNORMAL CONDITION	R4075D OPERATION	SYSTEM OPERATION
Safe Start Check—A flame, or a condition simulating a flame, is present before the START button is pressed. NOTE: *This check does not apply if using a continuous (standing) pilot, or if using a C7012E or F Flame Detector with the jumper connected between terminals 11 and 3.*	Relay 2K pulls in when the flame (or flame-simulating condition) is detected. Contact 2K2 opens, preventing relays 1K and 3K from pulling in when the START button is pressed. • Contact 1K2 remains closed. • Contact 1K3 stays open; the START station is not bypassed. Power is removed from terminal 3 when the START button is released. • Contact 3K1 remains open.	The pilot (or 1st stage oil burner) is ignited when the START button is pressed, but the system will shut down when the START button is released. • The alarm remains energized. • When the START button is released, the ignition transformer and the pilot valve (or 1st stage oil valve) are de-energized. The valve closes and the pilot flame goes out. • The automatic main fuel valve(s) cannot be energized.
The pilot (or 1st stage oil burner) is not ignited.	Relay 2K does not pull in. • Contact 2K1 stays open; the START station is not bypassed. When the START button is released, power is removed from terminal 3 and relays 1K and 3K drop out. • Contact 2K3 stays open; power cannot be applied to terminal 5. • Contact 1K2 closes.	System cannot be started. • When the START button is released, the ignition transformer and the pilot valve (or 1st stage oil valve) are de-energized. The pilot valve closes. • The automatic main fuel valve(s) cannot be energized. • The alarm is energized.
The flame goes out during the run period.	Relay 2K drops out. • Contact 2K1 opens; power is removed from terminal 3 and relays 1K and 3K drop out. • Contact 2K3 opens; power is removed from terminal 5. • Contact 1K2 closes.	Safety shutdown occurs. • The pilot valve (or 1st stage oil valve) is de-energized and the valve closes. • The main fuel valve(s) is de-energized and the valve(s) closes. • The alarm is energized.
Momentary power failure.	Power is removed from all terminals; all relays except 1K drop out. The charge on capacitor C1 will hold in 1K for about 1 second. • If power is restored before 1K drops out and before the pilot flame goes out— —relay 2K will pull back in; 2K1 and 2K3 will close, and 2K2 will open. —the START station will be bypassed through 2K1 and 1K3. —power will be reapplied to terminal 3. —relays 3K and 4K (if used) will pull back in. —operation will return to normal. • If 1K drops out or the pilot flame goes out before power is restored— —the START station cannot be bypassed (1K3 or 2K1 is open). —power will *not* be reapplied to terminal 3. —relays cannot pull back in.	• If power is restored within 1 second and the pilot flame (or 1st stage oil flame) is still burning (the pilot valve must be slow closing), normal operation will be resumed. The alarm will not be energized. If the main burner flame has gone out, it will be re-ignited. • Safety shutdown occurs, but the alarm is not energized until power is restored.
IF USING A SELF-CHECKING FLAME DETECTION SYSTEM: The flame detection system fails while the system is turned off.	Relay 2K cannot pull in when the system is started—same operation as if the pilot is not ignited.	Safety shutdown occurs.
The flame detection system fails during the run period with the burner firing.	Relay 2K drops out—same operation as if the flame goes out.	Safety shutdown occurs.

INSTALLATION

CAUTION

1. Installer must be a trained, experienced, flame safeguard control service technician.
2. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage.
3. All wiring must comply with applicable local electrical codes, ordinances, and regulations.
4. All wiring must be NEC Class 1 (line voltage).
5. Voltage and frequency of the power supply and flame detector(s) connected to this control must agree with those marked on the device.
6. Loads connected to the control terminals must not exceed those listed in the SPECIFICATIONS section.
7. Limits must be rated to carry and break current to the ignition transformer, pilot valve (or 1st stage oil valve), and main fuel valve(s) simultaneously.
8. If replacing an R4075 in an existing installation, remove all jumpers from the terminal strip except those required for the new installation.
9. Perform all required checkout tests after installation is complete.

IMPORTANT

1. For on-off gas-fired systems, some authorities having jurisdiction prohibit the wiring of any limit or operating contacts in series between the flame safeguard control and the main fuel valve(s).
2. For continuous (standing) pilot applications, Factory Mutual requires that gas to the pilot burner be automatically shut off on pilot flame failure. A separate control must be used for this purpose. Exception 1 on page 16 of Chapter 40 in Factory Mutual Engineering Corporation's Handbook of Industrial Loss Prevention is interpreted to mean that this control can be a thermally actuated valve.
3. Do not connect more than two C7012E or F Purple Peeper Ultraviolet Flame Detectors (with self-checking shutters) in parallel to the same terminals.

Use applicable installation instructions provided by the burner manufacturer in addition to the corresponding instructions given here. Before putting the system into service, check out the installation using the procedures in the CHECKOUT section of this sheet, and any others stipulated by the burner manufacturer.

LOCATION

TEMPERATURE

Install the R4075 where the surrounding temperatures will remain within the Ambient Operating Temperature Ratings in the SPECIFICATIONS section.

HUMIDITY

Install the R4075 where the relative humidity never reaches the saturation point. Condensation of moisture on the R4075 may cause enough leakage to short the flame signal to ground and thus prevent the burner from starting.

VIBRATION

Do not install the R4075 where it could be subject to excessive vibration. Vibration shortens the life of the electronic components.

WEATHER

The R4075 is not designed to be weathertight. If it is installed outdoors, it must be protected.

MOUNTING THE CABINET OR SUBBASE

See Figs. 4, 5, and 6 for installation dimensions.

1. Select the location on a vertical wall or instrument panel. (The Q295A Subbase may be mounted directly in the customer's cabinet.) Be sure to allow clearances for servicing and for removal of the R4075.

2. For surface mounting (Q294A Cabinet or Q295A Subbase), use the back of the cabinet or subbase as a template to mark the screw locations. Drill the pilot holes.

(continued on page 12)

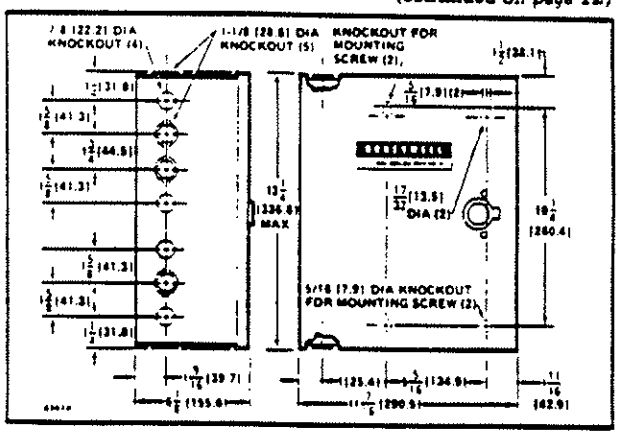


FIG. 4—MOUNTING DIMENSIONS OF THE Q294A SURFACE-MOUNTED CABINET, IN INCHES [MILLIMETRES SHOWN IN BRACKETS].

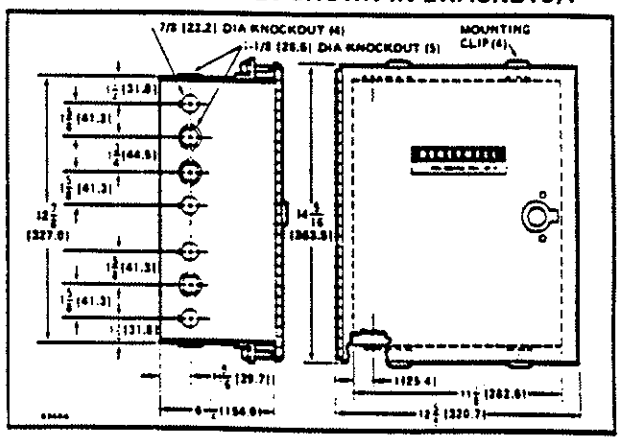


FIG. 5—MOUNTING DIMENSIONS OF THE Q442A FLUSH-MOUNTED CABINET, IN INCHES [MILLIMETRES SHOWN IN BRACKETS].

3. For flush mounting (Q442A Cabinet), make an opening in the vertical wall or instrument panel just slightly larger than the cabinet, not including the flange. Add the external mounting clips to the sides of the cabinet after it is in place.

4. Insert the 4 mounting screws and tighten them securely.

5. Install necessary conduit fittings.

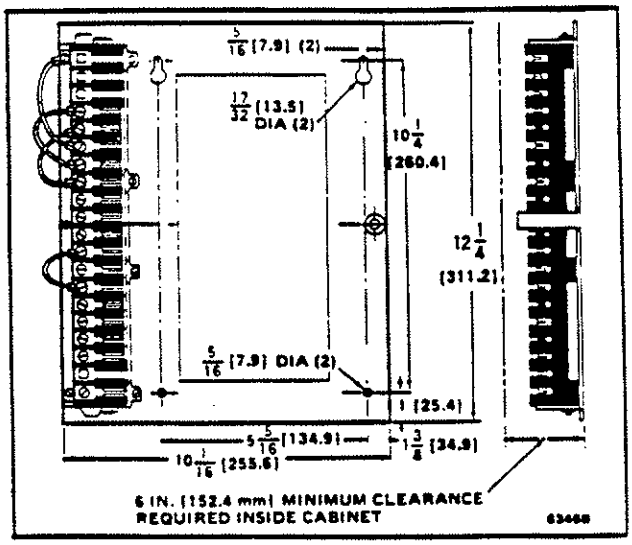


FIG. 6—MOUNTING DIMENSIONS OF THE Q295A SUBBASE, IN INCHES [MILLIMETRES SHOWN IN BRACKETS].

WIRING TO TERMINAL STRIP (FIG. 1, 2, OR 3)

1. All wiring must comply with applicable electrical codes, ordinances, and regulations. Use NEC Class 1 (line voltage) wiring.

2. *For normal installations*, use moisture-resistant No. 14 wire suitable for at least 167 F [75 C].

3. *For high temperature installations*, use moisture-resistant No. 14 wire, selected for a temperature rating above the maximum operating temperature, for all but the ignition and flame detector "F" leadwires.

   a. *For the ignition*, use Honeywell Spec. No. R1061012 Ignition Cable or equivalent. (This wire is rated at 350 F [177 C] for continuous duty, and up to 500 F [260 C] for intermittent use. It has been tested to 25,000 volts.)

   b. *For the flame detector "F" leadwire*, use Honeywell Spec. No. R1298020 or equivalent. (This wire is rated up to 400 F [204 C] for continuous duty. It is tested for operation up to 600 volts and breakdown up to 7500 volts.)

4. For *ignition installations in a contaminating environment*, use Honeywell Spec. No. R1239001 High Tension Ignition Cable or equivalent. (This wire is very resistant to severe conditions of oil, heat, and corona, and is tested to withstand high voltages up to 25,000 volts RMS in a salt bath for 1 minute without breakdown. It is rated at 200 F [93 C] for continuous duty, and up to 350 F [177 C] for intermittent use.)

IMPORTANT

Do not run high voltage ignition transformer wires in the same conduit with the flame detector wiring.

5. Refer to Fig. 1, 2, or 3 for typical field wiring connections. Follow the burner manufacturer's wiring diagram if provided.

6. Do not remove the factory-installed jumpers from the terminal strip in the cabinet or on the subbase unless you are installing a C7012E or F Purple Peeper Ultraviolet Flame Detector (with self-checking shutter). If you are installing a C7012E or F, remove the jumpers between terminals 12 and F and between terminals 11 and 10 (if there are jumpers), and add a jumper between terminals 11 and 3. Do not remove any other jumpers.

7. Make sure the loads do not exceed the terminal ratings. Refer to the label on the R4075 or to the Terminal Ratings in the SPECIFICATIONS section.

8. *Check the power supply circuit.* The voltage and frequency must match those of the R4075. Do not connect the R4075 to a circuit which is subject to line voltage variations, such as would occur with on-off switching of heavy loads. A separate power supply circuit may be required for the flame safeguard control. Add required disconnect means and overload protection.

9. Check all wiring circuits and complete the STATIC CHECKOUT (page 14) before installing the R4075.

INSTALLING THE FLAME DETECTOR

Proper flame detector installation is the basis of a safe and reliable flame safeguard installation. Refer to the instructions packed with the flame detector and to the burner manufacturer's instructions. Follow the instructions carefully to make the best possible application of the flame detector.

Keep the flame signal leadwires from the flame detector to the terminal strip or wiring subbase as short as possible. Capacitance increases with leadwire length, reducing the signal strength. The maximum permissible leadwire length depends on the type of flame detector, leadwire, and conduit. *The ultimate limiting factor in flame signal leadwire length is the signal current.* Refer to Table III in the CHECKOUT section.

WIRING THE FLAME DETECTOR

Wiring connections for the flame detectors are shown on Fig. 1, 2, or 3 for most applications. If an optional autotransformer is required to power the shutter of a C7012E or F with electron (vacuum) tubes, see Fig. 8.

For normal installations, use moisture-resistant No. 14 wire suitable for at least 167 F [75 C].

For high temperature installations, use Honeywell Spec. No. R1298020 or equivalent for the "F" leadwire. (This wire is rated up to 400 F [204 C] for continuous duty. It is tested for operation up to 600 volts and breakdown up to 7500 volts.) For the other leadwires, use moisture-resistant No. 14 wire selected for a temperature rating above the maximum operating temperature.

All wiring must be NEC Class 1 and conform to local electrical codes, ordinances, and regulations. If the leadwires aren't long enough to reach the terminal strip, splices must be made in a junction box.

SPECIAL CONSIDERATIONS FOR THE C7012E OR F

Two sources of power must be provided for the C7012E or F Purple Peeper Ultraviolet Flame Detector (with self-checking shutter). The power to the *black* leadwires of the C7012E may be 120V, 208V, 220V, or 240V ac, depending on the model of the detector. The

C7012F is available only in a 120V model. This voltage must match the power supply of the flame safeguard control. The power to the *white* leadwires *must* be 120V ac; this is the power supply for the operation of the self-checking shutter.

For 120V models of the R4075, the line power supply feeds the white shutter leadwires directly through switching action within the plug-in R7247C Flame Signal Amplifier. For 208V, 220V, and 240V models of the R4075, an internal transformer provides 120V power between terminals 11 and 2A to supply power for shutter operation.

USING THE OPTIONAL 130716A AUTOTRANSFORMER (FIGS. 7 AND 8)

If a C7012E or F with electron (vacuum) tubes must be mounted with its sighting axis within 45 degrees of vertical (instead of the preferred horizontal position), or with the arrow on its faceplate not pointing directly downward (Fig. 7), the shutter requires 135 volts to operate properly. An optional 130716A Autotransformer will provide the correct voltage. However, it can only be used with 120 volt flame safeguard controls as it overloads the internal transformer on 208, 220, and 240 volt models and causes excessive heating. The wiring diagram for connecting the autotransformer is shown in Fig. 8.

NOTE: A solid state C7012E or F can be mounted horizontally or vertically, or at any angle in between, *without* an autotransformer (provided that the arrow on the faceplate is pointing downward). *Do not use the 130716A Autotransformer with solid state C7012's.*

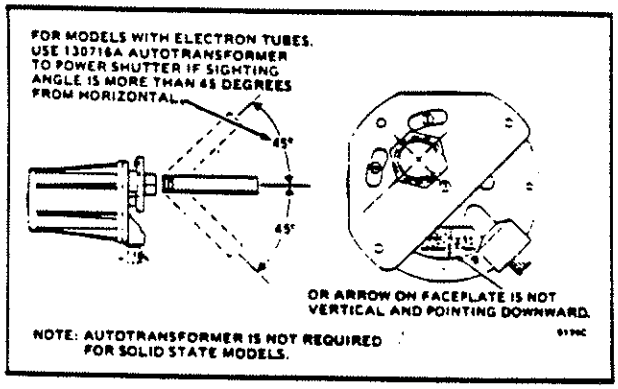


FIG. 7—CORRECT MOUNTING POSITION FOR A C7012E OR F WITH ELECTRON TUBES.

USING REDUNDANT PARALLEL C7012E OR F DETECTORS

For a flame that is difficult to sight, using 2 parallel C7012E or F Flame Detectors will reduce nuisance shutdowns. If only one of the parallel detectors loses the flame signal, the other will still indicate the presence of the flame and will keep the burner running. *A flame-simulating failure in either detector will cause the burner to shut down.* Two C7012E detectors may be wired in parallel to the same terminals on any R4075 (if the voltage ratings match). Two C7012F detectors can be wired in parallel on 120V models only. To avoid exceeding the rating of the solid state shutter switch in the R7247C Flame Signal Amplifier, *do not connect more than two C7012E or F detectors in parallel.*

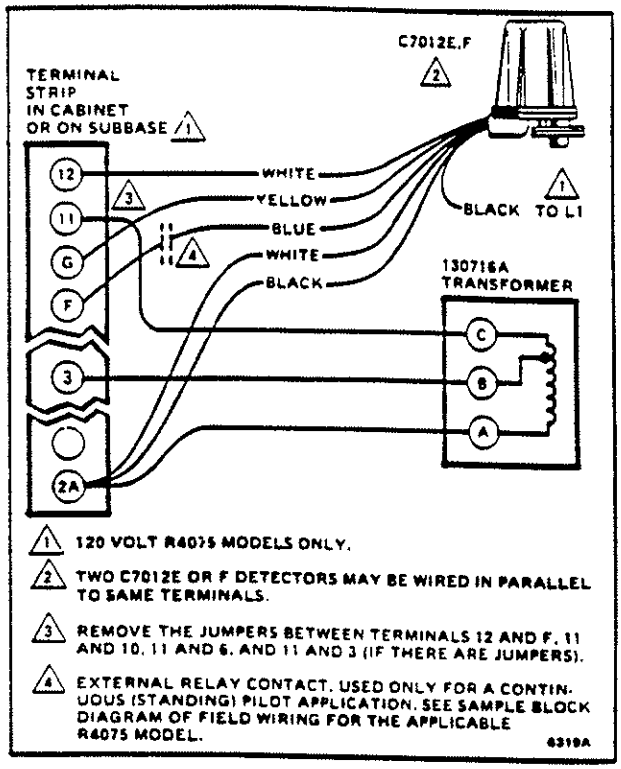


FIG. 8—WIRING DIAGRAM (120 VOLT R4075 MODELS ONLY) FOR MOUNTING A C7012E OR F FLAME DETECTOR WITH ELECTRON TUBES WITH ITS SIGHTING AXIS VERTICAL (OR WITHIN 45 DEGREES OF VERTICAL).

INSTALLING AN OPTIONAL R4155A ALARM SILENCING RELAY (FIG. 9)

For 120 volt, 60 Hz models of the R4075, an R4155A Alarm Silencing Relay may be used instead of the dpst alarm silencing switch shown in Fig. 1 or 3. Wire the R4155A as shown in Fig. 9 below. For mounting instructions, refer to the R4155A instruction sheet, form 60-2314.

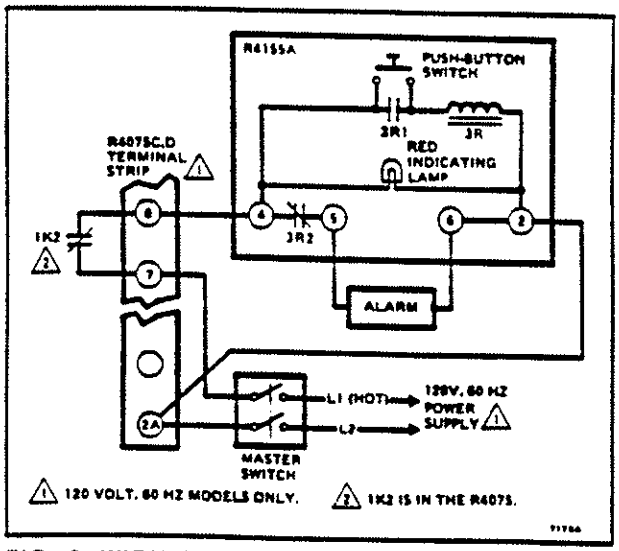


FIG. 9—WIRING DIAGRAM FOR AN R4155A ALARM SILENCING RELAY (120V, 60 HZ MODELS ONLY).

(continued on page 14)

The R4155A operates as follows:

1. When the master switch is closed, power is applied to terminal 8 through 1K2.
2. The alarm is energized through 3R2, and the RED indicating lamp lights.
3. Pressing the push button energizes the coil, 3R; 3R1 closes and 3R2 opens.
4. When 3R2 opens, the alarm is de-energized.
5. When the push button is released, 3R is held in through 1K2 and 3R1.
6. The alarm is now off, but the RED indicating lamp is still on.
7. When the START button is pressed, relay 1K in the R4075 pulls in and 1K2 opens, removing power from terminal 8.
8. The RED Indicating lamp goes out and 3R drops out; 3R1 opens and 3R2 closes; the R4155A is reset.
9. If the pilot is not ignited or if the flame goes out during the run period, relay 1K in the R4075 drops out and 1K2 closes, applying power to terminal 8.
10. The alarm is energized and the RED indicating lamp lights.

STATIC CHECKOUT (TABLE II)

CAUTION

1. Use utmost care while performing these tests; line voltage is present on many terminals when power is on.
2. Open the master switch before installing or removing a test jumper.
3. Be sure to remove the test jumper after completing each test before continuing to the next test.
4. Replace all external devices not operating properly. Do not bypass external devices.
5. Close all manual fuel shutoff valves before starting these tests.

After checking all wiring circuits, perform this checkout *before* installing the R4075 in the cabinet or on the subbase. These tests ensure that the terminal strip (in the cabinet or on the subbase) is wired correctly, and that the external switches, limits, actuators, valves, transformers, and other devices are operating properly.

EQUIPMENT REQUIRED

1. Voltmeter (W136A or equivalent)—set on 0 to 300V ac scale.
2. Jumper wire—No. 14 wire, insulated, 12 inches [304.8 mm] long, with alligator clips at both ends.

GENERAL INSTRUCTIONS

1. Perform all tests in Table II below, in the order listed. *Those in italics are for special applications.*
2. Make sure all manual fuel shutoff valves are closed.
3. Make sure the master switch is open before beginning.
4. Close the alarm silencing switch (if used).
5. For each test, open the master switch and install the jumper wire between the terminals listed under TEST JUMPER.
6. Close the master switch before observing operation.
7. Read the voltage between the terminals listed under VOLTMETER (terminals vary with the model).
8. If there is no voltage or operation is abnormal, check the circuits and external devices as described in the last column.
9. Check all wiring in the circuits for correct connections, tight terminal screws, correct wire, and proper wiring techniques. Replace all worn or incorrectly sized wires.
10. Replace faulty switches, limits, actuators, valves, transformers, and other devices, as required.
11. Normal operation must be obtained for each required test before continuing the checkout.
12. Be sure to remove the test jumper after completing each test before continuing to the next test.

TABLE II–STATIC TESTS OF EXTERNAL DEVICES

TEST NO.	MODELS	TEST JUMPER	VOLT-METER	NORMAL OPERATION	IF OPERATION IS ABNORMAL, CHECK THE ITEMS LISTED BELOW
	CAUTION Make sure all manual fuel shutoff valves are closed.				1. Make sure that: a. the master switch is closed. b. the alarm silencing switch (if used) is closed. c. power is connected to the master switch. d. overload protection (fuse, circuit breaker, etc.) has not opened the power line. **IMPORTANT** Low fuel pressure limits, if used, *could be open*. Bypass them with jumpers for the rest of the Static Tests (if required). e. the limits are closed. If open, determine cause(s) and correct the condition(s). f. the STOP switch in the S445A (or equivalent) is closed.
1	120V Models	None	6-2A	Line voltage at terminal 6.	
	208V Models	None	6-2B		
	220V and 240V Models	None	6-2C		

TABLE II–STATIC TESTS OF EXTERNAL DEVICES *(continued)*

TEST NO.	MODELS	TEST JUMPER	VOLT-METER	NORMAL OPERATION	IF OPERATION IS ABNORMAL, CHECK THE ITEMS LISTED BELOW
2	All Models	7-8	–	Alarm (if used) is energized.	1. Make sure that the alarm is functioning properly.
3	120V Models	None	3-2A	**WARNING** Make sure all manual fuel shutoff valves are closed. Push in START button and hold it in. 1. Line voltage at terminal 3. 2. Ignition transformer is energized. 3. Automatic pilot valve (or 1st stage oil valve if using direct spark ignition) opens. 4. *For a continuous pilot application only—external contact 3K1 closes (4K1 for an R4075D).* 5. *If using a C7012E or F Purple Peeper Ultraviolet Flame Detector, move the voltmeter lead from terminal 3 to terminal 11.* **CAUTION** Line voltage is present. *Line voltage should be measured (about 135V if using a 130716A Autotransformer).*	1. Make sure that: a. the internal jumper is installed in the S445A (or equivalent). b. the START switch is closed. 2. Watch for spark or listen for buzz. Make sure that the ignition electrodes are clean. 3. Listen for click or feel head of valve for activation. Make sure that the actuator (if used) and the pilot valve (or 1st stage oil valve) are operating properly. 4. *Make sure that the external relay 3K (4K for an R4075D) is installed properly and that it pulls in.* 5. *Make sure that either:* a. *a jumper is installed between terminals 11 and 3 on the terminal strip.* *OR* b. *if using a 130716A Autotransformer* (1) *there is no jumper between terminals 11 and 6 or between 11 and 3, and* (2) *the transformer is wired correctly and is operating properly.*
	208V Models	None	3-2B		
	220V and 240V Models	None	3-2C		
4	All Models	None	–	Release START button. 1. Ignition transformer is de-energized. 2. Automatic pilot valve (or 1st stage oil valve if using direct spark ignition) closes.	1. Observe that the spark goes out and/or the buzz stops. If not, make sure the START switch is open. 2. Make sure that the actuator (if used) and the pilot valve (or 1st stage oil valve) are operating properly.
5	All Models	5-4	–	**WARNING** Make sure all manual fuel shutoff valves are closed. Automatic main fuel valve(s) opens.	1. Make sure that the jumper is installed between terminals 6 and 4 on the terminal strip. 2. Listen for and observe operation of the main fuel valve(s) and actuator(s). Make sure that they are operating properly.
6	120V Models	5-4	6-2A	Push in STOP button. 1. No voltage at terminal 6. 2. Automatic main fuel valve(s) closes. **CAUTION** Upon completing these tests, open the master switch, remove the test jumper between terminals 5 and 4 on the terminal strip, and remove bypass jumpers from the low fuel pressure limits (if used).	1. Make sure that the STOP switch is open. 2. Make sure that the valve(s) and actuator(s) are operating properly.
	208V Models	5-4	6-2B		
	220V and 240V Models	5-4	6-2C		

INSTALLING THE R4075 (FIGS. 10 AND 11)

1. Open the master switch.

2. Make sure no wiring is projecting outward from the terminal strip. Tuck wiring in against the back of the cabinet or subbase so it does not interfere with the contacts.

3. Grasp the handle of the R4075 chassis and insert the 2 ears (at the top and bottom along the left side) into the slots at the top and bottom of the terminal strip (Fig. 10).

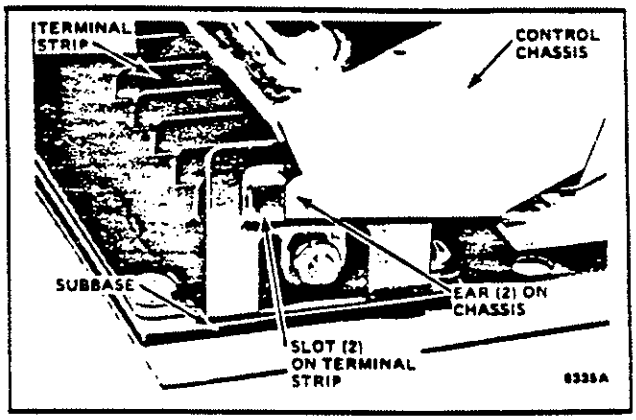


FIG. 10—INSERTING EARS (ON R4075) INTO SLOTS AT TOP AND BOTTOM OF TERMINAL STRIP.

4. Swing the chassis inward until the knife-blade contacts on the control engage the spring connectors alongside the terminal strip. Push in until the contacts are fully engaged.

5. Insert the chassis retaining screw (Fig. 11) into the threaded stud on the subbase or in the cabinet, and tighten it securely.

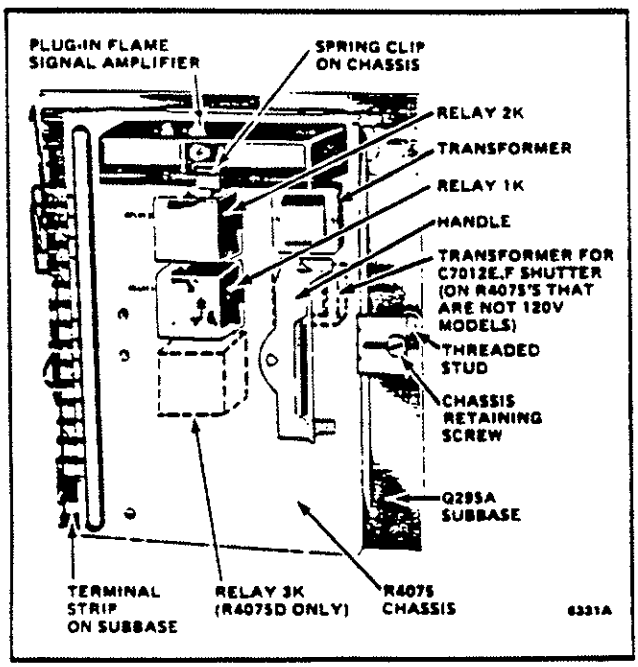


FIG. 11—COMPONENTS OF THE R4075C AND D (SHOWN INSTALLED ON A Q295A SUBBASE).

INSTALLING A PLUG-IN FLAME SIGNAL AMPLIFIER (FIG. 12)

1. Make sure the amplifier nameplate is on the outside. Then align the circuit board with the keyed receptacle at the top of the R4075 chassis.

2. Push in the amplifier until the circuit board is fully inserted into the receptacle.

3. Make sure the spring clip on the R4075 chassis fits over the amplifier and that the amplifier is firmly in place.

NOTE: For further information about self-checking amplifiers, refer to the R7247B,C instruction sheet, form 60-2358, or to the R7248B instruction sheet, form 60-2357, packed with the amplifier.

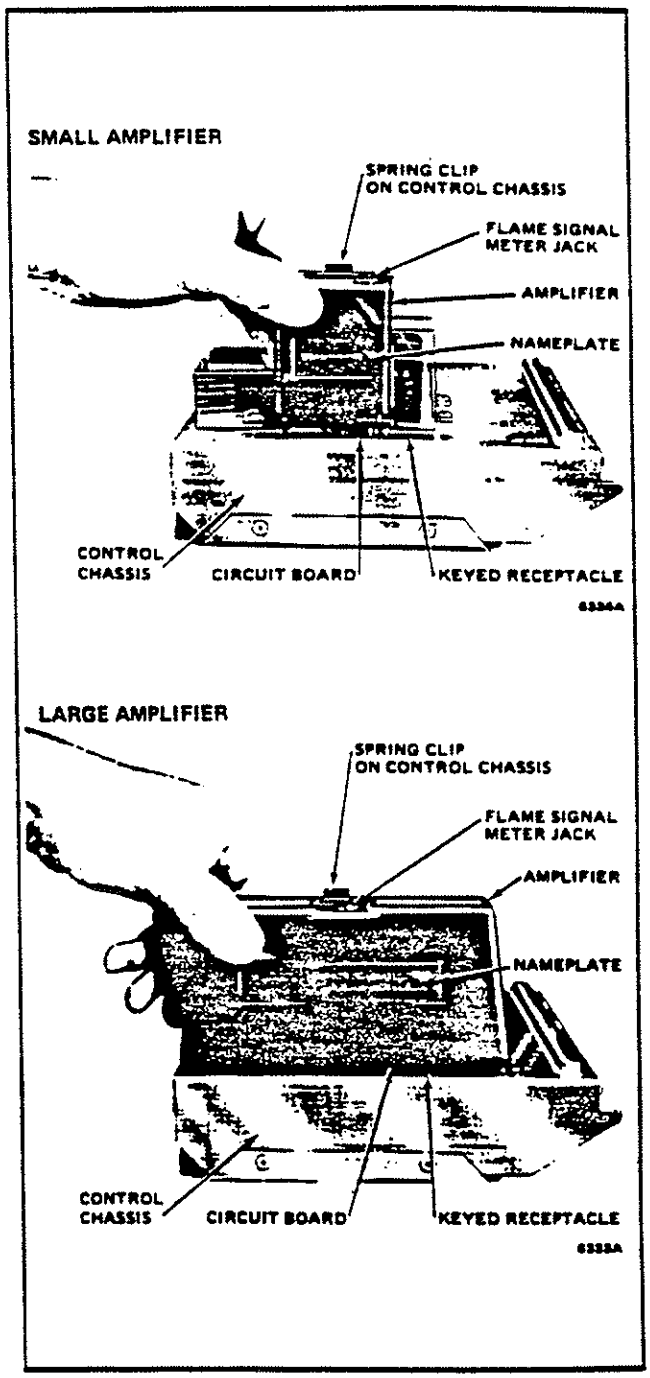


FIG. 12—INSTALLING A PLUG-IN FLAME SIGNAL AMPLIFIER.

CHECKOUT

WARNING

Do not allow fuel to accumulate in the combustion chamber. If fuel is allowed to enter the chamber for longer than a few seconds without igniting, an explosive mixture could result. It is recommended that you limit the trial for pilot to 10 seconds, and limit the attempt to light the main burner to 5 seconds. In any case, do not exceed the normal lightoff time specified by the burner manufacturer; close the manual fuel shutoff valves if the flame is not burning at the end of the specified time.

CAUTION

1. Use utmost care while testing the R4075; line voltage is present on most terminals when power is on.
2. Open the master switch before removing the R4075 from the cabinet or subbase, before reinstalling the R4075, before installing or removing any jumpers, and before making any adjustments.
3. Make sure all manual fuel shutoff valves are closed before starting the Initial Lightoff Check and the Pilot Turndown Test.
4. If low fuel pressure limits are bypassed for any of the tests, make sure you remove the jumpers from these limits before putting the system into service.
5. Do not put the system into service until you have satisfactorily completed all applicable tests described in this Checkout section and any others required by the burner manufacturer.

IMPORTANT

a. If the system fails to perform properly, note the point at which trouble occurs and refer to the TROUBLESHOOTING section.
b. Repeat ALL required Checkout tests after all adjustments have been made. ALL tests must be satisfied with the flame detector(s) in its FINAL position(s).

EQUIPMENT REQUIRED

1. Voltmeter (Honeywell W136A or equivalent)–with 0 to 300V ac scale.
2. Microammeter (Honeywell W136A or equivalent)–with 0 to 25 microamp range and SPL scale with damping.
3. Meter connector plug–Part No. 117053 or equivalent.
4. Jumper wires (2)–No. 14 wire, insulated, 12 inches [304.8 mm] long, with alligator clips at both ends.
5. Watch or clock–with second hand.
6. Manometer (or pressure gauge)–to measure pilot gas pressure.
7. Thermometer or thermocouple–to measure temperature at the flame detector(s).
8. Orifice plates (aperture discs) or filters–as necessary to adjust sensitivity of flame detector(s).

CHECKOUT SUMMARY

The following list summarizes the checkout tests required for each type of installation. Instructions for each test are included in this section; also consult the burner installation instructions.

- Preliminary Inspection–all installations.
- Flame Signal Measurement–all installations.
- Initial Lightoff Check for Proved Pilot–all installations using a pilot.
- Initial Lightoff Check for Direct Spark Ignition of Oil–oil burners not using a pilot.
- Pilot Turndown Test–all installations using a pilot.
- Ignition Interference Test–all installations using flame rods.
- Hot Refractory Saturation Test–all installations using infrared (lead sulfide) flame detectors.
- Hot Refractory Hold-in Test–all installations using rectifying photocells or infrared (lead sulfide) flame detectors.
- Ultraviolet Response Tests–all installations using ultraviolet (Purple Peeper or Minipeeper) flame detectors.
- Flame Signal with Hot Combustion Chamber–all installations.
- Safety Shutdown Tests–all installations.

Refer to Fig. 1, 2, or 3 for terminal locations, and to Fig. 11 for locations of component parts.

PRELIMINARY INSPECTION (ALL INSTALLATIONS)

Perform this inspection to avoid common problems. Make certain that:

1. Wiring connections are correct and all terminal screws are tight.
2. Flame detector(s) is clean, and it is installed and positioned properly. Consult the appropriate instruction sheet.
3. Correct combination of amplifier and flame detector(s) is used. Refer to Table 1 in the SPECIFICATIONS section.
4. Voltage rating of the flame detector(s) matches the power supply of the R4075.
5. Spring clip on R4075 chassis is holding the plug-in flame signal amplifier securely in the receptacle.
6. Burner is completely installed and ready to fire (consult burner manufacturer's instructions); fuel lines are purged of air.
7. Combustion chamber and flues are clear of fuel and fuel vapor.
8. Power is connected to the system disconnect switch (master switch).
9. All limits and interlocks are reset.

FLAME SIGNAL MEASUREMENT—FIG. 13 AND TABLE III

(ALL INSTALLATIONS)

Measure the flame signal at the appropriate times defined in the following checkout tests. Read the flame signal in microamps at the meter jack on the plug-in flame signal amplifier.

1. Use a Honeywell W136A Test Meter. (If a W136A is not available, a microammeter with a 0 to 25 microamp dc range may be used.)

2. Set the selector switch on the test meter to:

   25μA—for all standard amplifiers (R7247A, R7248A, and R7249A) or for an R7248B Dynamic Ampli-Check Infrared Amplifier,

   OR

   SPL—for an R7247B or C or an R7476A Dynamic Self Check Amplifier. (If the test meter is not a W136A, shunt the 0 to 25 microamp dc range with a 50 microfarad capacitor.)

3. Use a 117053 Meter Connector Plug. (It may be ordered separately.) Connect its RED spade tip to the RED (+) meter lead and its BLACK spade tip to the BLACK (−) meter lead.

4. Insert the plug into the flame signal meter jack and allow a few seconds for the meter reading to stabilize.

5. Read the average *stable* current. For an R7247B or C or an R7476A Dynamic Self Check Amplifier, disregard the peaks due to self-checking operation. The red flame-indicating lamp on a self-checking amplifier should blink—

   —about 2-1/2 to 4 times a second on an R7247B.

   —about 1 to 2 times a second on an R7247C or R7476A.

   —at the same rate that the flame is flickering (may be as high as 20 times a second) on an R7248B.

   If the lamp is ON or OFF continuously while reading the flame signal, replace the amplifier.

6. The meter reading must be as specified in Table III after all tests have been completed and all adjustments have been made.

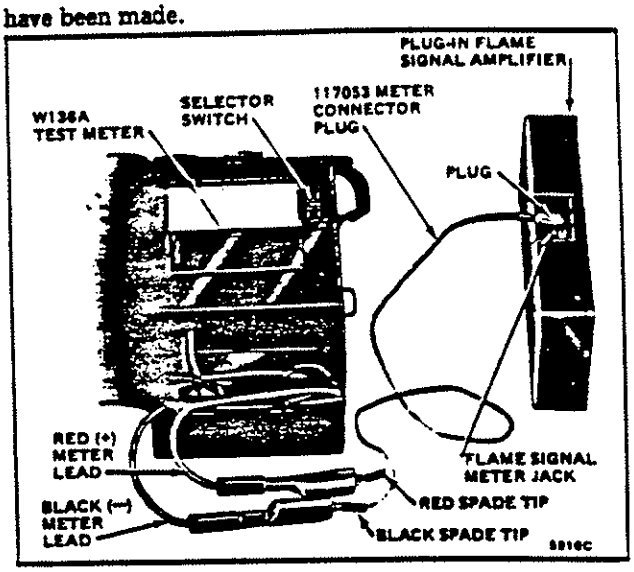


FIG. 13—MEASURING THE FLAME SIGNAL.

If the signal is unstable, or less than the minimum acceptable current, check the flame detector installation and circuitry.

1. Check the supply voltage at the master switch.
2. Check the detector wiring for defects, including—
   —wrong type or size of wire.
   —deteriorated wire.
   —open circuits.
   —short circuits.
   —leakage paths caused by moisture, soot, or accumulated dirt.

TABLE III—FLAME SIGNAL

FLAME DETECTOR	FLAME SIGNAL AMPLIFIER	MINIMUM ACCEPTABLE STEADY CURRENT[a] (MICROAMPERES)	MAXIMUM CURRENT EXPECTED (MICROAMPERES)
RECTIFYING FLAME ROD	R7247A (GREEN)	2	5
	R7247B (GREEN: SELF CHECK)	1-1/4	2-1/2
RECTIFYING PHOTOCELL	R7247A (GREEN)	2	5[b]
	R7247B (GREEN: SELF CHECK)[c]	1-1/4	2-1/2
C7012A,C ULTRAVIOLET (PURPLE PEEPER)	R7247A (GREEN)	2	6
	R7247B (GREEN: SELF CHECK)[c]	2	4
C7012E,F ULTRAVIOLET (PURPLE PEEPER)[d]	R7247C (GREEN: SELF CHECK)	2[d]	7
C7015A INFRARED (LEAD SULFIDE CELL)	R7248A (RED)	2-1/4[e]	5
	R7248B (RED: AMPLI-CHECK)	3-1/2[e]	5
C7027A, C7035A, OR C7044A ULTRAVIOLET (MINIPEEPER)	R7249A (PURPLE)	3-1/2	7-1/2
C7076A ADJUSTABLE SENSITIVITY ULTRAVIOLET[d]	R7476A (BLUE: SELF CHECK)	2-1/2	5-1/2

[a] THIS MINIMUM OR STRONGER SIGNAL SHOULD EASILY BE OBTAINED IF THE DETECTOR IS CORRECTLY INSTALLED AND POSITIONED TO SENSE FLAME PROPERLY. THIS CURRENT MUST BE OBTAINED BEFORE COMPLETING CHECKOUT.

[b] DO NOT PERMIT SIGNAL TO EXCEED 5 MICROAMPERES AS IT WOULD SHORTEN PHOTOCELL LIFE. REDUCE SIGNAL BY USE OF ORIFICE PLATES (APERTURE DISCS) OR FILTERS AS NECESSARY.

[c] IF USING A RECTIFYING PHOTOCELL OR A C7012A OR C WITH AN R7247B, THE CIRCUITRY TESTS ONLY THE FLAME SIGNAL AMPLIFIER DURING BURNER OPERATION AND SHUTS DOWN THE BURNER IF THE AMPLIFIER FAILS.

[d] SHUTTER OPERATION OF THE C7012E OR F OR C7076A CAUSES FLUCTUATIONS IN THE CURRENT READING. READ THE AVERAGE STABLE CURRENT, DISREGARDING THE PEAKS.

[e] THE LEAD SULFIDE CELLS ARE AVAILABLE IN 4 RANGES OF SENSITIVITY: 104662A (RED), LOWEST; 104662B (YELLOW), MEDIUM; 104662C (GREEN), HIGH; 104662D (WHITE), HIGHEST SENSITIVITY. IF A SUFFICIENTLY STRONG SIGNAL CANNOT OTHERWISE BE OBTAINED, TRY A DIFFERENT CELL OF THE SAME RANGE. IF NECESSARY, SUBSTITUTE A CELL OF HIGHER SENSITIVITY.

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3. For a flame rod, make sure–
   –there is enough ground area.
   –the flame rod is located in the flame properly.
   –temperature at the flame rod insulator is no greater than 500 F [260 C].
   –ignition interference is not present (see Ignition Interference Test in this section).

4. For all other detectors, clean the detector lens, filter, viewing window, and sighting pipe (as applicable).

5. For a C7012A,C,E, or F Purple Peeper Ultraviolet Flame Detector, replace the 113236 and 115330 Electron Tubes (unless the detector is a solid state model).

6. Check that the temperature at the detector does not exceed its maximum rated temperature.

7. Make sure that the flame adjustment is not too lean.

8. Make sure the detector is sighting the flame properly.

9. If necessary, resight or reposition the detector.

If you cannot obtain proper operation, replace the plug-in amplifier. If you still cannot obtain proper operation, replace the flame detector.

INITIAL LIGHTOFF CHECK FOR PROVED PILOT

(ALL INSTALLATIONS USING A PILOT)

Perform this check on all installations using a pilot. It should immediately follow the preliminary inspection.

NOTE: Low fuel pressure limits, if used, *could be open*. If so, bypass them with jumpers during this check.

1. Open the master switch.

2. Make sure the manual main fuel shutoff valve(s) is closed. Open the manual pilot shutoff valve.

3. Close the master switch and the alarm silencing switch (if used). The alarm will be energized.

4. Start the system by pushing in the START button and holding it in. The alarm will be de-energized.

5. Spark should occur and the pilot should ignite. If it ignites, release the START button and proceed to step 8.

6. If the pilot flame is not established in 10 seconds, release the START button.

7. Wait approximately 1 minute and push in the START button again. If the pilot still does not ignite within 10 seconds, release the START button. Make the following ignition/pilot adjustments.

   a. *Open the master switch.*
   b. Jumper terminal 6 on the terminal strip directly to the ignition terminal at the START switch.
   c. Close the master switch to energize the ignition transformer only.
   d. If the ignition spark is not strong and continuous, *open the master switch* and adjust the ignition electrode spark gap setting to the manufacturer's recommendation. Make sure the ignition electrodes are clean. Then close the master switch and observe the spark.
   e. Once a continuous spark is obtained, push in the START button to energize both the ignition transformer and the pilot valve.
   f. If the pilot does not ignite and if the ignition spark is still continuous, hold in the START button and adjust the pilot gas pressure regulator until a pilot is established.

      NOTE: This step requires 2 people–one to hold in the START button and one to adjust the regulator.

   g. When the pilot ignites properly and stays ignited, *open the master switch and remove the jumper* from terminal 6 to the ignition.
   h. Close the master switch.

8. When the pilot ignites, release the START button and measure the flame signal. If necessary, adjust the flame or detector to give a proper flame signal.

9. Push the STOP button to shut off the pilot, and then push the START button to restart the system. When the pilot ignites, release the START button and recheck the pilot flame signal.

10. Make sure the automatic main fuel valve(s) opens; then *smoothly* open the manual main fuel shutoff valve (and manually opened safety shutoff valve, if used) and watch for main burner flame ignition. When the main burner flame is established, proceed to step 16.

NOTE: This step requires 2 people–one to open the manual valve(s) and one to watch for ignition.

11. If the main burner flame is not established within 5 seconds, or within the normal lightoff time specified by the burner manufacturer, *close the manual main fuel shutoff valve(s) and open the master switch.*

12. Purge the combustion chamber to remove any unburned fuel. Check all burner adjustments.

13. Wait about 3 minutes. Close the master switch, push in the START button, ignite the pilot, and release the START button. *Smoothly* open the manual main fuel shutoff valve(s) and try lightoff again. The first attempt may have been required to purge the lines and bring sufficient fuel to the burner.

NOTE: This step requires 2 people–one to open the manual valve(s) and one to watch for ignition.

14. If the main burner flame is not ignited within 5 seconds, *close the manual main fuel shutoff valve(s) and open the master switch.*

15. Repeat steps 12 through 14 to establish the main burner flame.

16. When the main burner flame is established, make burner adjustments for flame stability and input rating.

17. Shut down the system by pushing in the STOP button. *Make sure the pilot and main burner flames go out and all automatic fuel valves close. If used, remove the bypass jumpers from the low fuel pressure limits.*

18. Restart the system by pushing in the START button. Observe that the pilot and main burner flames are established within the normal lightoff time specified by the burner manufacturer. Then release the START button.

19. Measure the flame signal. Continue to check for the proper signal (Table III) into the run period. Check the signal at both high and low firing rate positions and while modulating, if applicable.

20. Run the burner through another sequence, observing the flame signal for–
   –pilot alone (unless using direct spark ignition),
   –pilot and main burner flame together, and
   –main burner flame alone (unless monitoring intermittent or continuous pilot).

Also observe the time to light the main burner.

21. Make sure all readings are in the required ranges before proceeding.

INITIAL LIGHTOFF CHECK FOR DIRECT SPARK IGNITION OF OIL (OIL BURNERS NOT USING A PILOT)

This check applies for oil burners not using a pilot. It should immediately follow the preliminary inspection.

NOTE: Low fuel pressure limits, if used, *could be open.* If so, bypass them with jumpers during this check.

1. Open the master switch.
2. Complete the normal "ready-to-fire" checkout of the oil supply and equipment as recommended by the burner manufacturer.
3. Close all manual fuel shutoff valves. Check that the automatic fuel valves are closed. *Make sure oil is not entering the combustion chamber.*
4. Close the master switch and the alarm silencing switch (if used). The alarm will be energized.
5. Start the system by pushing in the START button and holding it in. The alarm will be de-energized.
6. Watch for ignition spark and listen for the click of the 1st stage oil solenoid. If spark occurs, release the START button and proceed to step 8.
7. If ignition spark does not occur, release the START button. Adjust the ignition electrodes as follows:
   a. *Open the master switch.*
   b. Jumper terminal 6 on the terminal strip directly to the ignition terminal at the START switch.
   c. Close the master switch to energize the ignition transformer only.
   d. If the ignition spark is not strong and continuous, *open the master switch* and adjust the ignition electrode spark gap setting to the manufacturer's recommendation. Make sure the ignition electrodes are clean. Then close the master switch and observe the spark.
   e. Once a continuous spark is obtained, *open the master switch* and remove the jumper from terminal 6 to the ignition.
   f. Close the master switch.
8. Push in the START button to obtain ignition spark. Hold in the START button and *smoothly* open the manual 1st stage shutoff valve(s).

NOTE: This step requires 2 people—one to hold in the START button and one to open the manual valve(s).

9. Watch for the burner flame to be established. If it is, release the START button and proceed to step 15.
10. If the burner flame is not established within 5 seconds, or within the normal lightoff time specified by the burner manufacturer, release the START button, *close the manual shutoff valve(s), and open the master switch.*
11. Purge the combustion chamber to remove any unburned oil; then check all burner adjustments.
12. Wait about 3 minutes. Close the master switch and push in the START button to energize the ignition. Then *smoothly* open the manual 1st stage shutoff valve(s) and try lightoff again. The first attempt may have been required to purge the lines and bring sufficient oil to the burner.

NOTE: This step requires 2 people—one to hold in the START button and one to open the manual valve(s).

13. If the burner flame is not established within 5 seconds, release the START button, *close the manual shutoff valve(s), and open the master switch.*
14. If necessary, repeat steps 11 through 13 to establish the burner flame. When it is, release the START button and proceed to step 15.
15. When the 1st stage burner flame is established, make burner adjustments for flame stability and input rating. *If a 2nd stage is used, make sure the automatic 2nd stage oil valve has opened.*
16. Shut down the system by pushing in the STOP button. *Make sure the burner flame goes out and all automatic oil valves close. If used, remove the bypass jumpers from the low fuel pressure limits.*
17. *If a 2nd stage is used,* check the lightoff as follows. Otherwise proceed to step 18.
   a. Open the manual 2nd stage oil valve.
   b. Restart the system by pushing in the START button.
   c. When the 1st stage burner flame is established, watch for the automatic 2nd stage oil valve(s) to open. Observe that the 2nd stage lights off properly.

      NOTE: This step requires 2 people—one to hold in the START button and one to watch for lightoff of the 2nd stage.

   d. Release the START button.
   e. Make burner adjustments for flame stability and input rating.
   f. Shut down the system by pushing in the STOP button. *Make sure the burner flames go out and all automatic oil valves close.*
   g. Proceed to step 18.
18. Restart the system by pushing in the START button. Observe that the burner flame(s) is established within the normal lightoff time specified by the burner manufacturer. Then release the START button.
19. Measure the flame signal. Continue to check for the proper signal (Table III) into the run period. Check the signal at both high and low firing rate positions and while modulating, if applicable. Any pulsating or unsteady readings will require further adjustments.
20. Make sure all readings are in the required ranges before proceeding.

PILOT TURNDOWN TEST (ALL INSTALLATIONS USING A PILOT)

Perform this check on all installations using a pilot. It should immediately follow the initial lightoff check. The purpose of this test is to ensure that the main burner can be lighted by the smallest pilot flame that will hold in the 2K (flame) relay. Clean the flame detector(s) to ensure that it will detect the smallest acceptable pilot flame.

NOTE: Low fuel pressure limits, if used, *could be open.* If so, bypass them with jumpers during this test.

1. Open the master switch.
2. Close the manual main fuel shutoff valve(s).
3. Connect a manometer (or pressure gauge) to measure pilot gas pressure during the turndown test.
4. Open the manual pilot shutoff valve.
5. Close the master switch and the alarm silencing switch (if used). The alarm will be energized.
6. Start the system by pushing in the START button and holding it in. The alarm will be de-energized. When the pilot ignites, relay 2K should pull in. Release the START button.

7. Turn the pilot pressure down very slowly, reading the manometer (or gauge) as it drops. Stop instantly when relay 2K drops out. Note the pressure at dropout point. The pilot is at the turndown position.

8. Push in the START button and hold it in. Turn up the pilot pressure until the pilot ignites and relay 2K pulls in. Then release the START button.

NOTE: This step requires 2 people—one to hold in the START button and one to adjust the pilot pressure.

9. Repeat step 7 to verify the pilot gas pressure reading at the exact point of relay 2K dropout.

10. Repeat step 8 to pull in 2K, and then slowly turn down the pilot pressure to obtain a pressure reading just above the dropout point.

11. Make sure the automatic main fuel valve(s) opens; then *smoothly* open the manual main fuel shutoff valve (and manually opened safety shutoff valve, if used) and watch for main burner flame ignition. If the main burner flame is established, proceed to step 18.

NOTE: This step requires 2 people—one to open the manual valve(s) and one to watch for ignition.

12. If the main burner flame is not established within 5 seconds, or within the normal lightoff time specified by the burner manufacturer, *close the manual main fuel shutoff valve(s) and open the master switch.*

13. Purge the combustion chamber to remove any unburned fuel. Check all burner adjustments.

14. Wait about 3 minutes. Close the master switch, push in the START button, ignite the pilot, and release the START button. Repeat steps 11 and 12 (try lightoff once more).

15. If the second attempt is unsuccessful, adjust the flame detector position so that a larger pilot is required to hold in flame relay 2K. This may require relocating the flame detector to sense further out on the pilot flame, or adding an orifice plate.

16. Measure the pilot flame signal after adjusting the flame detector to make sure it is stable and above the minimum (see Table III).

17. Repeat steps 6 through 16 until the main burner positively lights with the pilot flame just holding in flame relay 2K.

18. Shut down the system by pushing in the STOP button. Repeat the lightoff of the main burner several times (steps 6 through 11) with the pilot at turndown.

19. When the main burner lights reliably with the pilot at turndown, disconnect the manometer (or gauge) and turn the pilot up to normal. *If used, remove the bypass jumpers from the low fuel pressure limits.*

20. Run the system through another cycle to check for normal operation.

IGNITION INTERFERENCE TEST
(ALL FLAME RODS)

Test to make certain that a false signal from a spark ignition system is not superimposed on the flame signal.

Ignition interference can subtract from (decrease) or add to (increase) the flame signal. If it decreases the flame signal enough, it will cause safety shutdown (relay 2K will not pull in and the R4075 will act as though the pilot has not been ignited). If it increases the flame signal, it could cause relay 2K to pull in when the true flame signal is below the minimum acceptable value.

TEST

Start the burner and measure the flame signal with both ignition and pilot on (hold in the START button), and then with the pilot only (release the START button). Any significant difference (greater than 1/2 microamp) indicates ignition interference.

TO ELIMINATE IGNITION INTERFERENCE:

1. Make sure there is enough ground area.
2. Be sure the ignition electrode and the flame rod are on opposite sides of the ground area.
3. Check for correct spacing on the ignition electrode:

   6,000 volt systems—1/16 to 3/32 inch [1.6 to 2.4 millimetres].

   10,000 volt systems—1/8 inch [3.2 millimetres].
4. Make sure the leadwires from the flame rod and ignition electrode are not too close together anywhere.
5. Replace any deteriorated leadwires.
6. If the problem cannot be eliminated, you may have to change to an ultraviolet flame detection system.

HOT REFRACTORY SATURATION TEST
(ALL INFRARED DETECTORS)

Test to make certain that radiation from hot refractory does not mask the flickering radiation of the flame itself.

Start the burner and monitor the flame signal during the warmup period. A decrease in signal strength as the refractory heats up indicates hot refractory saturation. If saturation is extreme, the flame relay 2K will drop out and the system will shut down as though a flame failure has occurred.

If hot refractory saturation occurs, the condition must be corrected. Add an orifice plate ahead of the cell to restrict the viewing area. If this doesn't work, resight the detector at a cooler, more distant background. You can also try lengthening the sighting pipe or decreasing the pipe size (diameter). Continue adjustments until hot refractory saturation is eliminated.

HOT REFRACTORY HOLD-IN TEST
(RECTIFYING PHOTOCELLS OR INFRARED DETECTORS)

Test to make certain that hot refractory will not cause flame relay 2K to stay pulled-in after the burner flame goes out. This condition would delay response to flame failure and also would prevent a system restart as long as hot refractory is detected.

First check the plug-in flame signal amplifier by initiating a burner cycle. Terminate the firing cycle while the refractory is at a low temperature by pushing in the STOP button. Measure the time it takes for the flame relay 2K to drop out after the flame goes out. (Watch or listen to the flame relay to determine when it drops out.) If the flame relay fails to drop out within 4 seconds, open the master switch and replace the amplifier.

To check rectifying photocells for hot refractory hold-in, operate the burner until the refractory reaches its maximum temperature. Then terminate the firing cycle by pushing in the STOP button. (Do not open the master switch.) Visually observe when the burner flame goes out. After the flame goes out, measure the time it takes for the flame relay 2K to drop out. (Watch or listen to the flame relay to determine when it drops out.)

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If the flame relay fails to drop out within 4 seconds, the photocell is sensing hot refractory. This condition must be corrected as described in the last paragraph of this test.

Infrared (lead sulfide) detectors can respond to infrared rays emitted by a hot refractory, even when the refractory has visibly ceased to glow. Infrared radiation from a hot refractory is steady, whereas radiation from a flame has a flickering characteristic. The infrared detection system responds only to a flickering infrared radiation; it can reject a steady signal from hot refractory. The refractory's steady signal can be made to fluctuate if it is reflected, bent, or blocked by smoke or fuel mist within the combustion chamber. Care must be taken when applying an infrared system to ensure its response to flame only.

To check infrared (lead sulfide) detectors for hot refractory hold-in, operate the burner until the refractory reaches its maximum temperature. If the installation has a multifuel burner, burn the fuel most likely to reflect, bend, or obscure the hot refractory's steady infrared radiation. (Burn solids instead of liquids, or liquids instead of gases.) When the maximum refractory temperature is reached, close *all* manual fuel shutoff valves, or open the electrical circuits of *all* automatic fuel valves. Visually observe when the burner flame goes out. After the flame goes out, measure the time it takes for the flame relay 2K to drop out. (Watch or listen to the flame relay to determine when it drops out.) If the flame relay fails to drop out within 4 seconds, the infrared detector is sensing hot refractory. Immediately terminate the firing cycle by pushing in the STOP button. (Do not open the master switch.)

NOTE: Some burners continue to purge their oil lines between the valve(s) and nozzle(s) even though the fuel valve(s) is closed. Termination of the firing cycle (instead of opening the master switch) will allow purging of the combustion chamber, if available. This will reduce a buildup of fuel vapors in the combustion chamber caused by oil line purging.

If the detector is sensing hot refractory, the condition must be corrected. Add an orifice plate ahead of the cell to restrict the viewing area of the detector. If this doesn't work, resight the detector at a cooler, more distant part of the combustion chamber. While resighting the detector, keep in mind that it must also sight the flame properly. For an infrared detector, you can also try lengthening the sighting pipe or decreasing the pipe size (diameter). Refer to the C7015A instruction sheet, form 60-2306, for detailed instructions. Continue adjustments until hot refractory hold-in is eliminated.

ULTRAVIOLET RESPONSE TESTS
(ALL ULTRAVIOLET DETECTORS)
IGNITION SPARK RESPONSE TEST

Test to make certain that ignition spark is not actuating flame relay 2K.

1. Close the pilot and main burner manual shutoff valves.

2. Push in the START button to energize the ignition transformer. Ignition spark should occur, but relay 2K must not pull in. The flame signal should not be more than 1/4 microamp.

3. If relay 2K does pull in, resight the detector farther out from the spark, or away from possible reflection. It may be necessary to construct a barrier to block the ignition spark from the detector's view. Continue adjustments until the flame signal due to ignition spark is less than 1/4 microamp.

NOTE: Honeywell's Q624A Solid State Spark Generator will prevent detection of ignition spark when properly applied with flame detection systems using C7027, C7035, or C7044 Minipeeper Ultraviolet Flame Detectors. The Q624A is for use only with gas pilots.

RESPONSE TO OTHER ULTRAVIOLET SOURCES

Some sources of artificial light produce small amounts of ultraviolet radiation. Under certain conditions, an ultraviolet detector will respond to them as if it is sensing a flame. DO NOT USE AN ARTIFICIAL LIGHT SOURCE TO CHECK THE RESPONSE OF AN ULTRAVIOLET DETECTOR. To check for proper detector operation, flame failure response tests should be conducted under all operating conditions.

FLAME SIGNAL WITH HOT COMBUSTION CHAMBER
(ALL INSTALLATIONS)

With all initial startup tests and burner adjustments completed, operate the burner until the combustion chamber is at maximum expected temperature. (Observe the burner manufacturer's warmup instructions.) Recycle the burner under these hot conditions and measure the flame signal. Check the pilot alone, the main burner flame alone, and both together (unless monitoring only the pilot flame when using an intermittent or continuous pilot, or only the 1st stage oil flame when using direct spark ignition). Check the signal at both high and low firing rate positions and while modulating, if applicable.

Also check the flame failure response time. Push in the STOP button, and observe the time it takes flame relay 2K to drop out after the burner flame goes out. (2K should drop out within 4 seconds.)

If the flame signal is too low or unsteady, check the flame detector temperature. Relocate the detector if the temperature is too high. If necessary, realign the sighting to obtain the proper signal and response time. If the response time is still too slow, replace the plug-in flame signal amplifier. If the detector is relocated or resighted, or the amplifier is replaced, repeat all required checkout tests.

Repeat ALL required Checkout tests after all adjustments have been completed. ALL tests must be satisfied with the flame detector(s) in its FINAL position.

SAFETY SHUTDOWN TESTS
(ALL INSTALLATIONS)

Perform these tests at the end of Checkout after all other tests have been completed.

Safety shutdown should occur upon (1) failure to ignite the pilot (or 1st stage oil burner if using direct spark ignition of oil), (2) failure to light the main burner *(only if external circuitry has been added to obtain an interrupted pilot)*, and (3) loss of flame during the run period.

On safety shutdown, the pilot and main fuel valve(s) are de-energized. If used, the external alarm is energized. The START button must be manually pressed to restart the system.

1. *Failure to Ignite Pilot* (or 1st stage oil burner if using direct spark ignition of oil)
   a. Close all manual fuel shutoff valves (including the pilot valve or 1st stage oil valve, and the main burner shutoff valve).
   b. Close the master switch and the alarm silencing switch (if used). The external alarm (if used) will be energized.
   c. Start the system by pushing in the START button; relay 1K will pull in and the external alarm will be de-energized.
   d. Ignition spark should occur, and the automatic pilot valve (or 1st stage oil valve) should be energized, but the pilot (or 1st stage oil burner) cannot ignite. No flame is detected so relay 2K cannot pull in.
   e. Release the START button. The ignition spark will go out and the automatic pilot valve (or 1st stage oil valve) will be de-energized.
   f. Relay 1K will drop out and the external alarm (if used) will be energized. The alarm will stay on until the alarm silencing switch or the master switch is opened.
2. *Failure to Light Main Burner* (unless flame detector is monitoring intermittent or continuous pilot, or 1st stage oil flame)
   NOTE: *This test applies to a system with an interrupted pilot, which can be obtained only by the addition of external circuitry.*
   a. Open the manual pilot shutoff valve (or manual 1st stage oil valve); leave the manual main fuel shutoff valve(s) closed.
   b. Close the master switch and the alarm silencing switch (if used). The external alarm will be energized.
   c. Start the system by pushing in the START button; relay 1K will pull in and the external alarm will be de-energized.
   d. The pilot (or 1st stage oil burner) should ignite and pull in relay 2K, but the main burner cannot light.
   e. Release the START button. The ignition spark will go out.
   f. When the pilot (or 1st stage oil flame) goes out (interrupted by external circuitry), relay 2K should drop out within 4 seconds.
   g. Relay 1K will drop out and the external alarm will be energized. The alarm will stay on until the alarm silencing switch or the master switch is opened.
3. *Loss of Flame During the Run Period*
   a. Open the manual main fuel shutoff valve(s); the manual pilot shutoff valve (or 1st stage oil valve) must also be open.
   b. Close the master switch and the alarm silencing switch (if used). The external alarm will be energized.
   c. Start the system by pushing in the START button; relay 1K will pull in and the external alarm will be de-energized.
   d. The pilot (or 1st stage oil valve) and the main burner should ignite normally.
   e. Release the START button. The ignition spark will go out.
   f. Close the manual main fuel shutoff valve(s) to extinguish the main burner flame. (If monitoring intermittent or continuous pilot, or 1st stage oil flame, also close the manual pilot or 1st stage fuel valve.)
   g. Relay 2K should drop out within 4 seconds after the flame goes out.
   h. Relay 1K will drop out and the external alarm will be energized. The alarm will stay on until the alarm silencing switch or the master switch is opened.

IMPORTANT

If the system fails to shut down on any of these tests, replace the R4075 and rerun all Checkout tests from the beginning.

CAUTION:

If low fuel pressure limits have been bypassed for any of the tests in this Checkout section, make sure you remove the jumpers from these limits before putting the system into service.

TROUBLESHOOTING

CAUTION:

1. Close *all* manual fuel shutoff valves as soon as trouble occurs.
2. Use utmost care while troubleshooting the R4075; line voltage is present on most terminals when power is on.
3. Open the master switch before removing the R4075 from the cabinet or subbase, before reinstalling it, before making any adjustments, and before replacing any devices.
4. Replace all external devices not operating properly. Do not bypass external devices.

EQUIPMENT REQUIRED

1. Voltmeter (Honeywell W136A or equivalent)—with 0 to 300V ac scale.
2. Microammeter (Honeywell W136A or equivalent)—with 0 to 25 microamp range and SPL scale with damping.
3. Meter connector plug – Part No. 117053 or equivalent.
4. 123514A Flame Simulator—for use with R7247A Rectification Flame Signal Amplifiers (green).
5. 123514B Flame Simulator—for use with R7249A Ultraviolet Flame Signal Amplifiers (purple).
6. Jumper wires (2)—No. 14 wire, insulated, 12 inches [304.8 mm] long, with alligator clips at both ends.

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7. Shorting wire–10 inch (254 mm) long, insulated, with 3/4 inch (19.1 mm) of insulation removed from each end; for simulating flame with an R7248A Infrared Flame Signal Amplifier (red).

8. Watch or clock–with second hand.

9. Manometer (or pressure gauge)–to measure pilot gas pressure.

10. Thermometer or thermocouple–to measure temperature at the flame detector.

11. Orifice plates (aperture discs) or filters–as necessary to adjust sensitivity of flame detector(s).

TROUBLESHOOTING PROCEDURES

Refer to the normal operation summary on page 5 for an R4075C, or on page 9 for an R4075D. Observe the operation carefully to determine at what point the trouble occurs. Then refer to Table IV and follow the procedure outlined.

Refer to Fig. 1, 2, or 3 for location of terminals, Fig. 11 for location of components, and Fig. 15 for location of relay contacts.

IMPORTANT

a. Before proceeding, perform the Static Checkout (Table II in the INSTALLATION section) to determine if any external devices are operating improperly. Replace defective devices and wiring as required.

b. If, after completing an applicable troubleshooting procedure, proper operation still cannot be obtained, replace the R4075 (except the amplifier, unless noted).

c. At the completion of troubleshooting, be sure to perform *all* tests in the CHECKOUT section of this sheet.

TABLE IV–TROUBLESHOOTING CHART

SYMPTOM	TEST	POSSIBLE CAUSE/CORRECTION
A. 1. ALARM (IF USED) DOES NOT GO ON WHEN ALARM SILENCING SWITCH (IF USED) IS CLOSED. (NOT APPLICABLE TO 220V, 50 HZ MODELS.)	1. Check for line voltage between terminal 8 and terminal 2A (120V model), 2B (208V model), or 2C (240V model).	1. If none is detected, check that 1K2 is closed. If 1K2 is closed, check external wiring and power supply.
2. If 1K2 is open–	2. Check for line voltage between terminal 3 and terminal 2A (120V model), 2B (208V model), or 2C (240V model).	2. If voltage is detected, make sure START switch is open. Replace if defective.
3. If no voltage is detected at terminal 3 and 1K2 stays open–	—	3. Replace the R4075.
B. 1. SYSTEM WON'T START WHEN "START" BUTTON IS HELD IN. ALARM (IF USED) STAYS ON (EXCEPT FOR A 220V, 50 HZ MODEL).	1. Check that relay 1K has pulled in.	1. If 1K has pulled in but 1K2 has not opened (or closed on a 220V, 50 Hz model), replace the R4075.
2. If 1K has not pulled in–	2. Check for line voltage between terminal 3 and terminal 2A (120V model), 2B (208V model), or 2C (220V or 240V model).	2. If voltage is not detected, make sure START switch, STOP switch, and limits are closed. Replace if defective.
3. If voltage is present at terminal 3–	3. Check that relay 2K has not pulled in.	3. If relay 2K has not pulled in but 2K2 is open, replace the R4075.
4. If relay 2K has pulled in (safe start check)–	4. Proceed to symptom H.	—
C. 1. PILOT (OR 1ST STAGE OIL BURNER) DOES NOT IGNITE WHEN "START" BUTTON IS HELD IN.	1. Check for ignition spark.	1. Make sure START switch, STOP switch, and limits are closed. Replace if defective. Clean ignition electrodes. Replace ignition transformer if defective.
2. If ignition spark is present–	2. Check for line voltage between terminal 3 and terminal 2A (120V model), 2B (208V model), or 2C (220V or 240V model).	2. If voltage is not detected, make sure START switch is closed.
3. If voltage is present at terminal 3–	3. Make sure manual pilot (or 1st stage) shutoff valve is open and fuel lines are not plugged.	3. Make sure automatic pilot valve (or 1st stage oil valve) opens. Replace if not operating properly.
D. 1. PILOT (OR 1ST STAGE OIL BURNER) IGNITES, BUT MAIN BURNER DOES NOT LIGHT.	1. Check that relay 2K has pulled in.	1. If 2K has pulled in, but 2K1 and 2K3 are not closed, replace the R4075.
2. If relay 2K has not pulled in–	2. Perform the Flame Signal Check immediately following this table. *For a continuous pilot application, first make sure the external relay contact 3K1 (4K1 on an R4075D) has pulled in.*	2. Follow instructions in Flame Signal Check.
3. If relay 2K has pulled in–	3. Check that Relay 1K has pulled in (and 3K in the R4075D).	3. If 1K has pulled in, but 1K1 and 1K3 have not closed, replace the R4075. (In the R4075D, if 3K has pulled in, but 3K1 has not closed, replace the R4075D.)
4. If relay 1K (and 3K in the R4075D) have pulled in–	4. Make sure manual main fuel shutoff valve(s) is open and fuel line(s) is not plugged.	4. Make sure automatic main fuel valve(s) opens. Replace if not operating properly.

TABLE IV–TROUBLESHOOTING CHART *(continued)*

SYMPTOM	TEST	POSSIBLE CAUSE/CORRECTION
E. 1. IGNITION SPARK DOES NOT GO OUT WHEN "START" BUTTON IS RELEASED.	1. Check that START button is not stuck.	1. If START switch is open, check wiring and operation of the ignition transformer.
F. 1. SHUTDOWN OCCURS DURING THE RUN PERIOD.	1. Check the limits.	1. If one or more limit has opened, determine the causes and correct the conditions before restarting the burner.
2. If limits are closed–	2. Perform the Flame Signal Check immediately following this table. *If using an infrared flame detector, first do the Hot Refractory Saturation Test in the CHECKOUT section.*	2. Follow instructions in Flame Signal Check.
3. If flame signal is proper–	3. Check the fuel lines and automatic fuel valves.	3. Clean fuel lines. Replace valves and actuators if defective.
G. 1. BURNER KEEPS FIRING WHEN "STOP" BUTTON IS PRESSED.	1. Check that STOP button is not stuck or wired incorrectly.	1. If STOP switch is open, check wiring of automatic fuel valves and actuators.
H. 1. RELAY 2K STAYS IN WHEN "STOP" BUTTON IS PRESSED. SYSTEM WON'T START AGAIN.	1. Check that the pilot flame (or 1st stage oil flame) and main burner flame are out.	1. If flame is still burning, check the external wiring and operation of the automatic valves and actuators. Replace if defective.
2. If there is no flame–	2. Perform the Flame Relay (2K) Hold-In Check following this table on page 27.	2. Follow instructions in Flame Relay (2K) Hold-In Check.
I. 1. ALARM (IF USED) DOES NOT GO ON WHEN "STOP" BUTTON IS HELD IN. (NOT APPLICABLE TO 220V, 50 HZ MODELS.)	1. Check that STOP button is not stuck.	1. If STOP switch is open, check external wiring. Replace deteriorated leadwires.
2. If STOP switch and external wiring are okay–	2. Check that 1K2 is closed.	2. If relay 1K has dropped out, but 1K2 is still open, replace the R4075.
3. If 1K2 is closed–	3. Check the alarm.	3. Replace if defective.
J. 1. ALARM (IF USED) STAYS ON WHEN ALARM SILENCING SWITCH (IF USED) IS OPENED.	1. Check external wiring and alarm silencing switch.	1. Replace deteriorated leadwires. Replace alarm silencing switch if defective.

FLAME SIGNAL CHECK

IMPORTANT

If the flame relay 2K does not pull in when the pilot (or 1st stage oil burner) ignites, or if shutdown occurs during the run period, perform this check. The flame detector, plug-in flame signal amplifier, and flame relay 2K form a flame detection system which can be disabled by failure of any of the components.

1. Open the master switch and plug a microammeter into the meter jack on the plug-in amplifier (Fig. 13); then close the master switch. Make sure the alarm silencing switch (if used) is closed.
2. Push in the START button and hold it in. When the pilot (or 1st stage oil burner) ignites, measure the flame signal as described in Flame Signal Measurement in the CHECKOUT section. If the signal is unstable or weak, check the flame detector installation and circuitry as instructed.
   NOTE: The pilot (or 1st stage oil flame) will go out if the START button is released. Hold in the START button until the flame signal is measured; then release it.
3. If you check the flame detector, measure the flame signal again. If it is still unstable or less than the minimum acceptable value listed in Table III, proceed to step 5. Otherwise continue with step 4.
4. If the flame signal is stable and above the minimum acceptable value listed in Table III, either the amplifier or the R4075 is faulty.
   a. Open the master switch.
   b. Replace the plug-in amplifier with a new one of the same part number.
   c. Close the master switch. Make sure the alarm silencing switch (if used) is closed.
   d. Hold in the START button. When the pilot (or 1st stage oil burner) ignites, measure the flame signal again.
   e. If the flame signal is okay but relay 2K still does not pull in, replace the R4075. (Keep the plug-in amplifiers.)
5. The procedure in this step depends on the model of the plug-in flame signal amplifier used.
   a. All self-checking models:
      R7247B Dynamic Self Check Rectification Amplifier (green)–used with rectifying flame rods, rectifying photocells, or C7012A or C Purple Peeper Ultraviolet Flame Detectors.
      R7247C Dynamic Self Check Rectification Amplifier (green)–used with C7012E or F Purple Peeper Ultraviolet Flame Detectors (with self-checking shutter).
      R7248B Dynamic Ampli-Check Infrared Amplifier (red)–used with C7015A Infrared (lead sulfide) Flame Detectors, and

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R7476A Dynamic Self Check Ultraviolet Amplifier (blue)—used with C7076A Adjustable Sensitivity Ultraviolet Flame Detectors.

(1) Open the master switch.

(2) Replace the plug-in amplifier with a new one of the same part number.

(3) Close the master switch and hold in the START button.

(4) When the pilot (or 1st stage oil burner) is ignited, relay 2K should pull in.

(5) If relay 2K pulls in, operation is normal. Omit step 6 and perform the Pilot Turndown Test in the CHECKOUT section, unless using direct spark ignition.

(6) If relay 2K does not pull in, either the flame detector or the R4075 is faulty.
—Install the original amplifier.
—Check the flame detector and its circuit as described in step 6, below.
—If the problem still exists, replace the R4075.

b. R7247A Rectification Amplifier (green)—used with rectifying flame rods, rectifying photocells, or C7012A or C Purple Peeper Ultraviolet Flame Detectors.

(1) Open the master switch and remove the flame detector leadwire from terminal F on the terminal strip. *Be sure the leadwire does not touch anything after removal.*

(2) Close the master switch. Make sure the alarm silencing switch (if used) is closed.

(3) Touch the probe of a 123514A Flame Simulator to the F terminal on the terminal strip, and hold the plug (lead end) of the simulator against the R4075 chassis (Fig. 14). Relay 2K should pull in and stay in while the probe is on the F terminal and the plug is in contact with the chassis.

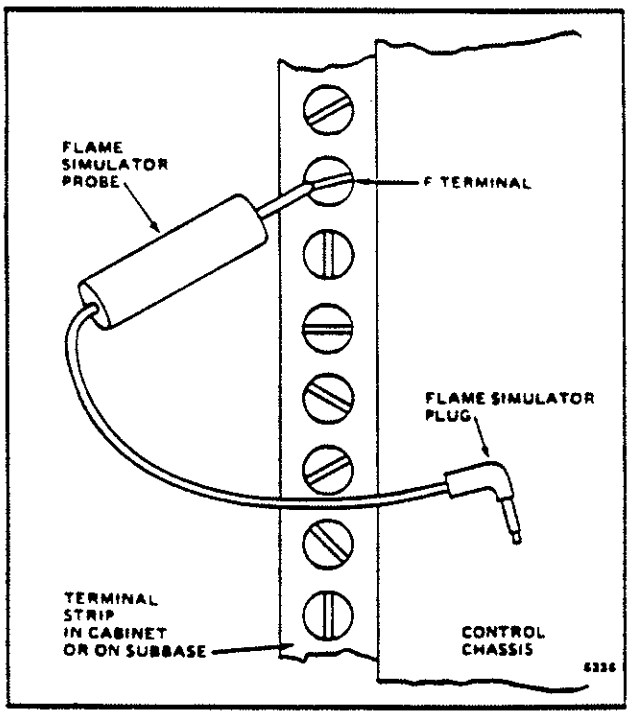


FIG. 14—USING A FLAME SIMULATOR.

(4) If relay 2K pulls in, the trouble is in the flame detector or its circuitry outside the R4075. Proceed to step 6 below.

(5) If relay 2K does not pull in, open the master switch.

(6) Replace the plug-in amplifier with a new one of the same part number.

(7) Close the master switch. Make sure the alarm silencing switch (if used) is closed.

(8) Repeat (3).

(9) If relay 2K pulls in, restore the R4075 to operating condition as instructed in step 6.a below.

(10) If relay 2K still does not pull in, replace the R4075.

c. R7248A Infrared Amplifier (red)—used with C7015A Infrared (lead sulfide) Flame Detectors.

(1) Open the master switch and remove the flame detector leadwire from terminal F on the terminal strip. *Be sure the leadwire does not touch anything after removal.*

(2) Close the master switch. Make sure the alarm silencing switch (if used) is closed.

(3) Remove 3/4 inch [19.1 mm] of insulation from each end of a 10 inch [254 mm] length of insulated wire.

(4) Touch one end of this wire to the F terminal on the terminal strip, and tap the other end of the wire against the R4075 chassis at a rapid frequency (about 2 times a second) to simulate flame. Relay 2K should pull in and stay in while flame is simulated.

(5) If relay 2K pulls in, the trouble is in the flame detector or its circuitry outside the R4075. Proceed to step 6 below.

(6) If relay 2K does not pull in, open the master switch.

(7) Replace the plug-in amplifier with a new one of the same part number.

(8) Close the master switch. Make sure the alarm silencing switch (if used) is closed.

(9) Repeat (4).

(10) If relay 2K pulls in, restore the R4075 to operating condition as instructed in step 6.a below.

(11) If relay 2K still does not pull in, replace the R4075.

d. R7249A Ultraviolet Amplifier (purple)—used with C7027A, C7035A, or C7044A Minipeeper Ultraviolet Flame Detectors.
—Follow the same procedure as described in 5.b above for an R7247A Rectification Amplifier, except substitute a 123514B Flame Simulator in (3).

6. Check the flame detector and its circuitry outside the R4075.

a. Restore the R4075 to operating condition as follows:

(1) Open the master switch.

(2) Reconnect the flame detector leadwire to terminal F on the terminal strip.

b. Check the detector and its circuitry as follows:
   (1) Check the detector wiring for defects, including–
      –wrong type or size of wire.
      –deteriorated wire.
      –open circuits.
      –short circuits.
      –leakage paths caused by moisture, soot, or accumulated dirt.
   (2) For a flame rod, make sure–
      –there is enough ground area.
      –the flame rod is located in the flame properly.
      –temperature at the flame rod insulator is no greater than 500 F [260 C].
      –ignition interference is not present (see Ignition Interference Test in the CHECKOUT section).
   (3) For all other detectors, clean the detector lens, filter, viewing window, and sighting pipe (as applicable).
   (4) For a C7012A,C,E, or F Purple Peeper Ultraviolet Flame Detector, replace the 113236 and 115330 Electron Tubes (unless the detector is a solid state model).
   (5) Check that the temperature at the detector does not exceed its maximum rated temperature.
   (6) Make sure that the flame adjustment is not too lean.
   (7) Make sure the detector is sighting the flame properly.
   (8) If necessary, resight or reposition the detector.
   (9) If trouble persists, replace the detector. (Open the master switch before replacing the flame detector.)

FLAME RELAY (2K) HOLD-IN CHECK

1. If the flame detector is a rectifying photocell or infrared (lead sulfide) detector, perform the Hot Refractory Hold-in Test in the CHECKOUT section.

2. If the plug-in flame signal amplifier is an R7247B or C or R7476A Dynamic Self Check Amplifier (green or blue) or an R7248A or B Infrared Amplifier (red), open the master switch and install a new amplifier.

3. If the plug-in flame signal amplifier is an R7247A Rectification Amplifier (green) or an R7249A Ultraviolet Amplifier (purple), momentarily short terminal F to terminal G on the terminal strip. If this does not cause relay 2K to drop out, open the master switch and install a new amplifier.

4. Check the external wiring and operation of the flame detector (see step 6.b of the Flame Signal Check above). Replace if faulty.

IMPORTANT

If you make any changes in the flame detection system (including the plug-in amplifier), repeat ALL required tests in the CHECKOUT section.

SERVICE INFORMATION

CAUTION!

1. Only qualified service technicians should attempt to service or repair flame safeguard controls and burner systems.
2. Open the master switch before removing or replacing a relay cover, or before cleaning contacts. Line voltage may be present on most contacts when power is on. If cleaning is necessary, be sure to replace the relay cover.

SCHEDULED INSPECTION AND MAINTENANCE

A schedule should be set up and followed for periodic inspection and maintenance, including the burner and all other controls as well as the R4075. Include the following in that schedule.

1. Always keep the burner and fuel mixture adjusted according to the burner manufacturer's recommendations.

2. Clean the flame detector lens, filter, viewing window, and sighting pipe (as applicable).

3. Check the flame signal (Table III) using a Honeywell W136A Test Meter, or equivalent (and a 117053 Meter Connector Plug if needed).

4. If using a C7012A,C,E or F Purple Peeper Ultraviolet Flame Detector, replace the 113236 and 115330 Electron Tubes annually (unless the detector is a solid state model). These tubes are tested by Honeywell to ensure reliability and safety. DO NOT REPLACE WITH COMMERCIAL SUBSTITUTES.

CONTACT CLEANING

Field cleaning of relay contacts is *not recommended*. If they must be cleaned, use *only* Honeywell pressurized contact cleaner, Part No. 132569. Honeywell's chemical analysis laboratory has found this cleaner to be acceptable for this task. Directions for using this cleaner are printed on the can.

IMPORTANT

1. Do not clean contacts unless absolutely necessary.
2. Use only Honeywell contact cleaner, Part No. 132569. Do not use any other type of contact cleaner.
3. Use utmost care to avoid bending the contacts or changing their specifications or configuration in any way.
4. Do not use an abrasive or a burnishing tool to clean contacts.
5. Do not use hard paper, such as a business card, to clean contacts.

(continued on page 28)

Do not use other types of contact cleaners. Honeywell's chemical analysis laboratory tested other pressurized type contact cleaners but did not approve them for these reasons:

1. The solvents could deteriorate plastic parts and wire insulation.
2. The cleaners leave an oily residue which will collect dust and dirt. The residue will also break down to form various carbonaceous products. Either result will cause early contact failure.

Do not use an abrasive (sand paper stick, file, etc.) or a burnishing tool to clean contacts. Its use can cause early contact failure for these reasons:

1. Some relay and timer contacts are plated with gold for increased reliability. Burnishing can quickly remove the plating.
2. The radii or points of the contacts are designed with specific shapes to best serve the intended functions of the contacts. Burnishing can rapidly alter these contact configurations.
3. Use of an abrasive loosens fine particles of the contact material which adhere to the surface of the contact, thus increasing its resistance.
4. Contact specifications (contact pressures, press-back, and gaps) are carefully controlled during manufacturing to ensure maximum contact life. Burnishing can easily change these specifications.

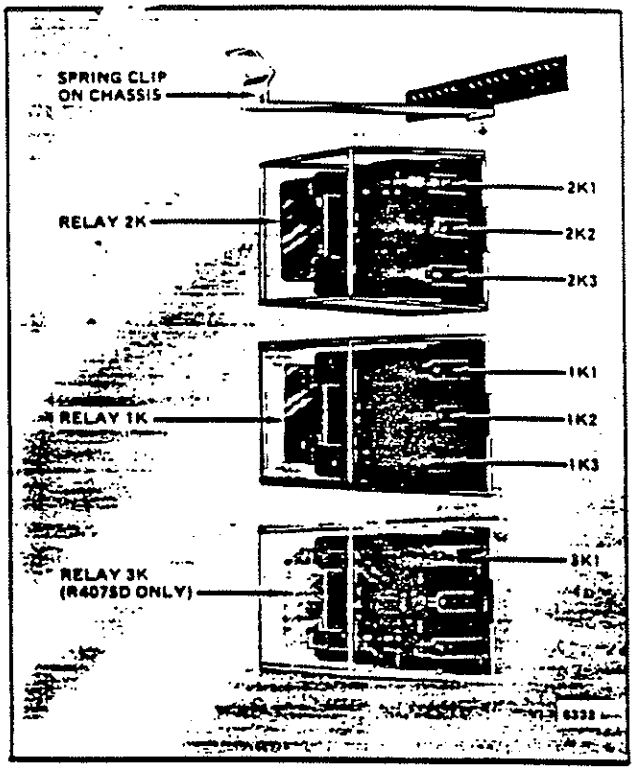


FIG. 15—LOCATION OF RELAY CONTACTS.

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HONEYWELL MINNEAPOLIS, MINN. 55408 INTERNATIONAL Sales Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

PRINTED IN U.S.A.

JOHN ZINK COMPANY
A DIVISION OF KOCH ENGINEERING

SPECIFICATION
POTENTIOMETER INSTRUMENTS

SPEC.NO. 3
S.O.NO. BF -A0012224
PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL | TAG.NO. : TSH-101
INQ.: | JZ.PO.NO: | CUST.PO.NO.:

GENERAL	1	Service	HIGH STACK TEMP SHUT-DOWN
	2	Function	Record ☐ Indicate ■ Control ☐ Blind ☐ Transmit ☐
			Other:
	3	Type	Auto Bal. ■ Man Bal. ☐ Galv ☐ Other:
	4	Case	MFR STD ■ Nom Size Color: MFR STD ☐ Other:
	5	Mounting	Flush ■ Surface ☐ Rack ☐ Multi-case ☐ Other:
			For Multiple Case, See Spec. Sheet
	6	Enclosure Class	Gen Purpose ■ Weather Proof ☐ Explosion-Proof ☐ Class Other:
	7	Power Supply	117 V 60Hz ■ Other:
	8	Chart	Strip ☐ Circ ☐ Time Marks ☐ Range No.
			Chart Speed: Change Gears
	9	Scales	Type Range 1 2
	10	Printout	No. of Points Sec Per Point Full Travel Speed
			Print Character and Color Point Select ☐
	11	Selector Switches	No. and Form In Case ☐ External ☐
			Switch Cabinet Specs
XMTR	12	Trans Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
			Input-Output Isolation ☐ For Receiver See Sheet
CONTROLLER	13	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P ☐ PI ☐ PD ☐ PID ☐ If ☐ Df ☐ Is ☐ Ds ☐
			Other:
	14	Actior	On Meas. Increase Output: Increases ☐ Decreases ☐
	15	Auto-Man Switch	None ☐ MFR STD ☐ Specify:
	16	Set Point Adj.	Manual ☐ External ☐ Remote ☐ Specify:
	17	Manual Reg.	None ☐ MFR STD ☐ Other:
	18	Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
INPUT	19	Thermocouple Type	J(IC) ☐ K(CA) ■ T(CC) ☐ E(CHR-CON) ☐ Other:
			Ref Junction Comp ☐ Lead Resistance (Galv)
	20	Other Input	Resistance Temp Sensor ☐ Calibration
			Other:
ALARMS	21	Alarm Switches	Quantity 2 Form
	22	Function	Meas. Var. ■ Deviation ☐ Contacts to OPEN Measure
			Other:
	23		Front Adj. Back Adj.
OPTIONS	24	T/C Burnout Drive	None ☐ Upscale ■ Downscale ☐
	25	Accessories	Case Illuminator ☐
			Filter Reg. ☐ Other:
	26	MFR & Model No.	OMRON E5C2-32 TO 2192-AC120

Notes: MOUNT IN PNL-101
JZ PART NO.

MOUNT: PANEL ■ SKID ☐ FIELD ☐ OTHER ☐

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 1 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 1 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE: 07/25/1995	APP: CL	Shipment Promise Date: / /

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SPECIFICATION
POTENTIOMETER INSTRUMENTS

SPEC.NO. 4
S.O.NO. BF -A0012224
PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL | TAG.NO. : TR-201
INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.:1

GENERAL	1	Service	TEMPERATURE RECORDER
	2	Function	Record ■ Indicate □ Control □ Blind □ Transmit □
			Other:
	3	Type	Auto Bal. □ Man Bal. □ Galv □ Other:
	4	Case	MFR STD ■ Nom Size Color: MFR STD ■ Other:
	5	Mounting	Flush □ Surface ■ Rack □ Multi-case □ Other:
			For Multiple Case, See Spec. Sheet
	6	Enclosure Class	Gen Purpose ■ Weather Proof □ Explosion-Proof □ Class Other:
	7	Power Supply	117 V 60Hz ■ Other:
	8	Chart	Strip □ Circ ■ Time Marks □ Range No.
			Chart Speed: Change Gears
	9	Scales	Type Range 1 (4-20mA) 0-4000 ACFM 2 (4-20ma) 0-2400 F
	10	Printout	No. of Points Sec Per Point Full Travel Speed
			Print Character and Color Point Select □
	11	Selector Switches	No. and Form In Case □ External □
			Switch Cabinet Specs
XMTR	12	Trans Output	4-20 mA □ 10-50 mA □ 21-103 kPa (3-15 psig) □ Other:
			Input-Output Isolation □ For Receiver See Sheet
CONTROLLER	13	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P □ PI □ PD □ PID □ If □ Df □ Is □ Ds □
			Other:
	14	Action	On Meas. Increase Output: Increases □ Decreases □
	15	Auto-Man Switch	None □ MFR STD □ Specify:
	16	Set Point Adj.	Manual □ External □ Remote □ Specify:
	17	Manual Reg.	None □ MFR STD □ Other:
	18	Output	4-20 mA □ 10-50 mA □ 21-103 kPa (3-15 psig) □ Other:
INPUT	19	Thermocouple Type	J(IC) □ K(CA) □ T(CC) □ E(CHR-CON) □ Other:
			Ref Junction Comp □ Lead Resistance (Galv)
	20	Other Input	Resistance Temp Sensor □ Calibration
			Other:
ALARMS	21	Alarm Switches	Quantity NONE Form
	22	Function	Meas. Var. □ Deviation □ Contacts to Measure
			Other:
	23		Front Adj. Back Adj.
OPTIONS	24	T/C Burnout Drive	None ■ Upscale □ Downscale □
	25	Accessories	Case Illuminator □
			Filter Reg. □ Other:
	26	MFR & Model No.	HONEYWELL # DR45AT-1100-00-000-A-000S00-0

Notes: TR201 MOUNTED IN PNL 101
JZ PART NO. 404296

MOUNT: PANEL ■ SKID □ FIELD □ OTHER □

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 2 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 3 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 4 DATE:	APP:	Shipment Promise Date: / /

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Honeywell

DR4500A Truline Circular Chart Recorder With or Without Control Product Manual

44-45-25-30C
2/95

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Revision C – 2/95

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Phoenix, AZ 85023

About This Publication

How this manual is organized

This manual covers both model DR45AT and DR45AR Truline recorders. The data is tailored primarily for the standard model DR45AT, but it also applies for model DR45AR except where noted. The DR45AR functions that differ from model DR45AT are detailed in Appendix C.

The manual contains 13 sections. The first four sections deal with set-up tasks for a DR4500A recorder; sections 5, 6, 7, and 8 cover operation, setpoint programming and calibration, respectively. Section 9 covers troubleshooting/service. Section 10 is a parts list, and sections A, B, and C are appendices. Use the master table of contents to locate specific topics.

Warranty

The device described herein has been manufactured and tested for correct operation and is warranted as follows:

The DR4500A Truline Recorder carries a two year warranty. This warranty includes immediate technical assistance via a toll free telephone number and complete replacement of the controller, if necessary.

Technical Assistance

If you encounter a problem with your DR4500A recorder, review all the configuration data under the Set-up groups to verify that your selections are consistent with your application; i.e. Inputs, Outputs, Alarms, Limits, etc. If the problem persists after checking the above, you can get technical assistance by dialing

1-800-423-9883 USA
1-800-461-0013 Canada

An engineer will discuss your problem with you. Please have your complete model number, serial number, and Software version available. The model and serial numbers can be found on the chassis nameplate. The software version can be viewed under Setup Group "Status." See *subsection 9.2*.

If it is determined that a hardware problem exists, a replacement controller or part will be shipped with instructions for returning the defective unit. Do not return your controller without authorization from Honeywell's Technical Assistance Center or until the replacement has been received.

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Acronyms

3PSTEP	3 Position Step Control
EMI	electromagnetic interference
HID	high intensity discharge
IEEE	Institute of Electrical and Electronics Engineers
MOVs	Metal Oxide Varistors
RC	resistance-capacitance
RFI	radio frequency interference
RH	Relative Humidity
SCRs	silicon controlled rectifiers

Parameters

2IN	Input 2
2SP	Local Setpoint 2
3IN	Input 3
4IN	Input 4
A1S1 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 1
A1S1 H L	Alarm 1, Setpoint 1 State
A1S1 VAL	Alarm 1, Setpoint 1 Value
A1S1TYPE	Alarm 1, Setpoint 1 Type
A1S2 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 2
A1S2 H L	Alarm 1, Setpoint 2 State
A1S2 VAL	Alarm 1, Setpoint 2 Value
A1S2TYPE	Alarm 1, Setpoint 2 Type
A2S1 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 1
A2S1 H L	Alarm 2, Setpoint 1 State
A2S1 VAL	Alarm 2, Setpoint 1 Value
A2S1TYPE	Alarm 2, Setpoint 1 Type
A2S2 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 2
A2S2 H L	Alarm 2, Setpoint 2 State
A2S2 VAL	Alarm 2, Setpoint 2 Value
A2S2TYPE	Alarm 2, Setpoint 2 Type
A3S1 EV	SP Programming Event Alarm State for Alarm 3, Setpoint 1
A3S1 H L	Alarm 3, Setpoint 1 State
A3S1 VAL	Alarm 3, Setpoint 1 Value
A3S1TYPE	Alarm 3, Setpoint 1 Type
A3S2 EV	SP Programming Event Alarm State for Alarm 3, Setpoint 2
A3S2 HL	Alarm 3, Setpoint 2 State
A3S2 VAL	Alarm 3, Setpoint 2 Value
A3S2TYPE	Alarm 3, Setpoint 2 Type
A4S1 EV	SP Programming Event Alarm State for Alarm 4, Setpoint 1
A4S1 H L	Alarm 4, Setpoint 1 State
A4S1 VAL	Alarm 4, Setpoint 1 Value
A4S1TYPE	Alarm 4, Setpoint 1 Type
A4S2 EV	SP Programming Event Alarm State for Alarm 4, Setpoint 2
A4S2 H L	Alarm 4, Setpoint 2 State
A4S2 VAL	Alarm 4, Setpoint 2 Value
A4S2TYPE	Alarm 4, Setpoint 2 Type
A5S1 EV	SP Programming Event Alarm State for Alarm 5, Setpoint 1
A5S1 H L	Alarm 5, Setpoint 1 State
A5S1 VAL	Alarm 5, Setpoint 1 Value
A5S1TYPE	Alarm 5, Setpoint 1 Type

A5S2 EV.....SP Programming Event Alarm State for Alarm 5, Setpoint 2
A5S2 H L.....Alarm 5, Setpoint 2 State
A5S2 VAL.....Alarm 5, Setpoint 2 Value
A5S2TYPE.....Alarm 5, Setpoint 2 Type
A6S1 EV.....SP Programming Event Alarm State for Alarm 6, Setpoint 1
A6S1 H L.....Alarm 6, Setpoint 1 State
A6S1 VAL.....Alarm 6, Setpoint 1 Value
A6S1TYPE.....Alarm 6, Setpoint 1 Type
A6S2 EV.....SP Programming Event Alarm State for Alarm 6, Setpoint 2
A6S2 H L.....Alarm 6, Setpoint 2 State
A6S2 VAL.....Alarm 6, Setpoint 2 Value
A6S2TYPE.....Alarm 6, Setpoint 2 Type
ACTION.....Control Output Direction
AL HYST.....Alarm Hysteresis
AL1 HYST.....Alarm 1 Hysteresis
AL2 HYST.....Alarm 2 Hysteresis
AL3 HYST.....Alarm 3 Hysteresis
AL4 HYST.....Alarm 4 Hysteresis
AL5 HYST.....Alarm 5 Hysteresis
AL6 HYST.....Alarm 6 Hysteresis
AUTO.....Lower display automatically displays setpoint value in engineering units
Com ADDR.....Communications Station Address
CONTROL1.....Control 1 Loop
CONTROL2.....Control 2 Loop
CYC SEC.....Cycle Time (Heat)
CYC2 SEC.....Cycle Time 2 (Cool)
DEADBAND.....Output Relay Deadband
DEV.....Deviation
DROPOFF.....Controller Dropoff Value
END SEG.....End Segment Number
EVENT 1.....Event 1 Trigger
EVENT 2.....Event 2 Trigger
EVENT 3.....Event 3 Trigger
EVENT 4.....Event 4 Trigger
EVENT 5.....Event 5 Trigger
EVENT 6.....Event 6 Trigger
FAILSAFE.....Failsafe Output Value
FILTER 1.....Input 1 Filter
FINAL SP.....Single Setpoint Ramp Final Setpoint
GAIN.....Gain
GAIN2.....Gain 2
IN1 HI.....Input 1 High Range Value
IN1 LO.....Input 1 Low Range Value
IN1 TYPE.....Input 1 Actuation Type
INPTCOMP.....Input Compensation
INPUT 1.....Input 1 Actuation
INPUT 2.....Input 2 Actuation
INPUT 3.....Input 3 Actuation
INPUT 4.....Input 4 Actuation
MAN.....Lower display automatically indicates output in %
MAN RSET.....Manual Reset
MINorRPM.....Reset Units
OUT HYST.....Output Relay Hysteresis
OUT.....Output Value
OUTHILIM.....High Output Limit
OUTLOLIM.....Low Output Limit
PBorGAIN.....Proportional Band or Gain Units
PID SETS.....Tuning Parameter Sets

PROG END.....Program Termination State
PROP BD..... Proportional Band
PROP BD2 .....Proportional Band 2
RAMPUNIT..... Engineering units for ramp segments
RAMPXXOM.....Minutes remaining in Setpoint Ramp
RATE MIN..... Rate in minutes
RATE2MIN .....Rate 2 in minutes
RECYCLES.....Number of Program Recycles
REJ FREQ.....Rejection Frequency
RSET MIN.....Reset in minutes/repeat
RSET RPM.....Reset in repeats/minute
RSP.....Remote Setpoint
SHED SP .....Shed Setpoint Recall
SHEDMODE.....Shed Controller Mode and Output Level
SHEDTIME.....Shed Time
SOAK DEV..... Guaranteed Soak Deviation Value
SP HILIM .....High Setpoint Limit
SP .....Local Setpoint 1
SP LOLIM.....Low Setpoint Limit
SP PROG.....Setpoint Programming
SP SOURC.....Setpoint Source
SP TRACK .....Setpoint Tracking
STATE.....Program state at program end
STERILIZ..... Fo Sterilization Time
STRT SEG.....Start Segment Number
SW VALUE.....Automatic Switchover Value
TIME MIN.....Single Setpoint Ramp Time
XMITTER.....Transmitter Characterization

Section 1 – Overview

1.1 Introduction

Function

The DR4500A Truline Recorder is a one to four-channel microprocessor-based circular chart recorder. Its "one-pen" stylus printhead produces up to four analog traces and prints alphanumeric chart data on a blank heat-sensitive chart. All four traces share the same time line reference which the Truline prints. This eliminates the error caused by pen alignment offsets in conventional pen designs. Since the Truline prints the chart and generates the analog traces at the same time, there is no error due to variations in chart size caused by changes in temperature and humidity.

In addition to printing chart records, the Truline recorder alternately displays process variable values for all channels in the selected engineering units.

Models with up to four input channels accept inputs from any one of a variety of sensors or transmitters within the configurable range limits.

The Truline is also available with one or two independent digital controllers.

Microprocessor controlled recording and printing

Both the chart and printhead are driven by stepper motors controlled by the microprocessor with configurable chart speed through the keypad.

You can configure various "printed" chart data such as range marking in engineering units, digital values for process variables, and trace identification. This data plus printed time lines and engineering units of scale eliminate the need to maintain an inventory of a variety of preprinted charts.

The Truline recorder uses a dot fill technique from a microprocessor algorithm to produce a continuous analog trace of a process variable.

Digital controller

The DR4500A recorder controller includes an integral microprocessor-based, single loop, PID controller. A variety of output types, including a duplex variation for heat cool applications, lets you select the output that is right for your final control element.
You can configure the control action as On-Off, PID-A, PID-B, or PD with manual reset. English language prompts guide you through the entry of all the controller's configurable parameters.

Construction

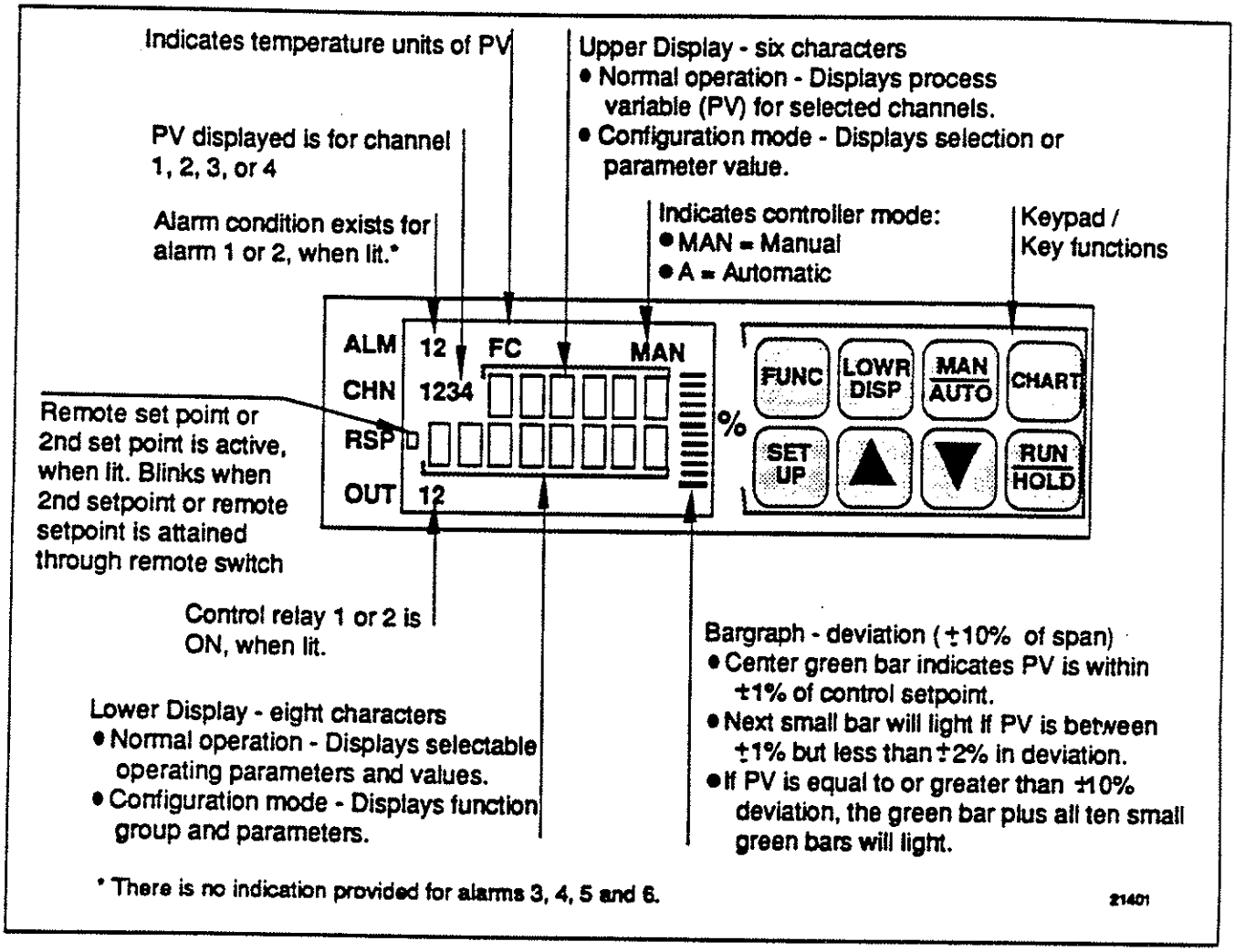
The DR4500A recorder is housed in a molded case which can be panel or surface mounted. A glass or acrylic windowed door protects the internal components while allowing easy access to the chart and operator interface. Circuitry is partitioned on printed circuit boards for ease of service. Power, input, and output wiring connect to terminations inside the case. Knockouts in the sides and bottom of the case accept conduit connections for convenient wire entry.

1.2 Operator Interface

Operator Interface

Figure 1-1 shows the operator interface and defines the displays and indicators. The function of the keys is described in Table 1-1.

Figure 1-1 Operator Interface



Continued on next page

Key functions

Table 1-1 shows each key on the operator interface and defines its function.

Table 1-1 Function of Keys

Key	Function
SET UP	• Places the controller in the Configuration Set Up group select mode. Sequentially displays Set Up groups and allows the FUNC key to display individual functions in each Set Up group.
FUNC	• Used in conjunction with the SET UP key to select the individual functions of a selected Configuration Set Up group. • Used to toggle between SP1 and SP2. • Used during field calibration procedure.

LOWR DISP	• Selects an operating parameter to be shown in the lower display:
	OUT = Output Value
	SP = Local Setpoint 1
	2SP = Local Setpoint 2
	RSP = Remote Setpoint
	2IN = Input 2
	3IN = Input 3
	4IN = Input 4
	DEV = Deviation
	EU = PV Engineering Units
	RH = % RH Value
	PIDSETX = Tuning Parameter Set X=1 or 2
	RAMP = Minutes remaining in Setpoint Ramp
	#RA = Minutes remaining in SP Prog Ramp
	#SK = Minutes remaining in SP Prog Soak
	RECYC = Number of recycles left in SP Program

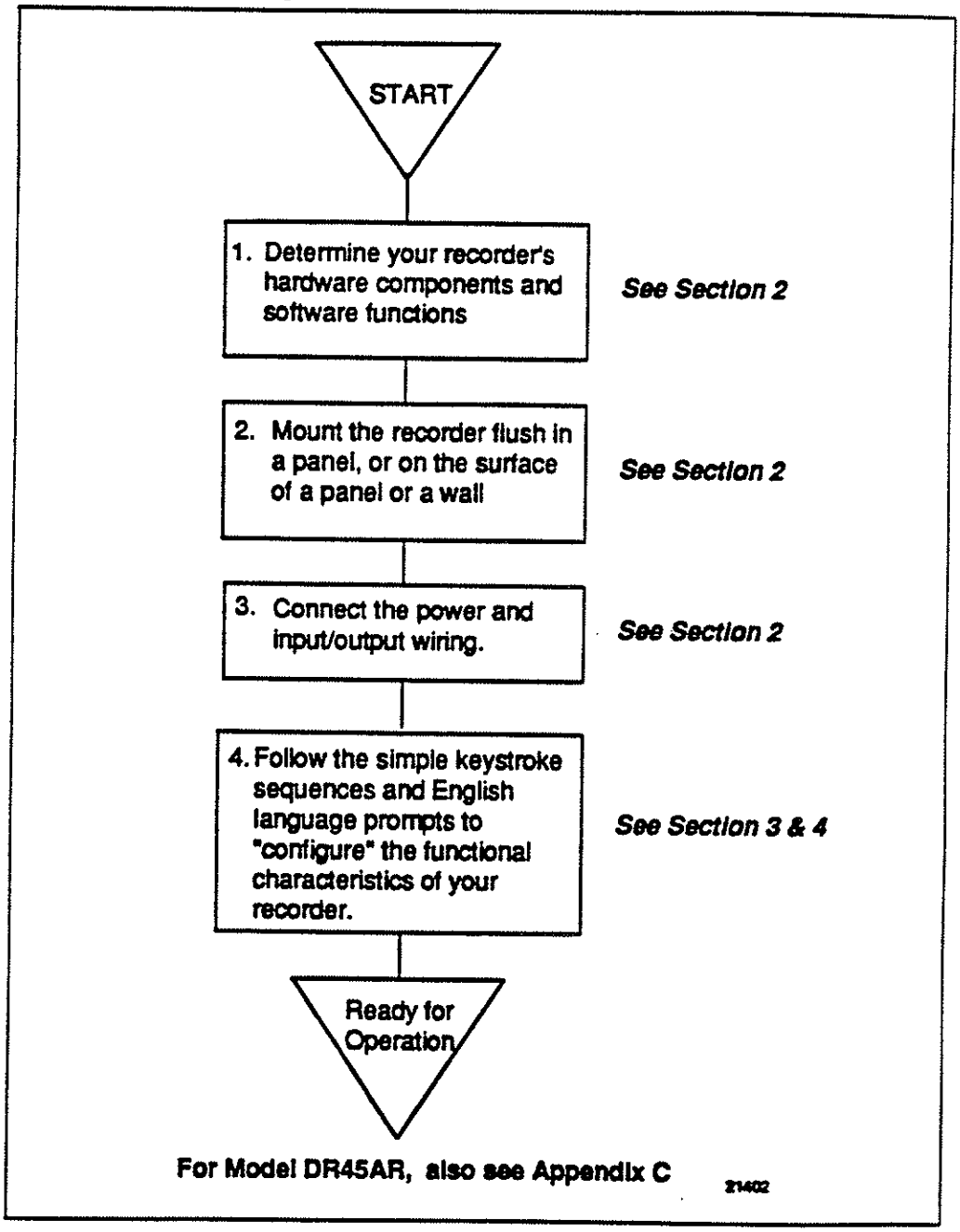
MAN AUTO	• Alternately selects: AUTO Lower display automatically displays setpoint value in engineering units. MAN Lower display automatically indicates output in %.
CHART	• Used to stop printing operation and move pen to outer limit for chart change. Display will revert to date and time.
RUN HOLD	• Alternate action switch initiates or holds the Setpoint Ramp or Setpoint Program. • In configuration mode, restores the original value or selection if you do not want to enter a change you are making to a parameter.
▲	• Increases the setpoint, output, or configuration values displayed.
▼	• Decreases the setpoint, output, or configuration values displayed.

1.3 Set Up Tasks

Major set-up tasks

As shown in Figure 1-2, there are four major tasks that you must complete to "Set Up" the DR4500A recorder for operation. For easy reference the section numbers for each task are shown.

Figure 1-2 Set Up Tasks



Section 2 – Installation

2.1 Overview

Introduction

Installation of the DR4500A Recorder consists of mounting and wiring the recorder according to the instructions given in this section.
Read the preinstallation information, check the model number interpretation and become familiar with your model selections, then proceed with installation.

What's in this section?

This section contains the following information:

	Topic	See Page
2.1	Overview	5
	Preinstallation Information	5
	Operating Limits	6
2.2	Model Number Interpretation	7
2.3	Mounting Considerations and Overall Dimensions	10
2.4	Mounting Methods	11
2.5	Wiring Prerequisites	18
	Taking Electrical Noise Precautions	18
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	Identify Your Wiring Requirements	19
2.6	Input Wiring Procedures	20
	AC Line Power	20
	Thermocouple, RTD, mV, or 0–5 Vdc Inputs	22
	4–20 mA Inputs	24
	0–10 Volt dc Inputs	26
2.7	Output Wiring Procedures	28
	4–20 mA Control Output	28
	Position Proportional Control Output	30
	Relay Control Output	32
2.8	Option Wiring Procedures	34
	Alarm Output and Digital Inputs	34
	DMCS Communications	36

Preinstallation Information

If the recorder has not been removed from its shipping carton, inspect the carton for damage and remove the recorder. Inspect the unit for any obvious shipping damage and report any damage due to transit to the carrier.
Make sure a bag containing mounting hardware is included in the carton with the recorder.
Check that the model number shown on the chart plate agrees with what you have ordered.

Continued on next page

Condensed specifications

We recommend that you review and adhere to the operating limits listed in Table 2-1 when you install your recorder.

Table 2-1 Operating Limits

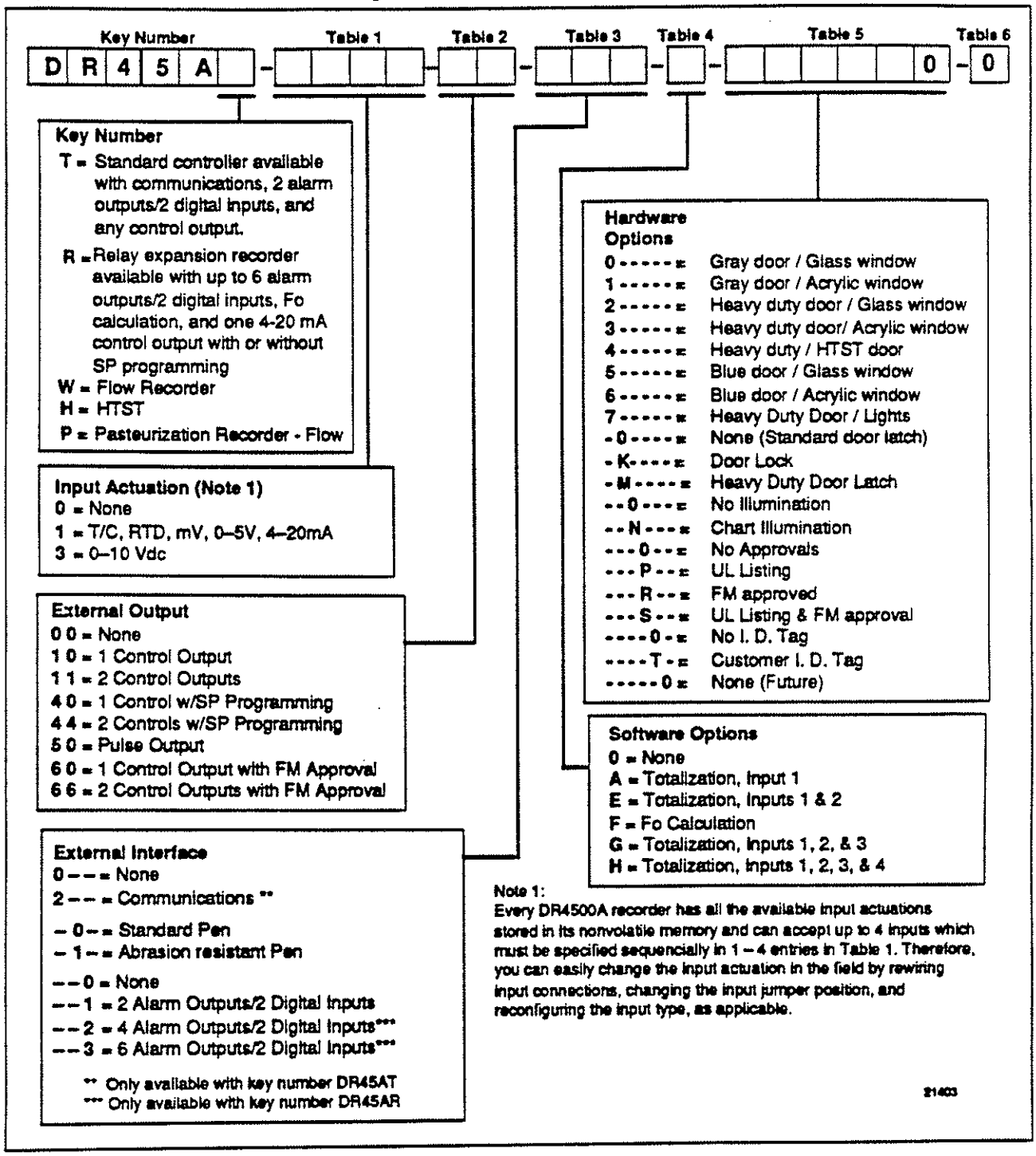
Condition	Specifications
Ambient Temperature	32 to 131°F (0 to 55°C)
Relative Humidity	5 to 90% RH at 40°C (104°F) non-condensing
Vibration Frequency Acceleration	 0 to 200 Hz 0.2g
Mechanical Shock Acceleration Duration	 5g 30 ms
Power	102 to 132 Vac 50/60 Hz 204 to 264 Vac 50/60 Hz
Power Consumption	24 VA Maximum
Stray Rejection	Common Mode Rejection Ratio: 12 dB or 1 LSB (whichever is greater) at 60 Hz with maximum source impedance of 100 ohms. Normal Mode Rejection Ratio: 60 dB with a 100% span peak to peak maximum at 60 Hz.
Input Impedance	4-20 mAdc 250 ohms 0-10 Vdc 200K ohms All others 10 megaohms
Span Step Response Time	RTD: 100 ohms per lead maximum 6 second maximum with no filtering
Sampling Rate	Each input 3 times a second (1 or 2 inputs), 3 times in 2 seconds
Input Filter	Software: Single pole dewpass section with selectable time constants (off to 120 seconds.)
Transmitter Supply Voltage	22 to 26 Vdc at input terminals 950 mAdc max. at 24 Vdc)
Approval Bodies	U.L. approval depending on model (consult Model Selection Guide) FM approval for Class 1, Div. 2 , Groups A, B, C, D areas depending on model.
Weight	13.2 lbs (6 kg)
Alarm Output	Two SPST electromechanical relays on DR45AT 7 DR45AW models Two, four, or six available on DR45AR model Relay Contact ratings First two relays, Resistive Load 1A@ 120 Vac, 1/2A @240 Vac Relays 3 through 6 resistive Load 5A @ 120 Vac, 2.5A @ 240 Vac
Digital Input	+20 Vdc source for external dry contact or isolated solid state contacts. Selects one configured input.
Totalizers	Eight digit "totals' with multiplier on digital display, 14 digit totalization printout on chart.
DMCS Communications	Baud Rate: 19,200 Protocol: DMCS Length Link: 4000 ft (1219 m) max Link Characteristics: Two wire multidrop
Chart Speed	*Chart Speed*: 8hrs, 24hrs, 7days, or selected hours per revolution *Hours per Revolution*: 6 to 744 Hours (12 hrs for abrasion resistant pen) ATTENTION Below 8 hrs chart speed (24 hrs with abrasion resistant pen) printing may be degraded.

2.2 Model Number Interpretation

Model number

The model number interpretation is shown in Figure 2-1. Write the model number into the spaces provided and compare it to the model number interpretation. This information will also be useful when you wire your recorder. The example on the next page will help you to decode the model.

Figure 2-1 Model Number Interpretation



Continued on next page

Example of model number decoding

Assume that the model number on the label is

DR45AT - 1300 - 44 - 001 - A - 1KN0T0 - 0

Using the table code definitions from Figure 2-1, this recorder has the following features and options:

- 2-input type with thermocouple, RTD, mV, 0–5 Vdc or 4–20 mA input for channel 1
- 0–10 Vdc input for channel 2
- Two controllers with set point programming capability
- Alarm output / digital input capability
- High speed pen
- Totalization for input 1
- Gray door with acrylic window
- Door lock
- Chart illumination
- Customer I.D. tag
- No approvals

Location of hardware components

After you decode your recorder's model number, refer to Figure 2-2 to match "table" selections with the location of actual recorder hardware components. This will help you to determine applicable input / output wiring requirements, as well as identify appropriate software functions to be configured later.

To access and view the actual components inside your recorder, follow the procedure in Table 2-2.

Table 2-2 Procedure to Access Components

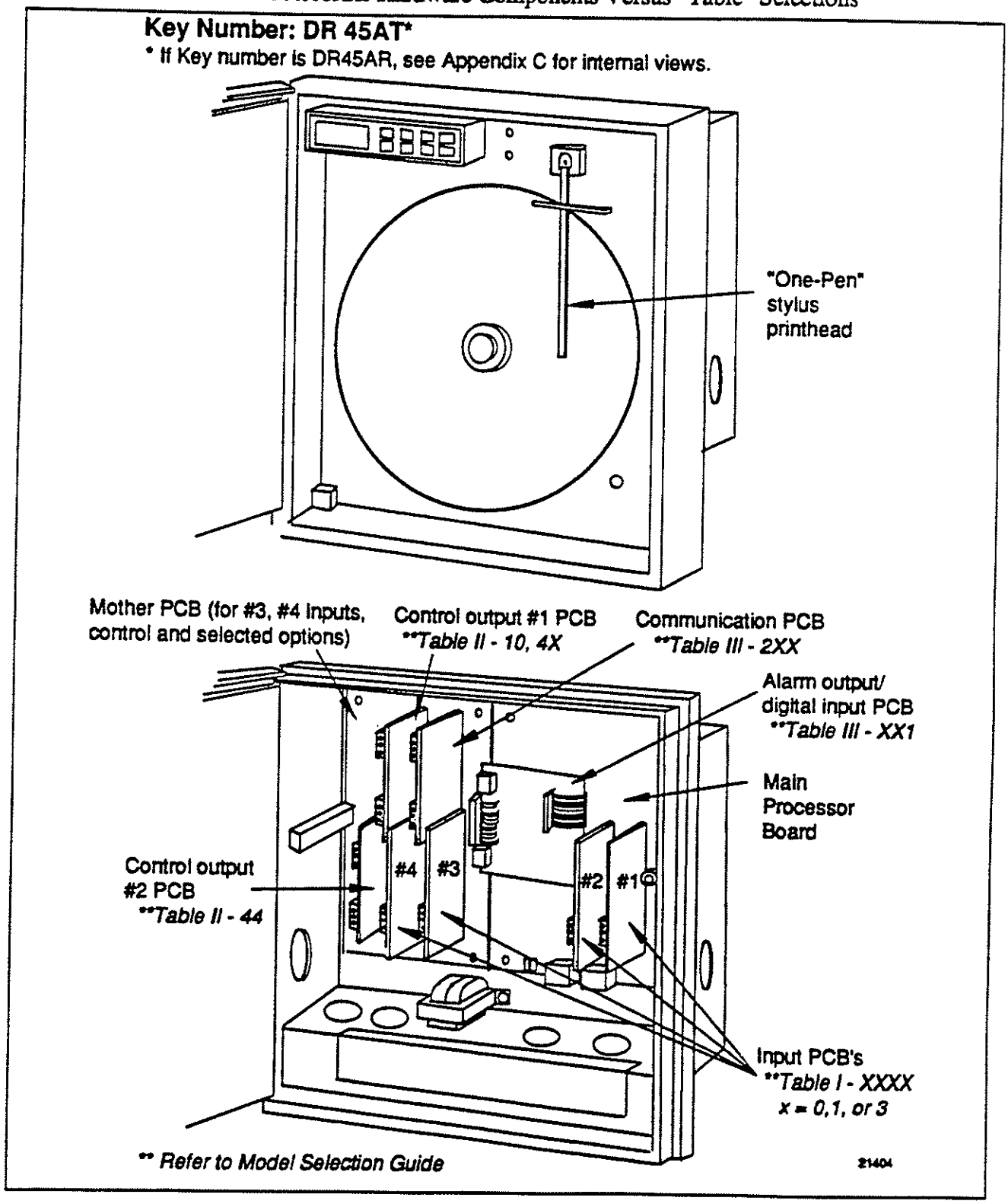
Step	Action
1	Push in the button or turn lock/heavy duty latch on the recorder door and swing the door open.
2	Loosen the captive screw on the right hand side of the chart plate and swing the chart plate out.
3	Reverse the steps to close the chart plate and door.

Continued on next page

View of hardware components

Figure 2-2 shows the location of the actual hardware components for key number DR45AT. If key number is DR45AR, see Appendix C for internal views.

Figure 2-2 DR4500A Recorder Hardware Components Versus "Table" Selections



2.3 Mounting Considerations and Overall Dimensions

Physical considerations

The recorder can be mounted in a panel by making a new cutout or using an existing cutout with a filler plate (see Table 2-4). Use the mounting kit supplied. Adequate access space must be available at the back of the panel for installation and servicing activities.

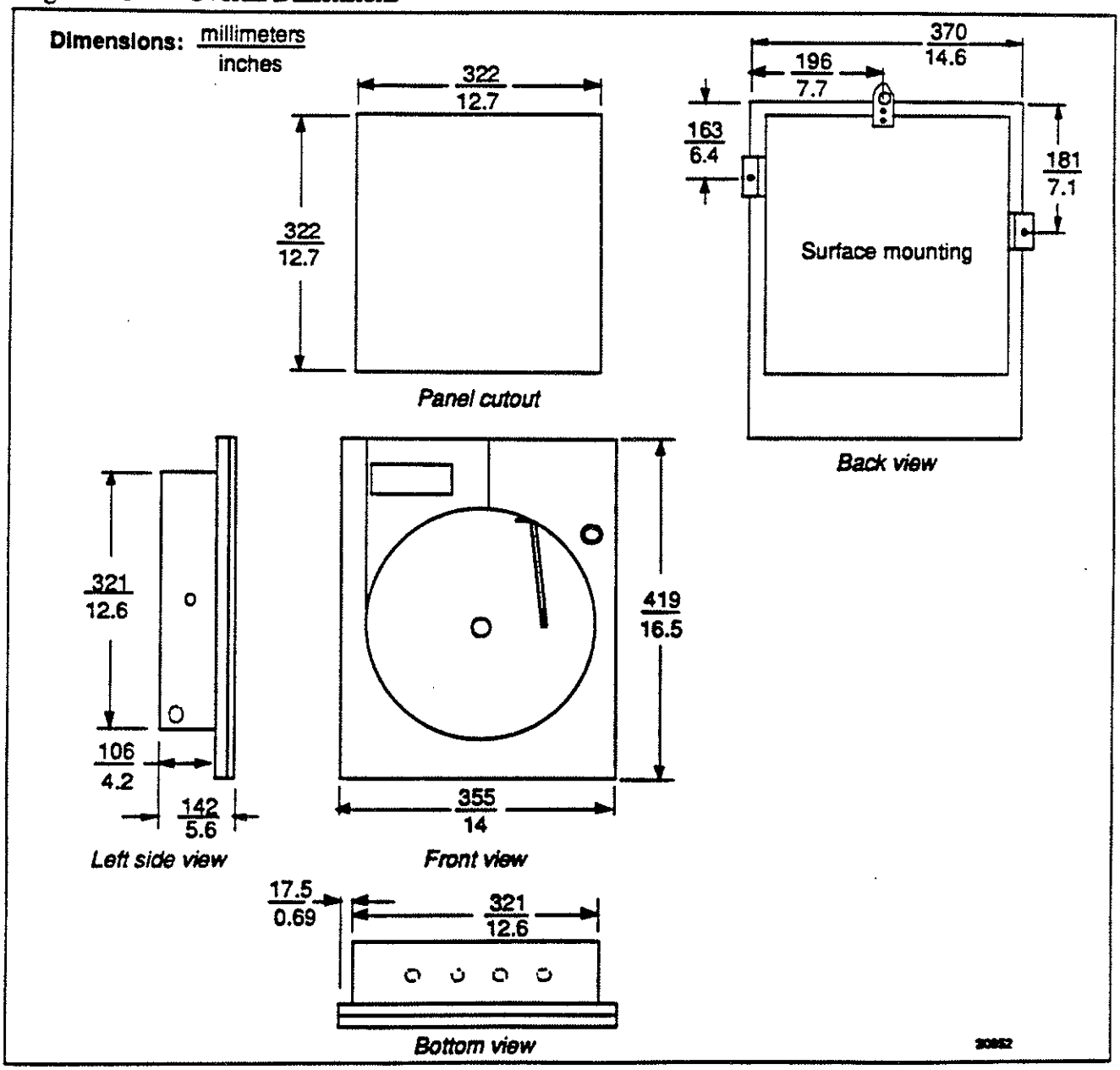
The overall dimensions and panel cutout requirements for mounting the recorder are shown in Figure 2-3.

The recorder's mounting enclosure must be grounded according to CSA standard C22.2 No. 0.4 or Factory Mutual Class No. 3820 paragraph 6.1.5.

Overall dimensions

Figure 2-3 shows the overall dimensions for mounting the recorder.

Figure 2-3 Overall Dimensions



2.4 Mounting Methods

Introduction

There are several methods available for mounting your recorder. They are:

- Flush in Panel (new panel cutout)
- Flush in Panel (using an existing panel cutout)
  - using universal filler plate kit
  - using cutout made for Kent Model 105M
- On Surface (of panel or wall)

Procedures for each method follow. Choose the one that meets your mounting requirements. Use the associated dimension drawings for reference.

How to remove knockouts for conduits

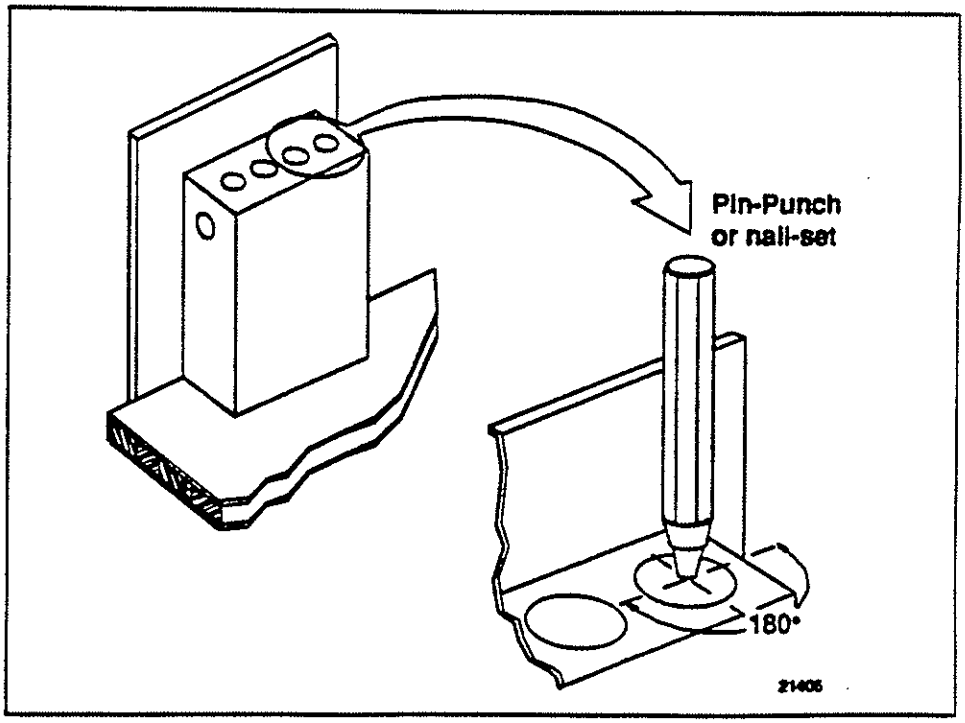
Before you mount the recorder, remove the appropriate "knockouts" in the bottom and/or sides of the recorder case. Refer to Figure 2-4 and follow the procedure in Table 2-3.

ATTENTION In some cases, the knockouts have already been removed at the factory and plugs have been inserted in their place. If your recorder has plugs instead of knockouts, just push out the appropriate plugs and skip the procedure in Table 2-3.

Table 2-3 How to Remove Knockouts

Step	Action
1	Place the recorder on a flat work surface as shown in Figure 2-4.
2	Place a flat-faced tool (such as a pin punch or nail set) on the knockout 180° from "web" and strike the tool firmly with a hammer.
3	Repeat step 2 for every knockout to be removed.

Figure 2-4 How to Remove Knockouts



Continued on next page

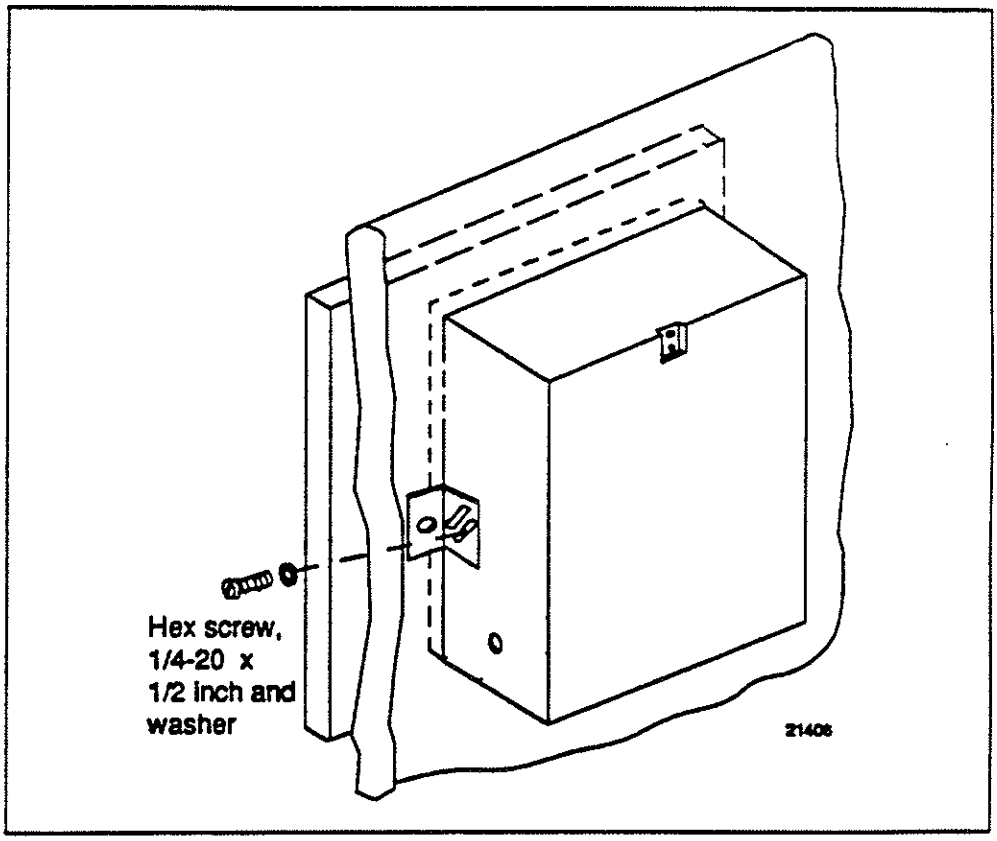
Mounting flush in panel (New panel cutout)

Refer to Figure 2-5 and follow the procedure in Table 2-4 to make a new cutout in a panel and mount your recorder in the cutout.

Table 2-4 Mounting Flush in a New Panel Cutout

Step	Action
1	At the appropriate location, make a square cutout in the panel measuring 12.7 ±0.060 inches by 12.7 ±0.060 inches (322.58 ±1.52 by 322.58 ±1.52 millimeters). See Figure 2-3.
2	Orient the recorder case properly and slide it into the cutout from the front of the panel. Support the recorder as shown in steps 3 and 4.
3	Refer to Figure 2-5. From the back of the panel, attach a mounting bracket to each side of the recorder case using a 1/4-20 x 1/2 inch hex screw and a lockwasher for each bracket (mounting hardware supplied with recorder). Leave the screws slightly loose so you can adjust the brackets.
4	While holding the recorder firmly against the panel, slide each bracket against the back of the panel and tighten the screws.

Figure 2-5 Mounting Flush in a New Panel Cutout



Continued on next page

Reference data for existing panel cutouts

Refer to Table 2-5 to determine whether the existing panel cutout can be used. Use the procedure for mounting with the universal filler kit unless otherwise noted.

Table 2-5 Reference Data for Mounting DR4500A in Existing Panel Cutouts

Manufacturer/Instrument	Dimensions of existing Panel Cutout (inches)	Need Universal Filler Plate Kit 30755134-001 Blue color 30755134-002 Gray color
Honeywell/Model AR100*, DR4200	12.7 x 12.7	No*
Honeywell/Class 15	15.8 x 17.2	Yes
Honeywell/Class 45	13.12 x 17.12	Yes
Badger Meter/Model Micro Chart	14.25 x 17.88	Yes
Bristol/Models 4330, 500 Classes 1, 2A, 3B, and 5	3.56 x 18.56	Yes
Fisher and Porter/Model 51-1100	13.75 x 17.31	Yes
Foxboro/Model 40	14.38 x 17.06	Yes
Kent/Model 105M**	13.6 x 13.46	No**
Partlow/Model ER*	13.5 x 12.69	No*
Taylor/Model 76J	13.78 x 16.5	Yes

* No adaption is required, use procedure for "Flush in Panel - New Panel Cutout"

** Use procedure for "Cutout made for Kent Model 105M"

Continued on next page

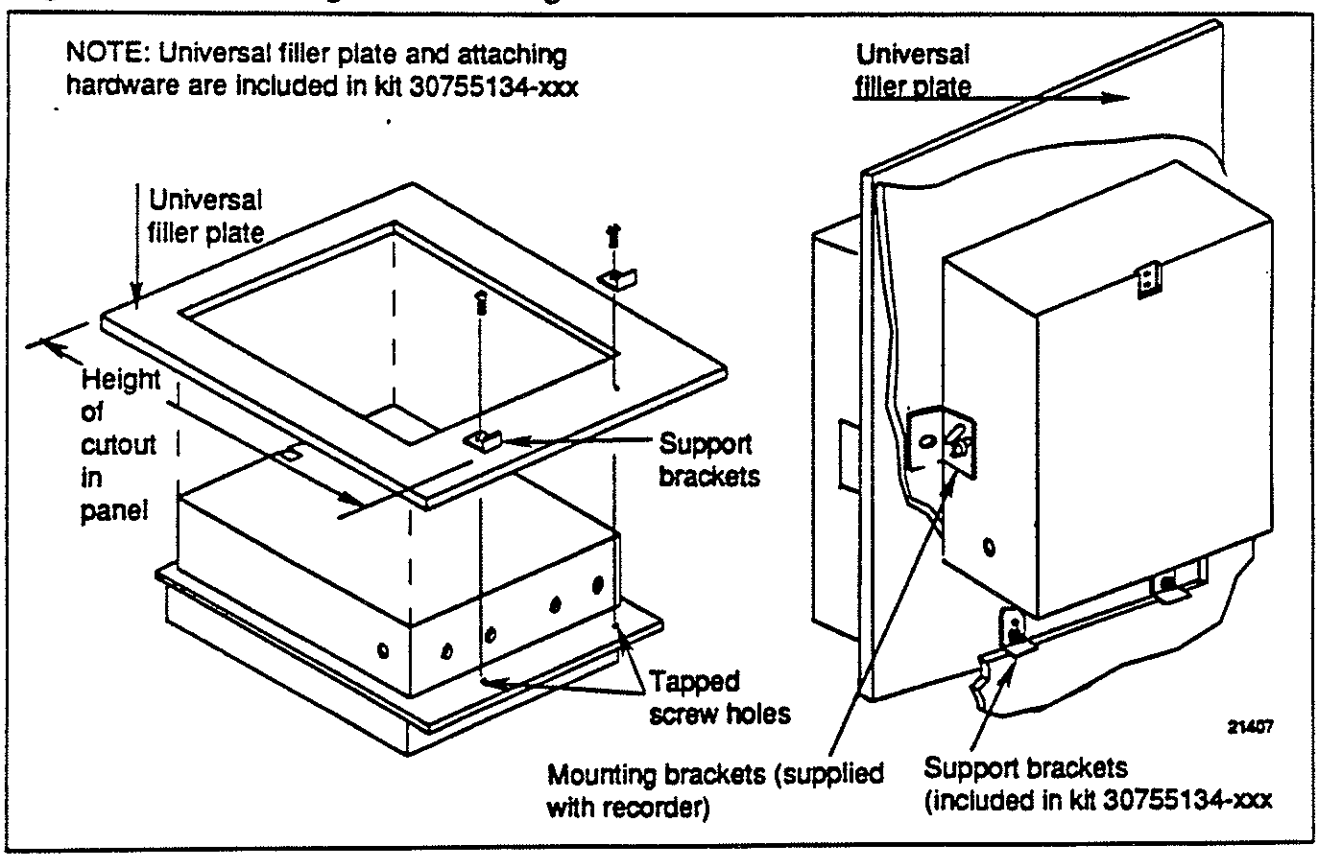
Mounting flush in panel (using universal filler plate kit)

Refer to Figure 2-6 and follow the procedure in Table 2-6 to mount your recorder in an existing cutout using the Universal Filler Kit.

Table 2-6 Mounting Flush in a Panel Using Universal Filler Kit

Step	Action
1	Lay the recorder face down on a clean work surface and position the universal filler plate as shown in Figure 2-6.
2	Measure the height of the existing panel cutout.
3	Refer to Figure 2-6. Position the support brackets, supplied with the kit, so that the distance from the top of the "window" in the filler plate to the right angle of the support brackets is just less than the height of the existing panel cutout.
4	Secure brackets with two 10-32 x 1/4 inch screws, provided in the kit, by inserting them through the holes in the filler plate into the tapped screw holes in the recorder case.
5	Insert the recorder into the cutout from the front of the panel as shown in Figure 2-6.
6	Refer to Figure 2-6. From the back of the panel attach a mounting bracket to each side of the recorder case using a 1/4-20 x 1/2-inch hex screw and a lockwasher for each bracket (mounting hardware supplied with recorder). Leave the screws slightly loose so you can adjust the brackets.
7	While holding the recorder firmly against the panel, slide each bracket against the back of the panel and tighten the screws.

Figure 2-6 Mounting in a Panel Using Universal Filler Kit



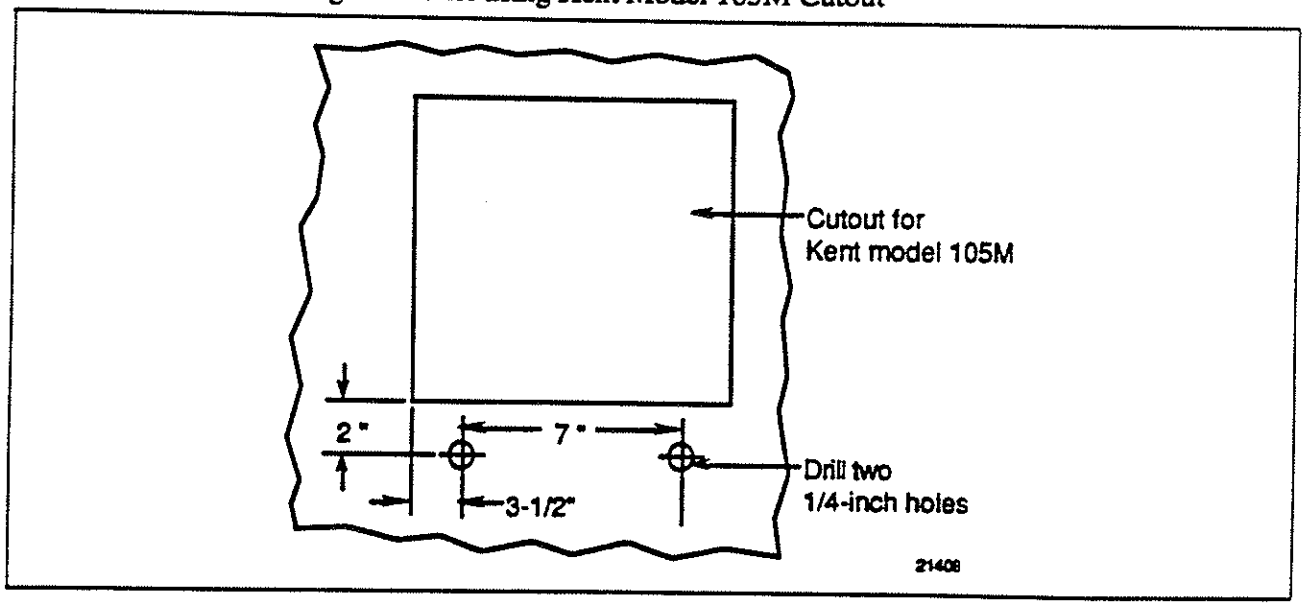
Mounting flush in panel (using cutout made for Kent Model 105M)

Refer to Figure 2-7 and follow the procedure in Table 2-7 to mount your recorder in an existing cutout using the cutout made for Kent Model 105M.

Table 2-7 Mounting Flush in a Panel Using Kent Model 105M Cutout

Step	Action
1	Drill two 1/4-inch holes in the back of the panel as shown in Figure 2-7. These holes are for 10-32 screws to be inserted from back of panel into threaded inserts in the back of the recorder case. **ATTENTION** If the panel is more than 1/4-inch thick, substitute 10-32 x 1/2-inch long screws for the 3/8-inch long screws supplied with the recorder.
2	While supporting the recorder, insert it through the panel cutout and orient the case so that the threaded inserts at the bottom of the case align with the holes drilled in the panel.
3	From the rear of the panel, insert two 10-32 pan head screws of appropriate length into threaded inserts in the recorder case.
4	From the back of the panel, attach a mounting bracket to each side of the recorder case using a 1/4-20 x 1/2-inch hex screw and a lockwasher for each bracket (mounting hardware supplied with recorder). Leave the screws slightly loose so you can adjust the brackets.
5	While holding the recorder firmly against the panel, slide each bracket against the back of the panel and tighten the screws.

Figure 2-7 Mounting in a Panel using Kent Model 105M Cutout



Continued on next page

Mounting on surface (of panel or wall)

Refer to Figure 2-8 and follow the procedure in Table 2-8 to mount your recorder on a surface (panel or wall).

ATTENTION You must supply three (3) screws for attaching the mounting hardware (brackets and support hook) to panel or wall.

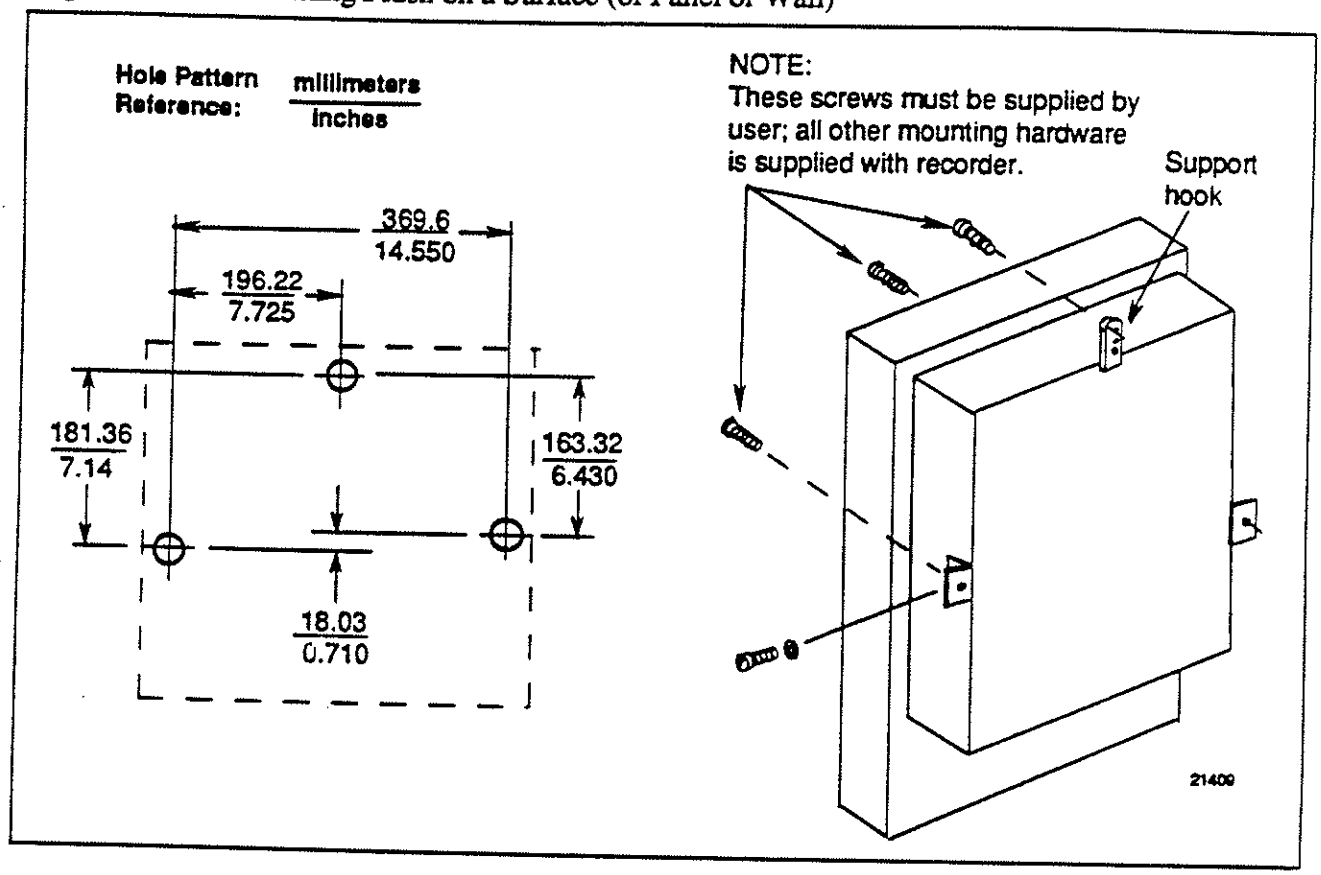
Table 2-8 Mounting Flush on a Surface (of Panel or Wall)

Step	Action
1	Using two flat-head 10-32 x 1/4-inch screws supplied with the recorder, fasten the support hook into the recess at the back of the recorder case as shown in Figure 2-8.
2	Using 1/4-20 x 1/2-inch hex screws and lockwashers, attach a mounting bracket to each side of the case. Leave the screws slightly loose so as to permit some adjustments of the brackets.
3	On the panel mark the locations for the three holes as shown by the hole pattern in Figure 2-8.
4	Using a drill of appropriate size for user-supplied screws, drill a hole in the front of the panel for the eye of the support hook.
5	Insert the screws for the support hook into the panel, allowing the screw head to protrude approximately 5/16-inch.
6	Hang the recorder support hook on the screw. Make sure that the locations for the other two holes (marked in step three) are correct. If not, make sure that the recorder is aligned vertically and use the brackets as templates to mark the proper locations.
7	Remove the recorder from the panel and drill the other two holes.
8	Hang the recorder on the screw by the support hook and insert the other two user-supplied screws through the brackets into the panel. Tighten the two hex screws that attach the brackets to the case.

Continued on next page

Mounting on surface (of panel or wall), continued

Figure 2-8 Mounting Flush on a Surface (of Panel or Wall)



Taking electrical noise precautions

Electrical noise is composed of unabated electrical signals which produce undesirable effects in measurements and control circuits.

Digital equipment is especially sensitive to the effects of electrical noise. Your recorder has built-in circuits to reduce the effect of electrical noise from various sources. If there is a need to further reduce these effects:

- Separate External Wiring - separate connecting wires into bundles (see Table 2-9) and route the individual bundles through separate conduits or metal trays.
- Use Suppression Devices - for additional noise protection, you may want to add suppression devices at the external source; appropriate suppression devices are commercially available.

ATTENTION For additional noise information, refer to *Appendix B*.

Permissible wire bundling

Table 2-9 shows which wire functions should be bundled together.

Table 2-9 Permissible Wiring Bundling

Bundle No.	Wire Functions
1	• Line power wiring • Earth ground wiring • Control relay output wiring • Line voltage alarm wiring
2	Analog signal wire, such as: • Input signal wire (thermocouple, 4 to 20 mA, etc.) • 4-20 mA output signal wiring • Slidewire feedback circuit wiring • Digital input signals • Communications
3	• Low voltage alarm relay output wiring • Low voltage wiring to solid state type control circuits

Continued on next page

Identify your wiring requirements

To determine the appropriate diagrams for wiring your recorder, refer to the model number interpretation in this section. The model number of the recorder can be found on the chart plate.

Wiring the recorder

Using the information contained in the model number, select the appropriate wiring diagrams from the figures listed below and wire the recorder accordingly.

Wiring Requirements	Figure
AC Line Power	2–9
Thermocouple, RTD, mV, or 0–5 Vdc Inputs	2–10
4–20 mA Inputs	2–11
0–10 Vdc Inputs	2–12
4–20 mA Current Outputs	2–13
Position Proportional Control Outputs	2–14
Relay Control Outputs – Time Proportioning – 3 Position Step Control	2–15
Alarm #1 and #2 Outputs and Digital Inputs	2–16
DMCS Communications Wiring	2–17

AC line power

Refer to Figure 2-9 and follow the procedure in Table 2-10 to connect the AC line power.

WARNING **Be sure that the line voltage is OFF before connecting the power wires to the recorder or personal injury could result.**

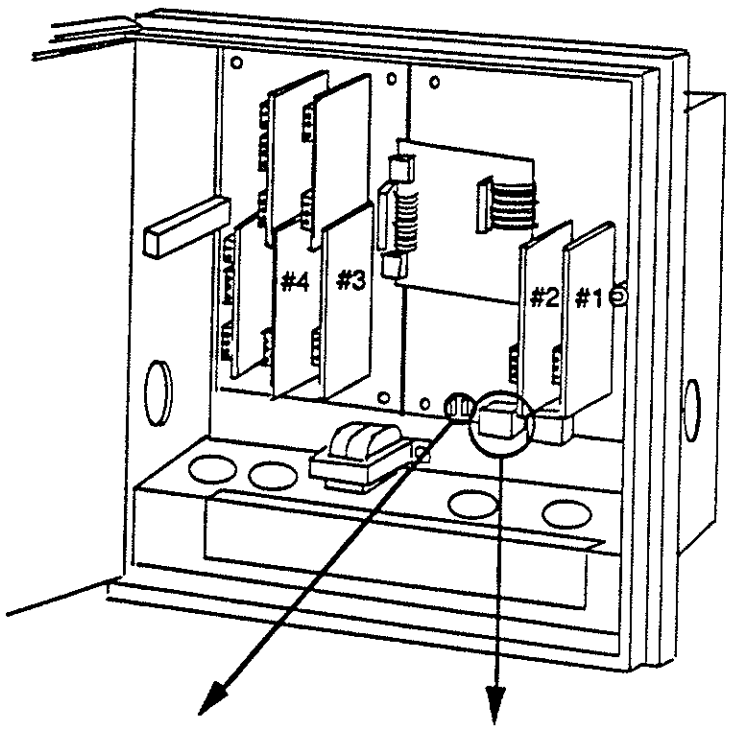
Table 2-10 AC Line Power Wiring

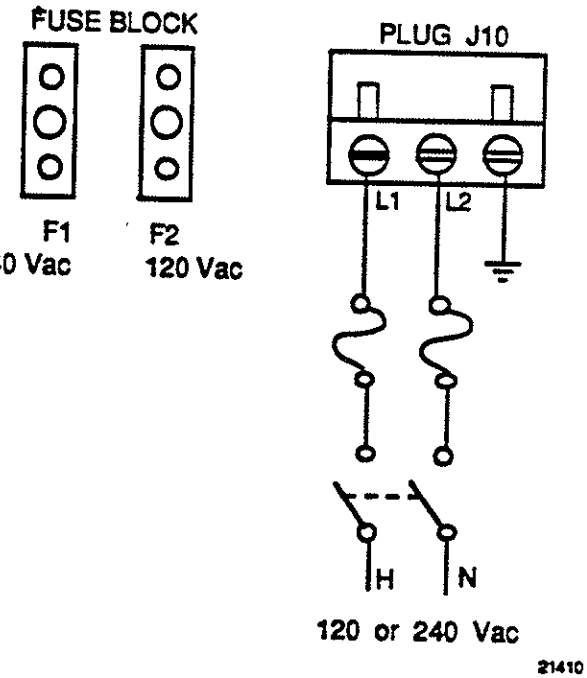
Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J10 on the bottom edge of the main printed circuit board. (refer to Figure 2-9).
3	Remove the unwired plug from J10.
4	Run the power wires separately through second conduit from the right
5	Strip 1/4-inch maximum of insulation from the end of each wire.
6	Loosen the screws in plug J10 terminals and position the plug as you would to plug it into J10.
7	Insert the *green* wire (G) into the first screw clamp from the right, the *white* wire (L2) into the second screw clamp from the right, and the *black* wire (L1) into the third screw clamp from the right. Tighten the screws to secure the wires. **CAUTION** **To avoid damaging the recorder, be sure that you install the power wires into the correct screw clamps. Make sure the fuse block is installed properly for the given supply rating — 120 or 240 Vac. The fuse is in the 120 Vac location from the factory.**
8	Make sure the fuse block is installed in the proper location. Refer to Figure 2-9 for fuse block location. • **120 Vac** – Fuse block in location **F2** • **240 Vac** – Fuse block in location **F1**
9	Dress the wires as slack as possible. This keeps the noise signal on these wires from bypassing built-in suppression. Also, do not bundle any low level signal wires with the power wires. Refer to Table 2-9 for permissible wire bundling. • Refer to *Appendix B* or additional information concerning noise interference prevention.
10	Insert the wired plug into J10. **WARNING** **Input line voltage will be present on the instrument ground plane if safety ground is not attached; personal injury and product damage could result.**

Continued on next page

AC line power, continued

Figure 2-9 AC Line Power Wiring





Continued on next page

Thermocouple, RTD, mV, or 0–5 Vdc Inputs

You can wire input 1, 2, 3, or 4 for thermocouple, RTD, mV, or 0–5 Vdc actuations.

The polarity for input #1, #2, #3, and #4 is identical.

The prerequisites are:

- Model Number - Table 1 = 1XXX, X1XX, XX1X, XXX1

ATTENTION For thermocouple or RTD inputs, calibrate the recorder to achieve the stated accuracy. Refer to *Section 7 – Input Calibration.*

Refer to Figure 2-10 and follow the procedure in Table 2-11 to wire Thermocouple, RTD, mV, or 0–5 Vdc inputs.

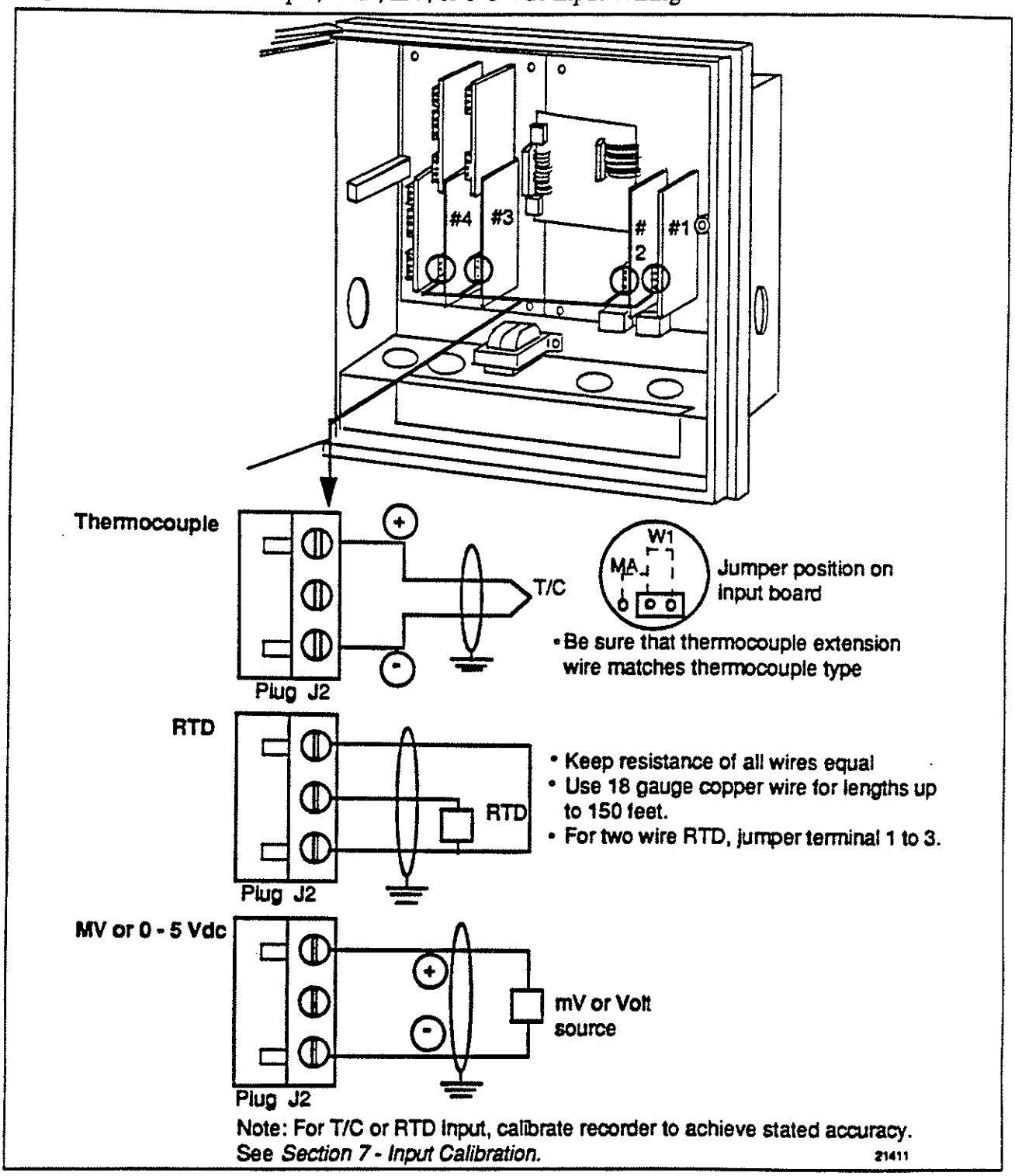
Table 2-11 Thermocouple, RTD, mV, or 0–5 Vdc Input Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J2 on the printed circuit board for input 1 (refer to Figure 2-10).
3	Remove the unwired plug from J2.
4	Run the input wires through the desired knockout - DO NOT bundle them with the power wires.
5	Locate jumper position W1 and make sure the jumper is in the W1 position (see Figure 2-10 for the location).
6	Strip 1/4-inch maximum of insulation from the end of each wire.
7	Loosen the screws in plug J2 terminals and position the plug as you would to plug it into J2.
8	Insert the wires into the appropriate screw clamps for the applicable input type. See Figure 2-10 for specific input actuation plug wiring. Tighten the screws to secure the wires.
9	Insert the wired plug into J2.
10	Repeat steps 2 through 9 for input 2, 3, and 4 printed circuit boards as applicable.

Continued on next page

Thermocouple, RTD, mV, or 0–5 Vdc Inputs continued

Figure 2-10 Thermocouple, RTD, mV, or 0–5 Vdc Input Wiring



Continued on next page

4–20 mA Inputs and transmitter power

You can wire input 1, 2, 3, or 4 for 4–20 mA actuations.

The polarity for input #1, #2, #3, and #4 is identical.

The prerequisites are:

- Model Number - Table 1 = 1XXX, X1XX, XX1X, XXX1

ATTENTION Connector J11 on the main processor printed circuit board can be used to provide 24 Vdc power to up to two field transmitters (without power) which are supplying the 4–20 mA input signals to the recorder
(1.2W @ 24 Vdc = 50 mA available).

Refer to Figure 2-11 and follow the procedure in Table 2-12 to wire 4–20 mA inputs.

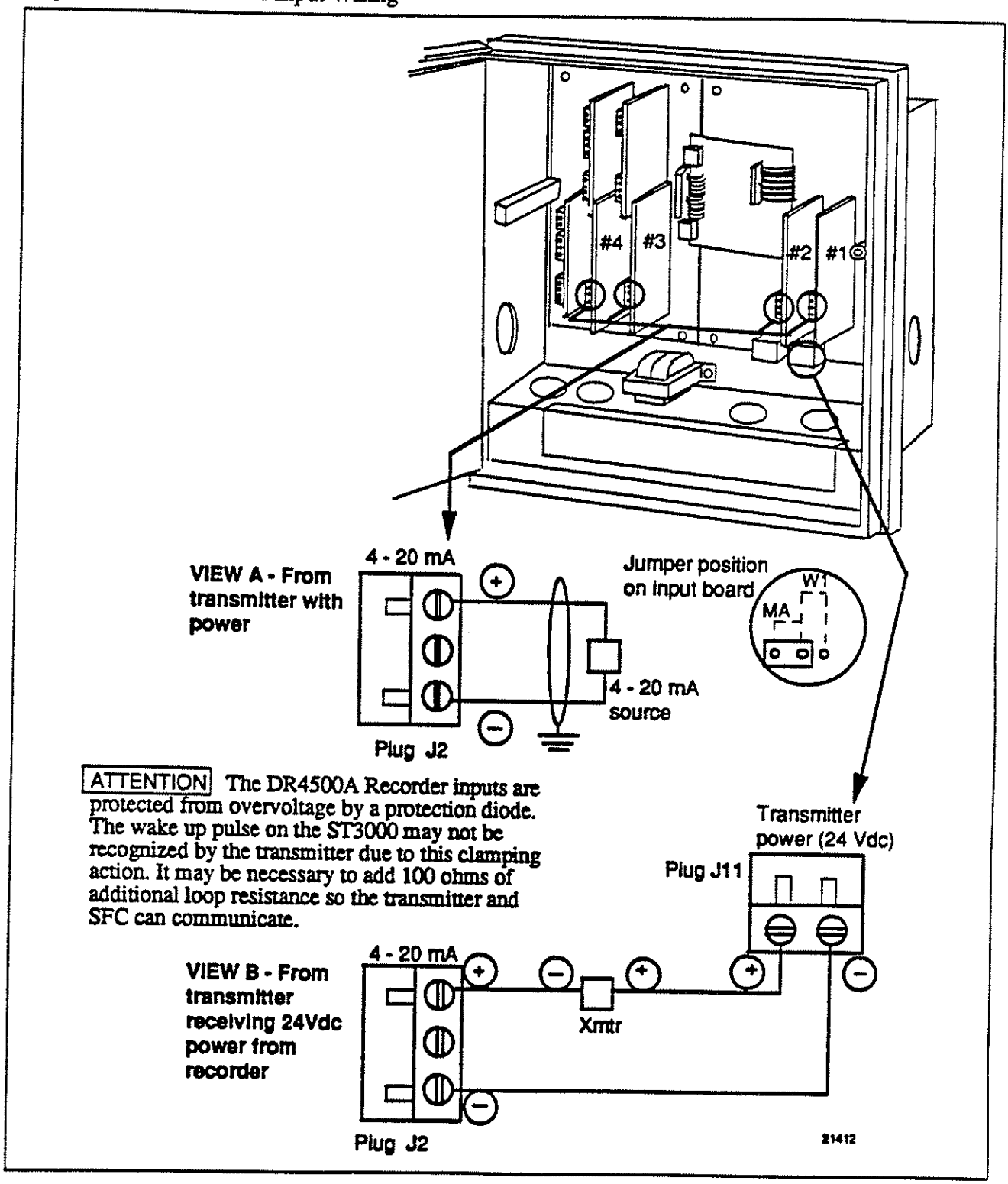
Table 2-12 4–20 mA Input Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Be sure that the jumper is installed in the position labeled "MA"; this connects an internal 250 ohm resistor across the 4–20 mA input terminals on J2 (refer to Figure 2-11 for location of jumper).
3	Locate connector J2 on the printed circuit board for input 1 (refer to Figure 2-11).
4	Remove the unwired plug from J2.
5	Run the input wires through the desired knockout - DO NOT bundle them with the power wires.
6	Strip 1/4-inch maximum of insulation from the end of each wire.
7	Loosen the screws in plug J2 terminals and position the plug as you would to plug it into J2.
8	• *For transmitters with power:* Insert the wires into the appropriate screw clamps and tighten the screws to secure the wires. **ATTENTION** The DR4500A Recorder inputs are protected from overvoltage by a protection diode. The wake up pulse on the ST3000 may not be recognized by the transmitter due to this clamping action. It may be necessary to add 100 ohms of additional loop resistance so the transmitter and SFC can communicate. • *For transmitters which require power:* Remove the unwired plug from J11 then wire the transmitter power to J11 and the input to J2. Tighten the screws in the plugs to secure the wires.
9	Insert the wired plug into J2 and J11 as applicable.
10	Repeat steps 2 through 9 for input 2, 3, and 4 printed circuit boards as applicable.

Continued on next page

4–20 mA Inputs, continued

Figure 2-11 4–20 mA Input Wiring



Continued on next page

0–10 Volt dc Inputs

You can wire input 1, 2, 3, or 4 for 0–10 Volt dc actuations.

The polarity for input #1, #2, #3, and #4 is identical.

The prerequisites are:

- Model Number - Table 1 = 3XXX, X3XX, XX3X, XXX3

ATTENTION Calibrate the recorder to achieve the stated accuracy. Refer to *Section 7 – Input Calibration.*

Refer to Figure 2-12 and follow the procedure in Table 2-13 to wire 0–10 Vdc inputs.

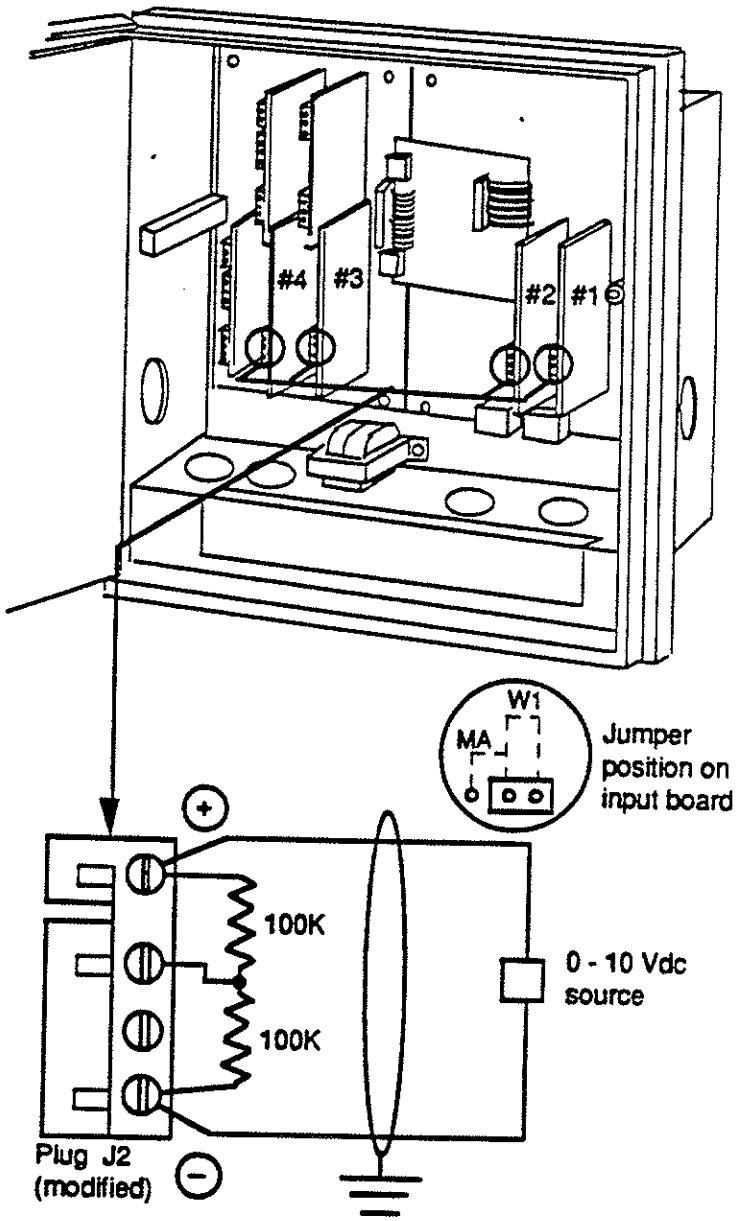
Table 2-13 0–10 Volt dc Input Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J2 on the printed circuit board for input 1 (refer to Figure 2-12).
3	Remove the unwired plug from J2 and replace it with the modified 4-screw plug from the bag of accessories supplied with the recorder.
4	Run the input wires through the desired knockout - DO NOT bundle them with the power wires.
5	Strip 1/4-inch maximum of insulation from the end of each wire.
6	Loosen the screws in plug J2 terminals and position the plug as you would to plug it into J2.
7	Insert the wires into the appropriate screw clamps and install two 100K-ohm resistors (30755232-002) from the bag of accessories supplied with the recorder across the wires as shown. Tighten the screws to secure the wires.
8	Install the wired plug into J2. Since J2 has only three receptacles, one of the modified plug connectors is designed to slide outside J2 when the plug is installed.
9	Locate jumper position W1 and make sure the jumper is in the W1 position (see Figure 2-12 for the location).
10	Repeat steps 2 through 9 for input 2, 3, and 4 printed circuit boards as applicable.

Continued on next page

0–10 Volt dc Inputs, continued

Figure 2-12 0–10 Volt dc Input Wiring



4–20 mA control output wiring

You can wire control output 1 or 2 for 4–20 mA output.

The prerequisites are:

- Model Number - Table 2 = 10, 40, 44, 60, or 66

Refer to Figure 2-13 and follow the procedure in Table 2-14 to wire 4–20 mA control outputs.

Table 2-14 4–20 mA Control Output Wiring

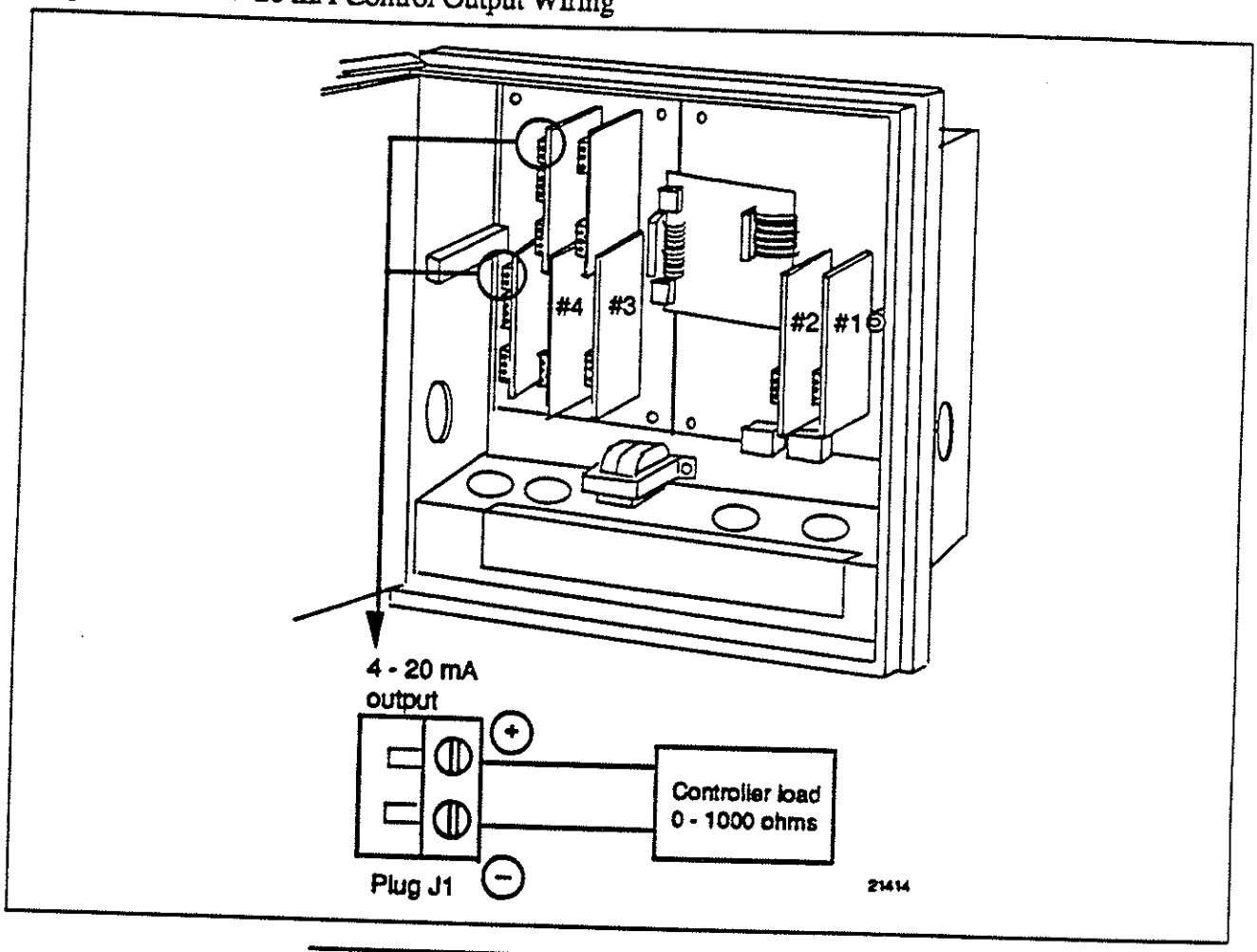
Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J1 near the top of the control output #1 printed circuit board (refer to Figure 2-13 for location).
3	Remove the unwired plug from J1.
4	Run the output wires through the desired knockout.
5	Strip 1/4-inch maximum of insulation from the end of each wire.
6	Loosen the screws in plug J1 terminals and position the plug as you would to plug it into J1.
7	Observing the polarity, insert the wires into the appropriate screw clamps as shown (refer to Figure 2-13). Tighten the screws to secure the wires.
8	Install the wired plug into J1.
9	Repeat steps 2 through 8 for control output #2 printed circuit boards as applicable.

ATTENTION Be sure that the 4-20 mA current output is aligned. Refer to *subsection 8.2 Current Proportional Output Calibration.*

Continued on next page

4–20 mA control output wiring, continued

Figure 2-13 4–20 mA Control Output Wiring



Continued on next page

Position proportional control output wiring

You can wire control output 1 or 2 for position proportional output.

The prerequisites are:

- Model Number Key = DR45AT
- Model Number - Table 2 = 10, 40, or 44

Refer to Figure 2-14 and follow the procedure in Table 2-15 to wire position proportional control outputs.

ATTENTION Be sure to calibrate the position proportional control output so that the increase and decrease relays operate properly with respect to the position of the external feedback slidewire. Refer to *Section 8 - Output Calibration* in this manual.

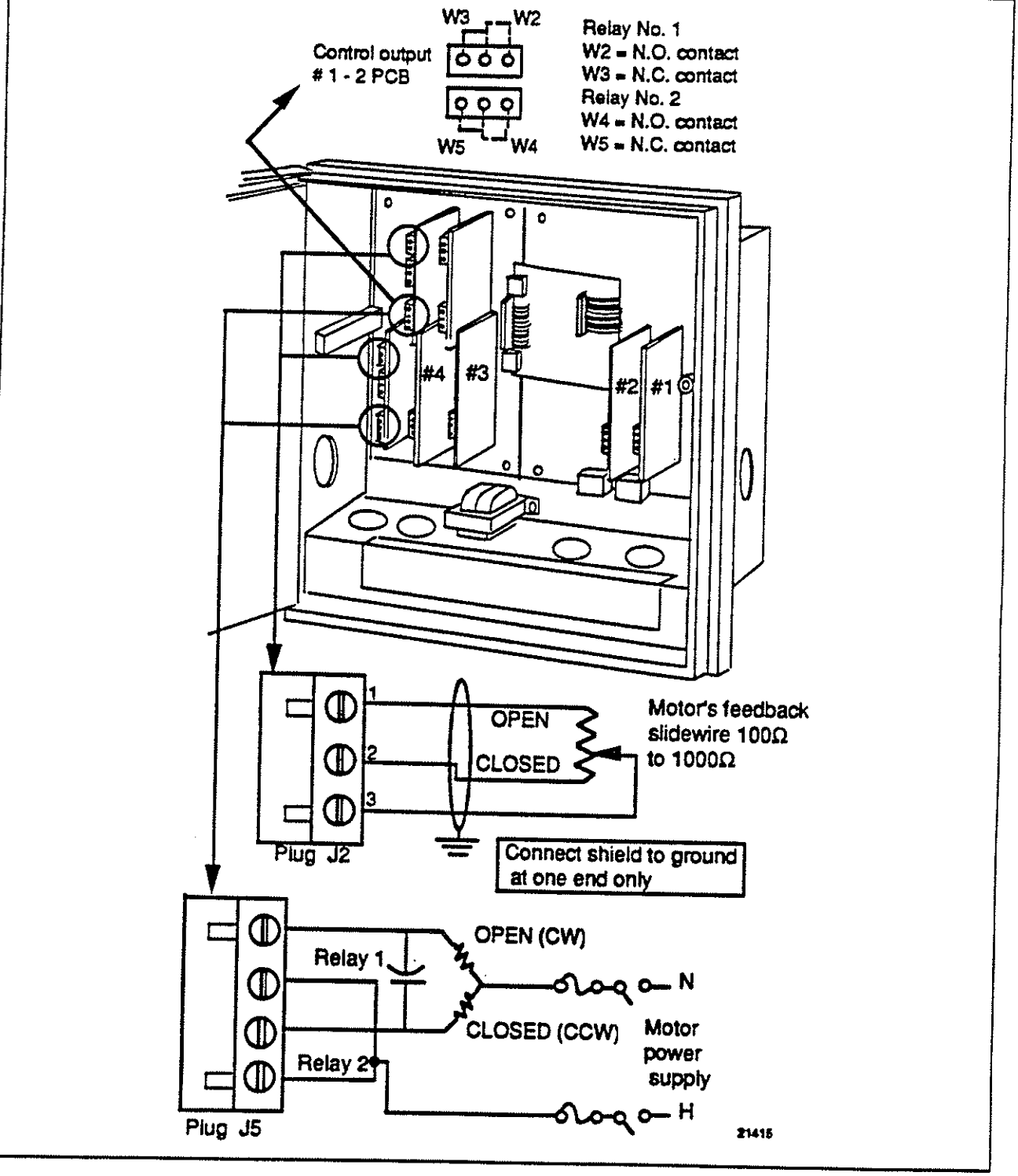
Table 2-15 Position Proportional Control Output Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J2 and J5 on the control output #1 printed circuit board (refer to Figure 2-14 for location).
3	Locate jumper positions W2/W3 and W4/W5 below connector J5 on the printed circuit board. Remove plug-in output #1 printed circuit board for better access to the jumpers. Be sure to tag and remove all the plug connections to the printed circuit board before removing it. Position the jumpers as shown in Figure 2-14 for desired relay contact action, then reinstall the printed circuit board.
4	Run the feedback slidewire and motor drive wires through the desired knockouts.
5	Strip 1/4-inch maximum of insulation from the end of each wire.
6	Loosen the screws in plug J2 terminals and position the plug as you would to plug it into J2.
7	Insert the wires from the motor's feedback slidewire into the appropriate screw clamps as shown (refer to Figure 2-14). Tighten the screws to secure the wires.
8	Loosen the screws in plug J5 terminals and position the plug as you would to plug it into J5.
9	Insert the wires for the motor into the appropriate screw clamps as shown (refer to Figure 2-14). Tighten the screws to secure the wires.
10	Install the wired plug into J2 and J5, as applicable.
11	Repeat steps 2 through 10 for Control Output #2 printed circuit boards as applicable.

Continued on next page

Position proportional control output wiring, continued

Figure 2-14 Position Proportional Control Output Wiring



Continued on next page

Relay control output wiring

You can wire control output 1 or 2 for relay output including Time proportional and 3 position step applications.

The prerequisites are:

- Model Number Key = DR45AT
- Model Number - Table 2 = 10, or 40

Refer to Figure 2-15 and follow the procedure in Table 2-16 to wire relay control outputs.

ATTENTION Relay #2 is used for time proportional and 3 position step control.

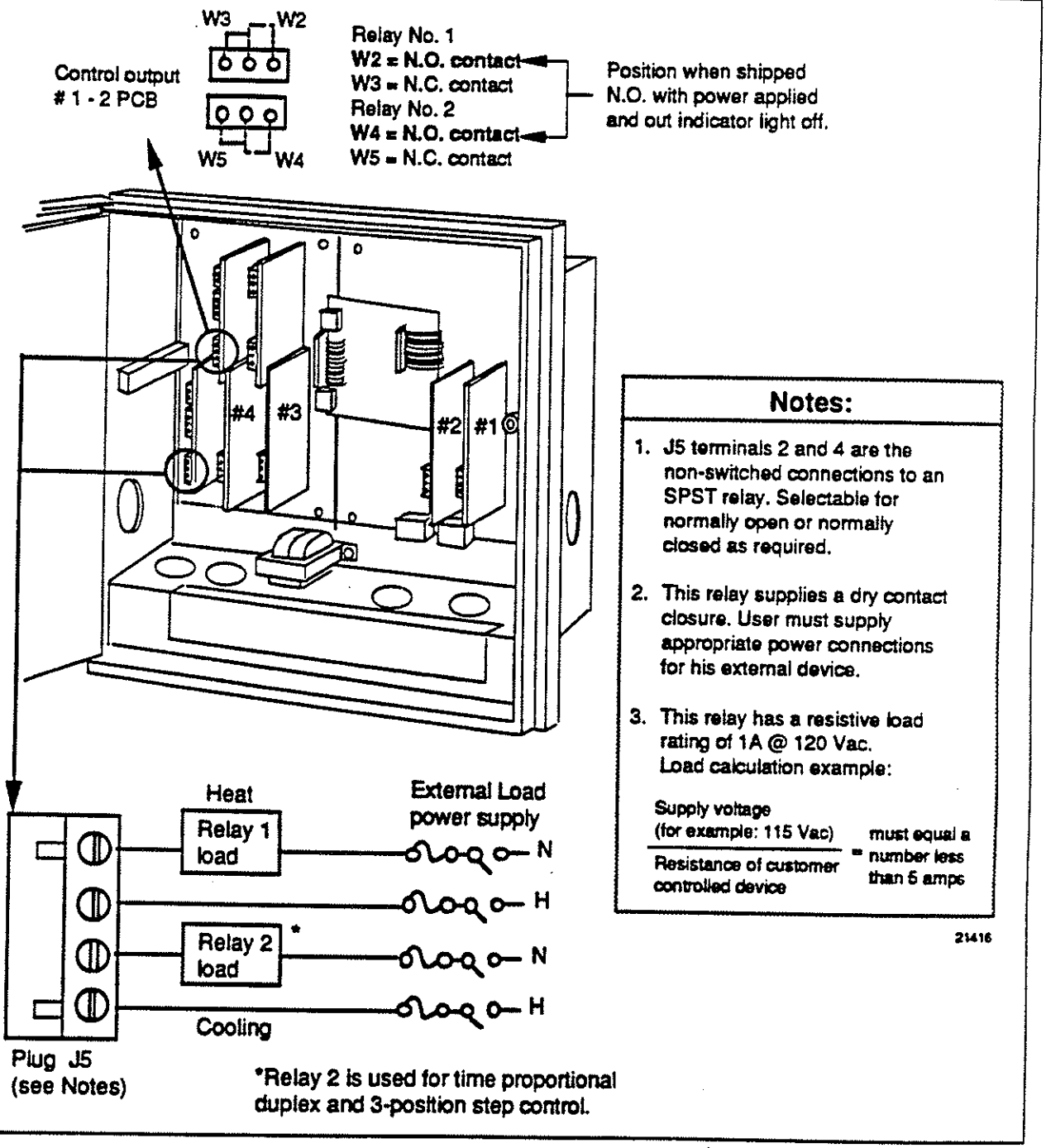
Table 2-16 Relay Control Output Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J5 on the control output #1 printed circuit board (refer to Figure 2-15 for location).
3	Remove the unwired plug from J5.
4	Locate jumper positions W2/W3 and W4/W5 below connector J5 on the printed circuit board. Remove plug-in output #1 printed circuit board for better access to the jumpers. Be sure to tag and remove all the plug connections to the printed circuit board before removing it. Position the jumpers as shown in Figure 2-15 for desired relay contact action, then reinstall the printed circuit board.
5	Run the relay load wires through the desired knockouts.
6	Strip 1/4-inch maximum of insulation from the end of each wire.
7	Loosen the screws in plug J5 terminals and position the plug as you would to plug it into J5.
8	Insert the relay wires and relay power into the appropriate screw clamps for single or duplex action as shown (refer to Figure 2-15); tighten the screws to secure the wires.
9	Install the wired plug into J5.
10	Repeat steps 2 through 9 for control output #2 printed circuit boards as applicable.

Continued on next page

Relay control output wiring, continued

Figure 2-15 Relay Control Output Wiring



Alarm output and digital input wiring

You can wire #1 and #2 Alarm Outputs and Digital Inputs.

The prerequisites are:

- Model Number - Table 3 = XX1

ATTENTION If Table 3 = 0X2 or 0X3

See Appendix C to wire #3, #4, #5, or #6 alarm outputs.

Refer to Figure 2-16 and follow the procedure in Table 2-17 to wire alarm outputs or digital inputs.

The alarm output is a dry contact closure.

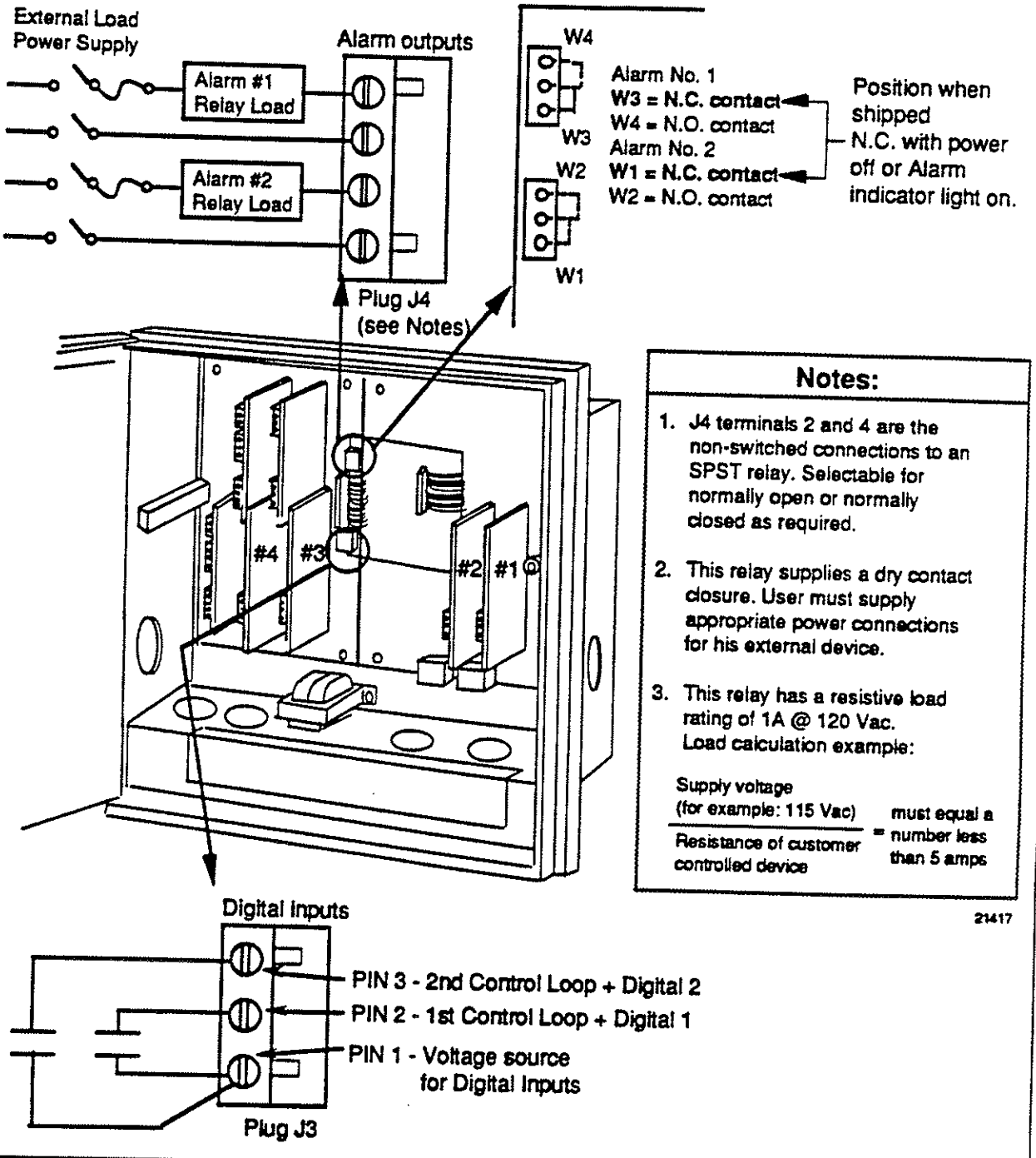
Table 2-17 Alarm Output or Digital Input Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J3 and J4 on the alarm output/digital input printed circuit board (refer to Figure 2-16 for location).
3	Remove the unwired plug from J3.
4	Run the digital input wires through the desired knockout.
5	Strip 1/4-inch maximum of insulation from the end of each wire.
6	Loosen the screws in plug J3 terminals and position the plug as you would to plug it into J3.
7	Insert the wires for the digital inputs into the appropriate screw clamps as shown (refer to Figure 2-16). Note that you can wire the contacts in an and /or fashion, so that both contacts or either contact initiates the configured action. Tighten the screws to secure the wires.
8	Install the wired plug into J3.
9	Remove the unwired plug from J4.
10	Run the alarm output wires through the desired knockout.
11	Strip 1/4-inch maximum of insulation from the end of each wire.
12	Loosen the screws in plug J4 terminals and position the plug as you would to plug it into J4.
13	Insert the wires for the alarm devices into the appropriate screw clamps as shown (refer to Figure 2-16). Tighten the screws to secure the wires.
14	Locate the jumper positions W1/W2 and W3/W4 on the printed circuit board. Reposition the jumpers as shown in Figure 2-16 for the desired relay control action. The recorder is shipped with the W1 and W3 in N.C. positions.
15	Install the wired plug into J4.

Continued on next page

Alarm output and digital input wiring, continued

Figure 2-16 Alarm Output or Digital Input Wiring



Continued on next page

DMCS communications wiring

DMCS Communications is an option available on the DR4500A recorder.

The prerequisites are:

- Model Key Number - DR45AT
- Model Number - Table 2 = 2XX

Refer to Figure 2-17 and follow the procedure in Table 2-18 to wire the DMCS communications option.

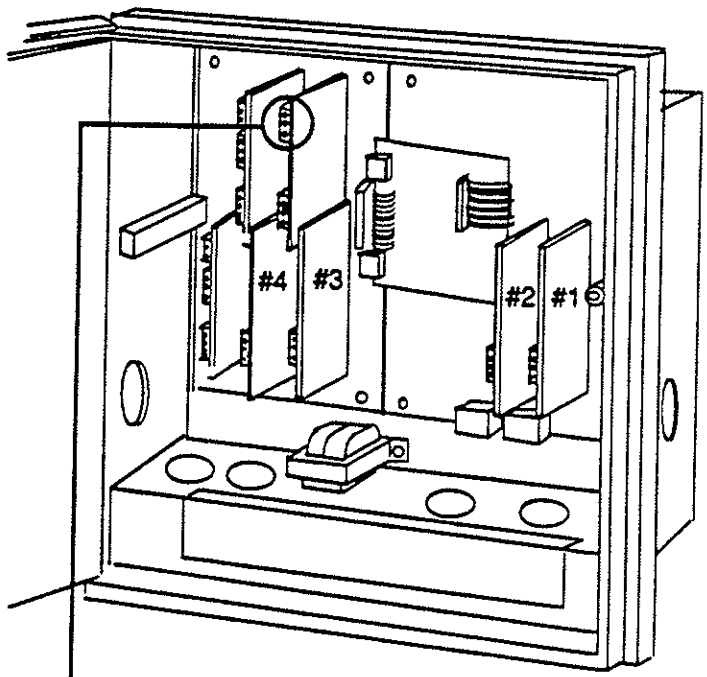
Table 2-18 DMCS Communications Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J1 on the communications option printed circuit board (refer to Figure 2-17 for location).
3	Remove the unwired plug from J1.
4	Run the communications option wires through the desired knockout.
5	Strip 1/4-inch maximum of insulation from the end of each wire.
6	Loosen the screws in plug J1 terminals and position the plug as you would to plug it into J1.
7	Insert the shielded wires for the communications option into the appropriate screw clamps as shown (refer to Figure 2-17). Tighten the screws to secure the wires.
8	Install the wired plug J1 into J1 connector on the communications board.

Continued on next page

DMCS communications wiring, continued

Figure 2-17 DMCS Communications Wiring



Communications master

D+ SHLD D-

Plug J1

To other communications instruments

Optional communication

Connect shield wires with Honeywell supplied crimp connector or equivalent

21418

Section 3 – Configuration

3.1 Overview

Introduction

Configuration is a dedicated operation where you use straightforward keystroke sequences to select and establish (configure) pertinent control data best suited for your application.

What's in this section?

The table below lists the topics that are covered in this section.

Topic		See Page
3.1	Overview	39
3.2	Configuration Prompts	40
3.3	How to Get Started	42
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Prompts

To assist you in the configuration process, there are prompts that appear in the upper and lower displays. These prompts let you know what group of configuration data (set up prompts) you are working with and also the specific parameters (function prompts) associated with each group.

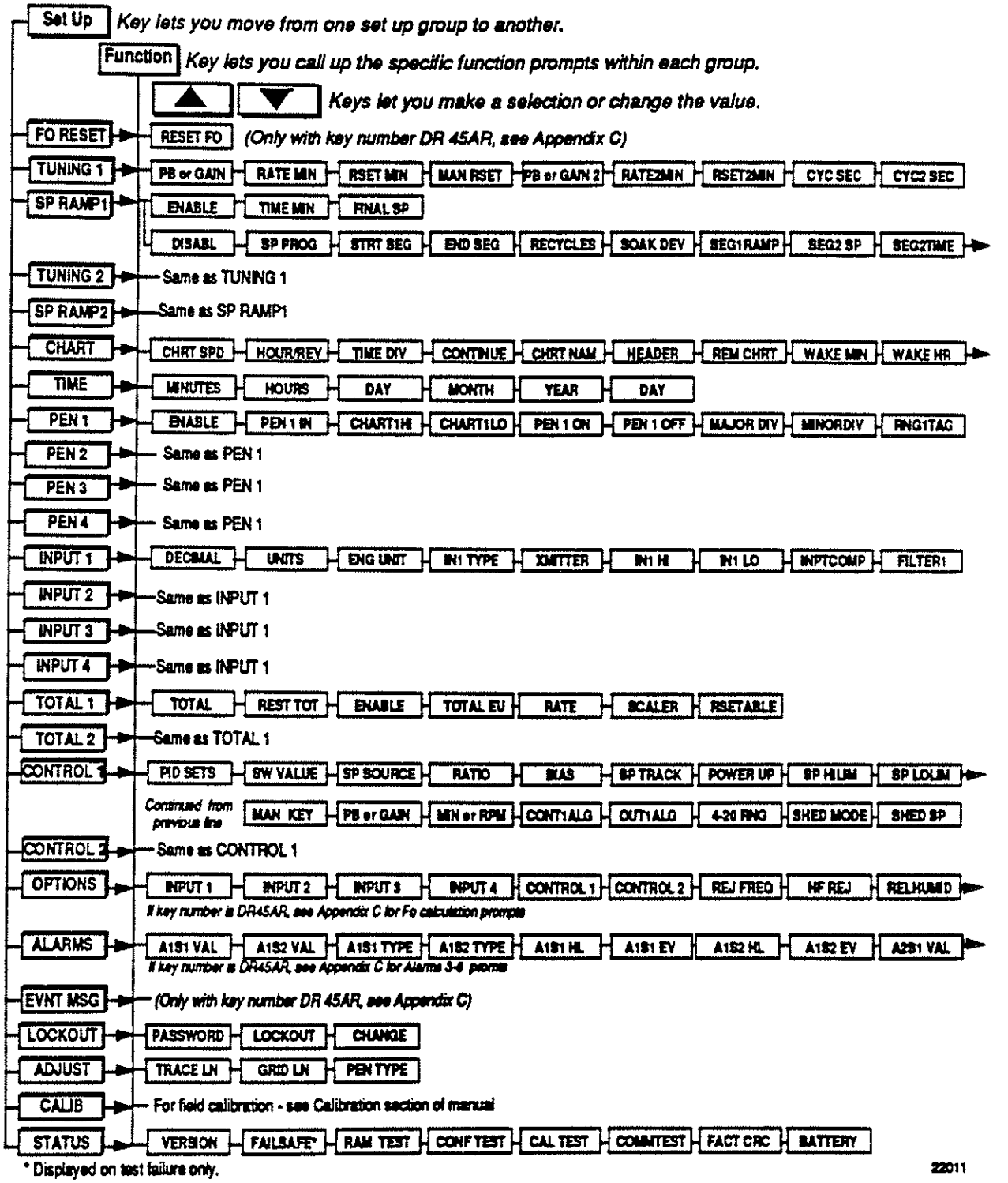
Figure 3-1 shows an overview of the prompt hierarchy.
As you will see, the configuration data is divided into 11 main set up groups.

Continued on next page

Diagram: prompt hierarchy

Figure 3-1 shows an overview of the DR4500A Set Up prompts and their associated Function prompt - read from left to right.

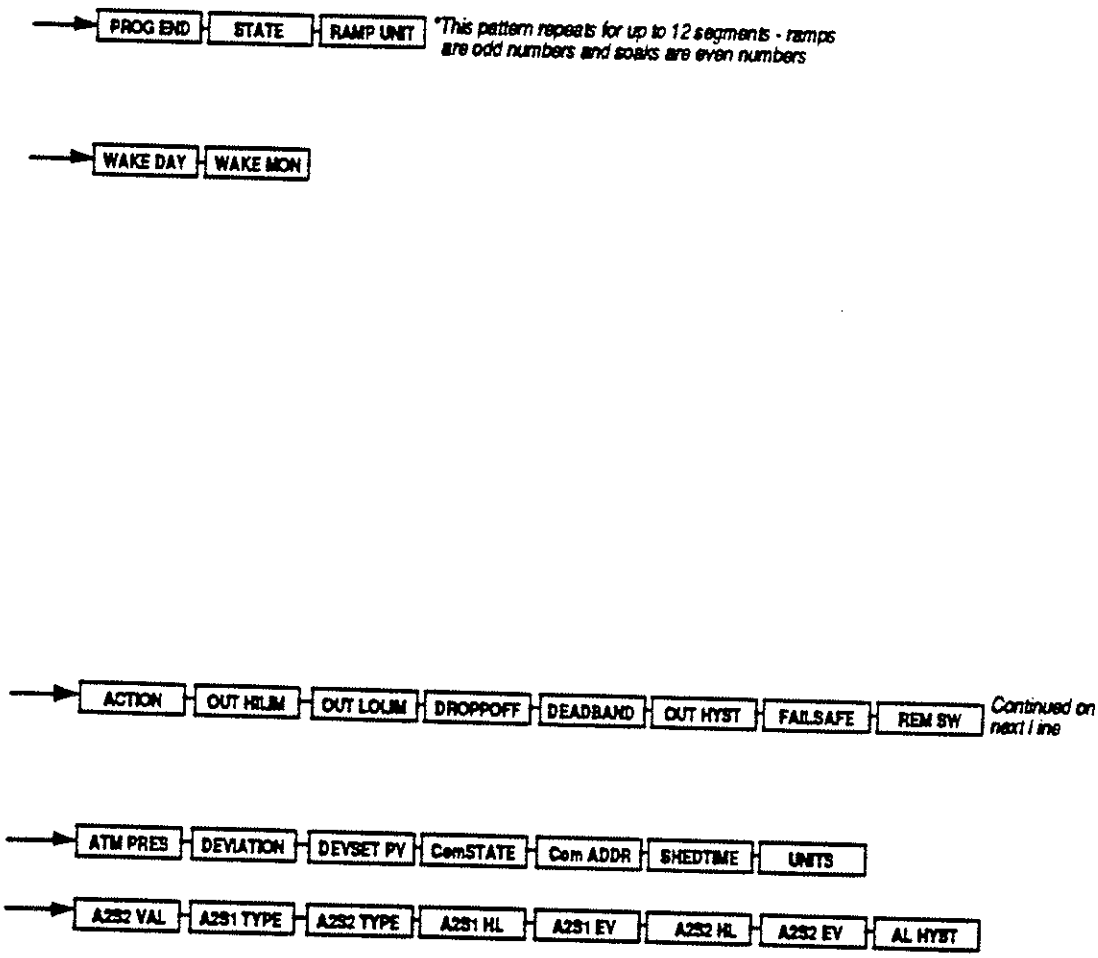
Figure 3-1 DR4500A Prompt Hierarchy



Continued on next page

Diagram: prompt hierarchy, continued

Figure 3-1 DR4500A Prompt Hierarchy, Continued



Read the configuration tips

Read *subsection 3.4 Configuration Tips* which will help you to easily and quickly configure your recorder.

Read configuration procedure

Read *subsection 3.5 Configuration Procedure* which tells you how to access the Set Up groups, and the function parameters within each of these groups that are shown in the Prompt Hierarchy in Figure 3-1.

Set Up groups

The Set Up groups and function parameters are listed in the order of their appearance. The list includes the name of the prompt, the range of setting or selections available, and the factory setting. It allows you to quickly find a parameter and obtain the available range or selection you require.

Parameter explanations or definitions

If you need a detailed explanation of any prompt listed, refer to *Section 4 – Configuration Parameter Definitions*. This section lists the set up and function prompts, the selections or range of settings that you can make for each, plus a detailed explanation or definition of each parameter .

Configuration record sheet

Located in *subsection 3.17* is a *Configuration Record Sheet*. When you make your configuration selections, record them on this sheet. Then you will have a record of how the recorder was configured.

Set up the recorder in this order:

- Inputs (Display will be correct)
- Pens (Trace will agree with display)
- Chart
- Alarms
- Control
- Tuning

3.4 Configuration Tips

Introduction

Listed below in Table 3-1 are a few tips that will help you enter the configuration data more quickly.

Table 3-1 Configuration Tips

Function	Tip
Displaying Groups	Use the SET UP key to display the Set Up groups. The group titles are listed in this section in the order that they appear in the recorder.
Displaying Functions	Use the FUNC key to display the individual parameters under each group. The prompts are listed in the order of their appearance in each group.
Scrolling	To get to a Set Up group prompt more quickly, hold the SET UP key in. To get to a function prompt more quickly, hold the FUNC key in. The display will scroll through the parameters. ATTENTION The prompting scrolls at a rate of 2/3 seconds when the SET UP or FUNC key is held in. Also, [▲] [▼] keys will move group prompts forward or backward at a rate twice as fast.
Changing values quickly	When Changing the value of a parameter, you can adjust a more significant digit in the upper display by holding in one key [▲] or [▼] , and pressing the other [▲] or [▼] at the same time. • The adjustment will move one digit to the left. • Press the key again and you will move one more digit to the left.
Restoring to the original value	When you change the value or selection of a parameter while in Set Up mode and decide not to enter it, press RUN/HOLD once, the original value or selection will be recalled.
Exiting SET UP mode	To exit Set Up mode, press the LOWR DISP key. This returns the display to the same state it was in immediately preceding entry into the Set Up mode.
Timing out from Set Up mode	If you are in Set Up mode and do not press any keys for one minute, the controller will time out and revert to the mode and display that was being used prior to entry into Set Up mode.
Key Error	When a key is pressed and the prompt "KEY ERROR" appears in the lower display, it will be for one of the following reasons: • parameter not available • not in Set Up mode, press SET UP key first • key malfunction, do keyboard test (operation) • individual key locked out

3.5 Configuration Procedure

Introduction

- Each of the Set Up groups and their functions are preconfigured at the factory.
- The factory settings are shown in the Set Up group tables that follow this procedure.
- If you want to change any of these selections or values, follow the procedure in Table 3-2. This procedure tells you the keys to press to get to any Set Up group and any associated Function parameter prompt.
- **If you need a detailed explanation of any prompt, refer to *Section 4 – Configuration Parameter Definitions.***

Procedure

Follow the procedure listed in Table 3-2 to access the Set Up groups and Function prompts.

[ATTENTION] The prompting scrolls at a rate of 2/3 seconds when the [SET UP] or [FUNC] key is held in. Also, [▲] [▼] keys will move group prompts forward or backward at a rate twice as fast.

Table 3-2 Configuration Procedure

Step	Operation	Press	Result
1	Select Set Up mode	SET UP	Upper Display: SET UP — Lets you know you are in the configuration mode and a Set Up group title is being displayed in the lower display. Lower Display: TUNING — This is the first Set Up group title.
2	Select any Set Up group	SET UP	•Successive presses of the [SET UP] key will sequentially display the other Set Up group titles shown in the prompt hierarchy in Figure 3-1. •You can also use the [▲] [▼] keys to scan the Set Up groups in both directions. •Stop at the Set Up group title which describes the group of parameters you want to configure. Then proceed to the next step.
3	Select a Function Parameter	FUNC	Upper Display: 1.0 — Shows the current value or selection for the first function prompt of the particular Set Up group that you have selected. Lower Display: PROP BAND OR G — Depending on what is selected in Set Up group "Control." Shows the first function prompt within that Set Up group. Example displays show Set Up group "Tuning", function prompt "Prop Band or Gain" and the value selected.

Table 3-2 is continued on next page

Procedure, continued

Table 3-2 Configuration Procedure, continued

Step	Operation	Press	Result
4	Select other Function Parameters	FUNC	• Successive presses of the FUNC key will sequentially display the other function prompts of the Set Up group you have selected. • Stop at the function prompt that you want to change, then proceed to the next step.
5	Change the value or selection	▲ or ▼	• These keys increment or decrement the value or selection that appears for the function prompt you have selected. • See *subsection 3.4 Configuration Tips* for instructions to increase or decrease value quickly. • Change the value or selection to meet your needs. • If the display flashes, you are trying to make an unacceptable entry.
6	Enter the value or selection	FUNC or SET UP	• This key selects another function prompt. • This key selects another Set Up group. The value or selection you have made will be entered into memory after another key is pressed.
7	Exit Configuration	LOWR DISP	This exits configuration mode and returns the recorder to the same state it was in immediately preceding entry into the Set Up mode. It stores any changes you have made.

3.6 Tuning 1 or Tuning 2 Parameters Set Up Group

Introduction

These Tuning Set Up groups contain the Function parameters that will allow your recorder to respond correctly to changes in process variable or setpoint. You can start with predetermined values but you will have to watch your process to determine how to modify them.

Function prompts

Table 3-3 lists all the function prompts in the Tuning 1 or Tuning 2 Set Up groups. How the "Algorithm" and "Control" Set Up groups are configured determines which prompts will appear. Use the configuration procedure in Table 3-2 to enter data.

Table 3-3 Tuning 1 or Tuning 2 Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
PROP BD or GAIN	Proportional Band, or Gain	0.1 to 1000% 0.1 to 1000	1.0
RATE MIN	Rate in minutes	0.08 to 10.00 minutes	0.00
RSET MIN	Reset in minutes/repeat	0.02 to 50.00	1.0
RSET RPM	Reset in repeats/minute	0.02 to 50.00	1.0
MAN RSET	Manual Reset	–100 to 100% output	0.0
CYC SEC	Cycle Time (Heat) Electromechanical Relays	1 to 120 seconds	20.0
PROP BD2 or GAIN 2	Proportional Band 2, or Gain 2	0.1 to 1000% 0.1 to 1000	5.0
RATE2MIN	Rate 2 in minutes	0.08 to 10.00 minutes	0.00
RSET2MIN	Reset 2 in minutes/repeat	0.02 to 50.00	0.2
RSET2RPM	Reset 2 in repeats/minute	0.02 to 50.00	0.2
CYC2 SEC	Cycle Time 2 (Cool) Electromechanical Relays	1 to 120 seconds	20.0

3.7 SP Ramp 1 or 2/Program Set Up Group

Single Setpoint Ramp

The Setpoint Ramp 1 or 2 Set Up groups contain the Function parameters that enable you to configure a single set point ramp to occur between the current local setpoint and a final setpoint over a time interval (SP RAMP). There are two setpoint ramps available.

Setpoint Program

Also included under this group are prompts for configuring a Setpoint program (SP PROG). The prompts and instructions for Setpoint programming are presented in the *Section 6 - Setpoint Ramp/Soak Programming Option.*

Function prompts

Table 3-4 lists all the function prompts in the SP RAMP 1 or SP RAMP 2 Set Up group. Configure each ramp separately.

Table 3-4 SP Ramp Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
SP RAMP 1 or SP RAMP 2	Single Setpoint Ramp Selection	DISABLE ENABLE	DISABL
TIME MIN	Single Setpoint Ramp Time	0 to 255 minutes	0
FINAL SP	Single Setpoint Ramp Final Setpoint	Enter a value within the setpoint limits	100.0
SP PROG (Option)	Setpoint Programming (Refer to Section 6)	DISABLE ENABLE	DISABL

3.8 Chart Set Up Group

Introduction

The functions listed in this group deal with the parameters that must be set to assure proper chart function.

Function prompts

Table 3-5 lists all the function prompts in the "Chart" Set Up group.

Table 3-5 Chart Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
CHRTSPD	Chart Speed Selection	8HR 24HR 7DAYS XHR (See prompt "HOUR/REV")	XHR
HOUR/REV	Hours per Revolution (appears only if "XHR" is selected above)	6 to 744 (12 hrs for abrasion resistant pen) ATTENTION Below 8 hrs chart speed (24 hrs chart speed with abrasion resistant pen), printing may be degraded.	12
TIME DIV	Time Division	8 to 24 time periods	24
CONTINUE	Continue Chart Rotation	YES NO	NO
CHARTNAM	Chart Name	0 to 9 A to Z + – / (blank)	TRULIN
HEADER	Header for Chart	YES NO	NO
REM CHRT	Remote Chart Activation	NONE EXT SW1 EXT SW2 ALARM 1 ALARM 2 TIME (See "WAKE MIN", "WAKE HOUR", "WAKE DAY", "WAKE MON".) SHED	NONE
WAKE MIN	Wake Minutes	0 to 59	0
WAKE HOUR	Wake Hour	0 to 23	0
WAKE DAY	Wake Day	0 to 31	0
WAKE MON	Wake Month	0 to 12	0

3.9 Time Set Up Group

Introduction

The functions listed in this group deal with the parameters that let you configure the real time that will appear on the chart.

Function prompts

Table 3-6 lists all the function prompts in the "Time" Set Up group.

Table 3-6 Time Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
MINUTES	Real Time in Minutes	0 to 59	Set to local time
HOURS	Real Time in Hours	0 to 23	
DAY	Real Time in Days	1 to 31	
MONTH	Real Time in Months	1 to 12	
YEAR	Real Time in Years	0 to 99	
DAY	Day of the Week	MONDAY TUEDAY WEDDAY THRDAY FRIDAY SATDAY SUNDAY	

3.10 Pen 1, 2, 3, 4 Set Up Group

Introduction

The functions listed in this group deal with how to configure pen #1, pen #2, pen #3, or pen #4. The procedure for configuring each pen is the same. The prompts shown in Table 3-7 show PEN 1.

- Repeat the process for each pen you want to set up.
- Press the SET UP key until PEN 2, PEN 3, or PEN 4 appears in the display.

Function prompts

Table 3-7 lists all the function prompts in the PEN Set Up groups.

Table 3-7 Pen 1, 2, 3, 4 Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
PEN 1 (or PEN 2, PEN3, or PEN 4)	Pen Record	ENABLE DISABL	ENABLE
PEN1IN (or PEN2IN, PEN3IN, or PEN4IN)	Pen Input	INPUT 1 RH OUTPT1 OUTPT2 SETPT1 SETPT2 DGTL1 DGTL2	INPUT 1
CHART1HI (or CHART2HI, CHART3HI, or CHART4HI)	Chart High Range Value	–999.0 to 999	302.0
CHART1LO (or CHART2LO, CHART3LO, or CHART4LO)	Chart Low Range Value	–999.0 to 999	292.0
PEN1ON (or PEN2ON, PEN3ON, or PEN4ON)	Pen Chart Position for ON Event	0 to 100%	91.0
PEN1OFF (or PEN2OFF, PEN3OFF, or PEN4OFF)	Pen Chart Position for OFF Event	0 to 100%	93.0
MAJORDIV	Major Chart Divisions	2 to 10	10
MINORDIV	Minor Chart Division	2 to 10	10
RNG1TAG	Range 1 Tag Name	0 to 9 A to Z + – / (blank)	RNG 1

ATTENTION Repeat this procedure for PEN 2, PEN 3, and PEN 4

3.11 Input Set Up Group

Introduction

This data deals with various parameters required to configure input 1, input 2, input 3, or input 4. These inputs must be enabled in the OPTIONS Set Up Group.

Function prompts

Table 3-8 lists all the function prompts in the "INPUT 1" Set Up group. Repeat the process for each input you want to set up.

- Press the [SET UP] key until INPUT 2, INPUT 3, or INPUT 4 appears in the display.

Table 3-8 Input Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
DECIMAL	Decimal Point Location	XXXX None XXX.X One XX.XX Two	XXX.X
UNITS	Temperature Units	DEG F DEG C EU (make selection at prompt "ENGUNITS")	DEG F
ENGUNITS	Engineering Units	0 to 9 A to Z + – \ (blank)	
IN1 TYPE	Input 1 Actuation Type	B TC E TC H E TC L J TC H J TC L K TC H K TC L NNM TC NIC TC R TC S TC T TC H T TC L W TC H W TC L 100 PT 200 HI 200 LO 500 PT 100 RH 4-20 mA 0-10 mV 10-50m 0-5 V 0-10 V	100 PT or 0-5 V with Control

Table 3-8 is continued on next page

Function prompts, continued

Table 3-8 Input 1 Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
XMITTER	Transmitter Characterization	B TC E TC H E TC L J TC H J TC L K TC H K TC L NNM TC H NIC TC R TC S TC T TC H T TC L W TC H W TC L 100 PT 500 PT 100 RH LINEAR* SQROOT* * Set "IN1HI" and "IN1LO"	Linear
IN1 HI	Input 1 High Range Value (linear inputs only)	–999.0 to 9999. in engineering units	900
IN1 LO	Input 1 Low Range Value (linear inputs only)	–999.0 to 9999. in engineering units	-300
INPTCOMP	Input Compensation	–999.9 to 9999.	0
FILTER 1	Input 1 Filter	0 to 120 seconds	0
BURNOUT	Burnout Protection	NONE UP DOWN	UP

ATTENTION Repeat this procedure for INPUT 2, INPUT 3, and INPUT 4

3.12 Totalizer Set Up Group

Introduction

The functions listed in this group deal with the calculation and display of the total flow volume as measured by input 1 (total 1) or input 2 (total 2). The displayed value is 8 digits with a configurable scale factor.

Function prompts

Table 3-9 lists all the function prompts in the "TOTAL 1" Set Up group. Repeat the process for each input you want to set up.

- Press the SET UP key until TOTAL 2 appears in the display.

Table 3-9 Totalizer Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
Actual Current Totalized Value	View Current Totalized Value	Current Scale Factor Example: E1 GPM	E0 GAL
RSET TOT	Reset Totalizer to Zero (RSETABLE must be set to "YES")	NO YES	
TOTAL 1 TOTAL 2	Totalization for Input 1 or 2	ENABLE DISABL	DISABL
TOTAL EU	Total Engineering Units	0 to 9 A to Z + – / (blank)	GAL
RATE	Rate of Integration	SECOND MINUTE HOUR DAY M/DAY (Millions of Units per Day)	SECOND
SCALER	Totalizer Scale Factor	1 10 100 1000 10000 100000 1E6 (1,000,000)	1
RSETABLE	Totalizer Reset	NO YES	NO

ATTENTION Repeat this procedure for INPUT 2.

3.13 Control 1 and Control 2 Set Up Group

Introduction

This data deals with various parameters required to effectively control your process.

Function prompts

Table 3-10 lists all the function prompts in the "CONTROL 1" or "CONTROL 2" Set Up group. You can enable the Control groups in the Option group.

Table 3-10 Control 1 or Control 2 Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
PID SETS	Tuning Parameter Sets	1 ONLY 2KEYBD 2PV SW 2SP SW	1 ONLY
SW VALUE	Automatic Switchover Value	–999.0 to 9999	0.00
SP SOURC	Setpoint Source	1 LOCAL REMOTE 2 LOCAL COMSP Note: If you select "REMOTE," Input #3 is automatically assigned as your RSP source for control #1; Input #4 is assigned for control #2. However, if the unit has only 2 inputs, then RSP will be on Input 2.	1 LOCAL
RATIO	Ratio for Remote Setpoint	–20.00 to 20.00	1.0
BIAS	Bias for Remote Setpoint	–999.0 to 9999 in engineering units	0
SP TRACK	Setpoint Tracking	NONE RSP	NONE
POWER UP	Power Up Controller Mode Recall	MANUAL A LSP A RSP	MANUAL
SP HILIM	High Setpoint Limit	–999.0 to 9999.	500
SP LOLIM	Low Setpoint Limit	–999.0 to 9999.	0
ACTION	Control Output Direction	DIRECT REVRSE	REVERSE
OUTHILIM	High Output Limit	–5.0 to 105.0% of output	100.0
OUTLOLIM	Low Output Limit	–5.0 to 105.0% of output	0

Table 3-10 is continued on next page

Function prompts, continued

Table 3-10 lists all the function prompts in the Control Set Up group.

Table 3-10 Control 1 or Control 2 Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
DROPOFF	Controller Dropoff Value	–5.0 to 105.0% of output	0.0
DEADBAND	Output Relay Deadband	• *Time Proportional Duplex:* –5.0 to 25.0% • *On-Off Duplex:* 0.0 to 25.0% • *Position Proportional* 0.5 to 5.0%	2.0
OUT HYST	Output Relay Hysteresis	0.0 to 5.0% of PV Span	0.5
FAILSAFE	Failsafe Output Value	0 to 100%	50
REM SW	Remote Switching (Digital Input)	NONE TO MAN TO LSP TO 2SP TO DIR RN/HLD	NONE
MAN KEY	Manual Mode Key Selection	ENABLE DISABL	ENABLE
PBorGAIN	Proportional Band or Gain Units	PB PCT GAIN	GAIN
MINorRPM	Reset Units	R P M (repeats per minute) M I N (minutes per repeat)	MIN
CONT1 ALG or CONT2 ALG	Control Algorithm	ON-OFF* PID-A PID-B PD+MR* 3PSTEP* * not applicable for model DR45AR	PID-A
OUT1 ALG or OUT2 ALG	Output Algorithm	TIME * CURRNT POSITN * TIME D * CUR TI * TI CUR * *not applicable for Model DR45AR	CURRENT
4–20RNG	Current/Time Duplex Range (CUR D)	100PCT (FULL) 50 PCT (SPLIT)	50PCT
SHEDMODE	Shed Controller Mode and Output Level	LAST TO MAN FSAFE	LAST
SHED SP	Shed Setpoint Recall	TO LSP TO CSP	TO LSP

3.14 Options Set Up Group

Introduction

This data deals with various options that are available with your controller. If your controller does not have any of these options the prompts will not appear.

Function prompts

Table 3-11 lists all the function prompts in the Option Set Up group.

Table 3-11 Options Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
INPUT 1	Input 1 Actuation	DISABL ENABLE	ENABLE
INPUT 2	Input 2 Actuation	DISABL ENABLE	ENABLE
INPUT 3	Input 3 Actuation	DISABL ENABLE	ENABLE
INPUT 4	Input 4 Actuation	DISABL ENABLE	ENABLE
CONTROL 1	Control 1 Loop	DISABL ENABLE	ENABLE
CONTROL 2	Control 2 Loop	DISABL ENABLE	ENABLE
REJ FREQ	Rejection Frequency	50HZ 60HZ	60HZ
HF REJ	High Frequency Rejection	ENABLE DISABL	ENABLE
RELHUMID	Relative Humidity	NO YES	NO
ATMPRES	Atmospheric Pressure Compensation	760 to 800 mmHg	
DEVIATION	Deviation Recording Action	NONE SETPNT CHAN1	NONE
DEVSETPT	Deviation Setpoint Value	–999.0 to 9999	
ComSTATE	State of Communications Option	ENABLE DISABL	DISABL
Com ADDR	Communications Station Address	1 to 99	0
SHEDTIME	Shed Time	1 to 255 sample periods	0
UNITS	Communication Units	PERCNT ENG	PERCENT

3.15 Alarms Set Up Group

Introduction

This data deals with the Alarms function that is available with your recorder.

- There are two alarms available. Each alarm has two setpoints.
- You can configure each of these two setpoints to alarm on various controller parameters. There are two alarm output selections, high or low.
- You can also configure the two setpoints to alarm on the same event and to alarm both high and low, if desired. A single adjustable hysteresis of 0.0% to 5.0% is configurable for the alarm setpoint.

Function prompts

Table 3-12 lists all the function prompts in the Alarms Set Up group.

Table 3-12 Alarms Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A1S1 VAL	Alarm 1, Setpoint 1 Value	Value in engineering units	90
A1S2 VAL	Alarm 1, Setpoint 2 Value	Value in engineering units	95
A1S1TYPE	Alarm 1, Setpoint 1 Type	NONE IN 1 (Input 1) IN 2 (Input 2) IN 3 (Input 3) IN 4 (Input 4) RH (Relative Humidity) DEV (Loop 1 Deviation) OUT (Loop 1 Output) DEV2 (Loop 2 Deviation) OUT2 (Loop 2 Output) SHED (Communications) EV1ON (SP Programming-Loop 1 Event On) EV1OFF(SP Programming-Loop 1 Event Off) EV2ON (SP Programming-Loop 2 Event On) EV2OFF (SP Programming-Loop 2 Event Off)	INPUT1
A1S2TYPE	Alarm 1, Setpoint 2 Type	Same as A1S1TYPE	INPUT1
A1S1 H L	Alarm 1, Setpoint 1 State	LO (Low Alarm) HI (High Alarm)	LO
A1S1 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 1	BEGIN END	
A1S2 H L	Alarm 1, Setpoint 2 State	LO HI	HI
A1S2 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 2	BEGIN END	
A2S1 VAL	Alarm 2, Setpoint 1 Value	Value in engineering units	80
A2S2 VAL	Alarm 2, Setpoint 2 Value	Value in engineering units	85

Table 3-12 is continued on next page

Function prompts, continued

Table 3-12 Alarms Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A2S1TYPE	Alarm 2, Setpoint 1 Type	Same as A1S1TYPE	INPUT2
A2S2TYPE	Alarm 2, Setpoint 2 Type	Same as A1S1TYPE	INPUT2
A2S1 H L	Alarm 2, Setpoint 1 State	LO HI	LO
A2S1 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 1	BEGIN END	
A2S2 H L	Alarm 2, Setpoint 2 State	LO HI	HI
A2S2 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 2	BEGIN END	
AL HYST	Alarm Hysteresis	0.0 to 5.0 % of Input Span as appropriate	0.1

3.16 Lockout Set Up Group

Introduction

These are the parameters that you will select to lockout any unauthorized changes to the recorder's configuration and calibration prompts. You must know the password in order to change the Lockout configuration.

Function prompt

Table 3-13 lists all the function prompts in the Lockout Set Up group.

Table 3-13 Lockout Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
PASSWORD	Lockout Password	Select up to 4 alphanumeric characters (++++ is factory default password)	XXXX
LOCKOUT	Lockout	NONE CALIB +CONF +VIEW MAX **CAUTION** Do not move Lockout selection to none unless you are doing calibration. Never leave it in "NONE."	CALIB
CHANGE	Change Password	0 to 9 A to Z	XXXX

3.17 Adjust Printing

Introduction

This data deals with the "Adjust Printing" feature of the Truline recorder. This feature is important to the operation of the hot stylus pen.

Configuration choices are provided for PEN TYPE and the selection must match the stylus design.

- PEN TYPE = NORMAL is for the high speed stylus design.
- PEN TYPE = JEWEL is used *only* for abrasion resistant stylus design.

CAUTION If the "JEWEL" selection is accidentally used with the high speed design, the life of that stylus will be shortened.

You can also make slight adjustments to the print contrast.

Function prompt

Table 3-14 lists all the function prompts in the Adjust Set Up group.

Table 3-14 Adjust Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
TRACE LN	Trace Line Contrast	DARK MEDIUM LIGHT	MEDIUM
GRID LN	Grid Line Contrast	DARK MEDIUM LIGHT	MEDIUM
PEN TYPE	Stylus Selection	NORMAL – Select if high speed stylus (black tip) is installed. JEWEL – Select if abrasion resistant stylus (beige tip) is installed.	NORMAL

3.18 Configuration Record Sheet

Keep a record

Enter the value or selection for each prompt on this sheet so you will have a record of how your recorder was configured.

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TUNING 1	PROP BD		1.0
	or		
	GAIN		1.0
	RATE MIN		0.00
	RSET MIN		1.0
	or		
	RSET RPM		1.0
	or		
	MAN RSET		0.0
	CYCSEC		20.0
	PROP BD2		1.0
	or		
	GAIN 2		1.0
	RATE2MIN		0.00
	RSET2MIN		1.0
	or		
	RSET2RPM		1.0
	CYC2SEC		20.0
TUNING 2	PROP BD		1.0
	or		
	GAIN		1.0
	RATE MIN		0.00
	RSET MIN		1.0
	or		
	RSET RPM		1.0
	or		
	MAN RSET		0.0
	CYCSEC		20.0
	PROP BD2		1.0
	or		
	GAIN 2		1.0
	RATE2MIN		0.00
	RSET2MIN		1.0
	or		
	RSET2RPM		1.0
	CYC2SEC		20.0
SP RAMP1	SP RAMP		DISABL
	TIME MIN		0
	FINAL SP		100.0
	SP PROG		DISABL
SP RAMP 2	SP RAMP		DISABL
	TIME MIN		0
	FINAL SP		100.0
	SP PROG		DISABL
CHART	CHRTSPD		XHR
	HOUR/REV		12
	TIME DIV		24
	CONTINUE		NO
	CHART NAM		TRULIN
	HEADER		NO
	REMSW		NONE
	WAKEMIN		0
	WAKE HR		0
	WAKE DAY		0
	WAKE MON		0
TIME	MINUTES		Set
	HOURS		to
	DAY		local
	MONTH		time
	YEAR		
	DAY		
PEN 1	PEN 1		ENABLE
	PEN1IN		INPUT1
	CHART1HI		302.0
	CHART1LO		292.0
	PEN1ON		91.0
	PEN1OFF		93.0
	MAJORDIV		10
	MINORDIV		10
	RNG1TAG		RNG1

Group Prompt	Function Prompt	Value or Selection	Factory Setting
PEN 2	PEN 2		ENABLE
	PEN2IN		INPUT2
	CHART2HI		302.0
	CHART2LO		292.0
	PEN2ON		91.0
	PEN2OFF		93.0
	MAJORDIV		10
	MINORDIV		10
	RNG2TAG		RNG2
PEN 3	PEN 3		ENABLE
	PEN3IN		INPUT3
	CHART3HI		302.0
	CHART3LO		292.0
	PEN3ON		91.0
	PEN3OFF		93.0
	MAJORDIV		10
	MINORDIV		10
	RNG3TAG		RNG3
PEN 4	PEN 4		ENABLE
	PEN4IN		INPUT4
	CHART4HI		302.0
	CHART4LO		292.0
	PEN4ON		91.0
	PEN4OFF		93.0
	MAJORDIV		10
	MINORDIV		10
	RNG4TAG		RNG4
INPUT 1	DECIMAL		XXX.X
	UNITS		DEGF
	ENGUNITS		—
	IN1 TYPE		100PT
	XMITTER		LINEAR
	IN1 HI		900
	IN1 LO		-300
	INPTCOMP		0
	FILTER 1		0
	BURNOUT		UP
INPUT 2	DECIMAL		XXX.X
	UNITS		DEGF
	ENGUNITS		—
	IN2 TYPE		100PT
	XMITTER		LINEAR
	IN2 HI		900
	IN2 LO		-300
	INPTCOMP		0
	FILTER 2		0
	BURNOUT		UP
INPUT 3	DECIMAL		XXX.X
	UNITS		DEGF
	ENGUNITS		—
	IN3 TYPE		100PT
	XMITTER		LINEAR
	IN3 HI		900
	IN3 LO		-300
	INPTCOMP		0
	FILTER 3		0
	BURNOUT		UP
INPUT 4	DECIMAL		XXX.X
	UNITS		DEGF
	ENGUNITS		—
	IN4 TYPE		100PT
	XMITTER		LINEAR
	IN4 HI		900
	IN4 LO		-300
	INPTCOMP		0
	FILTER 4		0
	BURNOUT		DEGF

Continued on next page

Keep a record, continued

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TOTAL 1	(Value)		E0 GAL
	RSETTOT		NO
	TOTAL 1		DISABL
	TOTALEU		GAL
	RATE		SECOND
	SCALER		1
	RSETABLE		NO
TOTAL 2	(Value)		E0 GAL
	RSETTOT		NO
	TOTAL 2		DISABL
	TOTALEU		GAL
	RATE		SECOND
	SCALER		1
	RSETABLE		NO
CONTROL 1	PID SETS		1ONLY
	SW VALUE		0.0
	SP SOURC		1LOCAL
	RATIO		1.0
	BIAS		0
	SP TRACK		NONE
	POWER UP		MANUAL
	SP HILIM		500
	SP LOLIM		0
	ACTION		REVERSE
	OUT HILIM		100.0
	OUT LOLIM		0
	DROPOFF		0.0
	DEADBAND		2.0
	OUT HYST		0.5
	FAILSAFE		50
	REM SW		NONE
	MAN KEY		ENABLE
	PBorGAIN		GAIN
	MINorRPM		MIN
	CONT1ALG		PIDA
	OUT1ALG		CURRENT
	4-20 RNG		50PCT
	SHEDMODE		LAST
	SHED SP		TOLSP
CONTROL 2	PID SETS		1ONLY
	SW VALUE		0.0
	SP SOURC		1LOCAL
	RATIO		1.0
	BIAS		0
	SP TRACK		NONE
	POWER UP		MANUAL
	SP HILIM		500
	SP LOLIM		0
	ACTION		REVERSE
	OUT HILIM		100.0
	OUT LOLIM		0
	DROPOFF		0.0
	DEADBAND		2.0
	OUT HYST		0.5
	FAILSAFE		50
	REM SW		NONE
	MAN KEY		ENABLE
	PBorGAIN		GAIN
	MINorRPM		MIN
	CONT1ALG		PIDA
	OUT1ALG		CURRENT
	4-20 RNG		50PCT
	SHEDMODE		LAST
	SHED SP		TO LSP

Group Prompt	Function Prompt	Value or Selection	Factory Setting
OPTIONS	INPUT 1		ENABLE
	INPUT 2		ENABLE
	INPUT 3		ENABLE
	INPUT 4		ENABLE
	CONTROL 1		ENABLE
	CONTROL 2		ENABLE
	REJ FREQ		60
	HF REJ		ENABLE
	RELHUMID		NO
	ATMPRES		—
	DEVIATION		NONE
	DEVSETPT		0
	ComSTATE		DISABL
	ComADDR		0
	SHEDTIME		0
	UNITS		PERCENT
ALARMS	A1S1 VAL		90
	A1S2 VAL		95
	A1S1TYPE		INPUT1
	A1S2TYPE		INPUT1
	A1S1 H L		LO
	A1S1 EV		—
	A1S2 H L		HI
	A1S2 EV		—
	A2S1 VAL		80
	A2S2 VAL		85
	A2S1TYPE		INPUT2
	A2S2TYPE		INPUT2
	A2S1 H L		LO
	A2S1 EV		—
	A2S2 H L		HI
	A2S2 EV		—
	AL HYST		0.1
LOCKOUT	PASSWORD		XXXX
	LOCKOUT		CALIB
	CHANGE		XXXX
ADJUST	TRACE LN		MEDIUM
	GRID LN		MEDIUM
	PEN TYPE		NORMAL

Section 4 – Configuration Parameter Definitions

4.1 Overview

Introduction

This section provides information for all the user configurable control parameters listed in the configuration section. If you aren't familiar with these parameters, this section gives you the parameter prompt, the selection or range of setting that you can make, and a definition of how each parameter setting affects recorder performance. It will also refer you to any other prompts that might be affected by your selection.

Parameter groups and prompts

- The control information is found in three configuration groups which are accessed by the SET UP key.
- Each of these groups contains prompts, viewed in the lower display, which deal with functions that are pertinent to that particular group. These are accessed by pressing the FUNC key.
- The selections or values are listed in the upper display. Refer to *Section 3 - Configuration* for step by step instructions.

What's in this section?

The table below lists the topics that are covered in this section. They are listed in the order of their appearance in the recorder.

Set Up Groups		See Page
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4.2 Tuning Parameters Set Up Group

Introduction

Tuning consists of establishing the appropriate values for the tuning constants you are using so that your recorder responds correctly to changes in process variable and setpoint. You can start with predetermined values but you will have to watch the system to see how to modify them. There are two Tuning groups available.

Tuning group prompts

Table 4-1 lists all the function prompts in the Tuning 1 and Tuning 2 setup group and their definitions.

Table 4-1 Tuning Group Prompt Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PROP BD or **GAIN**	0.1 to 1000% or 0.1 to 1000	**PROPORTIONAL BAND** is the percent of the range of the measured variable for which a proportional recorder will produce a 100% change in its output. **GAIN** is the ratio of output change (%) over the measured variable change (%) that caused it. $G = \frac{100\%}{PB\%}$ where PB is the proportional band (in %) • If the PB is 20%, then the Gain is 5. Likewise, a 3% change in the error signal (SP-PV) will result in a 15% change in the recorder's output due to proportional action. If the gain is 2, then the PB is 50%. • Used with control algorithm PID-A or PID-B. Defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. • The selection of Proportional Band or Gain is made in the control parameter group under prompt "PBorGAIN."
RATE MIN	0.08 to 10.00 minutes 0.08 or less = OFF	**RATE** action affects the recorder's output whenever the deviation is changing; and affects it more when the deviation is changing faster. • Used with control algorithm PID-A or PID-B. Defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.

Table 4-1 is continued on next page

Table 4-1 Tuning Group Prompt Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
RSET MIN or **RSET RPM**	0.02 to 50.00	**RSET MIN** = RESET IN MINUTES / REPEAT **RSET RPM** = RESET IN REPEATS / MINUTE **RESET** adjusts the recorder's output in accordance with both the size of the deviation (SP-PV) and the time it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional action is repeated/minute. • Used with control algorithm PID-A or PID-B. Defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. • The selection of minutes per repeat or repeats per minute is made in the control parameters group under prompt "MINorRPM."
MAN RSET	–100 to +100 (in % output)	**MANUAL RESET** is only applicable if you have control algorithm PD WITH MANUAL RESET. Because a proportional recorder will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint.
PROP BD2 or **GAIN 2**	0.1 to 1000% or 0.1 to 1000	**PROPORTIONAL BAND 2** or **GAIN 2**, **RATE 2**, and **RESET 2** parameters are the same as previously described for "Heat" except that they refer to the **cool** zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent.
RATE2MIN	0.08 to 10.00 minutes 0.08 or less = OFF	
RSET2MIN **RSET2RPM**	0.02 to 50.00	
CYC SEC	1 to 120 seconds	**CYCLE TIME (HEAT)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications. • Electromechanical relays
CYC2 SEC	1 to 120 seconds	**CYCLE TIME 2 (COOL)** is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for 2nd set of PID constants. • Electromechanical relays

4.3 Setpoint Ramp 1 or 2/Program Set Up Group

Introduction

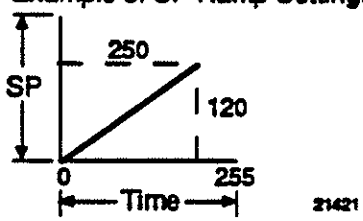
A single setpoint ramp can be configured to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes. There are two setpoint ramps available.

- You can also configure a 12 segment program from a Ramp/Soak profile.
- You can start and stop the ramp/program using the RUN/HOLD key.

Setpoint Ramp/ Program group prompts

Table 4-2 lists all the function prompts in the Setpoint Ramp 1 or 2/Program setup group and their definitions.

Table 4-2 Setpoint Ramp 1 or 2/Program Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP RAMP 1 or **SP RAMP 2**	ENABLE DISABL	**SINGLE SETPOINT RAMP** — Make selection to enable or disable the setpoint ramp function. Make sure you configure a ramp time and a final setpoint value. "SP PROG" must be disabled. **ENABLE SETPOINT RAMP** — Allows you to start the setpoint ramp (in automatic mode). **DISABLE SETPOINT RAMP** — Disables the setpoint ramp.
TIME MIN	0 to 255 minutes	**SETPOINT RAMP TIME** — Enter the number of minutes desired to reach the final setpoint. A ramp time of "0" implies an immediate change of setpoint. Example of SP Ramp Settings: 
FINAL SP	Within SP limits	**SETPOINT RAMP FINAL SETPOINT** — Enter the value desired for the final setpoint. The recorder will operate at the setpoint set here when ramp is ended.
SP PROG (option)	ENABLE DISABL	**SETPOINT RAMP/SOAK PROGRAM** Available only with recorders that contain this option. For reasons of convenience, the information for the prompts when SP PROG is enabled are included in *Section 6 — Setpoint Ramp/Soak Programming Option.* "SP RAMP" must be disabled.

4.4 Chart Parameters Set Up Group

Introduction

The functions listed in this group deal with how the chart will be set up. It includes time divisions, speed, name, rotation, header, remote activation, and wake time parameters that have to be set for the proper chart function.

Chart group prompts

Table 4-3 lists all the function prompts in the chart parameters setup group and their definitions.

Table 4-3 Chart Parameters Group Definitions

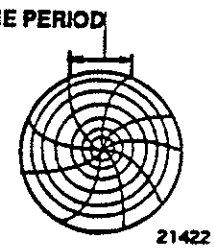
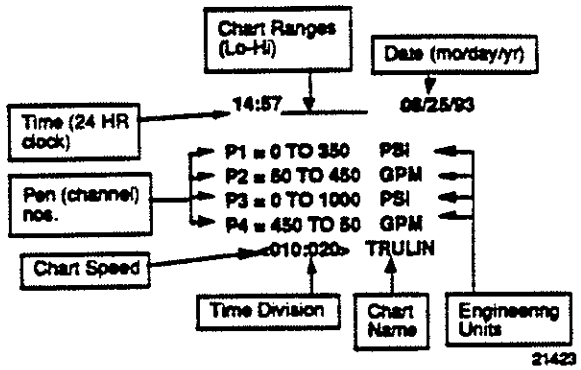
Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CHRTSPD		CHART SPEED — This is the time it will take to drive the chart one complete revolution.
	8HR 24HR 7DAYS XHR	8 Hour revolution 24 Hour revolution 7 Day revolution X hour revolution - make Hours per Revolution selection at prompt "HOUR/REV".
HOUR/REV	6 to 744 Hours (12 hrs for abrasion resistant pen)	HOURS PER REVOLUTION — Set the desired chart speed. Appears only if XHR was selected at prompt "CHRT SPD". ATTENTION Below 8 hrs chart speed (24 hrs with abrasion resistant pen) printing may be degraded.
TIME DIV MAJOR	8 to 24 time periods	TIME DIVISION — This is the number of time periods into which the chart record is to be divided.  ATTENTION Make sure that the chart selected is evenly divisible into the time periods. For example: 7 day = 14 or 21 lines.
TIME DIV MINOR	Software set for 4 seg/major time divisions	
CONTINUE	YES NO	CONTINUE CHART ROTATION — Do you want to continue or stop the chart drive after a single 360° rotation. Yes—continue chart drive No—stop chart drive
CHARTNAM	0 TO 9 A TO Z + – / (BLANK)	CHART NAME - This is where you determine the chart name identifier. For example, TRULINE/4. • For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. • The value of each digit can be changed only when it is highlighted.

Table 4-3 is continued on next page

Chart group prompts, continued

Table 4-3 Chart Parameters Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
HEADER	YES NO	**HEADER FOR CHART** – Is the header to be printed each time the recorder goes from chart hold to chart run the CHART key is pressed. **HEADER EXAMPLE**  • If you select "NO" only the chart name will be printed.
REM CHRT	NONE EXT SW1 EXT SW2 ALARM 1 ALARM 2 TIME SHED	**REMOTE CHART ACTIVATION** – Select the desired function to activate the chart from a remote location or an internal signal. **NONE** - No selection **EXT SW 1** - External Switch #1 activates chart **EXT SW 2** - External Switch #2 activates chart **ALARM 1** - Alarm 1 activates chart **ALARM 2** - Alarm 2 activates chart **TIME** - Wake Time activates chart **SHED** - Shed from communications activates chart • If you select "TIME", set wake minutes at prompt "WAKE MIN" and wake hours at prompt "WAKE HR".
WAKE MIN	0 to 59	**WAKE MINUTES** – Wake time specifies time, in minutes, at which pen record will begin. Appears only if "Time" is selected at prompt "REM CHRT."
WAKE HR	0 to 23	**WAKE HOUR** – Wake time specifies time, in hours, at which pen record will begin. Appears only if "Time" is selected at prompt "REM CHRT."
WAKE DAY	0 to 31	**WAKE DAY** – Wake time specifies time, in days, at which pen record will begin. Appears only if "Time" is selected at prompt "REM CHRT."
WAKE MON	0 to 12	**WAKE MONTH** – Wake time specifies time, in months, at which pen record will begin. Appears only if "Time" is selected at prompt "REM CHRT."

4.5 Time Parameters Set Up Group

Introduction

The functions listed in this group deal with how to configure the real-time in minutes, hours, days, months, and years. There is also a selection for days of the week.

Time group prompts

Table 4-4 lists all the function prompts in the Time parameters setup group and their definitions.

Table 4-4 Time Parameters Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
MINUTES	0 to 59	**REAL-TIME IN MINUTES** — Set the present time in minutes.
HOURS	0 to 23	**REAL-TIME IN HOURS** — Set the hour in 24 HR clock format.
DAY	1 to 31	**REAL-TIME IN DAYS** — Set a number corresponding to a day.
MONTH	1 to 12	**REAL-TIME IN MONTHS** — Set a number corresponding to a month.
YEAR	0 to 99	**REAL-TIME IN YEARS** — Set a number corresponding to a year.
DAY	MONDAY TUEDAY WEDDAY THRDAY FRIDAY SATDAY SUNDAY	**DAY OF THE WEEK** — Select a day of the week.

Introduction

The functions listed in this group deal with how to configure pen #1, pen #2, pen #3, or pen #4. The procedure for configuring each pen is the same. The prompts shown in Table 4-5 show PEN 1.

- Press the SET UP key until PEN 1, PEN 2, PEN 3, or PEN 4 appears in the display.

Pen 1-2-3-4 group prompts

Table 4-5 lists all the function prompts in the Pen 1, 2, 3, 4 set up groups and their definitions.

Table 4-5 Pen 1, 2, 3, or 4 Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PENn **(n - 1, 2, 3 or 4)**	ENABLE DISABL	**PEN RECORD** — This selection lets you enable or disable the pen (channel) record • Remember, the lower display prompt could read PEN2, PEN3, or PEN4.
PENnIN **(n = 1, 2, 3 or 4)**	INPUT 1 RH OUTPT1 OUTPT2 SETPT1 SETPT2 DGTL1 DGTL2	**PEN INPUT** — What do you want the pen to record? **INPUT 1** - records the input **RELATIVE HUMIDITY** - records in %RH. It initiates an external calculation for measuring relative humidity. The second input must be configured for RH. The RH prompt only appears when REL HUMID prompt in the OPTIONS group is configured as YES. **OUTPUT 1** - records Output 1 **OUTPUT 2** - records Output 2 **SETPOINT 1** - records Setpoint 1 **SETPOINT 2** - records Setpoint 2 **DIGITAL 1 INPUT** - records EVENT pen function on contact closure across digital 1 input. **DIGITAL 2 INPUT** - records EVENT pen function on contact closure across digital 2 input.
CHARTnHI **(n = 1, 2, 3 or 4)**	–999.0 to 999	**CHART HIGH RANGE VALUE** — Enter a value that corresponds with the chart high range value for pen 1(pen 2, pen 3, or pen 4).
CHARTnLO **(n = 1, 2, 3 or 4)**	–999.0 to 999	**CHART RANGE LOW VALUE** — Enter a value that corresponds with the chart low range value for pen 1(pen 2, pen 3, or pen 4). • CHART HI minus CHART LO equals Chart Range (must be whole number = 2 or greater).

Table 4-5 is continued on next page

Pen 1-2-3-4 group prompts, continued

Table 4-5 Pen 1, 2, 3, or 4 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PENnON (n = 1, 2, 3 or 4)	0 to 100%	**PEN CHART POSITION FOR ON EVENT** — This is the event marker configuration using digital inputs. Select the chart position where pen 1 (pen 2, pen 3, and pen 4) is to mark (trace) occurrence of an ON event. • Prompt only appears if DGTL1 or 2 is selected as pen 1 (pen 2, pen 3, or pen 4) input.
PENnOFF (n = 1, 2, 3 or 4)	0 to 100%	**PEN CHART POSITION FOR OFF EVENT** — This is the event marker configuration using digital inputs. Select the chart position where Pen 1 (pen 2, pen 3, and pen 4) is to mark (trace) occurrence of an OFF event. • Prompt only appears if DGTL1 or 2 is selected as pen 1 (pen 2, pen 3, or pen 4) input.
MAJORDIV	2 to 10	**MAJOR CHART DIVISIONS** — This is the number of Major Divisions in range of chart 1(2, 3, or 4) scale (between CHART1HI and CHART1LO). Must divide evenly into chart range. Chart range of 0-1 can not be accomplished.
MINORDIV	2 to 10	**MINOR CHART DIVISIONS** — This is the number of Minor Divisions in range of chart 1(2, 3, or 4) scale (increments in each Major Division).
RNGnTAG (n = 1, 2 , 3 or 4)	0 to 9 A to Z + – / (blank)	**RANGE 1 TAG NAME** — Enter a tag name for chart 1(2, 3, or 4) range. It can be up to 5 characters. • For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can only be changed when it is highlighted.

ATTENTION Repeat this procedure for PEN 2, PEN 3, and PEN 4 CONFIGURATION

4.7 Input 1, 2, 3, or 4 Parameters Set Up Group

Introduction

These are the parameters required for input 1, 2, 3, or 4; temperature units, decimal location, actuation, transmitter characterization, high and low range values in engineering units, input compensation, filter, and burnout.

Input group prompts

Table 4-6 lists all the function prompts in the Input 1, 2, 3, or 4 setup group and their definitions.
Function prompt "INPUT 1", "INPUT 2", "INPUT 3", or "INPUT 4" must be enabled in the OPTIONS Set Up group

Table 4-6 Input Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DECIMAL	XXXX XXX.X XX.XX	**DECIMAL POINT LOCATION** – This selection determines where the decimal point appears in the display. None One Place Two Places NOTE: Auto-ranging will occur when one decimal position has been selected and the value increases above 999.9 but auto-ranging *will not* similarly occur when two decimal positions are selected.
UNITS	DEG F DEG C EU	**TEMPERATURE UNITS** – This selection will be indicated on the PV display. If you select EU, go to prompt "ENGUNITS" Degrees Fahrenheit Degrees Celsius Engineering Units
ENGUNITS	0 to 9 A to Z + – / (blank)	**ENGINEERING UNITS** – Make up 5 selections to create unit identifier. • For example, create unit identifier H_2O by selecting an "H" from A to Z, a "2" from 0 to 9, and an "O" from A to Z. • For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can be changed only when it is highlighted.

Table 4-6 is continued on next page

Table 4-6 Input Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition		
INn TYPE **(n = 1, 2, 3, or 4)**		**INPUT ACTUATION TYPE** – This selection determines what actuation you are going to use for input one. Be sure that the values configured for high and low chart range, soak setpoint, alarm setpoint, etc. are within the measuring range for the selected actuation type.		
	B TC	B thermocouple	105 to 3300°F	41 to 1815°C
	E TC H	E thermocouple high	–454 to 1832°F	–270 to 1000°C
	E TC L	E thermocouple low	–200 to 1100°F	–129 to 593°C
	J TC H	J thermocouple high	0 to 1600°F	–18 to 871°C
	J TC L	J thermocouple low	20 to 770°F	–7 to 410°C
	K TC H	K thermocouple high	–320 to 2500°F	–196 to 1371°C
	K TC L	K thermocouple low	–20 to 1000°F	–29 to 538°C
	NNM TC[1]	NNM NiNiMo thermocouple	32 to 2500°F	0 to 1371°C
	NIC TC[1]	NIC Nicrosil-Nisil thermocouple	0 to 2372°,F	–178 to 1300°C
	R TC[1]	R thermocouple	0 to 3100°F	–18 to 1704°C
	S TC	S thermocouple	0 to 3100°F	–18 to 1704°C
	T TC H	T thermocouple high	–300 to 700°F	–184 to 371°C
	T TC L	T thermocouple low	–200 to 500°F	–129 to 260°C
	W TC H[1]	W5W26 thermocouple high	0 to 4200°F	–18 to 2316°C
	W TC L[1]	W5W26 thermocouple low	0 to 2240°F	–18 to 1227°C
	100 PT	100 Ohm–RTD	–300 to 1200°F	–184 to 649°C
	200 HI[2]	200 Ohm–RTD	32 to 752	0 to 400
	200 LO[2]	200 Ohm–RTD	32 to 392	0 to 200
	500 PT	500 Ohm–RTD	–300 to 900°F	–184 to 482°C
	100 RH	100 Ohm–RTD	–130 to 392°F	–90 to 200°C
	4-20mA[3]	4 to 20 Milliamps[4]		
	0-10mV[3]	0 to 10 Millivolts[4]		
	10-50m[3]	10 to 50 Millivolts[4]		
	1-5 V[3]	1 to 5 Volts[4]		
	0-10 V[3]	0 to 10 Volts[4]		

[1]. Only available with Model DR45AT
[2]. Only available with Model DR45AR
[3]. These selections appear only with IN1TYPE, IN2TYPE, IN3TYPE, or IN4TYPE prompt.
[4]. Go to prompt "XMITTER" to characterize the input.

Table 4-6 is continued on next page

Table 4-6 Input Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
XMITTER		**TRANSMITTER CHARACTERIZATION** — This selection lets you instruct the recorder to characterize a linear input to represent a nonlinear one. • NOTE: Prompt only appears when a linear actuation is selected at prompt "IN1 TYPE". • FOR EXAMPLE: If input 1 is a 4 to 20 mA signal, but the signal represents a type "K" thermocouple; select "K TC H" and the recorder will characterize the 4 to 20 mA signal so that it is treated as a type "K" thermocouple input (high range).
	B TC E TC H E TC L J TC H J TC L K TC H K TC L NNM H NIC TC R TC S TC T TC H T TC L W TC H W TC L 100 PT 500 PT 100 RH LINEAR SQROOT	B Type Thermocouple E Type Thermocouple High E Type Thermocouple Low J Type Thermocouple High J Type Thermocouple Low K Type Thermocouple High K Type Thermocouple Low NNM NiNiMo Type Thermocouple High NIC Nicrosil Nisil Thermocouple R Type Thermocouple S Type Thermocouple T Type Thermocouple High T Type Thermocouple Low W5W26 Type Thermocouple High W5W26 Type Thermocouple Low 100 Ohm–RTD 500 Ohm–RTD 100 Ohm –RTD Linear Range Extracts Square Root
INn HI (n = 1, 2, 3, or 4)	–999.9 to 9999. or –999 to 9999 in engineering units	**INPUT HIGH RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. Otherwise, this is a read-only display of the higher range value for the selected T/C or RTD input including transmitter characterization, if applicable. • Scale the #1 input signal to the display value you want for 100%. • **EXAMPLE:** Actuation (Input) = 4 to 20 mA Process Variable = Flow Range of Flow = 0 to 250 Gal/Min High Range display value = 250 Then 20 mA = 250 Gal/Min The control setpoint will be limited by the range of units selected here.

Table 4-6 is continued on next page

Table 4-6 Input Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
INn LO (n = 1, 2, 3, or 4)	–999.9 to 9999. or –999 to 9999 in Engineering units	**INPUT LOW RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. • Otherwise, this is a read-only display of the low range value for the selected T/C or RTD input including transmitter characterization, if applicable. • Scale the input signal to the display value you want for 0%. See example on previous page. The control setpoint for Input will be limited by the range of units selected here.
INPTCOMP	–999.9 to 9999.	**INPUT COMPENSATION** — used to compensate the input for drift of an input value due to deterioration of a sensor, or some other cause; select the value you want on the input.
FILTER n (n = 1, 2, 3, or 4)	0 to 120 seconds No filter = 0	**FILTER FOR INPUT** — a software digital filter is provided for the input to smooth the input signal. You can configure the first order lag time constant from 1 to 120 seconds. If you do not want filtering, enter 0.
BURNOUT	NONE UP DOWN	**BURNOUT PROTECTION (SENSOR BREAK)** provides most input types with upscale or downscale protection if the input fails. • Not available for inputs 0-5V, 0-10V, or 4-20 mA. **NO BURNOUT** — Failsafe output applied for failed input. **UPSCALE BURNOUT** will make the indicated PV signal increase when a sensor fails, and flash the upper display. **DOWNSCALE BURNOUT** will make the indicated PV signal decrease when a sensor fails, and flash the upper display. NOTE: For no Burnout, (that is, "None,") to function properly on a linear input, there must be a dropping resistor directly across the *input* terminals (that is, not remote), then the unit can detect the "zero" voltage that occurs when the 4-20 mA line is opened.

ATTENTION Repeat the procedure for INPUT 2, INPUT 3, and INPUT 4 CONFIGURATION.

4.8 Total 1 and Total 2 Parameters Set Up Group

Introduction

The functions listed in this group deal with the calculation and display of the total flow volume as measured by Input 1 (Total 1), or Input 2 (Total 2). The displayed value is eight digits with a configurable scale factor.

Totalizer 1 and 2 group prompts

Table 4-7 lists all the function prompts in the Totalizer 1 and 2 Set Up group and their definitions.

Table 4-7 Totalizer Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
(Actual Current totalized value)	(Current scale factor) Example: E1 GPM	**VIEW CURRENT TOTALIZED VALUE** — this selection lets you view the current totalized value. • In the example shown, E1 represents exponential value of total (total times 10^1). GPM represents total engineering units selected. • See "SCALER" and "TOTAL EU" function prompts in this group for selections.
RSETTOT	YES NO	**RESET TOTALIZER TO ZERO** — this selection lets you reset the totalizer to zero. • Selecting YES will reset the totalizer to zero.
TOTAL1 TOTAL2	ENABLE DISABL	**TOTALIZATION FOR INPUT 1 OR 2** — this selection allows you to enable or disable the the totalizer function. • ENABLE allows selection of the rest of the prompts associated with totalization.
TOTALEU	0 to 9 A to Z + – / (blank)	**TOTAL ENGINEERING UNITS** — this selection allows you to make up to 3 selections to create a unit identifier that the total represents. • For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can be changed only when it is highlighted.
RATE	SECOND MINUTE HOUR DAY M/DAY	**RATE OF INTEGRATION** — This selection allows you to select the desired rate of integration. It must match input units: **Example:** GPM must use "MINUTE" PPH must use "HOUR" **SECOND** - EU (Engineering Units) per second. **MINUTE** - EU per second. **HOUR** - EU per hour **DAY** - EU per day **M/DAY** - Millions of Units per day (multiplier) 10^6 x input

Table 4-7 is continued on next page

Totalizer 1 and 2 group prompts, continued

Table 4-7 Totalizer Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SCALER	1 10 100 1000 10000 100000 1E6	TOTALIZER SCALE FACTOR — this selection allows you to select a scale factor (that is, a Multiplier) for the totalizer display. It affects only the display. • The desired factor is applied to the calculated value to extend the maximum flow range that can be displayed. • Scaler selection does not affect the totalization value printed on the chart. **EXAMPLE:** • 1E6 equals 1 times 106. (1,000,000)
RSETABLE	NO YES	TOTALIZER RESET— this selection (YES) allows the totalizer value to be reset.

ATTENTION Repeat the configuration for TOTAL 2, TOTAL 3, or TOTAL 4.

4.9 Control 1 or 2 Parameters Set Up Group

Introduction

The functions listed in this group deal with how the DR4500A will control the process including: number of tuning parameter sets, setpoint source, ratio, bias, tracking, power-up recall, setpoint limits, output direction and limits, deadband and hysteresis, control algorithm, output algorithm, and the current duplex range. There are two control groups.

Control group prompts

Table 4-8 lists all the function prompts in the Control 1 or Control 2 setup groups and their definitions.

Table 4-8 Control 1 or 2 Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PID SETS		**NUMBER OF TUNING PARAMETER SETS** — this selection lets you choose one or two sets of tuning constants (gain, rate, and reset).
	1 ONLY	**ONE SET ONLY** — only one set of tuning parameters is available. Configure the values for: Gain (proportional band) Rate Reset Time Cycle Time (if time proportional is used)
	2KEYBD	**TWO SETS KEYBOARD SELECTABLE** — two sets of tuning parameters can be configured and can be selected at the operator interface. • Press LOWR DISP key until you see "PID SET1" or "PID SET2" to switch between sets. Configure the values for: Gain, Rate , Reset, Cycle Time Gain #2, Rate #2, Reset #2, Cycle #2 Time
	2PV SW	**TWO SETS PV AUTOMATIC SWITCHOVER** — when the process variable is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the recorder will use Gain, Rate, Reset, and Cycle Time. The active PID SET can be read in the lower display. • When the process variable is *LESS* than the value set at prompt "SW VALUE," the recorder will use Gain #2, Rate #2, Reset #2, and Cycle #2 Time. The active PID SET can be read in the lower display. Other prompts affected: SW VALUE
	2SP SW	**TWO SETS SP AUTOMATIC SWITCHOVER** — when the setpoint is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the recorder will use Gain, Rate, Reset, and Cycle. • When the setpoint is *LESS* than the value set at prompt "SW VALUE," the recorder will use Gain #2, Rate #2, Reset #2, and Cycle #2. • Other prompts affected: SW VALUE

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SW VALUE	-999.0 to 9999	AUTOMATIC SWITCHOVER VALUE —this is the value of process variable or setpoint at which the recorder will switch from Tuning Constant Set #2 to Set #1. Only appears when PID SETS selections "2PV SW" or "2SP SW" are selected.
SP SOURC		SETPOINT SOURCE — this selection determines what your setpoint source will be; One local or Two local. Toggled by the "SETPOINT SELECT" key.
	1LOCAL	LOCAL SETPOINT — the setpoint entered from the keyboard.
	REMOTE	REMOTE SETPOINT — a signal is brought in through the second input printed circuit board connector J2 and used as the control setpoint. • If you select "REMOTE", Input #3 is automatically assigned as your RSP source for CONTROL #1; INPUT #4 is assigned for CONTROL #2. However, if the unit has only 2 inputs then RSP will be on input 2. • Ratio and Bias can be applied to the remote setpoint. Mutually exclusive with 2 Local setpoints. • Other prompts affected: RATIO, BIAS.
	2LOCAL	TWO LOCAL SETPOINTS — this selection lets you switch between two local setpoints. Mutually exclusive with Remote setpoint.
	COMP.SP	COMPUTER SETPOINT - setpoint selected by computer.
RATIO	-20.00 to 20.00	RATIO — used when input 2* operates as a remote setpoint, prompt "REMOTE." • This ratio value can be applied to the remote setpoint. It establishes the correct relationship between the remote setpoint and the input 2 signal applied according to the formula below (under Bias). • Input 2 must be enabled.
BIAS	-9999 to 9999 (engineering units)	BIAS — used when input 2 operates as a remote setpoint (prompt "REMOTE"). • Bias, together with ratio, establishes the correct relationship between the remote setpoint and the input 2 signal applied according to the formula: REMOTE SETPOINT = IN2 VALUE (RATIO) + BIAS NOTE: IN2 VALUE = Actual (engineering units) • All values must be within configured setpoint high and low limits. • Input 2 must be enabled.

* For recorders with two controllers, use input 3 for controller #1 and input 4 for controller #2.

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP TRACK		**SETPOINT TRACKING** — the local setpoint can be configured to track the remote setpoint as listed below:
	NONE	• **NO TRACKING** — if local setpoint tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made.
	RSP	• **LSP (LOCAL SETPOINT) TRACKS RSP (REMOTE SETPOINT) IN AUTO** — if configured, when the recorder transfers out of remote setpoint, the last value of the remote setpoint (RSP) is inserted into the local setpoint.
POWER UP		**POWER UP CONTROLLER MODE RECALL** — this selection determines which mode and setpoint the recorder will use when the it restarts after a power loss. Select one from below:
	MANUAL	• **MANUAL, LSP** — at power-up, the recorder will use *manual* mode with the output value displayed.
	A LSP	• **AUTOMATIC, LOCAL SETPOINT** — at power-up, the recorder will return to the *automatic* mode and will use the local setpoint for control.
	A RSP	• **AUTOMATIC, REMOTE SETPOINT** — at power-up, the recorder will return to the *automatic* mode and will use the remote setpoint for control.
SP HILIM	-999.0 to 9999. input units	**SETPOINT HIGH LIMIT*** — this selection prevents the local and remote setpoints from going above the value selected here. The setting must be equal to or less than the upper range of input 1 and input 2. Input 2,** when configured for remote setpoint, will be restricted to this upper limit.
SP LOLIM	-999.0 to 9999. inputs units	**SETPOINT LOW LIMIT*** — this selection prevents the local and remote setpoints from going below the value selected here. The setting must be equal to or greater than the lower range of input 1 and input 2. Input 2,** when configured for remote setpoint, will be restricted to this lower limit.

*The Local Setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and the SP HILIM is changed to 1200, the new Local Setpoint will be 1200.

** Applies for Input 3 and Input 4 for recorders with two controllers.

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
ACTION		**CONTROL OUTPUT DIRECTION** — in what direction do you want the recorder output to go when the process variable increases.
	DIRECT	**DIRECT ACTING CONTROL** — the recorder's output increases as the process variable increases.
	REVRSE	**REVERSE ACTING CONTROL** — the recorder's output decreases as the process variable increases.
OUTHILIM	–5.0 to 105.0% of output	**HIGH OUTPUT LIMIT** — this is the highest value of output beyond which you do not want the recorder automatic output to exceed. Use 0 to 100% for time proportional output type.
OUTLOLIM	–5.0 to 105.0% of output	**LOW OUTPUT LIMIT** — this is the lowest value of output below which you do not want the recorder automatic output to exceed. Use 0 to 100% for time proportional output type.
DROPOFF	–5 to 105.0% of output	**CONTROLLER DROPOFF VALUE** — select an output value that below which the recorder output will dropoff to the low output limit value set in prompt "OUT LOLIM."
DEADBAND		**DEADBAND** is an adjustable gap between the operating ranges of output 1 and output 2 in which neither output operates (positive value) or both outputs operate (negative value). It is the difference between the nominal trip points of relay 1 and relay 2.
	–5.0 to 25.0% 0 to 25.0% 0.5 to 5.0%	Time Duplex On-Off Duplex Position Proportional

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
OUT HYST	0.0 to 5.0% of PV span	**HYSTERESIS (OUTPUT RELAY ONLY)** is an adjustable overlap of the ON/OFF states of each control output. This is the difference between the value of the process variable at which the control outputs energize and the value at which they de-energize. Only applicable for Position Proportional and ON-OFF control.
FAILSAFE	0 to 100%	**FAILSAFE OUTPUT VALUE** — select the value you want the output to be when power is returned after a power down. The value used here will also be the output level when you have Communications SHED or when NO BURNOUT is configured and input 1 fails.
REM SW		**REMOTE SWITCHING (DIGITAL INPUT)** — contact closure enables one of the following:
	NONE	**NO DIGITAL INPUT SELECTION**
	TO MAN	**TO MANUAL** — contact closure selects Manual mode.
	TO LSP	**TO LOCAL SETPOINT** — contact closure selects the local setpoint.
	TO 2SP	**TO LOCAL SETPOINT 2** — contact closure selects local setpoint 2.
	TO DIR	**TO DIRECT ACTION** — contact closure selects Direct Control Action.
	RN/HLD	**RUN/HOLD** — contact closure suspends setpoint Ramp/Program. Contact open resumes.
MAN KEY		**MANUAL MODE KEY SELECTION** — make selection to enable or disable the Manual Mode selection through the MAN/AUTO key.
	ENABLE	**ENABLE** — allows you to use the MAN/AUTO key to select Manual Mode.
	DISABL	**DISABLE** — disables the MAN/AUTO key.

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PBorGAIN		**PROPORTIONAL BAND UNITS** — select one of the following for the Proportional (P) term of the PID algorithm:
	PB PCT	• **PROPORTIONAL BAND** — selects units of percent proportional band for the P term of the PID algorithm, where: $PB\% = \frac{100\%FS}{GAIN}$
	GAIN	• **GAIN** selects the unitless term of gain for the P term of the PID algorithm, where: $GAIN = \frac{100\%FS}{PB\%}$
MINorRPM		**RESET UNITS** — selects units of minutes or repeat per minutes for the I term of the PID algorithm. 20 Repeats per Minute = 0.05 Minutes per Repeat.
	RPM	**REPEATS PER MINUTE** — the number of times per minute that the proportional action is repeated by reset.
	MIN	**MINUTES PER REPEAT** — the time between each repeat of the proportional action by reset.

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT ALG		The **CONTROL ALGORITHM** lets you select the type of control that is best for your process. **ATTENTION** If the recorder has two controllers (both enabled), CONT1ALG applies for controller #1 and CONT2ALG applies for controller #2.
	ON-OFF	**ON/OFF** is the simplest control type. The output can be either ON (100%) or OFF (0%). The Process Variable (PV) is compared with the setpoint (SP) to determine the sign of the error (ERROR = PV-SP). The ON/OFF algorithm operates on the sign of the error signal. • In Direct Acting Control, when the error signal is positive, the output is 100%; and when the error signal is negative, the output is 0%. If the control action is reverse, the opposite is true. An adjustable overlap (Hysteresis Band) is provided between the on and off states. • Other prompts affected: "OUT HYST" **DUPLEX ON/OFF** is an extension of this algorithm when the output is configured for Duplex. It allows the operation of a second ON/OFF output. There is a deadband between the operating ranges of the two inputs and an adjustable overlap (hysteresis) of the on and off states of each output. Both Deadband and Hysteresis are separately adjustable. With no relay action the controller will read 50%. •Other prompts affected: "OUT HYST" and "DEADBAND"
	PID A NOTE: PID A should not be used for Proportional only action (that is, no integral (reset) action.) Instead, use PD+MR with rate set to 0.	**PID A** is normally used for three-mode control. This means that the output can be adjusted somewhere between 100% and 0%. It applies all three control actions — Proportional (P), Integral (I), and Derivative (D) — to the error signal. • Proportional (Gain) — regulates the controller's output in proportion to the error signal (the difference between Process Variable and Setpoint). • Integral (Reset) – regulates the controller's output to the size of the error and the time the error has existed. (The amount of corrective action depends on the value of proportional Gain.) • Derivative (Rate) – regulates the controller's output in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional Gain.)

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT ALG continued	PID B	**PID B** unlike the PID-A equation, the controller gives only an integral response to a setpoint change, with no effect on the output due to the gain or rate action, and it gives full response to PV changes. Otherwise controller action is as described for the PID-A equation. See note on PID-A.
	PD+MR	**PD WITH MANUAL RESET** is used whenever integral action is not wanted for automatic control. The equation is computed with no integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the controller output. Switching between manual and automatic mode will not be bumpless. • If you select PD with Manual Reset you can also configure the following variations: • PD (Two Mode) control, • P (Single Mode) control. Set Rate (D) and/or Reset Time (I) to 0. • Other prompts affected: "MAN RSET"
	3PSTEP	**THREE POSITION STEP** - not available.
OUT ALG		The **OUTPUT ALGORITHM** lets you select the type of output you want. Not applicable with Control Algorithm prompt "3PSTEP." **ATTENTION** If the recorder has two controllers (both enabled), OUT1ALG applies for controller #1 and OUT2ALG applies for controller #2. *Selections are model dependent. For example, current output models cannot be configured for Time Proportioning Simplex Output.*
	TIME	**RELAY SIMPLEX** — type of output using one SPDT relay. Its normally open (NO) or normally closed (NC) contacts are selected by positioning an internal jumper. • Other prompts affected: "OUT HYST"
	CURRNT	**CURRENT SIMPLEX** — type of output using one 4 to 20 mA signal that can be fed into a positive or negative grounded load of 0 to 1000 ohms. The signal can be recalibrated for any desired range from 3.25 to 21 mA for 0 to 100% output.
	POSITN	**POSITION PROPORTIONAL SIMPLEX** — type of output using two SPDT relays and a motor which has a 100 to 1000 ohms feedback slidewire. • Other prompt affected: "DEADBAND"

Table 4-8 is continued on next page

Table 4-8 Control 1 or 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
OUT ALG (continued)	TIME D	**RELAY DUPLEX** — type of output using two SPDT relays. Its normally open (NO) or normally closed (NC) contacts are selected by positioning an internal jumper (see Installation section). • Other prompts affected: "DEADBAND"
	CUR TI	**CURRENT/RELAY DUPLEX (RELAY = HEAT)** is a variation of duplex with current active for 0 to 50% output (tuning set 2) and relay active 50 to 100% output (tuning set 1). • Other prompts affected: "4-20 RNG," "DEADBAND"
	TI CUR	**RELAY/CURRENT DUPLEX (RELAY = COOL)** is similar to "CUR-TI" except that current is active for 50 to 100% and relay is active for 0 to 50%. • Other prompts affected: "4-20 RNG," "DEADBAND"
4-20 RNG		**CURRENT DUPLEX RANGE ALGORITHM** — used with Output Algorithm selections "CUR-D," "CUR-TI", or "TI-CUR."
	50 PCT	**CURRENT DUPLEX RANGE (SPLIT)** enables the normal control current output to provide its full range for 50% output change. • If "CUR-TI" duplex was selected, the current output provides cool control.
	100PCT	**CURRENT DUPLEX RANGE (FULL)** enables the normal control current output to provide duplex heat control over 0 - 100% output change and the relay output to provide cool control.
SHEDMODE		**SHED CONTROLLER MODE AND OUTPUT LEVEL** — determines the mode of local control you want when the recorder is shed from the communications link.
	LAST	**LAST** — SAME MODE AS BEFORE SHED — the recorder will return to the same mode (manual or automatic) that it was in before shed.
	TO MAN	**TO MAN** — TO MANUAL MODE BUMPLESS OUTPUT — the recorder will return to manual mode at the same output level that it had before shed.
	FSAFE	**FSAFE** — TO MANUAL MODE, FAILSAFE OUTPUT — the recorder will return to manual mode at the output value selected at "CONTROL" prompt "FAILSAFE".
SHED SP		**SHED SP** — Shed setpoint
	TO LSP TO CSP	**TO LSP** — recorder will use last local SP used. **TO CSP** — recorder will use computer setpoint.

ATTENTION Repeat this procedure for Control 2 Configuration.

4.10 Options Set Up Group

Introduction

The Options Set Up Group lets you enable or disable some of the options that are available on the DR4500. You can enable or disable any of the inputs or control loops, select the power frequency, select relative humidity as a measurement and a atmospheric pressure compensation, select deviation recording action, set the desired deviation setpoint, and make some settings for the communication option.

Prompts

Table 4-9 lists all the function prompts in the Option setup group and their functions.

Table 4-9 Option Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
INPUT 1	ENABLE DISABL	**INPUT 1** – allows you to enable or disable Input 1. • Set up input under set up prompt "INPUT 1".
INPUT 2	ENABLE DISABL	**INPUT 2** – allows you to enable or disable Input 2. • Set up input under set up prompt "INPUT 2".
INPUT 3	ENABLE DISABL	**INPUT 3** – allows you to enable or disable Input 3. • Set up input under set up prompt "INPUT 3".
INPUT 4	ENABLE DISABL	**INPUT 4** – allows you to enable or disable Input 4. • Set up input under set up prompt "INPUT 4".
CONTROL 1	ENABLE DISABL	**CONTROL 1** – allows you to enable or disable control loop #1. • Set up control parameters under set up prompt "CONTROL 1".
CONTROL 2	ENABLE DISABL	**CONTROL 2** – allows you to enable or disable control loop #2. • Set up control parameters under set up prompt "CONTROL 2".
REJ FREQ	60HZ 50HZ	**REJECTION FREQUENCY** – be sure that this selection agrees with the line voltage frequency.
HF REJ	ENABLE DISABL	**HIGH FREQUENCY REJECTION** – This selection allows high frequency noise rejection. It is used to quiet noisy pens or PV. **ATTENTION** For fast processes it will cause additional lag.

Table 4-9 is continued on next page

Prompts, continued

Table 4-9 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
RELHUMID	NO YES	**RELATIVE HUMIDITY** – allows you to activate or deactivate the RH calculation algorithm. • You must select 100RH input type for two inputs to measure RH. It requires two 100-ohm RTD inputs so INPUT 2 must be enabled for this prompt to appear. • Also, you must select RH for "PEN2IN" which represents the "wet bulb" temperature when input 2 is selected.
ATMPRES	760 to 800 mmHg	**ATMOSPHERIC PRESSURE COMPENSATION** – This prompt only appears if you select "YES" at "RELHUMID" prompt previously. Select the desired compensation.
DEVIATION	NONE SETPNT CHAN1	**DEVIATION** - selects deviation recording action. • NONE - No deviation recording • SETPNT - Records deviation from setpoint • CHAN1 - Records channel 1 record.
DEVSETPT	–999.0 to 9999	**DEVIATION SETPOINT VALUE** – sets the desired deviation setpoint value for deviation recording. • This prompt only appears if "SETPNT" was selected at prompt "DEVIATION" previously.
ComSTATE	ENABLE DISABL	**DMCS COMMUNICATIONS FUNCTION** – allows you to enable or disable the communications function. • **ENABLE**— Allows DMCS communication prompts. • **DISABL** — Disables the communications option.
Com ADDR	1 to 99	**COMMUNICATIONS STATION ADDRESS** — This is a number that is assigned to a recorder that is to be used with the communications option.
SHEDTIME	0 to 255 sample periods	**SHED TIME** — The number that represents how many sample periods there will be before the recorder sheds from communications. Each period equals 1/3 seconds or 0 = no shed.
UNITS	PERCNT ENG	**COMMUNICATION UNITS** — This selection determines how the controller values are expressed during communications. **PERCENT OF SPAN** **ENGINEERING UNITS**

4.11 Alarms Set Up Group

Introduction

An alarm is an indication that an event that you have configured (for example—Process Variable) has exceeded one or more alarm limits. There are two alarms available. Each alarm has two setpoints. You can configure each of these two setpoints to alarm on various controller parameters. There are two alarm output selections, high and low. You can configure each setpoint to alarm either high or low. These are called single alarms. You can also configure the two setpoints to alarm on the same event and to alarm both high and low. A single adjustable hysteresis of 0.0% to 5.0% is configurable for the alarm setpoint.

Alarms group prompts

Table 4-10 lists all the function prompts in the Alarms setup group and their definitions.

Table 4-10 Alarms Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S1 VAL	Value in engineering units	**ALARM 1 SETPOINT 1 VALUE** — this is the value at which you want the alarm type chosen in prompt "A1S1TYPE" to actuate. The value depends on what the setpoint has been configured to represent. NO setpoint is required for Communications SHED. For SP Programming the value is the segment number for which the event applies.
A1S2 VAL	Value in engineering units	**ALARM 1 SETPOINT 2 VALUE** — this is the value at which you want the alarm type chosen in prompt "A1S2TYPE" to actuate. •The details are the same as "A1S1 VAL".
A1S1TYPE		**ALARM 1 SETPOINT 1 TYPE** — select what you want Setpoint 1 of Alarm 1 to represent. It can represent any of the Inputs, Relative Humidity, Deviation (loop 1 or 2), Output (loop 1 or 2), and if you have a model with communications, you can configure the recorder to alarm on SHED. If you have setpoint programming, you can alarm when a segment goes ON or OFF (loop 1 or 2).
	NONE	NO ALARM
	IN 1	INPUT 1
	IN 2	INPUT 2
	IN 3	INPUT 3
	IN 4	INPUT 4
	RH	RELATIVE HUMIDITY
	DEV (loop 1)	LOOP 1 DEVIATION
	OUT (loop 1)	LOOP 1 OUTPUT
	DEV2 (loop 2)	LOOP 2 DEVIATION
	OUT2 (loop 2)	LOOP 2 OUTPUT
	SHED	SHED FROM COMMUNICATIONS
	EV1 ON	EVENT ON (SP PROGRAMMING) - LOOP 1
	EV1 OFF	EVENT OFF (SP PROGRAMMING) - LOOP 1
	EV2 ON	EVENT ON (SP PROGRAMMING) - LOOP 2
	EV2 OFF	EVENT OFF (SP PROGRAMMING) - LOOP 2

Table 4-10 is continued on next page

Table 4-10 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S2TYPE	Same as A1S1 TYPE	**ALARM 1 SETPOINT 2 TYPE** — select what you want Setpoint 2 of Alarm 1 to represent. The selections are the same as A1S1TYPE.
		ALARM 1 SETPOINT 1 STATE — select whether you want the alarm type chosen in prompt "A1S1TYPE" to alarm high or low or the beginning or end of a segment in setpoint Ramp/Soak programming.
A1S1 H L	HI	**HI ALARM**
	LO	**LO ALARM**
A1S1 EV	BEGIN	**BEGIN (SP PROGRAMMING)**
	END	**END (SP PROGRAMMING)**
		ALARM 1 SETPOINT 2 STATE — select whether you want the alarm type chosen in prompt "A1S2TYPE" to alarm high or low or the beginning or end of a segment in setpoint Ramp/Soak programming.
A1S2 H L	HI	**HI ALARM**
	LO	**LO ALARM**
A1S2 EV	BEGIN	**BEGIN (SP PROGRAMMING)**
	END	**END (SP PROGRAMMING)**
A2S1 VAL	Value in engineering units	**ALARM 2 SETPOINT 1 VALUE** — this is the value at which you want the alarm type chosen in prompt "A2S1TYPE" to actuate. • The details are the same as "A1S1 VAL".
A2S2 VAL	Value in engineering units	**ALARM 2 SETPOINT 2 VALUE** — this is the value at which you want the alarm type chosen in prompt "A2S2TYPE" to actuate. • The details are the same as "A1S1 VAL".
A2S1TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 1 TYPE** — select what you want Setpoint 1 of Alarm 2 to represent. The selections are the same as A1S1TYPE. NOTE: Not applicable with Relay Duplex or Position Proportional outputs.
A2S2TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 2 TYPE** — select what you want Setpoint 2 of Alarm 2 to represent. The selections are the same as A1S1TYPE. NOTE: Not applicable with Relay Duplex or Position Proportional outputs.

Table 4-10 is continued on next page

Table 4-10 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A2S1 H L **A2S1 EV**	HI LO BEGIN END	**ALARM 2 SETPOINT 1 STATE** — select whether you want the alarm type chosen in prompt "A2S1TYPE" to alarm high or low or the beginning or end of a segment in setpoint Ramp/Soak programming. **HI ALARM** **LO ALARM** **BEGIN (SP PROGRAMMING)** **END (SP PROGRAMMING)**
A2S2 H L **A2S2 EV**	HI LO BEGIN END	**ALARM 2 SET POINT 2 STATE** — select whether you want the alarm type chosen in prompt "A2S2TYPE" to alarm high or low or the beginning or end of a segment in setpoint Ramp/Soak programming. **HI ALARM** **LO ALARM** **BEGIN (SP PROGRAMMING)** **END (SP PROGRAMMING)**
AL HYST	0.0 to 5.0% of span or full output as appropriate	**ALARM HYSTERESIS** — a single adjustable hysteresis is provided on alarms such that when the alarm is OFF it activates at exactly the alarm setpoint; when the alarm is ON, it will not deactivate until the variable is 0.0% to 5.0% away from the alarm setpoint. • Configure the hysteresis of the alarms based on INPUT signals as a % of input range span. • Configure the hysteresis of the alarm based on OUTPUT signals as a % of the full scale output range.

4.12 Lockout Parameters Set Up Group

Introduction

These are the parameters that you will set to lockout any unauthorized changes to the recorder's configuration and calibration prompts. You must know the PASSWORD in order to change the Lockout configuration.

Set this group last

Because this group contains functions that have to do with security and lockout, we recommend that you configure this group last, after all the other configuration data has been loaded.

Lockout group prompts

Table 4-11 lists all the function prompts in the Lockout setup group and their definitions.

Table 4-11 Lockout Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PASSWORD	Select up to four alphanumeric characters	**PASSWORD** – this selection determines the password that will be required to gain access to the lockout prompt. • Note that + + + + is the factory default password.
LOCKOUT		**LOCKOUT** applies to one of the functional groups: Configuration, Calibration, Tuning, Adaptive Tune. DO NOT CONFIGURE UNTIL ALL CONFIGURATION IS COMPLETE. • If the correct password was entered, you can call up this prompt.
	NONE	No Lockout – all groups read/write.
	CALIB	**CALIB** – All are available for read/write except for the Calibration group.
	+CONF	**+CONF** – Tuning, SP Ramp and program groups are read/write. All other groups are read only. Calibration group is not available.
	+VIEW	**+VIEW** – Tuning and Setpoint Ramp parameters are read/write. No other parameters are viewable.
	MAX	**MAX** – Calibration group not available. All other groups are Read-only. **ATTENTION** Do not leave in "NONE" Lockout.
CHANGE	Selections are: 0 to 9 A to Z	**CHANGE PASSWORD** – Changes default password to one of your own. Be sure to record the new password in a safe location. If you forget your password, you will have to call our technical assistance center (1-800-423-9883) to find out how to enter a new one.

4.13 Printing Characteristics Adjustments

Introduction

With software version 1005 (and newer), two different hot stylus pen designs are available; check your model number for:

Table III = _0_ for high speed stylus 30756304-001 (black tip)
Table III = _1_ for abrasion resistant jewel tip stylus 30756304-002 (beige tip)
The abrasion resistant stylus is designed for recording applications that include highly abrasive environments. The abrasion resistant stylus should only be used with chart speeds from 24 hrs/rev to 31 days/rev.

Configuration choices

Configuration choices are now provided for **PEN TYPE** and the selection made must match the stylus design.

- **PEN TYPE = NORMAL** is for the high speed stylus design.
- **PEN TYPE = JEWEL** is used only for abrasion resistant stylus design.

CAUTION If the "JEWEL" selection is accidently used with the high speed design, the life of that stylus will be shortened.

Printing characteristics adjustments

Normally there is no need to adjust the printing characteristics as part of an input or output calibration procedure. However, if the chart printing appears to be faded, you can use the procedure in Table 4-12 to make slight adjustments in the print contrast.

ATTENTION To access Set-up group prompt "ADJUST", the Set Up group prompt "LOCKOUT" must be set to "NONE". If the group prompt "LOCKOUT" has been configured for "CALIB", "+VIEW", or "MAX" selection, you will not be able to access the Printing Characteristics Group prompt. Refer to *Subsection 4.12* for details.

Continued on next page

Printing characteristics adjustments procedure

Table 4-12 is the procedure to adjust the printing characteristics of your recorder.

Table 4-12 Printing Characteristics Adjustment Procedure

Step	Description	Press	Action
1	Enter Set Up Group ADJUST	SET UP until you see:	Upper Display: ADJUST Lower Display: PRINTING
2	Select Trace Line Contrast	FUNC	Until you see: Upper Display: ◄ DARK / MEDIUM / LIGHT Lower Display: TRACE LN • Press ▲ or ▼ to select the desired contrast.
3	Select Grid Line Contrast	FUNC	Until you see: Upper Display: ◄ DARK / MEDIUM / LIGHT Lower Display: GRID LN • Press ▲ or ▼ to select the desired contrast.
4	Select Stylus	FUNC	Until you see: Upper Display: ◄ NORMAL / JEWEL Lower Display: PEN TYPE • Press ▲ or ▼ to select the pen type. • Select "NORMAL" if high speed stylus (black tip) is installed. • Select "JEWEL" only if abrasion resistant stylus (beige tip) is installed.
5	Return to normal operation	LOWR DISP	Return to normal operation and observe the change in printing characteristics. • Change Set Up group "LOCKOUT" to something other than "NONE".

Section 5 – Operation

5.1 Overview

Introduction

This section gives you all the information necessary to monitor and operate your recorder and for performing routine maintenance tasks. In this section assume that the recorder has been properly installed and configured, and that the inputs are properly calibrated.

Some of the procedures in this section are required only initially, and some are required only randomly, as conditions dictate. Once the recorder is up and running, required operation actions are infrequent and straightforward.

Review the Operator Interface, Display and Keypad descriptions shown in *Section 1 - Overview.*

What's in this section?

This section contains the following topics:

	Topic	See Page
5.1	Overview	95
5.2	Start-up	96
5.3	Monitoring Your Recorder	100
5.4	Operator Functions	105
5.5	Operating Modes	106
5.6	Setpoints	108
5.7	Single Setpoint Ramp	110
5.8	Using Two Sets of Tuning Constants (PID Values)	113
5.9	Alarm Setpoints	116
5.10	Digital Input Option (Remote Switching)	117
5.11	Resetting and Displaying Totalizer Value	118
5.12	Monitoring the External Event Operation	120
5.13	Maximizing Pen Life	121
5.14	Routine Maintenance	122
5.15	Installing/Replacing Chart	123
5.16	Chart Operation	124

5.2 Start-up

Preparation

Before start-up, there are two tasks to perform:

- Install or replace the circular chart as described in 5.14 - *Routine Maintenance.*
- Be sure that the configured settings for the current time and wake time (time at which recording begins) are correct. Note that the recorder is "awake" during start-up to verify interaction with the process.

During start-up, you should verify the interaction between your process and the DR4500A recorder to be sure that your process can tolerate some upsets during this procedure.

Diagnostic tests

When power is applied, the recorder will run four diagnostic tests. Table 5-1 lists the four diagnostic tests.

Table 5-1 Power Up Diagnostic Tests

Prompt on Lower Display	Condition
RAM TEST	Check RAM
CONFTEST	Check nonvolatile memory
CAL TEST	Check calibration
BATTERY	Check the battery

Test failures

If one or more of these tests fail, the recorder will go to the Failsafe Manual Mode, and "FAILSAFE" will flash in the lower display.

Troubleshooting

Refer to "STATUS TESTS" in *Section 9 - Troubleshooting/Service* to identify and correct the problem.

Continued on next page

Check the displays and keys

Use the procedure in Table 5-2 to run the display and key test.

Table 5-2 Procedure for Testing the Displays and Keys

Press	Result
SET UP and hold in, then FUNC at the same time	The recorder runs a display test. All the displays will light for 8 seconds, then the displays will look like this: Upper Display: KEYS Lower Display: TRY ALL
Press each key to see if it works	When the key is pressed, the lower display indicates the name of the key pressed.

Key Pressed	Lower Display
SET UP	SET UP
FUNC	FUNCTION
LOWR DISP	LWR DISP
MAN/AUTO	AUTO MAN
RESET	RESET
CHART	CHART
▲	INCRMENT
▼	DECRMENT
RUN/HOLD	RUN HOLD

- If no key is pressed for 25 seconds, the test times out and the recorder exits the key test.
- If any test fails, go to *subsection 9.3 Self Diagnostics* for more information.

Key error

When a key is pressed and the prompt "KEY ERROR" appears in the lower display, it will be for one of the following reasons:

- parameter not available,
- not in Set Up mode, press SET UP key first,
- key malfunction, perform keyboard test.

Continued on next page

Start-up procedure

Use the procedure listed in Table 5-3 to start up the recorder.

Open the recorder door. Apply power and wait for the recorder to run its power-up tests.

ATTENTION

- If FAILSAFE starts blinking in the lower display, refer to Section 9 for troubleshooting data.
- For recorders with two controllers (both enabled), be sure the CHN '1' indication is lit for steps 2-6. If CHN 1 is not lit, sequentially press the LOWR DISP key until "1" is lit when "OUT" is displayed.

Table 5-3 Procedure for Starting Up the Recorder

Step	Operation	Press	Action/Result
1	Pen check		For RECORDER ONLY models, just check that the pen is operating and skip to step 6.
2	Select manual mode	MAN AUTO	Until "MAN" indicator is ON. The recorder is in manual mode and the Output (OUT) in percent is displayed in the lower display.
3	Adjust the output	▲ or ▼	Adjust the output value and ensure that the final control element is functioning correctly. Upper Display → shows the PV value Lower Display → shows OUT and the output value in %. Make sure the pen trace on the chart corresponds to the change in output.
4	Tune the recorder	SET UP	Make sure the recorder has been configured properly and all the values and selections have been recorded on the Configuration Record Sheet. To tune your recorder manually, see *Appendix A - Manual Tuning*. Refer to Set Up group TUNING 1 or TUNING 2 to ensure that the proper selections for PROP BD or GAIN, RATE MIN, and RSET MIN or RSET RPM have been entered.

Table 5-3 is continued on next page

Start-up procedure, continued

Table 5-3 Procedure for Starting Up the Recorder, continued

Step	Operation	Press	Action/Result
5	Enter the local setpoint	LOWR DISP until	Upper Display shows the PV Value Lower Display SP and the local setpoint value
		▲ or ▼	Adjust the local setpoint to the value at which you want the process variable maintained. The local setpoint cannot be changed if the Setpoint Ramp function is enabled. "H" or "R" appears in the upper display.
6	Select automatic mode	MAN AUTO	Until "A" indicator is ON. The recorder is in Automatic mode. The recorder will automatically adjust the output to maintain the process variable at setpoint as tracked by the pen trace, if the recorder is properly tuned.
7	Start up Controller #2	LOWR DISP until	"2" is lit when "OUT" is displayed. For recorders with two controllers (both enabled), repeat steps 2-6 for controller #2, but be sure CHN "2" indicator is lit instead of CHN "1".
8	Exit Start-up		Close the door and monitor the operation.

5.3 Monitoring Your Recorder

Introduction

Besides the historical chart record, you can monitor the recorder's indicators and displays to get an instantaneous view of various process conditions and of the control loop status.

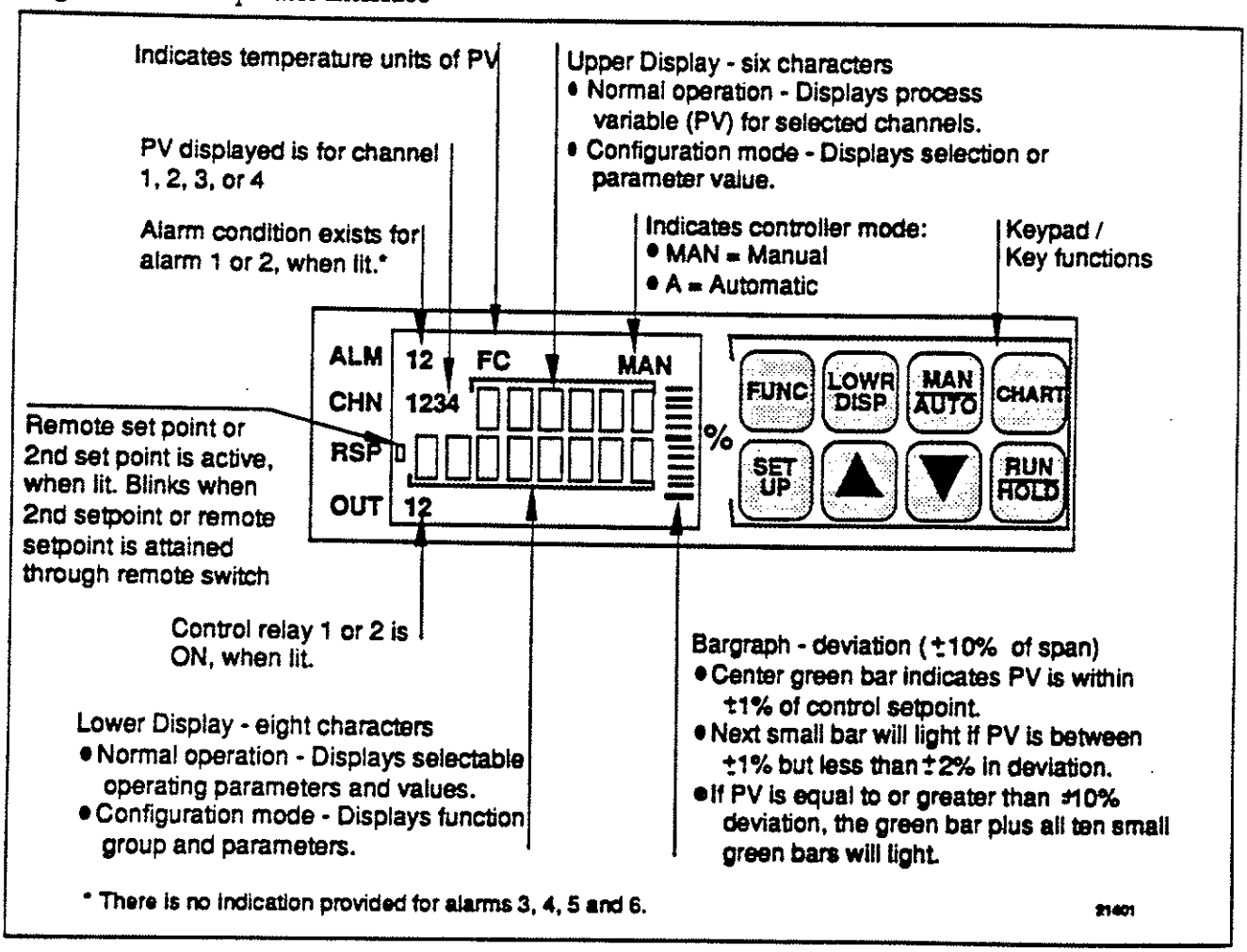
There are also diagnostic error messages to signal detection of malfunctions in certain internally monitored data.

Operator Interface

The indicators and displays on the operator interface let you see what is happening to your process and how the recorder is responding.

Figure 5-1 is a view of the operator interface. A description of the displays and indicators is included.

Figure 5-1 Operator Interface



Continued on next page

Meaning of Indicators

During normal operation, the indicators will light for the reasons shown in Table 5-4.

Table 5-4 Meaning of Indicators

Indicator	Definition when lit
ALM 1 2	Alarm condition exists for alarm 1 or 2.
CHN 1 2 3 4	PV displayed is for channel 1, 2, 3, or 4
RSP	Remote Setpoint (when available) or 2nd setpoint is active.
OUT 1 2	Control relay 1 or 2 is ON
A or MAN	Indicates the mode of operation: A = Automatic MAN = Manual
F or C or blank	Indicates the temperature units of PV: F = Fahrenheit C = Celsius
R or H or blank (in upper display)	Indicates the state of the setpoint ramp or program if enabled: R = Run H = Hold blank = Disabled
KEY ERR (in lower display)	Indicates parameter not available, not in set up mode, or key malfunction.

Continued on next page

Reading the deviation bargraph

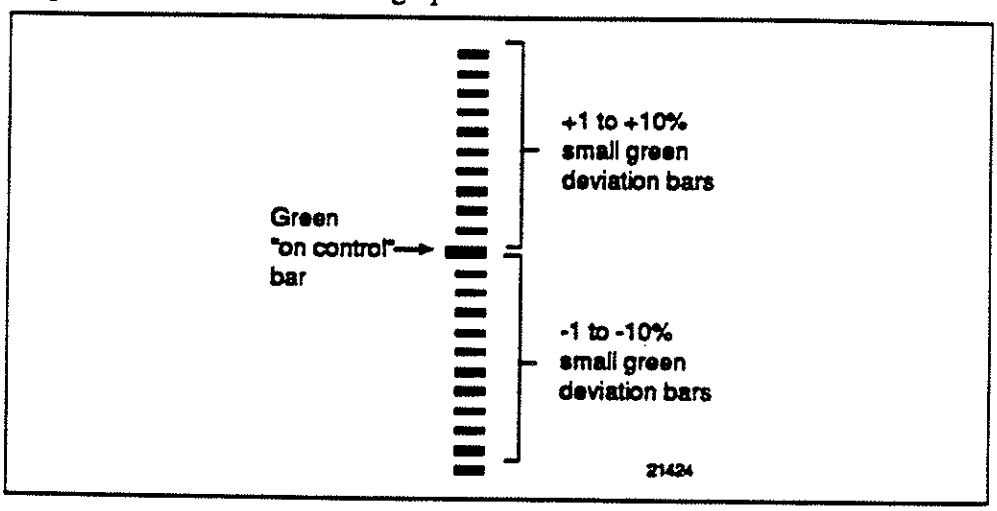
In addition to the indicators, a bargraph containing 21 bars displays Process Variable (PV) deviation from Setpoint (SP).

ATTENTION When CHN "1" indicator is lit, the bargraph display applies for Controller #1. It applies for Controller #2 when CHN "2" indicator is lit. Sequentially press the LOWR DISP key to light the appropriate CHN indicator (1 or 2) and view the corresponding controller displays.

- The green "on-control" bar lights when the PV is within ±1% of setpoint.
- The 10 small green bars above the "on-control" bar light for each positive deviation up to +10% and the 10 below light for each negative deviation down to –10%. If the process deviation is greater than ±10%, the "on-control" bar and the specific small green bars light.

Figure 5-2 shows how the deviation bargraph works.

Figure 5-2 Deviation Bargraph



Continued on next page

Viewing the operating parameters

The upper display is a six-character display, four of which show the value of the PV during normal operation.

- The lower display is an eight-character display. During normal operation, you can view various operating parameters. Press the LOWR DISP key to scroll through the operating parameters listed in Table 5-5.
- The lower display shows only those parameters and its value that apply to your specific model and the way in which it was configured.

For recorders with two controllers (both enabled) remember that any controller-related values displayed correspond with the lighted CHN indicator.– "1" means that the values apply for Controller #1 and "2" means that the values apply for Controller #2.

Table 5-5 Lower Display Key Parameter Prompts

Prompt	Description
OUT **	Output Value in Percent (%). Note that the output can only be adjusted through the raise/lower keys when the controller in in manual mode.
SP **	Local Setpoint 1. Also current setpoint of SP Ramp, or SP Ramp/Soak Program.
2SP **	Local Setpoint 2 (where remote setpoint does not apply)
RSP	Remote Setpoint (when configured)
2IN	Value of Channel 2 input (when available)
3IN	Value of Channel 3 input (when available)
4IN	Value of Channel 4 input (when available)
DEV	PV deviation from setpoint (±999.9 maximum)
EU	Engineering units that PV represents (when available)
RH	RH value in percent (%) (when available)
PIDSETX **	Tuning Parameter Set X = 1 or 2
RAMP	The time (minutes) remaining in the setpoint ramp
#RA	The time (minutes) remaining in the SP Ramp segment
#SK	The time (minutes) remaining in the SP Soak segment
RECYC	The number of recycles remaining to be run in the Setpoint Program

** You can press ▲ or ▼ to change the value of this parameter.

Continued on next page

Diagnostic error messages

The DR4500A runs background tests to verify data and memory integrity. If there is a malfunction, an error message will blink in the lower display. In the case of more than one simultaneous malfunctions, only the one with the highest priority will appear on the lower display.

A list of error messages is contained in Table 5-6. If any of these error messages occur, refer to *Section 9 - Troubleshooting/Service* for information to correct the failure.

Table 5-6 Error Messages

Prompt	Description
EE FAIL	Unable to write to nonvolatile memory
FAILSAFE	Failsafe
INP1FAIL	Two consecutive failures of input 1 integration
INP2FAIL	Two consecutive failures of input 2 integration
INP3FAIL	Two consecutive failures of input 3 integration
INP4FAIL	Two consecutive failures of input 4 integration
INP1 RNG INP2 RNG INP3 RNG INP4 RNG	Input out-of-range Linear: ±10% out-of-range Characterized: ±1% out-of-range
PV LIMIT	PV ±10% out-of-range
RV LIMIT	Remote Variable out-of-range Note: RV = (input 2 x ratio) + bias

Actions an operator can initiate

An operator can do the following:

- Change the Control Mode (Auto/Man)
- Adjust the Output Manually
- Change the Setpoint
- Switch between Setpoints
- Run or Disable a Setpoint Ramp
- Run or Disable a Setpoint Program
- Switch between Two Sets of PID Values
- Check the Alarm Setpoints
- Reset the Totalizer
- Run a Key Test

Note that some actions depend upon how the recorder was configured and the features supplied on your particular recorder model.

Refer to the following pages for functions and procedures.

CHN Indicator

Remember, for recorders with two controllers (both enabled) remember that any controller-related values displayed, including control mode, correspond with the lighted CHN indicator.– "1" means that the values apply for Controller #1 and "2" means that the values apply for Controller #2. Sequentially press the LOWR DISP key to scroll through the displays and light the appropriate CHN indicator for controller-related values.

5.5 Operating Modes

Available modes

The recorder can operate in any of three basic modes:

- Manual
- Automatic with Local Setpoint
- Automatic with Remote Setpoint

Manual and Automatic with Local set point are standard features and Automatic with Remote Setpoint is optional.

Mode definitions

Table 5-7 lists the three modes and their definitions.

Table 5-7 Operating Mode Definitions

Operating Mode	Definition
MANUAL	When switched to manual mode, the recorder holds its output at the last value used during automatic operation and stops adjusting the output for changes in setpoint or process variable. Instead, you adjust the output by changing the value shown in the lower display. See *"Selecting Modes"*.
AUTOMATIC with LOCAL SETPOINT	In automatic local mode, the recorder operates from the local setpoint and automatically adjusts the output to maintain the setpoint at the desired value. In this mode you can adjust the setpoint. See *"Setpoints"*.
AUTOMATIC with REMOTE SETPOINT	In automatic remote mode, the recorder operates from the setpoint measured at input 2. Adjustments are available to ratio this input and add a constant bias before it is applied to the control equation. See *subsection 3.13 Control 1 and Control 2 Set Up Group.*

What happens when you change modes

Table 5-8 explains what happens to the recorder when you switch from one mode to another.

Table 5-8 Changing Operating Modes

Mode Change	Description
Manual to Automatic Local Setpoint	The local setpoint is usually the value previously stored as the local setpoint.
Manual or Auto Local to Automatic Remote SP	The second input value with ratio and bias applied is used to calculate the control setpoint.
Automatic Remote SP to Manual or Auto Local Setpoint	If configured for RSP Tracking, when the recorder transfers out of remote setpoint, the last value of the control setpoint is inserted into the local setpoint. If RSP tracking is not configured, the local setpoint will not be altered when the transfer is made.

Continued on next page

Selecting manual or automatic mode

An alternate action switch places the recorder in automatic or manual mode of operation.

- Switching between manual and automatic will be bumpless, except when the PD+MR algorithm is selected.
- Table 5-9 includes procedures for selecting automatic or manual mode and changing the output while in manual.

Table 5-9 Procedure for Selecting Automatic or Manual Mode

Step	Operation	Press	Action/Result
1	Selecting automatic mode	MAN AUTO	Until "A" indicator is ON. The recorder regulates its output to maintain the PV at the desired setpoint. Upper Display → shows the PV value Lower Display → shows SP and the setpoint value The deviation bargraph indicates the PV deviation from the setpoint.
2	Selecting manual mode	MAN AUTO	Until "MAN" indicator is ON. The recorder holds its output at the last value used during automatic operation and stops adjusting the output for changes in setpoint or process variable. Upper Display → shows the PV value Lower Display → shows OUT and the output value in (%). The deviation bargraph indicates the PV deviation from the setpoint.
3	Adjust the output in manual mode	▲ or ▼	Adjust the output value while in manual mode. Upper Display → shows the PV value Lower Display → shows OUT and the output value in %.
4	Return to automatic mode	MAN AUTO	"A" indicator appears indicating automatic mode.

5.6 Setpoints

Introduction

You can configure the following setpoints for the DR4500A recorder.

- A single local setpoint
- 2 local setpoints
- A local setpoint and a remote setpoint
- A computer setpoint.

These setpoints can be toggled by the FUNC key.

Selecting the setpoint source

Use the procedure in Table 5-10 to select a single local setpoint source, a remote setpoint source, or two local setpoints.

Table 5-10 Procedure for Selecting the Setpoint Source

Step	Operation	Press	Action/Result
1	Enter set up mode	SET UP	Until the displays read: Upper Display: SET UP Lower Display: CONTROL
2	Display local setpoint source selections	FUNC	Until the displays read: Upper Display: ◄ Setpoint source selections Lower Display: SP SOURCE 1 LOCAL 2 LOCAL REMOTE
3	Select the desired source	▲ or ▼	Select the desired setpoint source in the upper display.
4	Return to control	LOWR DISP	Controller assumes normal control.

Changing the local setpoints

Use the procedure in Table 5-11 to change either local setpoint value.

Table 5-11 Procedure for Changing the Local Setpoint

Step	Operation	Press	Action/Result
1	Select the setpoint	LOWR DISP	Until you see: Upper Display: ◄ The PV value Lower Display: ◄ SP or SP2 and the local setpoint value
2	Change the value	▲ or ▼	Change the local setpoint to the value at which you want the process maintained. The deviation bargraph indicates PV deviation from setpoint.

Switching between setpoints

You can switch between Local and Remote setpoints or between two Local setpoints when configured. Use the procedure in Table 5-12 to switch between setpoints.

Table 5-12 Procedure for Switching Between Setpoints

Step	Operation	Press	Action/Result
1	Switch between setpoints	FUNC or LOWR DISP	Alternately select Local setpoint 1 and Remote setpoint or switch between the 2 Local Setpoints. or Press appropriate key until you see the desired setpoint indicated. ATTENTION "KEY ERROR" appears in the lower display if the remote setpoint or second local setpoint is not configured as a setpoint source, or if you attempt to change the setpoint while a setpoint ramp is enabled.
2	Change the **Local** setpoint value	▲ or ▼	The **REMOTE** setpoint cannot be changed at the keyboard.

Setpoint selection indication

Table 5-13 shows how the indicators react and what the displays show for each type of setpoint.

Table 5-13 Setpoint Selection Indication

	Using Local Setpoint	Using Remote Setpoint	Using 2nd Local Setpoint
RSP Indicator	OFF	ON (Note 1)	ON (Note 2) (Note 3)
Upper Display	PV	PV	PV
Lower Display	SP and the Local Setpoint Source	RSP and Remote Setpoint Value	2SP and the 2nd Local Setpoint Value
To Change Setpoint Value	Press ▲ or ▼	Cannot change the value at the keyboard.	Press ▲ or ▼

Note 1—RSP blinks when RSP is reached using Digital Input
Note 2—RSP solid for 2nd Setpoint
Note 3—RSP blinks for 2nd setpoint activated by Digital Switch

5.7 Single Setpoint Ramp

Configuring the setpoint ramp

You can configure a single setpoint ramp to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes. You can RUN or HOLD the ramp at any time.

Procedure

Table 5-14 lists the procedure for configuring the Setpoint Ramp 1 or 2 parameters. The procedure for SP Program is in *Section 6 – Setpoint Ramp/Soak Programming Option.*

Table 5-14 Procedure for Configuring a Single Setpoint Ramp

Step	Operation	Press	Action/Result
1	Select SP RAMP 1 or SP Ramp 2 Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: SP RAMP X X = 1 or 2
2	Select the Setpoint Ramp function	FUNC	Until you see: Upper Display: dISPbL Lower Display: SP RAMP X
3	Enable Setpoint Ramp	▲	Until you see: Upper Display: ENABLE Lower Display: SP RAMP X NOTE: You cannot change the current local setpoint if the setpoint ramp function is enabled. Make sure SP PROG is disabled.
4	Set the Ramp Time	FUNC	Until you see: Upper Display: ← The ramp time in minutes Lower Display: TIME MIN
		▲ or ▼	Change the upper display value to the number of minutes in which you want the final setpoint to be reached. Setting Range = 1 to 255 minutes NOTE: Entering "0" implies an immediate step change to the final SP.
5	Set the Final Setpoint value	FUNC	Upper Display: ← The Final Setpoint value Lower Display: FINAL SP
6		▲ or ▼	Change the upper display value to the desired final setpoint value. Setting Range = within the setpoint limits

Continued on next page

Running the setpoint ramp

Running a setpoint ramp includes starting, holding, viewing the ramp time, ending the ramp and disabling it.

Procedure

Table 5-15 lists the procedure for running the setpoint ramp.

Table 5-15 Procedure for Running a Setpoint Ramp

Step	Operation	Press	Action/Result
1	Put the controller into automatic mode	MAN AUTO	Until "A" indicator is ON and you will see: Upper Display ← H and the PV value Lower Display ← SP and the present setpoint value
2	Set Start SP	▲ or ▼	Until the start setpoint value you desire is indicated in the lower display: Upper Display ← H and the PV value Lower Display ← SP and the start setpoint value
3	Start the ramp	RUN HOLD	You will see: Upper Display ← R and the PV value Lower Display ← SP and a changing setpoint value NOTE: The value in the lower display will be increasing or decreasing toward the final setpoint value. The PV value in the upper display and the pen trace will also change.
4	Hold the ramp at the current value	RUN HOLD	This holds the ramp at the current setpoint value. Press again to continue run. A "KEY ERROR" prompt appears if RUN/HOLD key is pressed while "SP RAMP" is disabled.
5	View the remaining ramp time	LOWR DISP	Until you see: Upper Display ← R or H and the PV value Lower Display ← RAMP XXXX (Time remaining)

Table 5-15 is continued on next page

Procedure, continued

Table 5-15 Procedure for Running a Single Setpoint Ramp, continued

Step	Operation	Press	Action/Result
6	End the ramp		When the final setpoint is reached, the "R" changes to "H" in the upper display and the recorder operates at the new setpoint. ATTENTION Anytime the local setpoint is different from the final setpoint value and the RUN/HOLD key is pressed - the ramp will start again.
7	Disable the setpoint ramp function	SET UP	Until you see: Upper Display SET UP Lower Display SP RAMP X
		FUNC	You will see: Upper Display ENABLE Lower Display SP RAMP X
		▲	Until you see: Upper Display dISAbL Lower Display SP RAMP X
8	Return to normal operating mode	LOWR DISP	Returns to normal operating mode.

5.8 Using Two Sets of Tuning Constants (PID Values)

Introduction

You can use two sets of tuning constants for single output types and choose the way they are to be switched.

The sets can be:

- Keyboard selected
- Automatically switched when a predetermined Process Variable value is reached.
- Automatically switched when a predetermined Setpoint value is reached.

The following procedures show you how to:

- Select two sets
- Set the switchover value
- Set tuning constant value for each set
- Switch between two sets via the keyboard (without automatic switchover)

ATTENTION For recorders with two controllers (both enabled) remember that any controller-related values displayed correspond with the lighted CHN indicator.—"1" means that the values apply for Controller #1 and "2" means that the values apply for Controller #2.

Select two sets

The procedure in Table 5-16 tells you how to select two sets of tuning constants.

Table 5-16 Procedure for Selecting Two Sets of Tuning Constants

Step	Operation	Press	Action/Result
1	Select Control Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: CONTROL
2	Select PID SETS function	FUNC	Until you see: Upper Display:  Available selections are listed below Lower Display: PIDSETS **1 ONLY** - 1 set of constants **2 KEYBD** - 2 sets, keyboard selectable **2 PVSW** - 2 sets, auto switch at PV value **2 SPSW** - 2 sets, auto switch at SP value
		▲ or ▼	Select the type of PID SET.

Continued on next page

Set switchover value

If you select 2 PVSW or 2 SPSW, you must set a value at which the sets will switch over.
The procedure in Table 5-17 shows you how to set this value.

Table 5-17 Procedure for Setting Switchover Values

Step	Operation	Press	Action/Result
1	Select switchover value function	FUNC assuming you are still in Set Up group "CONTROL"	Until you see: Upper Display: ← The switchover value Lower Display: SW VALUE
		▲ or ▼	Select the switch-over value in the upper display.

Set Tuning constant values for each set

There are specific tuning constants that must be set for each set. The procedure in Table 5-18 shows you how to access these constants and change their values.

Table 5-18 Procedure for Setting Tuning Constant Values

Step	Operation	Press	Action/Result
1	Select Tuning Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: TUNING
2	Select the tuning constants	FUNC	Successively displays the following constants: Upper Display: ← Tuning constant value Lower Display: ← PROPBD or GAIN* RATEMIN* RSETMIN or RSETRPM* PROPBD2 or GAIN2** RATE2MIN** RSET2MIN or RSET2RPM**
		▲ or ▼	Change the value of any of the above listed prompts in the lower display.

*PIDSET1 – will be used when PV or SP, whichever is selected, is greater than the switchover value.
**PIDSET2 – will be used when PV or SP, whichever is selected, is less than the switchover value.

Continued on next page

Switch between two sets via the keyboard (without automatic switchover)

This procedure is operational only if 2 PID SETS was configured at "CONTROL" set up group.

The procedure in Table 5-19 shows you how to switch from one set to another.

Table 5-19 Procedure for Switching PID Sets from the Keyboard

Step	Operation	Press	Action/Result
1	Access the PID set display	LOWR DISP	Until you see: Upper Display ◄ The PV value Lower Display PidSETX X= 1 or 2
		▲ or ▼	Change PID SET 1 to PID SET 2 or vice versa.

5.9 Alarm Setpoints

Introduction

- An alarm consists of a relay contact and an operator interface indication. The alarm relay is de-energized if Alarm Setpoint 1 or Setpoint 2 is exceeded.
- The alarm relay is energized when the monitored value goes into the allowed region by more than the hysteresis.
- There are four alarm setpoints, two for each alarm.
- The type and state (High or Low) is selected during configuration: see *Section 3 - Configuration* for details.

Procedure for displaying the alarm setpoints

The procedure for displaying and changing the alarm setpoints is listed in Table 5-20.

Table 5-20 Procedure for Displaying or Changing the Alarm Setpoints

Step	Operation	Press	Action/Result
1	Access the Alarm Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: ALARMS
2	Access the Alarm Setpoint Values	FUNC	Successively display the alarm setpoints and their values. Their order of appearance is shown below. Upper Display → The alarm setpoint value Lower Display A1S1 VAL = (Alarm 1, Setpoint 1 value) A1S2 VAL = (Alarm 2, Setpoint 1 value) A2S1 VAL = (Alarm 2, Setpoint 2 value) A2S2 VAL = (Alarm 2, Setpoint 2 value)
		▲ or ▼	Change any alarm setpoint value you select in the upper display.
3	Return to normal operation	LOWR DISP	Returns to normal operation.

5.10 Digital Input Option (Remote Switching)

Introduction

The digital input option detects the state of external contacts wired to it. On contact closure, the controller responds according to how each digital input is configured.

- Make your selection under Set Up group "CONTROL1" or "CONTROL2", function group prompt "REM SW": see *Subsection 3.13—Table 3-10* or *Subsection 4.9—Table 4-8*.

Action on contact closure

Table 5-21 lists the configuration prompt selections, the "Action on Contact Closure", and the display indication for each selection available.

Table 5-21 Digital Input Option Action on Contact Closure

REM SW selections	Display Indication	Action on contact closure*
None	None	No Digital Input selection
To MAN	"MAN" blinks	Puts the controller into manual mode; contact open returns the controller to former mode unless AUTO/MAN key is pressed while digital input is active.
To LSP	"RSP" blinks	Puts the controller into local setpoint 1(switches out of remote). When contact opens, the controller returns to former operation unless the FUNC key is pressed while digital input is active.
To 2SP	"RSP" blinks	Puts the controller into local setpoint 2.
To DIR	None	Selects direct controller action, (transfer if in reverse).
RN/HOLD	"H" blinks in upper display	Suspends setpoint program or setpoint ramp. • Keyboard takes priority over external switch for RUN/HOLD function. • Contact open runs the program or ramp. • If initially in the HOLD state, close then open the contact to remotely start the SP ramp or Program

Keyboard operation

If a particular mode or parameter is selected by the contact closure, using the keyboard to select the same parameter ensures that the selected mode will be maintained after the remote digital switch is reopened.

5.11 Resetting and Displaying Totalizer Value

Introduction

If the totalizer is enabled and has been configured to allow resetting, you can reset the current totalizer value as follows.

- Refer to *Section 3 - Configuration*, under Set-up prompt "TOTAL 1" for Input #1 or "TOTAL 2" for Input #2 to enable the totalizer function and allow the totalizer to be reset.
- Refer to the procedures that follow to:
  - reset the totalizer
  - display the totalizer value.

Resetting the totalizer

Follow the procedure in Table 5-22 to reset the totalizer value.

Table 5-22 Procedure for Resetting the Totalizer

Step	Operation	Press	Action/Result
1	Access the Totalizer Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: TOTAL 1 or TOTAL 2
2	Allow Totalizer Reset	FUNC once	You will see: Upper Display: EX XXX Lower Display: (a Value)
		FUNC again	You will see: Upper Display: NO Lower Display: RSET TOT
		▲ or ▼	Change NO to YES in the upper display.
3	Return to normal operation	LOWR DISP	Returns to normal operation.

Continued on next page

Displaying the totalizer value

Follow the procedure in Table 5-23 to display the totalizer value.

Table 5-23 Procedure for Displaying the Totalizer Value

Step	Operation	Press	Action
1	Alternating Totalizer Display	LOWR DISP	Until you see: Upper Display TPU URLUE Lower Display (Total Value) ATTENTION When two totalizers are configured, notice that channels #1 and #2 totalizer values are alternately displayed.
2	Display Channel #1 totalizer	▲ or ▼	Until CHN "1" indicator lights. Upper Display 1TPU URLUE Lower Display (Total Value)
3	Display Channel #2 totalizer	▲ or ▼	Until CHN "2" indicator lights. Upper Display 2TPU URLUE Lower Display (Total Value)
4	Return to Alternating Display	▲ and ▼ simultaneously	You will see: Upper Display SCRN Lower Display (Total Value) After the keys are released, the upper display alternately shows #1, #2 PV values while lower display shows #1, #2 totalization values.
5	Return to Normal PV Display	LOWR DISP	Returns to normal PV display.

5.12 Monitoring the External Event Operation

Event pen function

If Function Prompt "PEN 1IN" under Set-up Prompt "PEN 1" has been configured as DGTL1 or DGTL2, the pen (channel) operates as an "event pen" and tracks the remote contact (switch) closure by way of the digital 1 or digital 2 input wired to the alarm output/digital input printed circuit board.

Event pen operation

When the switch opens, the trace for the channel tracks at the configured OFF position (0–100%) on the chart.

When the switch closes, the trace tracks at the configured ON position (0-100%) on the chart and tracks at this position until the switch is opened.

Thus, the "Event Pen" record makes it easy to monitor the on/off operation of an external event.

5.13 Maximizing Pen Life

Steps for maximizing pen life

Table 5-24 lists nine steps that will help to maximize the life of your chart pen.

Table 5-24 Maximizing Pen Life

Step	Action
1	Store the chart paper in a cool, clean dry place where the temperature does not exceed 40°C (104°F) and the humidity is below 65% RH.
2	Do not expose the pen tip and chart paper to abrasive chemicals or dust that cause excessive pen wear.
3	If the recorder is used in a dusty atmosphere, provide a positive 'clean air purge' to minimize dust particle accumulation on the chart paper.
4	Periodically clean the pen arm using a cotton swab dipped in alcohol. This is more important when the recorder is located in a dusty environment and no 'clean air purge' is used.
5	Never let the pen tip ride on the chart plate when the paper is not present. Use the pen lifter to raise the arm when changing the paper.
6	Keep the door closed while recording.
7	Always insert the pen arm tip into the shipping sponge when storing or shipping the recorder.
8	Be sure that the chart paper lays flat against the chart plate. Any ripple in the paper will cause light pen printing.
9	Be sure the chart hub assembly is pushed onto the motor shaft so that it is flush with the chart plate.

5.14 Routine Maintenance

Introduction

The DR4500A recorder does not require any periodic maintenance as such. But, you will have to clean the pen tip, and replace the chart and optional chart lamp as required.

WARNING **Do not lubricate the plastic gears on the chart and pen motors.**

Cleaning the pen tip

Follow the procedure in Table 5-25 to clean the pen tip.

ATTENTION Cleaning frequency varies with the recording application environment.

Table 5-25 Cleaning the Pen Tip

Step	Action
1	Open the recorder door.
2	Pull the pen lifter up in order to raise the pen from the chart.
3	Carefully clean the pen tip with a cotton swab that has been dipped in alcohol.
4	Push the pen lifter down to lower the pen.
5	Close the door and resume normal operation.

Replacing a burned-out chart lamp (optional)

Follow the procedure in Table 5-26 to replace a burned-out chart lamp.

Table 5-26 Replacing a Chart Lamp

Step	Action
1	Open the recorder door and remove power.
2	Unscrew and remove the hood from the lamp assembly.
3	Push the (bayonet-type) lamp in and turn it counterclockwise to remove it from the socket.
4	Reverse step 3 and install the replacement lamp (General Instrument type 1828 or equivalent) in the socket.
5	Replace the hood on the lamp assembly.
6	Close the door and apply the power.

Continued on next page

5.15 Installing/Replacing Chart

Installing/replacing procedure

Follow the procedure in Table 5-27 to install/replace the chart.

CAUTION Store replacement charts in a dust-resistant location. Otherwise, accumulated dust on the chart may cause excessive pen tip abrasion which can shorten expected pen life. In addition, you may want to air purge the case if the recorder is mounted in an extremely dusty environment.

Table 5-27 Installing/Replacing the Chart

Step	Action
1	Open the recorder door.
2	Press the CHART key. The pen moves to and stops at the outer limit of pen travel near the edge of the chart. Also, chart rotation stops and the date and time appear in the displays.
3	Pull the pen lifter up to raise the pen from the chart.
4	Carefully remove the used chart from the hub and retaining clips (do not remove the hub adapter).
5	Install the new chart so that its edges are under the four retaining clips and its small alignment hole is over the alignment pin on the hub (that is, press the chart down completely around the hub adapter).
6	Push the pen lifter down to lower the pen.
7	Press the CHART key. The recorder goes to the "CHART RUN." The date and time in the display is replaced by the parameter prompt/value that was last selected using the LOWR DISP key. ATTENTION The recorder has a non-volatile memory. You can reset the processor by cycling the power, but it will have no affect on any data stored. One portion of this stored data is how many motor steps remain in the 7200 steps contained in 360 degrees of chart rotation. The counter that holds this data is reset by going from "CHART HOLD" to "CHART RUN." If, in the "CHART" set up group, the recorder is configured for "HEADER" (YES), a new header is printed, then the pen recording of input values resumes. If "HEADER" (NO) is configured, recording resumes immediately.
8	Be sure to keep the door closed during operation to minimize dust collection on the chart.

Normal operation

The recorder functions differently if "NO CONTINUE" or "YES CONTINUE" is selected in Configuration Setup Group "CHART," function prompt "CONTINUE." Refer to *subsection 3.8* for selection instructions.

NO CONTINUE Operation

- A header is printed (only if "HEADER YES" is selected in Configuration Setup Group "CHART," function prompt "HEADER." Refer to *subsection 3.8* for selection instructions.)
- Graph starts with a major time line.
- Chart motor takes 7200 steps printing graph, time lines, and PV.
- Counter decrements to 0.
- Chart stops rotation.

YES CONTINUE Operation

- A header is printed (only if "HEADER YES" is selected in Configuration Setup Group "CHART," function prompt "HEADER." Refer to *subsection 3.8* for selection instructions.)
- Graph starts with a major time line.
- Chart motor takes 7200 steps printing graph, time lines, and PV.
- Counter decrements to 0.
- Graph stops printing.
- PV prints forever (or until the next transition from "CHART RUN" to "CHART HOLD."

Remote chart operation

The Remote Chart feature can be configured to activate on any one of six events. Refer to *Subsection 3.8—Table 3-5* or *Subsection 4.4—Table 4-3* under Function prompt "REMCHT" to select an event.

When the Remote Chart feature is activated, there are three chart modes as defined in Table 5-28.

Continued on next page

Remote chart operation, continued

Table 5-28 Remote Chart Modes

Mode	Definition
HOLD	HOLD is the mode when you are changing the paper or when the chart has completed. HOLD is indicated by the "CHT HLD" flashing in the display during the time display.
READY	You enter the READY mode from the Hold mode by pressing the CHART key *once*. When in the READY mode, the time display will flash "REM CHT". READY is the "armed" mode where the remote events are allowed. The chart is waiting to be activated by whatever event has been configured. It is not retriggerable.
RUN	RUN is the mode where the chart has received its trigger. The chart will remain in RUN until the chart is finished (for non-continue charts) or until you press the CHART key. When the CHART key is pressed during the RUN mode, the chart will enter the HOLD mode. RUN mode can be *forced* from the READY mode by pressing the CHART key.

All modes are saved in battery backed RAM and will be maintained over power cycles.

Recovery from a power loss

The chart will operate as listed below when power is restored after a power loss.

- Recorder shuts down with the remainder of the 7200 motor steps stored.
- The processor goes through memory self-test when power is restored.
- The recorder prints a new motor time line.
- The chart counter starts to decrement from the motor step value stored at power loss.
- Normal chart operation resumes.
- A new "HEADER" is *not* printed.
- If power is not interrupted again and normal operation is allowed to continue, the time and date will be printed behind the new major time line. This documents the time that power was restored.

ATTENTION Multiple major time divisions on varying time bases indicate power or operator problems.

Section 6 – Setpoint Ramp/Soak Programming Option

6.1 Overview

What is programming?

The term "programming" is used here to identify the process for selecting and entering the individual ramp and soak segment data needed to generate the required setpoint versus time profile (also called a program).

A segment is a ramp or soak function which together make up a setpoint program. Setpoint ramp/soak programming lets you configure 6 ramp and 6 soak segments to be stored for use as one program or several small programs. You designate the beginning and end segments to determine where the program is to start and stop.

Review program data and configuration

While the procedure for programming is straightforward, and aided by prompts we suggest that you read *subsection 6.2 Program Contents* as well as *Section 3 - Configuration* before doing the setpoint programming.

Fill out the worksheet

Draw a ramp/soak profile on the worksheet provided and fill in the information for each segment. This will give you a record of how the program was developed.

What's in this section

The table below lists the topics that are covered in this section.

	Topic	See Page
6.1	Overview	127
6.2	Program Contents	128
6.3	Drawing a Ramp/Soak Profile Example Program Record Sheet	130
6.4	Entering the Setpoint Program Data Introduction General Procedure Alarms on setpoint programs Prompt Hierarchy and selections	132
6.5	Run/Monitor the Program Introduction Run/Monitor Functions Run State Hold State External Hold Viewing the present segment number and time Viewing cycles End Program	137

What you will configure

Basically, you will configure all the data that is relevant to each ramp and soak segment for a given setpoint versus time profile. The recorder will prompt you through the sequence of segments and associated functions.

Ramp segments

A ramp segment is the time it takes to change the setpoint to the next setpoint value in the program.

- Ramps are odd number segments. Segment #1 will be the initial ramp time.
- Ramp time is determined in either:

  TIME* - Hours:Minutes Range = 0-99 hrs:59 min.

  or

  RATE* - Degrees/Minute Range = 0 to 999

  * This selection of time or rate is made at prompt "RAMP UNIT". Set this prompt before entering any Ramp.

ATTENTION Entering "0" implies an immediate step change in setpoint to the next soak.

Soak segments

A soak segment is a combination of soak setpoint (value) and a soak duration (time).

- Soaks are even number segments.
- Segment 2 will be the initial soak value and soak time.
- The soak setpoint range value must be within the setpoint high and low range limits in engineering units.
- SOAK TIME is the duration of the soak and is determined in:

  TIME - Hours:Minutes Range = 0-99 hrs:59 min.

Start segment number

This designates the number of the first segment.

- Range = 1 to 11

End segment number

This designates the number of the last segment. It must be a soak segment (even number).

- Range = 2 to 12

Recycle number

This number allows the program to recycle a specified number of times from beginning to end.

- Range = 0 to 99

Continued on next page

Guaranteed soak

Each soak segment can have a deviation value of from 0 to ±99 which guarantees the value for that segment.

Guaranteed soak segment values >0 guarantee that the segment's process variable is within the ± deviation for the configured soak time. Whenever the ± deviation is exceeded, soak timing is frozen.

There are no guaranteed soaks whenever the deviation value is configured to 0 (that is, soak segments start timing soak duration as soon as the soak setpoint is first reached, regardless of where the process variable remains relative to the soak segment).

The value is the number in engineering units, above or below the setpoint, outside of which the timer halts. The range is 0 to ± 99.

The decimal location corresponds to input 1 decimal selection.

Program state

This selection determines the program state after completion.

- The selections are:

  DISABL = program is disabled

  HOLD = program on hold

Program termination state

This function determines the status of the recorder upon completion.

- The selections are:

  LAST SP = hold at the last setpoint in the program

  F SAFE = Manual mode, Failsafe Output

ATTENTION If power is lost during a program, upon power-up the controller will be in hold and the setpoint value will be the setpoint value prior to the beginning of the setpoint program. The program is placed in hold at the beginning.

Ramp unit

This determines the engineering units for the ramp segments.

- The selections are:

  TIME = Hours:Minutes

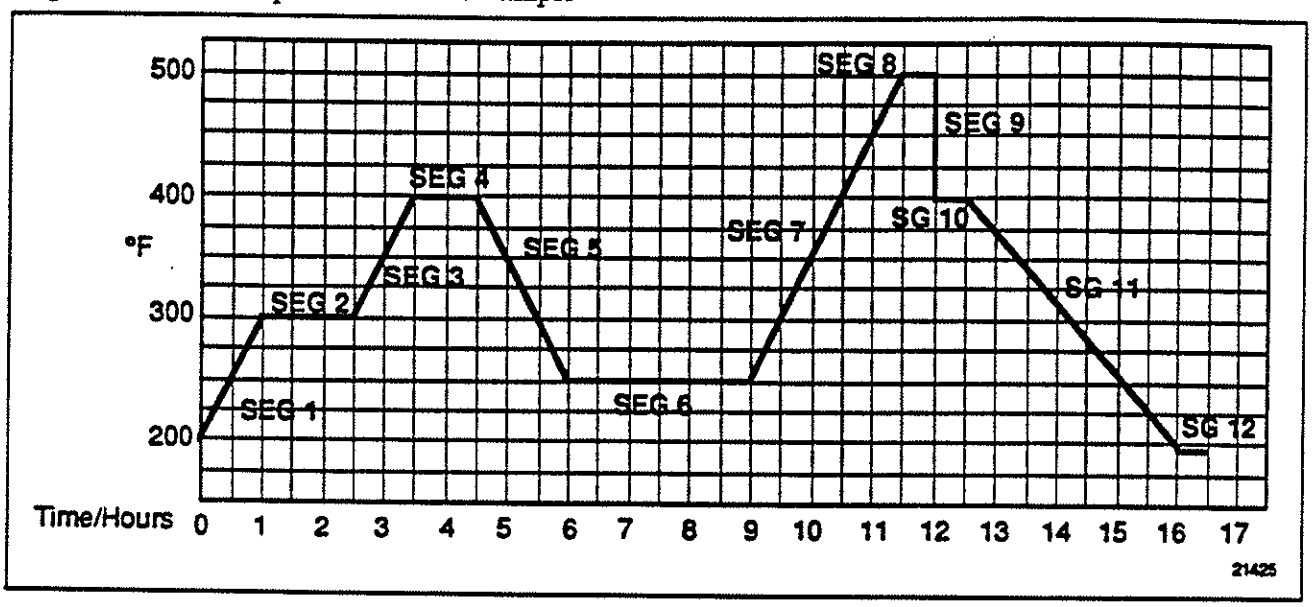
  RATE = Degrees/Minutes

6.3 Drawing a Ramp/Soak Profile

Ramp/soak profile example

Before you do the actual configuration, we recommend that you draw a ramp/soak profile in the space provided on the *"Program Record Sheet"* (Figure 6-2) and fill in the associated information.
An example of a Ramp/Soak Profile is shown in Figure 6-1.

Figure 6-1 Ramp/Soak Profile Example



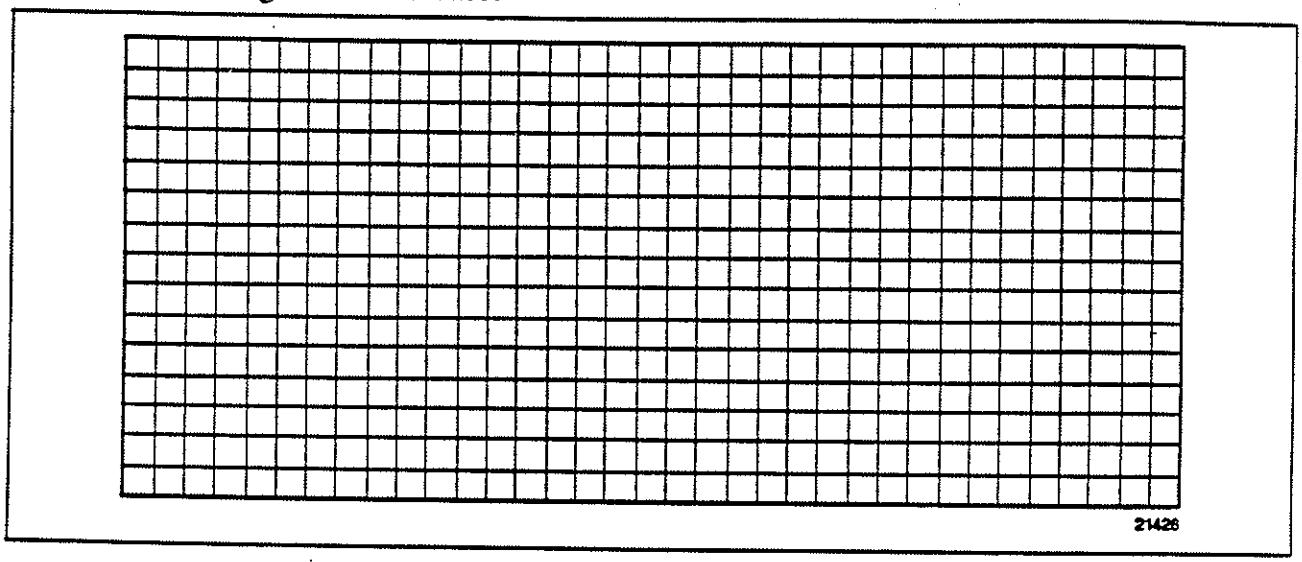
Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg.		1	SEG7RAMP	Ramp Time	7	2hrs:30min.
END SEG	End Seg.		12	SEG8 SP	Soak SP	8	500
RECYCLES	Number of Recycles		2	SEG8TIME	Soak Time	8	0hr.:30 min.
SOAK DEV	Deviation Value		0	SEG9RAMP	Ramp Time	9	0
SEG1RAMP	Ramp Time	1	1 hr.	SG10 SP	Soak SP	10	400
SEG2 SP	Soak SP	2	300	SG10 TIME	Soak Time	10	0hr.:30 min.
SEG2TIME	Soak Time	2	1hr.:30 min.	SG11RAMP	Ramp Time	11	3hrs:30min.
SEG3RAMP	Ramp Time	3	1hr.	SG12 SP	Soak SP	12	200
SEG4 SP	Soak SP	4	400	SG12TIME	Soak Time	12	0hr.:30 min.
SEG4TIME	Soak Time	4	1 hr.	STATE	Controller State at end		HOLD
SEG5RAMP	Ramp Time	5	1hr.:30 min.	PROG END	Controller Status		LAST SP
SEG6 SP	Soak SP	6	250	RAMP UNIT	Engr. Unit for Ramp		TIME
SEG6TIME	Soak Time	6	3hrs.:0min.				

Continued on next page

Program record sheet

Draw your ramp/soak profile on the record sheet shown in Figure 6-2 and fill in the associated information in the blocks provided. This gives you a permanent record of your program and assists you when entering the setpoint data.

Figure 6-2 Program Record Sheet



Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg.			SEG7RAMP	Ramp Time	7	
END SEG	End Seg.			SEG8 SP	Soak SP	8	
RECYCLES	Number of Recycles			SEG8TIME	Soak Time	8	
SOAK DEV	Deviation Value			SEG9RAMP	Ramp Time	9	
SEG1RAMP	Ramp Time	1		SG10 SP	Soak SP	10	
SEG2 SP	Soak SP	2		SG10 TIME	Soak Time	10	
SEG2TIME	Soak Time	2		SG11RAMP	Ramp Time	11	
SEG3RAMP	Ramp Time	3		SG12 SP	Soak SP	12	
SEG4 SP	Soak SP	4		SG12TIME	Soak Time	12	
SEG4TIME	Soak Time	4		STATE	Program Controller State		
SEG5RAMP	Ramp Time	5		PROG END	Controller Status		
SEG6 SP	Soak SP	6		RAMP UNIT	Engr. Unit for Ramp		
SEG6TIME	Soak Time	6					

6.4 Entering the Setpoint Program Data

Introduction

The procedure listed in Table 6-1 tells you what keys to press and what prompts you will see when entering the setpoint program data. Follow the prompt hierarchy listed in Table 6-2 when selecting the functions for setpoint programming.

ATTENTION Make sure SP RAMP is disabled first.

Table 6-1 Setpoint Program Data Entry Procedure

Step	Action	Press	Result
1	Select SP PROG Group	SET UP until you see	Upper Display: SET UP Lower Display: SP PROG
2	Select the functions	FUNC	Accesses the function prompts and enables Setpoint Programming. Upper Display → The current value for each prompt is shown Lower Display → The individual function prompts within the setpoint program group are shown. • Successive presses of the FUNCTION key sequentially displays all the functions and their values or selections. • Using the FUNCTION key, follow the prompt hierarchy shown in Table 6-2.
3	Change the value or selection of a function prompt	▲ or ▼	This changes the value or selection in the upper display. If the display blinks, you are trying to select an unacceptable value.
4	Enter value or selection into memory	FUNC	This enters the value or selection and goes to another prompt. • Repeat steps 3 and 4 for each function you want to change.
5	Exit configuration	LOWR DISP	This exits from the configuration mode.

Alarms on the Setpoint Program

You can configure an event to go ON or OFF at the beginning or end of any segment. Refer to *subsection 3.15 Alarms Set Up Group* for details.

Continued on next page

Prompt hierarchy

Table 6-2 lists all the function prompts for Setpoint Program data configuration in the order of their appearance.

- Follow the procedure in Table 6-1 to transfer the data from your setpoint ramp/soak profile into the recorder.
- All parameters may be changed while the program is disabled or in HOLD.

Table 6-2 Prompt Hierarchy and Available Selections

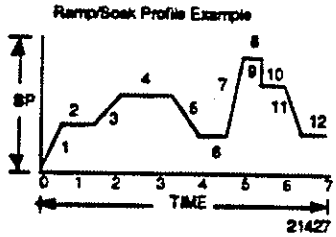
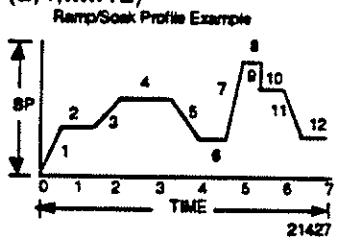
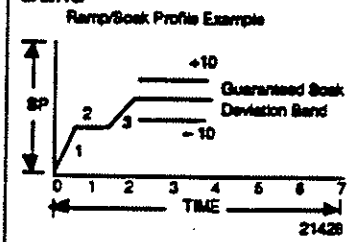
Function Prompt (Lower Display)	Definition	Value or Selection (Upper Display) (use ▲ or ▼ to change)	Remarks
SP RAMP	Setpoint Ramp Selection	*Selections*: DISABLE	SP RAMP must be disabled to allow Setpoint Programming.
SP PROG	Setpoint Ramp/Soak Programming	*Selections*: ENABLE DISABLE	SP PROG must be enabled to view the remaining prompts.
STRT SEG	Start Segment Number	*Enter Value*: 1 to 11	
END SEG	End Segment Number	*Enter Value*: 2 to 12	Always end in a soak segment (2,4,.....12) 
RECYCLES	Number of Program Recycles	*Enter Value*: 0 to 99 recycles	
SOAK DEV	Guaranteed Soak Deviation Value	*Enter Value*: 0 to ± 99 The number selected will be ± 0 to 99 from setpoint.	Example shows ±10 Guaranteed Soak Deviation Band 

Table 6-2 is continued on next page

Table 6-2 Prompt Hierarchy and Available Selections, continued

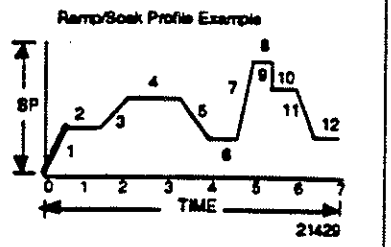
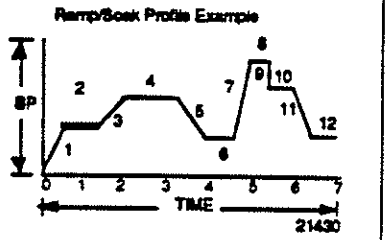
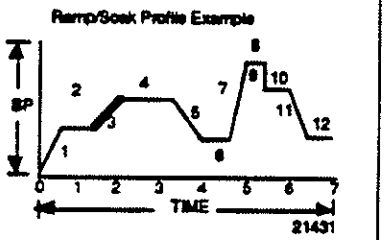
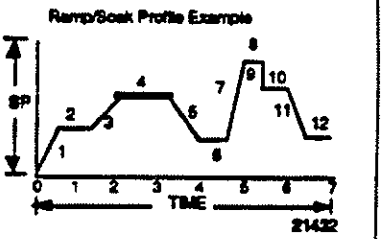
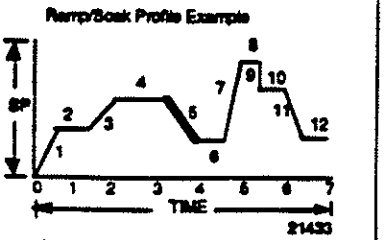
Function Prompt (Lower Display)	Definition	Value or Selection (Upper Display) (use ▲ or ▼ to change)	Remarks
SEG1RAMP	Segment #1 Ramp Time	*Enter Value*: 0-99hrs:0-59min, or 0-999 degrees/min Select HRS:MIN or DEG/MIN at prompt "RAMP UNIT". All ramps will use the same selection.	
SEG2 SP	Segment #2 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits	
SEG2TIME	Segment #2 Soak Duration	*Enter Value*: 0-99hrs:0-59min	
SEG3RAMP	Segment #3 Ramp Time	*Enter Value*: 0-99hrs:0-59min, or 0-999 degrees/min	
SEG4 SP	Segment #4 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits	
SEG4TIME	Segment #4 Soak Duration	*Enter Value*: 0-99hrs:0-59min	
SEG5RAMP	Segment #5 Ramp Time	*Enter Value*: 0-99hrs:0-59min, or 0-999 degrees/min	

Table 6-2 is continued on next page

Table 6-2 Prompt Hierarchy and Available Selections, continued

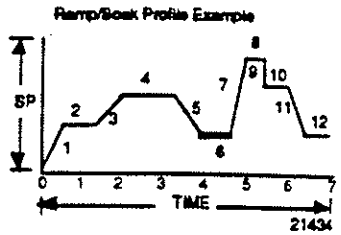
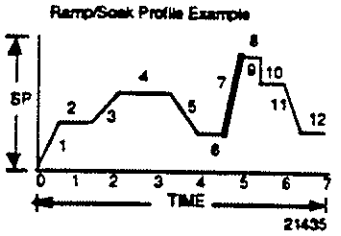
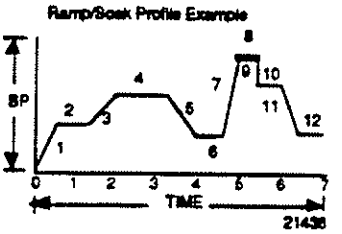
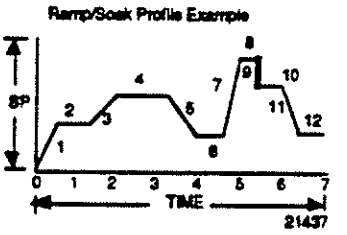
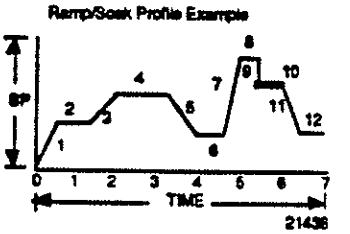
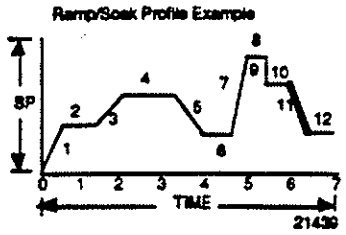
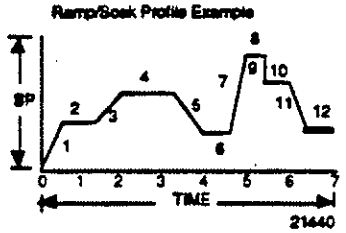
Function Prompt (Lower Display)	Definition	Value or Selection (Upper Display) (use ▲ or ▼ to change)	Remarks
SEG6 SP	Segment #6 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits	
SEG6TIME	Segment #6 Soak Duration	*Enter Value*: 0-99hrs:0-59min	
SEG7RAMP	Segment #7 Ramp Time	*Enter Value*: 0-99hrs:0-59min, or 0-999 degrees/min	
SEG8 SP	Segment #8 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits	
SEG8TIME	Segment #8 Soak Duration	*Enter Value*: 0-99hrs:0-59min	
SEG9RAMP	Segment #9 Ramp Time	*Enter Value*: 0-99hrs:0-59min, or 0-999 degrees/min	
SG10SP	Segment #10 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits	
SG10TIME	Segment #10 Soak Duration	*Enter Value*: 0-99hrs:0-59min	

Table 6-2 is continued on next page

Table 6-2 Prompt Hierarchy and Available Selections, continued

Function Prompt (Lower Display)	Definition	Value or Selection (Upper Display) (use ▲ or ▼ to change)	Remarks
SG11RAMP	Segment #11 Ramp Time	*Enter Value*: 0-99hrs:0-59min, or 0-999 degrees/min	
SG12SP	Segment #12 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits	
SG12TIME	Segment #12 Soak Duration	*Enter Value*: 0-99hrs:0-59min	
PROG END	Program Termination State	*Selections*: LAST SP F SAFE	Determines the status of the control output after the program is run. If you select LASTSP, the controller controls to the last setpoint value which becomes the LSP. For FSAFE selection, the controller is switched to manual mode and to the selected failsafe output value.
STATE	Program state at program end	*Selections:* DISABLE HOLD(hold mode)	Determines the state of the program after it completes the final program segment cycles. If you select DISABL, you must enable the program through the function prompt before you can run the program again. If you select HOLD, you can run the program again by pressing the [RUN/HOLD] key.
RAMPUNIT	Engineering units for ramp segments	*Selections*: TIME RATE	• TIME = Hrs:min • RATE = Deg/Min

ATTENTION Repeat this procedure for Setpoint Program 2 configuration.

6.5 Run/Monitor the Program

Introduction

Make sure all the "SP PROG" function prompts under the Set Up group "SP RAMP" have been configured with the required data.

•An "H" appears in the upper display indicating that the program is in the HOLD state. If an "H" doesn't appear, go to the SP Program configuration procedure and enable the program instead of disabling.

ATTENTION

For recorders with two controllers (both enabled), remember that any controller-related values displayed correspond with the lighted CHN indicator. "1" means that the values apply for Controller #1 and "2" means that the values apply for Controller #2.

Run/Monitor functions

Table 6-3 lists all the functions required to run and monitor the program.

Table 6-3 Run/Monitor Functions

Function	Press	Result
Run State	RUN HOLD	Initiates the setpoint program. "H" changes to "R" in the upper display indicating that the program is running. PV value and pen trace tracks the ramp soak profile.
Hold State	RUN HOLD	Holds the setpoint program. • An "H" appears in the upper display indicating that the program is in the HOLD state. • The setpoint holds at the current setpoint. Press again to continue to run.
External Hold		If Remote Switching (Digital Input Option) is present on your recorder, contact closure places the recorder in the HOLD state, if the setpoint program is running. • The "H" in the upper display blinks. ATTENTION The keyboard takes priority over external switch for the RUN/HOLD function. • Contact reopening runs program.

Table 6-3 is continued on next page

Run/Monitor functions, continued

Table 6-3 Run/Monitor Functions, continued

Function	Press	Result
Viewing the present ramp or soak segment number and time	LOWR DISP until you see	Upper Display ← "R" and the PV value Lower Display For Ramp segments: # RA XX.XX Ramp Time - Hours:Minutes or Ramp Rate - Degrees/Minute Indicates Ramp segment Segment Number (odd only) For Soak segments: # SK XX.XX Time remaining in segment in Hrs:Minutes including current partially completed minute Indicates Soak segment Segment Number (even only)
Viewing the number of cycles left in the program	LOWR DISP until you see	Upper Display ← "R" and the PV value Lower Display RECYC XX Remaining Cycles 0 to 99 This number includes the current partially completed cycle.
End Program		When the final segment is completed, the "R" in the upper display either changes to "H" if configured for HOLD state, or disappears if configured for DISABL of setpoint programming. • The recorder operates at the last setpoint in the program in automatic or will be in manual mode at the failsafe output.

Section 7 – Input Calibration

7.1 Overview

Introduction

This section describes the field calibration procedures for inputs 1, 2, 3, and 4. All DR4500A recorders are factory calibrated prior to shipment. It should not, therefore, be necessary to recalibrate the recorder when it is initially installed. However, you must recalibrate the input if any one of the conditions summarized below applies:

- The thermocouple or RTD input must meet published* accuracy rates. Note that the factory calibration at reference is ±1.2°F plus ±10 microvolts for thermocouples or ±0.3 ohms for RTDs.
  * Specifications 44-45-03-14
- You are using a 0–10 Vdc input. Recalibration is necessary because the resistor network used for this input has a tolerance of ±1.0%.
- You have cause to believe that the recorder is out of calibration.
- You must perform regularly scheduled or periodic recalibration based on your own needs.
- You have performed specific servicing activities such as replacement of an input PCB.

  ATTENTION Replacing a main PCB does not normally require recalibration since a new main PCB is already factory calibrated, whereas an input PCB is not.
- You have changed the input type through configuration which results in the loss of the previous field calibration, but restores factory calibration. See *subsection 7.2 Restoring Factory Calibration* paragraph that follows.

What's in this section?

This section contains the following topics:

	Topic	See Page
7.1	Overview	139
7.2	Restoring Factory Calibration	140
7.3	Minimum and Maximum Range Values	143
7.4	Preliminary Information – Disconnect the field wiring – Equipment needed	144 144 145
7.5	Calibration Set up for PV Inputs	146
7.6	Calibration Procedure	155
7.7	Printing Characteristics Adjustments	160

7.2 Restoring Factory Calibration

How to restore it

The factory calibration constants for all the input actuation types that can be used with the DR4500A recorder are stored in its nonvolatile memory. Thus, you can quickly restore the "Factory Calibration" for a given input actuation type by simply configuring the actuation type through the IN1 TYPE (or IN2 TYPE, IN3 TYPE, IN4 TYPE) prompt to another type and then changing it back to the original type. See Table 7-1 for the procedure.

ATTENTION

This procedure applies only for factory-installed inputs. Any input that was field-installed must be field calibrated.

Procedure

Table 7-1 lists the procedure for restoring factory calibration.

Table 7-1 Restoring Factory Calibration

Step	Operation	Press	Action/Result
1	Set "LOCKOUT" to "CALIB"	SET UP	Until you see: Upper Display: SET UP Lower Display: LOCKOUT
		FUNC	Until you see: Upper Display: (blank) ← One of the following: NONE, CALIB, + CONF, + VIEW, MAX Lower Display: LOCKOUT
		▲ or ▼	Until "CALIB" is in the lower display. ATTENTION Never leave the "LOCKOUT" selection in "NONE." Use "NONE LOCKOUT" only when you intend to make field adjustments to the factory calibration
2	Enter "INPUT" Setup Group	SET UP	Until you see: Upper Display: SET UP Lower Display: INPUT

Table 7-1 is continued on next page

Procedure, continued

Table 7-1 Restoring Factory Calibration, continued

Step	Operation	Press	Action/Result
3	Change input type	FUNC	Until you see: Upper Display [ ] ← Note the input type in the upperdisplay. Make sure that the selection matches the type of sensor that is connected to the input in your application. Write it down, if necessary. Lower Display IN# TYPE
		▲ or ▼	Until you see: Upper Display 0-10V Lower Display IN# TYPE ATTENTION If you are already using a 0-10V input, change to a 0-5V input type.
		FUNC	Until the upper display rolls through the input types and returns to Upper Display 0-10V Lower Display IN# TYPE
		▲ or ▼	Until you change the input selection in the upper display back to the proper selection. You will see: Upper Display [ ] ← Original input selection that matches your type of sensor. Lower Display IN# TYPE
4	Return to normal operating mode	LOWR DISP	To return to Normal operating mode. The factory calibration will be restored. If the problem is not corrected, contact the Honeywell Technical Assistance Center 1-800-423-9883 USA 1-800-461-0013 Canada

Continued on next page

CAUTION

A restored factory calibration overwrites any previous field calibration done for the input. Be sure to protect any field calibration from accidental overwrites by configuring the appropriate "LOCKOUT" selection after calibration. See the *Section 3 - Configuration* for specific instructions to set the lockout.

7.3 Minimum and Maximum Range Values

Select the range values

You should calibrate the recorder for the minimum (0%) and maximum (100%) range values of your particular sensor.

- If your recorder has two or more inputs, calibrate each input separately. Select the voltage or resistance equivalent for 0% and 100% range values from Table 7-2, use these values when calibrating your recorder.

Table 7-2 Voltage and Resistance Equivalents for 0% and 100% Range Values

Sensor Type	PV Input Range		Range Values *		
Thermocouples	°F	°C	0%	68°F/20°C	100%
B	105 to 3300	41 to 1816	0 mV	0.003 mV	13.763 mV
E	-454 to 1832	–270 to 1000	–9.835 mV	1.192 mV	76.358 mV
E (low)	-200 to 1100	–129 to 593	–6.471 mV		44.547 mV
J	0 to 1600	–18 to 871	–0.885 mV	1.019 mV	50.059 mV
J (low)	20 to 770	–7 to 410	–0.334 mV		22.397 mV
K	-320 to 2500	–196 to 1371	–5.822 mV	0.798 mV	54.845 mV
K (low)	–20 to 1000	–29 to 538	–1.114 mV		22.251 mV
NiNiMoly	32 to 2500	0 to 1371	–0.001 mV	1.458 mV	71.330 mV
NIC Nicrosil Nisil	0 to 2372	–17.8 to 1300	–0.461 mV	0.525 mV	47.502 mV
R	0 to 3100	–18 to 1704	–0.089 mV	0.111 mV	20.275 mV
S	0 to 3100	–18 to 1704	–0.092 mV	0.113 mV	17.993 mV
T	-300 to 700	–184 to 371	–5.341 mV	0.789 mV	19.095 mV
T (low)	-200 to 600	–129 to 316	–4.149 mV		15.789 mV
W5W26	0 to 4200	–18 to 2315	–0.234 mV	0.062 mV	37.066 mV
W5W26 (low)	0 to 2240	–18 to 1227	–0.234 mV		22.277 mV
RTD (IEC=0.00385)					
100 Ω	-300 to 900	–184 to 482	25.18 Ω		274.96 Ω
100 Ω (RH)	-130 to 392	–90 to 200	64.30 Ω		175.84 Ω
200 Ω	32 to 752	0 to 400	102.64 Ω		354.40 Ω
200 Ω	32 to 392	0 to 200	102.64 Ω		351.14 Ω
500 Ω	-300 to 900	-184 to 482	125..90 Ω		1374.80 Ω
Milliamps	4 to 20 mA		4 mA		20 mA
Millivolts	0 to 10 mV		0 mV		10 mV
	10 to 50 mV		10 mV		50 mV
Volts	0 to 5 Volts		0 Volt		5 Volts
	0 to 10 Volts **		0 Volts		10 Volts

* Range values for thermocouples are based on a cold junction temperature of 32°F (0°C). These values must be adjusted for the actual cold junction temperature when using the ambient temperature method for calibrating thermocouple inputs.

** Resistor network 30755232-002 must be installed in inputs #1, #2, #3, and #4 when using this range, see set up diagram for details.

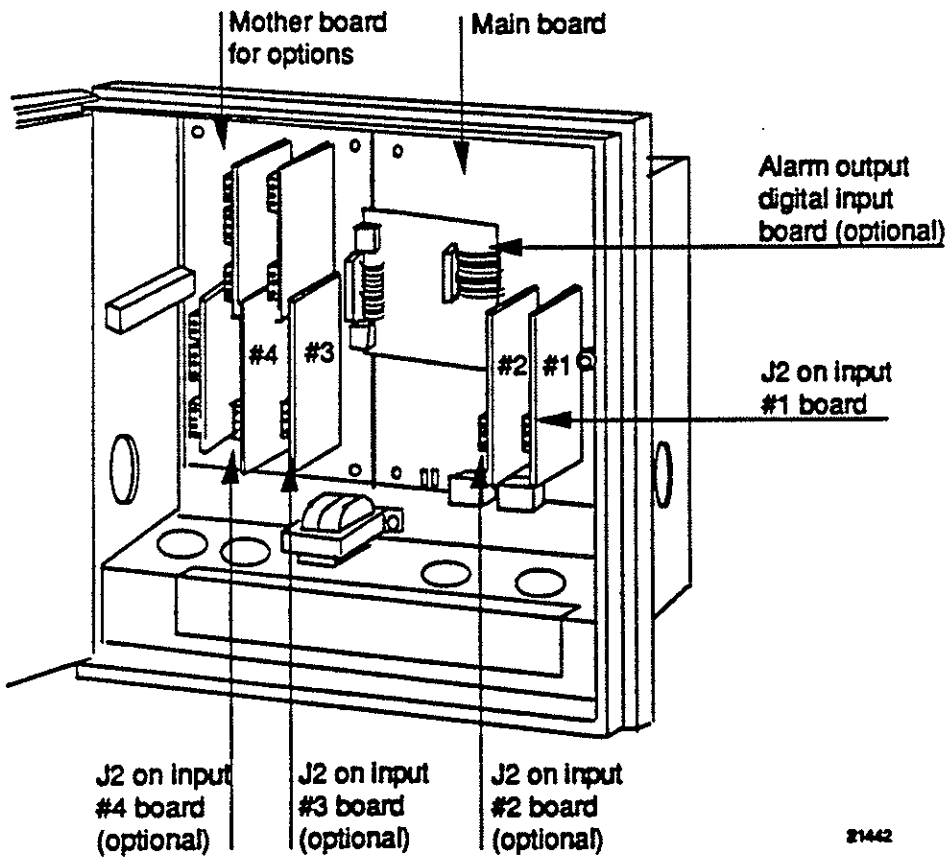
Disconnect the field wiring

Depending on which input (#1, #2, #3, or #4) you are going to calibrate, tag and disconnect any field wiring connected to the input terminals on the input boards inside the recorder. Reference Figure 7-1 and follow the procedure in Table 7-3.

Table 7-3 Disconnect the Field Wiring

Step	Action
1	Remove the operating power from the recorder.
2	Open the door on the recorder.
3	Loosen the slotted cap screw on the right side of the chart plate, and open the chart plate.
4	Depending on the input (1, 2, 3, or 4) you are going to calibrate, remove the wired plug from the input connector (J2) on the applicable circuit board. See Figure 7-1 for the location of the circuit boards and input connectors.
5	Tag and disconnect the field wiring installed in the applicable input connector plug.

Figure 7-1 Location of the Input Connections on the Input Boards



Continued on next page

Equipment needed

Table 7-4 lists the equipment required to calibrate the specific types of inputs listed in the table. You will need a medium size bladed screwdriver for general use and a small size bladed screwdriver for use with the screws on the connector plugs.

Table 7-4 Equipment Needed

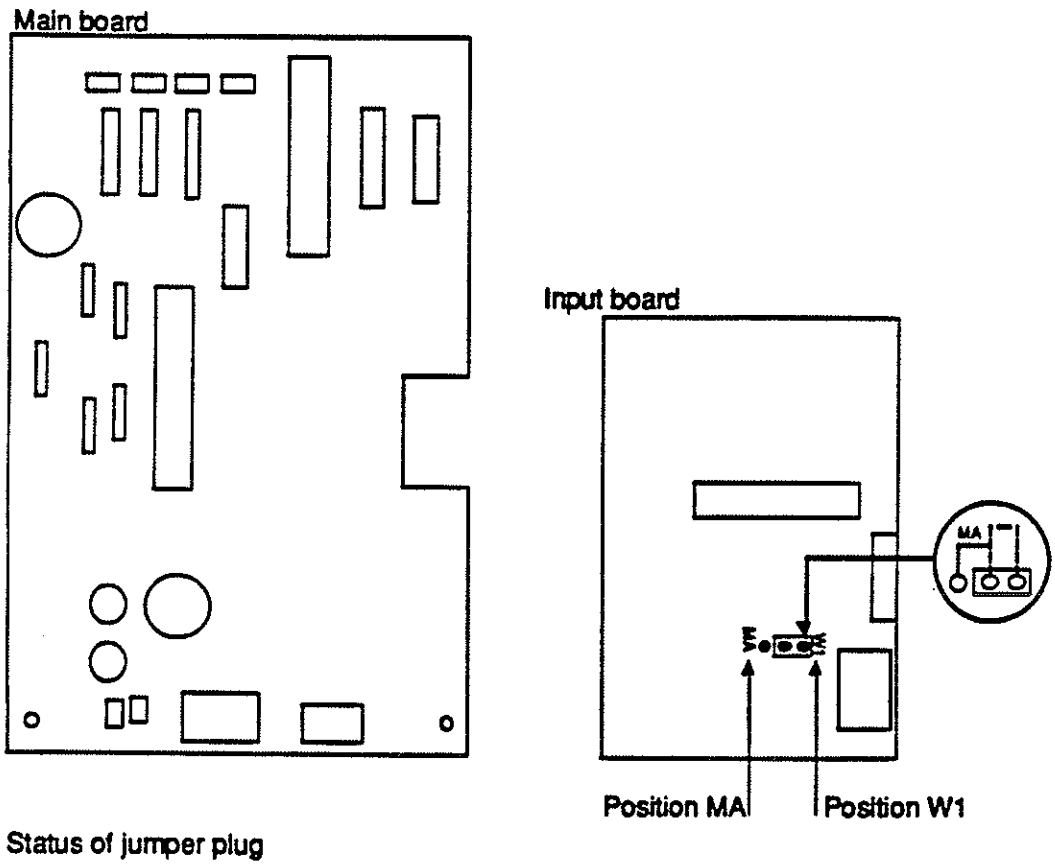
Type of Input	Equipment Needed
Thermocouple Inputs (Ice Bath)	• A calibrating device with ±0.02% accuracy for use as a signal source such as a millivolt source. • Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the recorder input. • Two insulated copper leads for connecting the thermocouple extension wire from the ice baths to the precision calibrator. • Two containers of crushed ice.
Thermocouple Inputs (Ambient Temperature)	• A calibrating device with ±0.02% accuracy for use as a signal source such as a millivolt source. • Two insulated copper leads for connecting the calibrator to the controller.
Thermocouple Inputs (Compensated Calibrator)	• A calibrating device with temperature compensation and ±0.02% accuracy for use as a signal source. • Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the recorder input.
RTD (Resistance Thermometer Device)	• A resistance decade box, with ±0.02% accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1400 Ohms with a resolution of 0.01 ohm. • Three insulated copper leads for connecting the decade box to the controller.
Milliampere, Millivolt, and Volts Inputs	• A calibrating device with ±0.02% accuracy for use as a signal source. • Two insulated copper leads for connecting the calibrator to the controller.

7.5 Calibration Set Up and Wiring for PV Inputs

Jumper positions

Before starting the calibration activity, check that the jumper plug on the applicable input circuit board is installed in the proper jumper position (in W1 or MA) for the particular sensor being used (refer to the wiring connection drawings in this section for each individual setting).
Refer to Figure 7-2 for the location of jumper positions W1 and MA on these circuit boards, and the status of these jumpers for each type of input sensor.

Figure 7-2 Location of Jumper Positions W1 and MA on the Input Boards



Continued on next page

Thermocouple input calibration methods

You can calibrate for a thermocouple input using one of three methods:

- using an ice bath,
- using a compensated calibrator, or
- by measuring the ambient temperature at the input terminals and subtracting the voltage contribution of the input terminal junction.

General set up procedure

Table 7-5 lists the general set up procedure for all methods of calibration. Do this procedure and then refer to the set up procedure and diagram for your specific input.

Table 7-5 General Set Up Procedure

Step	Action
1	Set up and connect the calibrator to the input plug for the applicable input circuit board in your recorder according to the particular input sensor being used. Refer to the following figures for corresponding set-up diagrams: • Figure 7-3 Thermocouple inputs using an ice bath • Figure 7-4 Thermocouple inputs using a compensated calibrator • Figure 7-5 Thermocouple inputs using the ambient temperature method • Figure 7-6 RTD (Resistance Thermometer Device) inputs • Figure 7-7 MV and Volts (except 0–10 Volts) inputs • Figure 7-8 0-10 Volts input • Figure 7-9 4–20 mA inputs
2	Route leads (for example: copper leads or thermocouple extension wires) through a conduit hole in the recorder case so that you will be able to close the chart plate.
3	Close the chart plate after you have completed the applicable calibration set up.

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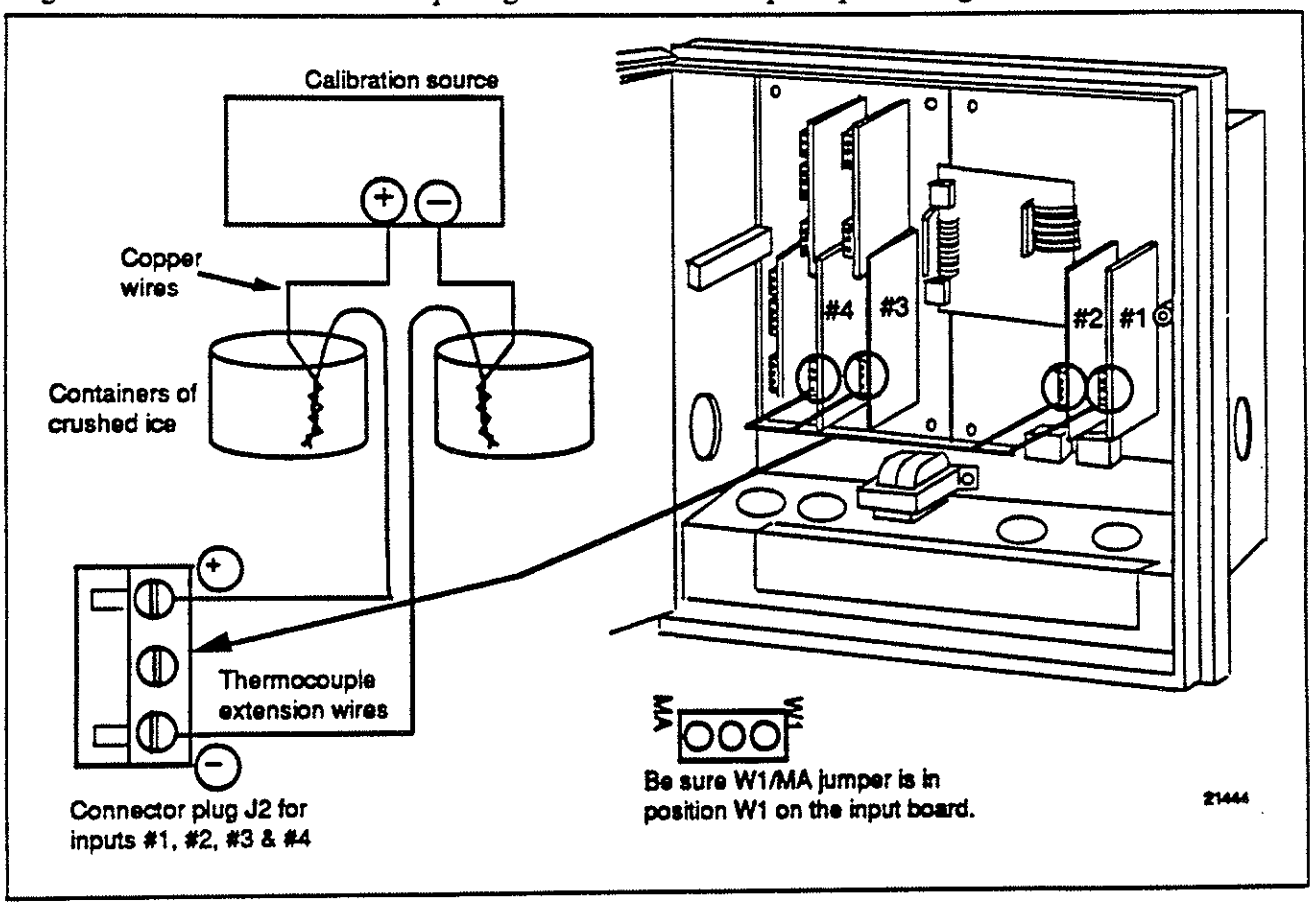
Thermocouple Inputs using an Ice Bath

Refer to Figure 7-3 and wire the recorder according to the procedure given in Table 7-6.

Table 7-6 Set Up Wiring Procedure for Thermocouple Inputs Using an Ice Bath

Step	Action
1	Connect the copper leads to the calibration source (see Figure 7-3).
2	Connect a length of thermocouple extension wire to the end of each copper lead and insert the junction points into the ice bath.
3	Connect the other end of the thermocouple extension wires to the clamp type terminals in the plug for the applicable input connector (J2).
4	Reinstall the plug into the input connector (J2) on the applicable circuit board for Input 1, Input 2, Input 3, or Input 4.

Figure 7-3 Calibration Set Up Diagram for Thermocouple Inputs Using an Ice Bath



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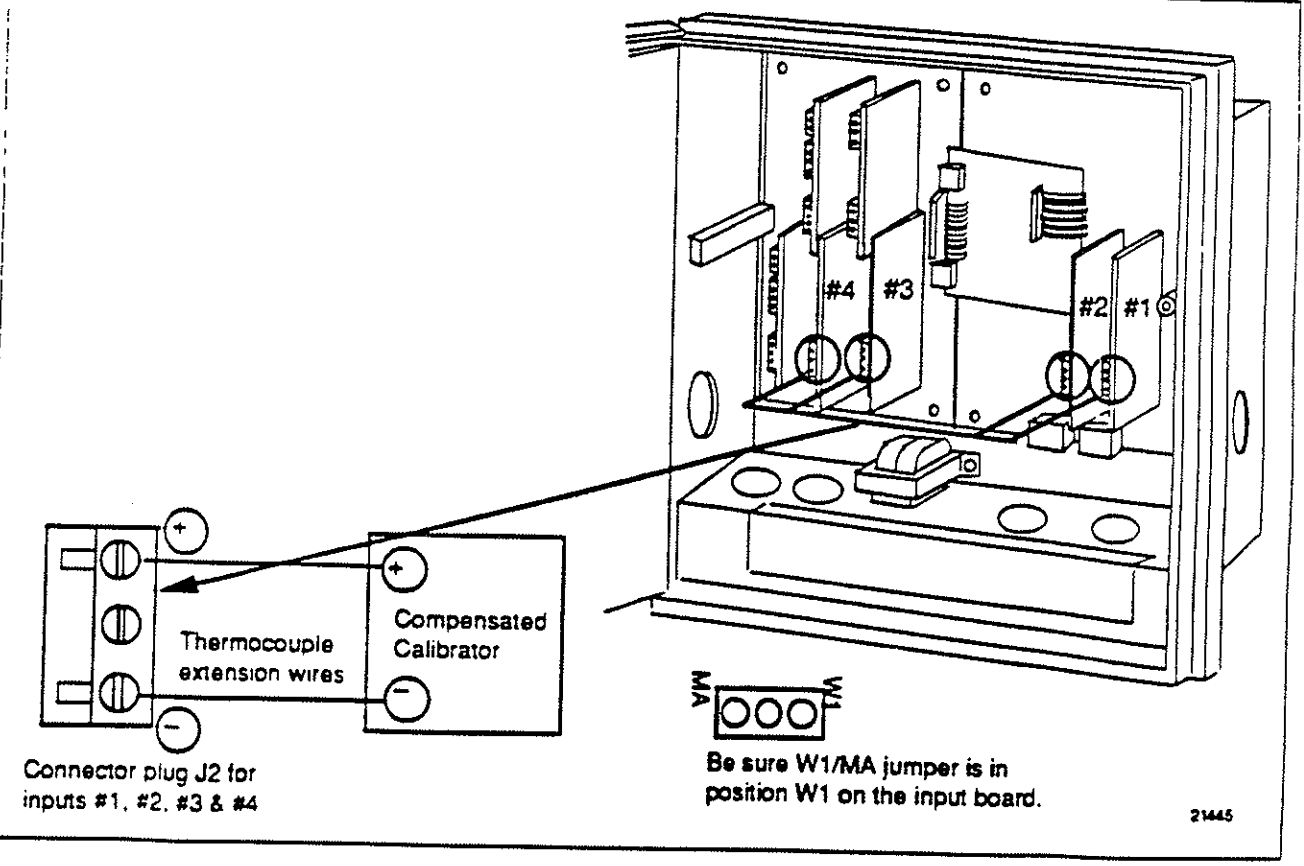
Thermocouple inputs using a compensated calibrator method

Refer to Figure 7-4 and wire the recorder according to the procedure given in Table 7-7.

Table 7-7 Set Up Wiring Procedure for Thermocouple Inputs Using a Compensated Calibrator Method

Step	Action
1	Connect the thermocouple extension wire to the Precision Compensated Calibrator (see Figure 7-4).
2	Connect the other end of the thermocouple extension wires to the clamp type terminals in the plug for the applicable input connector (J2).
3	Reinstall the plug into the input connector (J2) on the applicable circuit board for Input 1, Input 2, Input 3, or Input 4.

Figure 7-4 Calibration Set Up Diagram for Thermocouple Inputs Using a Compensated Calibrator Method



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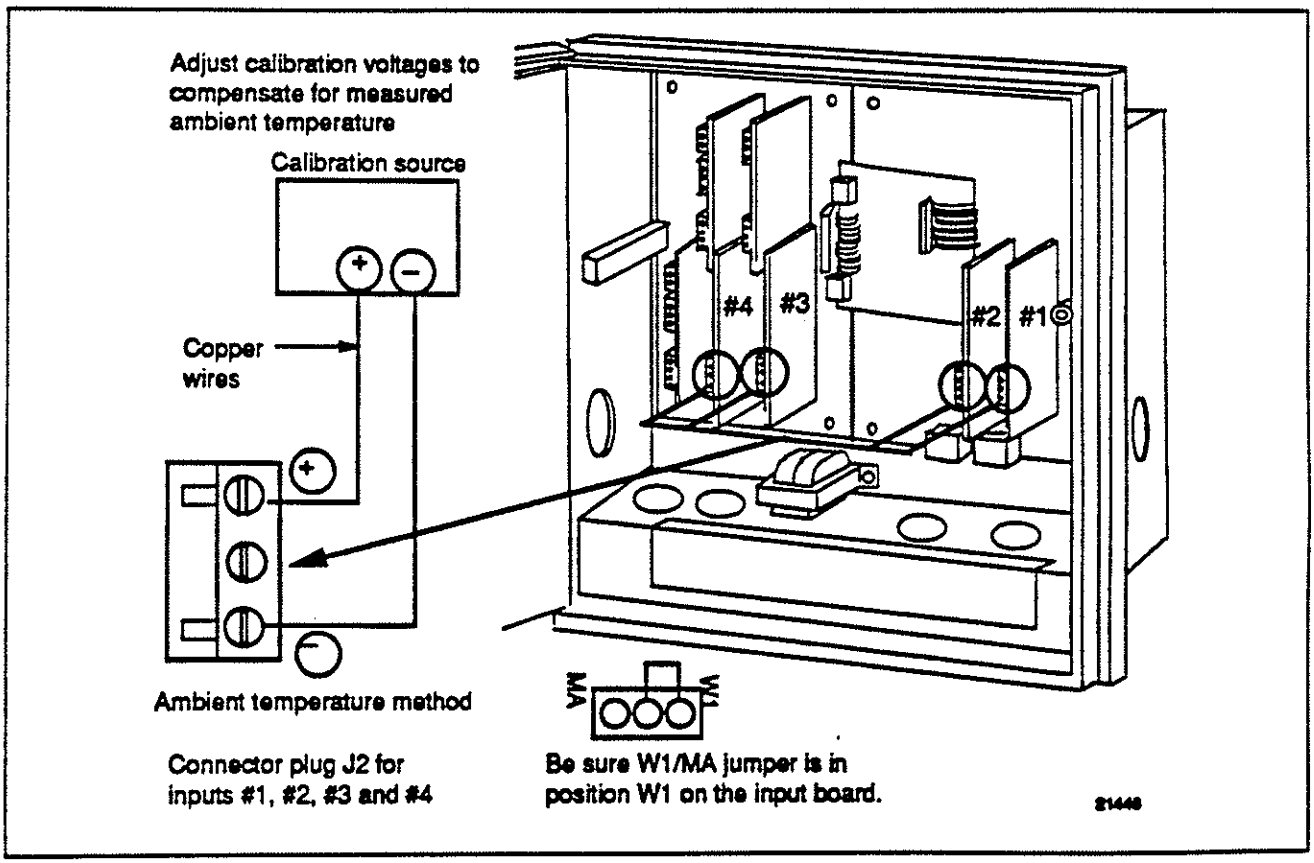
Thermocouple inputs using the ambient temperature method

Refer to Figure 7-5 and wire the recorder according to the procedure given in Table 7-8.

Table 7-8 Set Up Wiring Procedure for Thermocouple Inputs Using the Ambient Temperature Method

Step	Action
1	Connect the copper wire to the Precision Millivolt Source (see Figure 7-5).
2	Connect the other end of the copper wire to the clamp type terminals in the plug for the applicable input connector (J2).
3	Reinstall the plug into the input connector (J2) on the applicable circuit board for input 1, input 2, input 3, or input 4.

Figure 7-5 Calibration Set Up Diagram for Thermocouple Inputs using the Ambient Temperature Method



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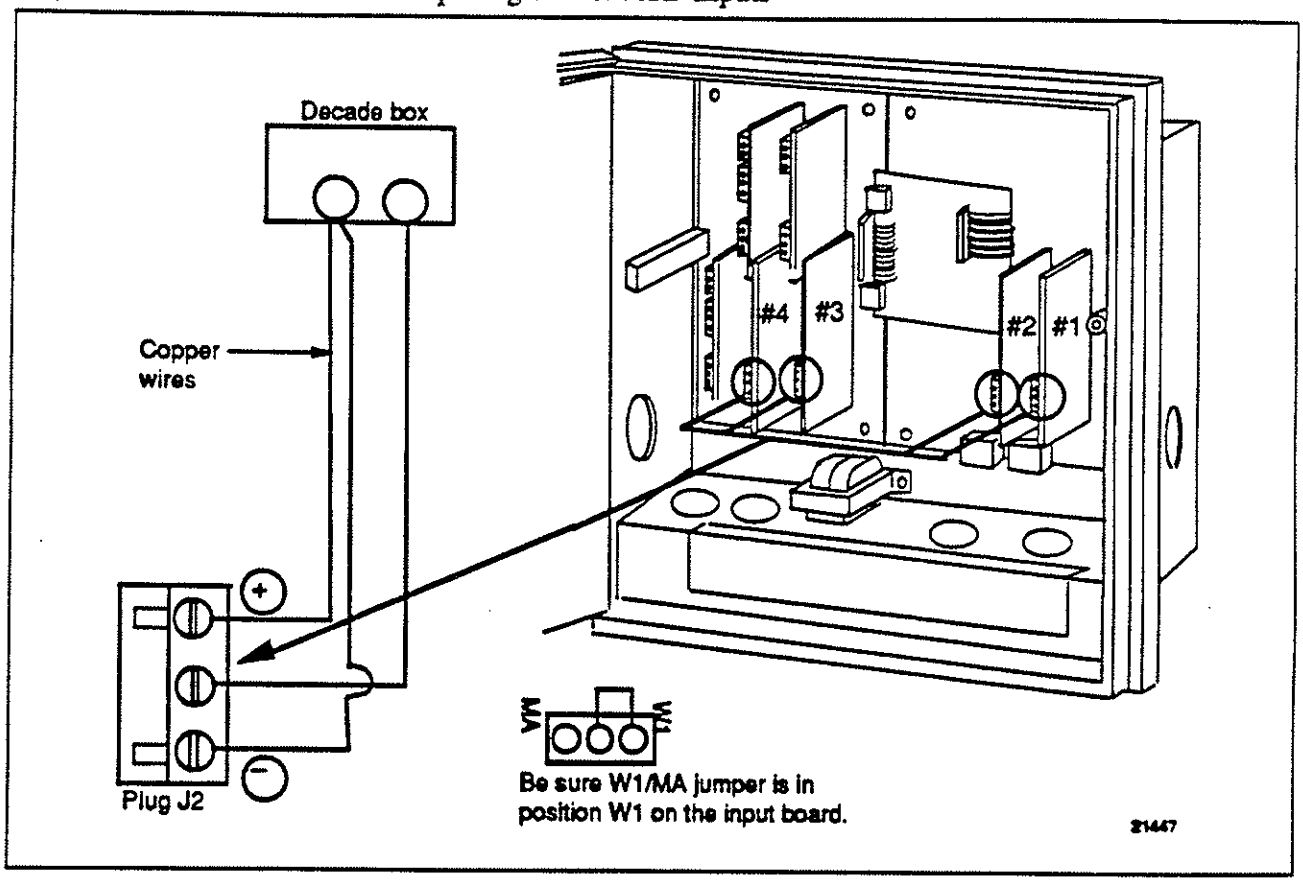
RTD (Resistance Thermometer Device) Inputs

Refer to Figure 7-6 and wire the recorder according to the procedure given in Table 7-9.

Table 7-9 Set Up Wiring Procedure for RTD Inputs

Step	Action
1	Connect the copper wire to the calibration source (see Figure 7-6).
2	Connect the other end of the copper wire to the clamp type terminals in the plug for the applicable input connector (J2).
3	Reinstall the plug into the input connector (J2) on the applicable circuit board for input 1, input 2, input 3, or input 4.

Figure 7-6 Calibration Set Up Diagram for RTD Inputs



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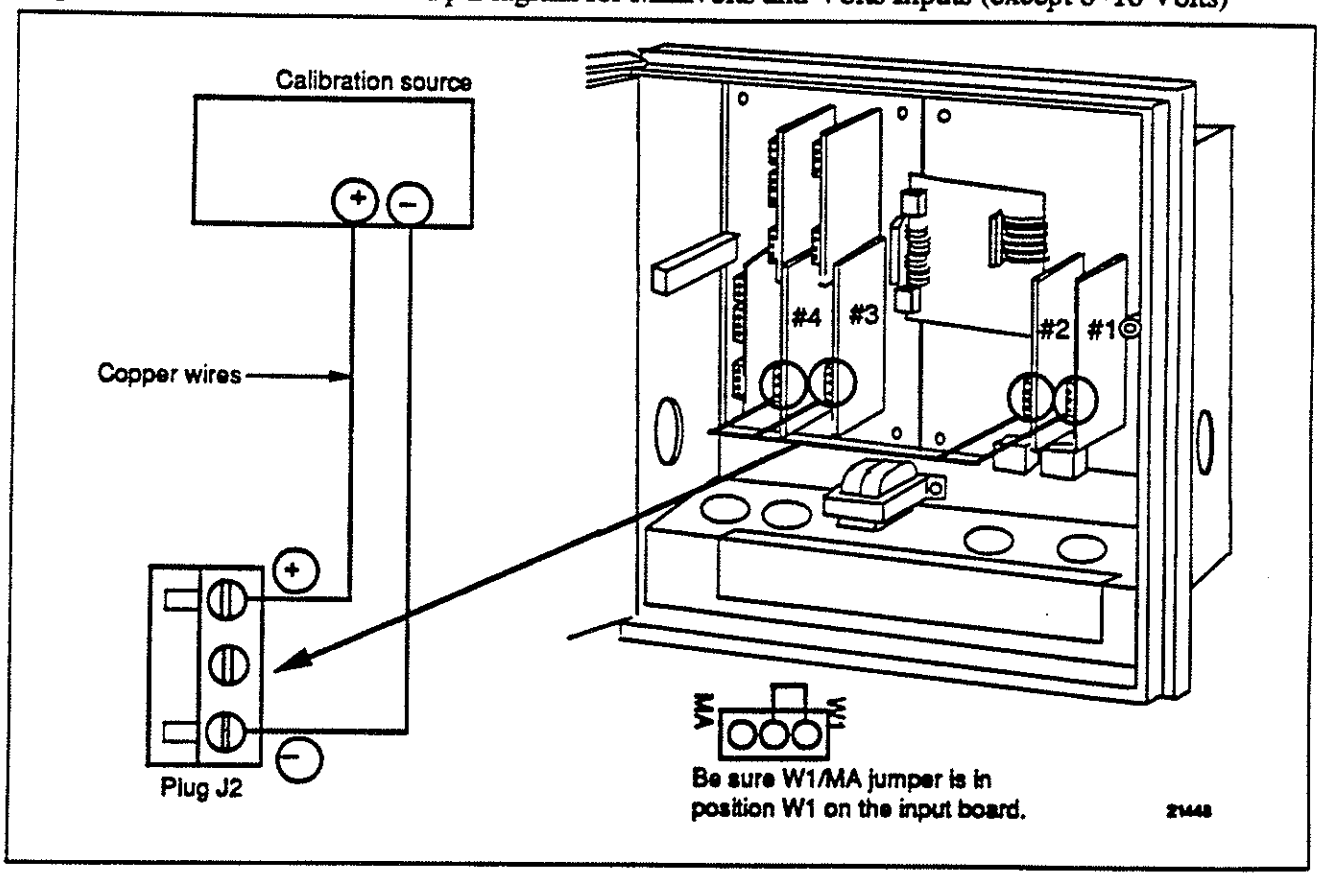
Millivolts and Volts Inputs (except 0–10 Volts)

Refer to Figure 7-7 and wire the recorder according to the procedure given in Table 7-10.

Table 7-10 Set Up Wiring Procedure for Millivolts and Volts Inputs (except 0–10 Volts)

Step	Action
1	Connect the copper wire to the calibration source (see Figure 7-7).
2	Connect the other end of the copper wire to the clamp type terminals in the plug for the applicable input connector (J2).
3	Reinstall the plug into the input connector (J2) on the applicable circuit board for input 1, input 2, input 3, or input 4.

Figure 7-7 Calibration Set Up Diagram for Millivolts and Volts Inputs (except 0–10 Volts)



Continued on next page

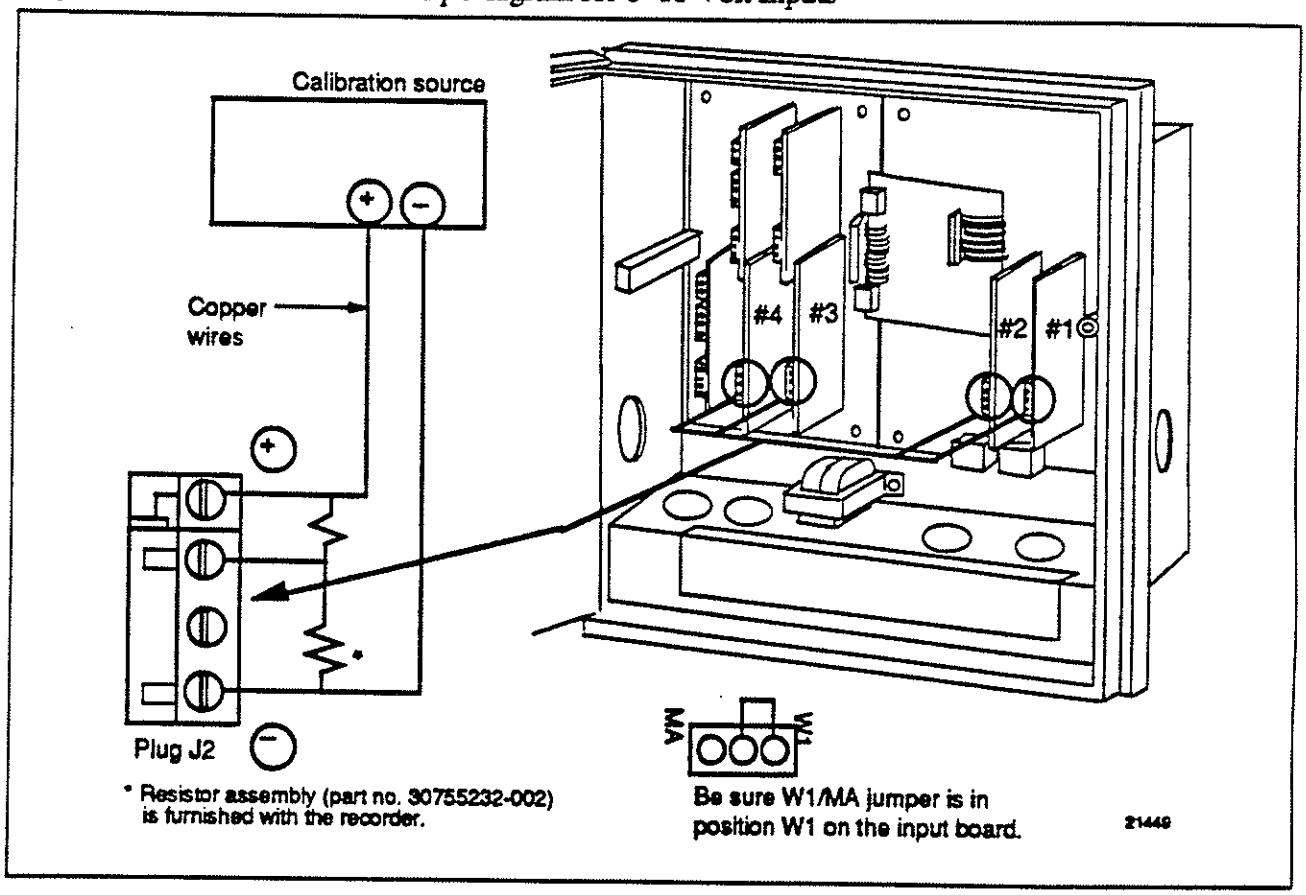
0–10 Volt Inputs

Refer to Figure 7-8 and wire the recorder according to the procedure given in Table 7-11.

Table 7-11 Set Up Wiring Procedure for 0–10 Volt Inputs

Step	Action
1	Connect the copper wire to the calibration source (see Figure 7-8).
2	Connect the other end of the copper wire to the clamp type terminals in the plug for the applicable input connector (J2).
3	Reinstall the plug into the input connector (J2) on the applicable circuit board for input 1, input 2, input 3, or input 4.

Figure 7-8 Calibration Set Up Diagram for 0–10 Volt Inputs



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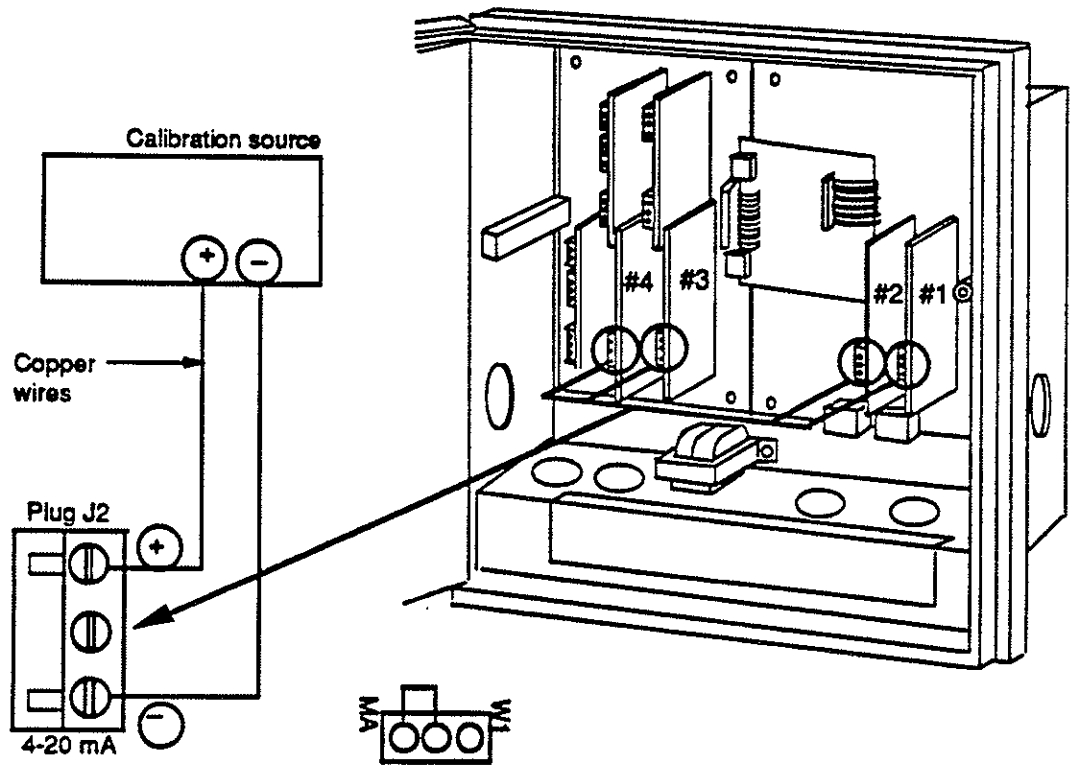
4–20 mA Inputs

Refer to Figure 7-9 and wire the recorder according to the procedure given in Table 7-12.

Table 7-12 Set Up Wiring Procedure for 4–20 mA Inputs

Step	Action
1	Connect the copper wire to the calibration source (see Figure 7-9).
2	Connect the other end of the copper wire to the clamp type terminals in the plug for the applicable input connector (J2).
3	Reinstall the plug into the input connector (J2) on the applicable circuit board for input 1, input 2, input 3, or input 4.

Figure 7-9 Calibration Set Up Diagram for 4–20 mA Inputs



7.6 Calibration Procedure

Introduction

Apply power and allow the recorder to warm up for one hour before you calibrate.

- Please read "*Set Up Wiring*" before beginning the procedure.
- Make sure "LOCKOUT" is set to "NONE." (see *Section 3 – Configuration).*
- The calibration procedure for inputs #1, #2, #3, and #4 are identical. The displays indicate the input number.

CAUTION For *milliampere inputs*, be sure the current source is at zero before switching on the calibrator. Do not switch the calibrator on/off while it is connected to the recorder's input.

ATTENTION For *linear inputs*, avoid step changes in input signal. Vary calibration source signal smoothly from initial value to final 100% value.

Calibration procedure sequence

The calibration procedure sequence for all inputs is listed in Table 7-13.

Table 7-13 Calibration Procedure Sequence

Step	Description	Press	Action/Result
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL Ib Lower Display: INPUT (X) (X) = input 1, input 2, input 3, or input 4 whichever is applicable. For this procedure, input 1 will be shown in the display examples.
		FUNC	You will see: Upper Display: dISABL Lower Display: CAL INI
		▲	The calibration sequence is enabled and you will see: Upper Display: bEGIN Lower Display: CAL INI

Table 7-13 is continued on next page

Table 7-13 Calibration Procedure Sequence, continued

Step	Description	Press	Action/Result
2	Calibrate 0%	FUNC	You will see: Upper Display APPLY Lower Display IN1 ZERO • Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor, see Table 7-2 for Voltage or Resistance equivalents. • Wait 30 seconds, then go to the next step.
	Using Ambient Temperature Method		ATTENTION If you are using the Ambient Temperature method to calibrate a thermocouple input, be sure to measure the temperature at the input terminals and subtract the equivalent millivolt value (for your particular thermocouple) from the 0% value just prior to doing calibration. For example, for a Type J Thermocouple and input temperature of 68°F: From –0.885 mV (Type J @ 0°F) Subtract –1.019 mV (Type J @ 68°F) To yield –1.904 mV (calibrator output for IN_n ZERO)

Table 7-13 is continued on next page

Table 7-13 Calibration Procedure Sequence, continued

Step	Description	Press	Action/Result
3	Calibrate 100 %	FUNC	You will see: Upper Display: APPLY Lower Display: IN1 SPAN Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor, see Table 7-2 for voltage or resistance equivalents, wait 30 seconds, and If... / Then... you are calibrating a thermocouple input — Go to step 4 you are calibrating other than a thermocouple input — Go to step 5
	Using Ambient Temperature Method		ATTENTION If you are using the Ambient Temperature method to calibrate a thermocouple input, be sure to measure the temperature at the input terminals and subtract the equivalent millivolt value (for your particular thermocouple) from the 100% value. For example, for a Type J Thermocouple and input temperature of 68°F: From 50.059 mV (Type J @ 1600°F) Subtract −1.019 mV (Type J @ 68°F) To yield 49.040 mV (calibrator output for IN_n SPAN)
4	Check the Cold Junction Temperature WARNING The accuracy of the recorder is directly affected by the accuracy of this value. Change this value only if the zero and span calibration procedures did not bring the controller within the specified accuracy requirements.	FUNC	The calculations for zero and span are now stored and you will see: Upper Display: ← The cold junction temperature at the rear terminals Lower Display: C-J TEMP • The value in the upper display is in the tenths of a degree. It is the current reading of the temperature as measured at the thermocouple terminals (that is, at J2) and recognized by the recorder. • When using the Ice Bath method, this value should be the terminal ambient temperature. – You can change this value, if it is in error, using the ▲ or ▼ key.
5	Exit the Calibration Mode	FUNC	The recorder stores the calibration constants and exit calibration mode.

7.7 Printing Characteristics Adjustments

Printing characteristics adjustments

Normally there is no need to adjust the printing characteristics as part of an input or output calibration procedure. However, if the chart printing appears to be faded, you can use the procedure in *Section 4 - Configuration Definitions*, Table 4-12 to make slight adjustments in the print contrast.

ATTENTION To access Set Up group prompt "ADJUST", the Set Up group prompt "LOCKOUT" must be set to "NONE". If the group prompt "LOCKOUT" has been configured for "CALIB", "+VIEW", or "MAX" selection, you will not be able to access the Printing Characteristics Group prompt. Refer to *Section 3 - Configuration* for details.

Section 8 – Output Calibration

8.1 Overview

Introduction

This section describes the field calibration procedures for the following types of outputs:

- Current Output
- Position Proportional Output

ATTENTION

Calibration for Control Outputs #1 and #2 is identical except for the particular printed circuit board involved.

What's in this section

This section contains the following topics:

	Topic	See Page
8.1	Overview	159
8.2	Current Proportional Output Calibration	160
	• Introduction	160
	• Equipment Needed	160
	• How to Connect the Calibrator	160
	• Calibration Procedure	161
8.3	Position Proportional Output Calibration	162
	• Position Proportional Control	162
	• Equipment Needed	162
	• Connections	162
	• Auto Mode versus Manual Mode	162
	• Displayed Values	162
	• Calibration Procedure	163

8.2 Current Proportional Output Calibration

Introduction

Calibrate the recorder so that the output provides the proper amount of current over the desired range.

- The recorder can provide an output current range of from 2 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other values between 2 and 21 mA.

Equipment needed

You will need a standard shop type milliammeter, with whatever accuracy is required, capable of measuring 0 to 20 milliamps.

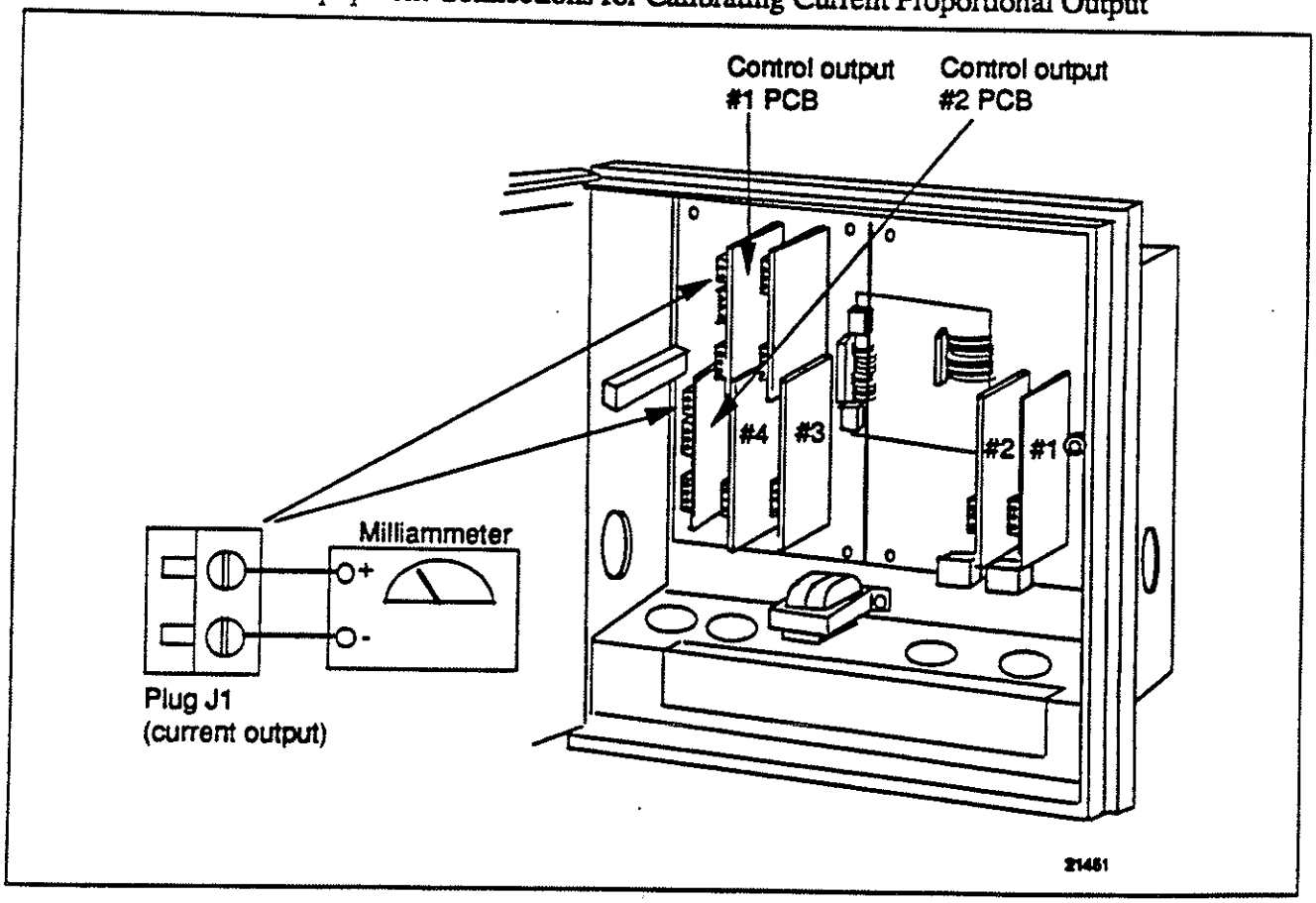
Calibrator connections

Refer to Figure 8-1 and wire the recorder according to the procedure given in Table 8-1.

Table 8-1 Set Up Wiring Procedure Current Proportional Output

Step	Action
1	With the power off, door open, and the chart plate swung out; tag and disconnect field wiring from the plug in connector J1 on the appropriate control output PCB (see Figure 8-1).
2	Observing polarity, connect a milliammeter's leads to the plug for connector J1.
3	Close the chart plate: apply power and allow the recorder to warm up 15 minutes before you calibrate.

Figure 8-1 Test Equipment Connections for Calibrating Current Proportional Output



Continued on next page

Procedure

The procedure for calibrating the Current Proportional Output is listed in Table 8-2. Make sure "LOCKOUT" in the Set Up group is set to "NONE." See *Section 3 – Configuration.*

Table 8-2 Current Proportional Output Calibration Procedure

Step	Description	Press	Action/Result
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL Ib Lower Display: CURRENT
2	Calibrate 0%	FUNC	You will see: Upper Display: ◄ a value Lower Display: ZERO URL
		▲ or ▼	Until the desired 0% output is read on the milliammeter. Use the values shown below depending on the action of your recorder. 4 mA For 4 to 20 mA Direct Action 20 mA For 4 to 20 mA Reverse Action
3	Calibrate 100%	FUNC	Stores the 0%value and, you will see: Upper Display: ◄ a value Lower Display: SPAN URL
		▲ or ▼	Until the desired 100% output is read on the milliammeter. Use the values shown below depending on the action of your recorder. 20 mA For 4 to 20 mA Direct Action 4 mA For 4 to 20 mA Reverse Action
4	Exit the Calibration Mode	FUNC	The recorder stores the span value.
		LOWR DISP or SET UP	To exit the calibration mode.

8.3 Position Proportional Output Calibration

Position proportional control

When the DR4500A Recorder has a position proportional control output, calibrate the recorder so that the increase and decrease relays operate properly with respect to the position of the external feedback slidewire.

Equipment needed

None

Connections

Leave all field wiring connected to the plugs in connectors J2 and J5 on the appropriate control output printed circuit board.

Apply power and allow the recorder to warm up 15 minutes before you calibrate.

Auto mode vs manual mode

There are two ways in which to calibrate Position Proportional control:
AUTO mode or MANUAL mode.

Rules for auto mode vs manual mode

The auto-mode selection must be done at least once before the manual mode will operate properly. Failure to use the auto-mode procedure will prevent the recorder from going into automatic control mode.

Displayed values

During the auto-mode calibration procedure, the values being displayed are used only to indicate if the motor is still traveling.

To view the actual calibration value, use the manual mode after the auto-mode is completed. These values can be changed for purposes of tweaking the calibration.

Continued on next page

Procedure

The procedure for calibrating the position proportional output is listed in Table 8-3.

- Make sure "LOCKOUT" in the Set Up group is set to "NONE." See *Section 3 – Configuration.*

Table 8-3 Position Proportional Output Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL ib Lower Display: POS PROP
2	Set Motor Traverse Time Note: This is the time it takes the motor to travel from 0 to 100%.	FUNC	Until you see: Upper Display: ◄ a value Lower Display: MTR TIME
		▲ or ▼	Until the proper motor stroke time is reached (see the motor specs or measure the time). • Range of setting = 5 to 255 Seconds

Table 8-3 is continued on next page

Table 8-3 Position Proportional Output Calibration Procedure, continued

Step	Description	Press	Action
3	Select Automatic or Manual Calibration	FUNC	until you see: Upper Display: dISAbLE Lower Display: POS PROP • You can calibrate the control output manually or let the recorder calibrate the control output automatically. • In the "Automatic Calibration Mode" (DO AUTO), the control relays automatically move the motor in the proper direction. • If desired, however, the motor may be manually positioned to 0% and 100% positions. Disconnect the relay wires. "DO MAN". • In the "Manual Calibration Mode" (DO MAN) the motor does not move. Instead, the existing 0% and 100% values may be changed with the ▲ or ▼ keys.
		▲ or ▼	Select automatic or manual calibration. Upper Display: ← DO AUTO or DO MAN Lower Display: POS PROP • If you select DO AUTO, go to step 4 • If you select DO MAN, go to step 6 ATTENTION When calibration is terminated, this selection reverts to DISABL.
4	DO AUTO Set 0% value	FUNC	The decrement relay is turned on to move the motor to 0% position. Upper Display: ← counts of feedback slidewire (0 to 2047) Lower Display: ZERO URL • When the motor stops, the display should stop counting; go to the next step.
5	Set 100% value	FUNC	The increment relay is turned on to move the motor to 100% position. Upper Display: ← counts of feedback slidewire (0 to 2047) Lower Display: SPAN URL • When the motor stops, the display should stop counting, then, go on to step 8.

Table 8-3 is continued on next page

Table 8-3 Position Proportional Output Calibration Procedure, continued

Step	Description	Press	Action/Result
6	DO MAN Set 0% value	FUNC	You will see: Upper Display ◄ The existing zero calibration value in counts. Lower Display ZERO URL
		▲ or ▼	Until the desired zero value is reached in the upper display. Upper Display ◄ The desired zero value Lower Display ZERO URL
7	Set 100% value	FUNC	The recorder stores the 0% value and you will see: Upper Display ◄ The existing span calibration value in counts Lower Display SPAN URL
		▲ or ▼	Until the desired span value is reached in the upper display. Upper Display ◄ The desired span value Lower Display SPAN URL For manual calibration, the motor does not move from its position prior to the start of position proportional calibration.
8	Exit the Calibration Mode	FUNC	The recorder stores the 100% value.
		LOWR DISP or SET UP	To exit the calibration mode.

Table 8-3 Position Proportional Output Calibration Procedure, continued

Step	Description	Press	Action
3	Select Automatic or Manual Calibration	FUNC	until you see: Upper Display dISABLE Lower Display POS PROP • You can calibrate the contro the recorder calibrate the c automatically. • In the "Automatic Calibratio the control relays automatic the proper direction. • If desired, however, the mot positioned to 0% and 100% Disconnect the relay wires. • In the "Manual Calibration M motor does not move. Inste 100% values may be chang keys.
		▲ or ▼	Select automatic or manual ca Upper Display ← DO AUTO or DO MAN Lower Display POS PROP • If you select DO AUTO, go • If you select DO MAN, go to ATTENTION When calibra selection reverts to DISABL.
4	DO AUTO Set 0% value	FUNC	The decrement relay is turne to 0% position. Upper Display ← counts of fee slidewire (0 t Lower Display ZERO URL • When the motor stops, the counting; go to the next st
5	Set 100% value	FUNC	The increment relay is turned to 100% position. Upper Display ← counts of feedb slidewire (0 to Lower Display SPAN URL • When the motor stops, the counting, then, go on to st

Table 8-

Section 9 – Troubleshooting / Service

9.1 Overview

Introduction

This section explains how to troubleshoot the DR4500A recorder using self-diagnostic test results and error messages as well as some visual failure symptoms. Using an optimum replacement unit repair philosophy, trouble is traced to a printed circuit board (PCB)/hardware assembly level rather than to an individual PCB/hardware assembly component. While troubleshooting is straightforward, we recommend that only trained service technicians repair the recorder.

What's in this section?

The following topics are covered in this section.

	Topic	See Page
9.1	Overview	167
9.2	Troubleshooting Aids	169
9.3	Self Diagnostics	171
9.4	Visual Failure Symptoms	183
9.5	Troubleshooting Procedures	184
9.6	Parts Replacement Procedures	192

Continued on next page

Types of problems

Instrument performance can be adversely affected by installation and application problems as well as hardware problems. We recommend that you investigate the problems in the following order:

- Installation related problems
- Application related problems
- Hardware and software related problems

and use the information presented in this section to solve them.
If a replacement of any part is required, follow the procedures in *subsection 9.6 Replacement Procedures*.

Installation related problems

Read the Installation section in this manual to make sure the DR4500A has been properly installed. The installation section provides information on protection against electrical noise, connecting external equipment to the recorder, and shielding and routing external wiring.

ATTENTION System noise induced into the recorder will result in diagnostic error messages recurring. If the diagnostic error messages can be cleared, it indicates a "soft" failure and is probably noise related.
If system noise is suspected, completely isolate the recorder from all field wiring. Use calibration sources to simulate PV and check all recorder and control functions; that is, Pen functions, Chart Trace, Gain, Rate, Reset, Output, Alarms, etc.

Application related problems

Review the application of the recorder; then, if necessary, direct your questions to the local sales office.

Hardware and software related problems

Use the troubleshooting error message prompts and recorder failure symptoms to identify typical failures which may occur in the recorder. Follow the troubleshooting procedures to correct them.

9.2 Troubleshooting Aids

Self diagnostics

The DR4500A recorder runs self-diagnostic tests to monitor the recorder's general health. The tests are divided into three main groups and will produce an error message when failed.
An error message can occur

- at power-up - run when power is cycled off and on,
- during continuous background tests while in normal operation, and
- when the Status Tests are requested by the operator.

Table 9-4 lists all the error message prompts that you could see, the reason for the failure, and how to correct the problem

Visual failure symptoms

Other failures may occur that deal with the power, pen functions, chart rotation, output, or alarms. Refer to the visual failure symptom in Table 9-7 to determine what is wrong and the troubleshooting procedures to use to correct the problem.

Check installation

If a set of symptoms still persists, refer to *Section 2 - Installation* and ensure proper installation and proper use of the recorder in the system.

Customer support

If you cannot solve the problem using the troubleshooting procedures listed in this section; get the **model number** and **serial number** from the label on the chart plate, and **software** version (see Table 9-1) then:

- call Customer Support Phone Number
  USA 1-800-423-9883
  Canada 1-800-461-0013
  (between the hours of 7:30 am and 4:00 pm E.S.T.).

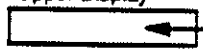
If it is determined that a hardware problem exists and the recorder is still within the two year warranty, a replacement recorder will be shipped with instructions for returning the defective unit.

Continued on next page

Determining the software version

Table 9-1 lists the procedure for identifying the software version number.

Table 9-1 Procedure for Identifying the Software Version

Step	Operation	Press	Action/Result
1	Select STATUS Set Up Group	SET UP	Until you see: Upper Display: REAd Lower Display: STATUS
2	Read the software version	FUNC	Until you see: Upper Display:  ← Software version Number Lower Display: VERSION Please give this number to the Customer Support person. It will indicate which version of DR4500A you have and help them determine a solution to your problem.

Troubleshooting

The troubleshooting procedures are divided into two parts:

- Self Diagnostics - Error Message Prompts, and
- Visual Failure Symptoms.

If a "Failed" indication is given for one of the power-up tests and/or an error message prompt blinks in the lower display, refer to the Self Diagnostic error message prompts.

If erratic operation is observed, refer to the Visual Failure symptoms. In either case, run the status tests to verify the status of the recorder's basic self-diagnostic tests.

9.3 Self Diagnostics

Power-up tests

When the recorder is powered-up, four tests are run by the DR4500A software to ensure memory integrity.

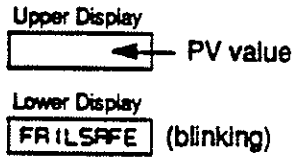
- As the tests are run, the displays appear as shown in Table 9-2.

Table 9-2 Power-up Tests

Lower Display	Upper Display
RAM TEST	PASS or FAIL
CONFTEST (configuration checksum)	PASS or FAIL
CAL TEST (working calibration)	PASS or FAIL
BATTERY	PASS or FAIL

Failsafe

If any of these four tests fail, "FAIL" appears momentarily in the upper display, then a display test is run, after which the controller goes into manual mode and you will see:



Refer to "*Status Tests*" (next page) to determine which tests have failed and how to correct them.

Continued on next page

Status tests

When required, the results of the power-up tests can be checked to determine the reason the recorder has gone to "Failsafe".

The procedure in Table 9-3 tells you how to display the results of the status tests. Table 9-4 lists the tests, the reason for the failure, and how to correct the problem.

Table 9-3 Procedure for Displaying the Status Tests Results

Step	Operation	Press	Action/Result
1	Select STATUS Set Up Group	SET UP	Until you see: Upper Display REAd Lower Display STATUS
2	Read the status tests results	FUNC	Until you see: Upper Display nO or YES — YES indicates a failure Lower Display FAILSAFE • Successive presses of the FUNC key will display the results of the status tests (PASS or FAIL)in the following order: RAM TEST CONF TEST CAL TEST FACT CRC BATTERY • Identify the problem and correct the failure as shown in Table 9-4.

Continued on next page

Error message prompts

The messages listed in Table 9-4 may appear during the power-up test or status test, or they may blink in the lower display as the result of ongoing background tests that verify data and memory integrity.

In the case of more than one simultaneous malfunction in the background tests, only the one with the highest priority will appear in the lower display.

Table 9-4 lists the error message, the test group that prompted the message, the reason for the failure, and how to correct the problem.

Table 9-4 Error Message Prompts

Lower Display Indication	Test Group	Reason For Failure	How to Correct the Problem
FAILSAFE	Status	This error message shows whenever the recorder goes into a failsafe mode of operation. This will happen if: • RAM test failed • Configuration test failed • Calibration test failed • Burnout configured for none and the input failed.	1. Check the operation of the input sensor. 2. Run through STATUS check to determine the reason for the failure. • Press the SET UP key until STATUS appears in the lower display. • Press the FUNC key to see what tests pass or fail, then run through the STATUS codes a second time to see if the error cleared. • Correct according to the recommendations given in this table.
RAM TEST	Power-up or Status	RAM Failure	1. Cycle power to see if the error clears. 2. If error doesn't clear, replace the main printed circuit board.
CONFTEST	Power-up or Status	Configuration data is in error.	1. Check all configuration prompts for accuracy. • See *Section 3 - Configuration* 2. If the recorder has not been field calibrated, refer to Table 9-6 Clearing the CONF TEST Failure. 3. Contact Customer Support: USA 1-800-423-9883 Canada 1-800-461-0013.
CAL TEST	Power-up or Status	The working calibration constants in the recorder are in error.	1. If the recorder has not been field calibrated, refer to Table 9-5 Clearing the CAL TEST Failure. 2. If the recorder has been field calibrated, recalibrate the recorder.
FACT CRC	Status	Factory set input constants have been changed due to the change in input type.	1. Check the calibration. Make sure 0 and 100% are correct values. 2. Cycle through Status to clear the error. 3. Recalibrate if step 2 is unsatisfactory. Refer to *Section 7 - Input Calibration.*

Table 9-4 is continued on next page

Error message prompts, continued

Table 9-4 Error Message Prompts, continued

Lower Display Indication	Test Group	Reason For Failure	How to Correct the Problem
EE FAIL	Background	Unable to write to nonvolatile memory. Anytime you change a parameter and it is not accepted, you will see EE FAIL.	1. Check the accuracy of the parameter and reenter. 2. Try to change something in configuration. 3. Run through STATUS tests to rewrite to EEPROM. 4. Contact Customer Support: USA 1-800-423-9883 Canada 1-800-461-0013
IN1FAIL IN2FAIL IN3FAIL IN4FAIL	Background	Two consecutive failures of input 1 integration (for example, cannot make analog to digital conversion.)	1. Be sure the range and actuation are configured correctly. 2. Check the input source. 3. See *Section 3 - Configuration* and change the input to a different type. Enter it, loop through the status tests, then return the input type to the original one. 4. Recalibrate if step 3 is unsatisfactory. Refer to *Section 7 - Input Calibration.* 5. Replace the input card. 6. Call Customer Support: USA 1-800-423-9883 Canada 1-800-461-0013
BATTERY	Power-up or Background	Battery failure.	1. Remove power. 2. Call Customer Support: USA 1-800-423-9883 Canada 1-800-461-0013
PV LIMIT	Background	Process Variable is out of range.	1. Be sure pen input configuration is correct. 2. Check the displayed PV value to see if it is outside input limits. 3. Call Customer Support: USA 1-800-423-9883 Canada 1-800-461-0013
RV LIMIT	Background	The result of the formula shown below is beyond the range of the remote variable. RV = INP2 X RATIO + BIAS	1. Make sure the input signal is correct. 2. Make sure the ratio and bias settings are correct. 3. Go to CONTROL prompt REMOTE SOURCE and change REMOTE to 1 LOCAL.

Table 9-4 is continued on next page

Error Message Prompts, continued

Table 9-4 Error Message Prompts, continued

Lower Display Indication	Test Group	Reason For Failure	How to Correct the Problem
IN1RNG IN2RNG IN3RNG IN4RNG	Background	Input out of range. The process input is outside the range limits. If you have a linear input and the range goes outside the range limits, the controller switches to manual mode at the configured Failsafe output value.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. Restore the factory calibration: a. Disconnect the wiring from the terminals on plug J2 on the input board (see Figure 2-10). Place a jumper across these terminals. The controller should read room temperature if it is configured for a thermocouple input. b. If it does not read room temperature, see *Section 3- Configuration* and change the IN1TYP prompt in the INPUT 1 group to another type of thermocouple. c. After the change, press FUNC key, then the LOWER DISPLAY key. The controller should read the correct room temperature. If it does not, the unit has an input failure. d. Repeat step b. This time switch the IN1TYP back to the originally selected thermocouple. e. Repeat step c. The controller is restored with factory calibration. f. Remove the jumper and reconnect the thermocouple to plug J2. 4. Field calibrate. See *Section 7 - Input Calibration.* 5. Replace the input card. 6. Call Customer Support: USA 1-800-423-9883 Canada 1-800-461-0013

Continued on next page

"CAL TEST" and "CONFTEST" failures

The recorder has memory checksum values stored for the factory-entered calibration data "CAL TEST" and for the customer-entered configuration data "CONFTEST."

When power is interrupted then restored, the recorder (on power up) recalculates this checksum and compares it with the value stored. When the two checksum values are not the same, the recorder goes to "FAILSAFE" and the memory test that was not passed is displayed as the controller powers up and also in the "READ STATUS" group prompts.

"FAIL CONFTEST" and "FAIL CAL TEST" are not caused by hardware failures. They only indicate that the stored memory has been corrupted by one of many possible external anomalies.

No calibration source is required and any model maybe cleared even if the options mentioned are not physically present in the recorder.

Clearing the "CALTEST" failure procedure is listed in Table 9-5.

Clearing the "CONFTEST" failure procedure is listed in Table 9-6.

Following the same procedure for Control Loop 2 will force the software to recalculate the checksum.

Clearing the CAL TEST failure

Follow the procedure in Table 9-5 to clear the CAL TEST failure.

Table 9-5 Clearing the CAL TEST Failure

Step	Operation	Press	Action
1	Set "LOCKOUT" to "NONE."	SET UP	Until you see: Upper Display: SETUP Lower Display: LOCKOUT
		FUNC	Until you see: Upper Display: (blank) — none / CAL Ib / + CONF / +VIEW / MAX Lower Display: LOCKOUT
		▲ or ▼	Until "NONE" is in upper display
2	Run through status	SET UP	Until you see: Upper Display: REAd Lower Display: STATUS
		FUNC	Repeatedly, until the lower display again reads "STATUS." That is, clear the CAL TEST failure in nonvolatile memory.

Table 9-5 is continued on next page

Clearing the CAL TEST failure, continued

Table 9-5 Clearing the CAL TEST Failure, continued

Step	Operation	Press	Action
3	Enable INPUT 2	SET UP	Until you see: Upper Display SET UP Lower Display OPTIONS
		FUNC	Until you see: Upper Display ENABLE Lower Display INPUT 2
		▲ or ▼	To ENABLE INPUT 2 Note: A second input card is not required to do this.
4	Enable the first control loop	FUNC	Until you see: Upper Display ENABLE Lower Display CONTROL 1
		▲ or ▼	To ENABLE CONTROL 1
5	Enable the second control loop	FUNC	Until you see: Upper Display ENABLE Lower Display CONTROL2
		▲ or ▼	To ENABLE CONTROL 2

Table 9-5 is continued on next page

Clearing the CAL TEST failure, continued

Table 9-5 Clearing the CAL TEST Failure, continued

Step	Operation	Press	Action
6	Change Control Algorithm 1 to "CURRENT"	SET UP	Until you see: Upper Display: SET UP Lower Display: CONTROL 1
		FUNC	Until you see: Upper Display: (blank) — TIME, CURRENT, POSITN, TIME d, CUR T1, T1 CUR Lower Display: OUT1 RLC
		▲ or ▼	To select "CURRENT" in the upper display.
7	Change Control Algorithm 2 to "CURRENT"	SET UP	Until you see: Upper Display: SET UP Lower Display: CONTROL2
		FUNC	Until you see: Upper Display: (blank) — TIME, CURRENT, POSITN, TIME d, CURT1, T1 CUR Lower Display: OUT2 RLC
		▲ or ▼	To select "CURRENT" in the upper display.

Table 9-5 is continued on next page

Clearing the CAL TEST failure, continued

Table 9-5 Clearing the CAL TEST Failure, continued

Step	Operation	Press	Action
8	Enter Calibration Function for Current 1	SET UP	Until you see: Upper Display: CAL 16 Lower Display: CURRENT 1
		FUNC	Until you see: Upper Display: [ ] ← A value (usually 360) Lower Display: ZERO URL
		▲ or ▼	and change the number to something else.
		FUNC	Until you see: Upper Display: [ ] ← A value Lower Display: SPAN URL It is not necessary to change this value.

Table 9-5 is continued on next page

Clearing the CAL TEST failure, continued

Table 9-5 Clearing the CAL TEST Failure, continued

Step	Operation	Press	Action
9	Enter Calibration Function for Current 2	SET UP	until you see: Upper Display: CAL 16 Lower Display: CURRENT2
		FUNC	You will see: Upper Display: [ ] ← a value (usually 300) Lower Display: ZERO URL
		▲ or ▼	and change the number to something else.
		FUNC	You will see: Upper Display: [ ] ← a value Lower Display: SPAN URL It is not necessary to change this value.
		FUNC	and the CAL TEST failure is cleared.
10	Reverse the procedure		Work in reverse order to remove the options where there is no hardware to support.

Clearing the CONFTEST failure

Turn *off* the power for no less than three minutes.

Turn *on* the power and watch the display as the microprocessor resets before going to the normal operating mode.

If the controller display does not show "PASSED CONFTEST," follow the procedure in Table 9-6 to correct the problem.

Table 9-6 Clearing the CONFTEST Failure

Step	Operation	Press	Action/Result
1	Call up "STATUS" Group display	SET UP	Until you see: Upper Display: REAd Lower Display: STATUS
2	Clear "CONFTEST"	FUNC	Until you see: Upper Display: FAIL Lower Display: CONFTEST
		FUNC	Until the display rolls all the way around the status tests and you see: Upper Display: PASSEd Lower Display: CONFTEST
3	Enter "CHART" Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: CHART

Table 9-6 is continued on next page

Clearing the CONFTEST failure, continued

Table 9-6 Clearing the CONFTEST Failure, Continued

Step	Operation	Press	Action/Result
4	Change "CHRTSPD"	FUNC	Until you see: Upper Display [ ] ← selected Chart Speed Lower Display [CHRT SPd]
		▲	to change chart speed to any other selection.
		FUNC	Until the display rolls all the way around the "CHART" Set Up Group and returns to: Upper Display [ ] ← Chart speed that you changed to previously. Lower Display [CHRT SPd]
		▼	to return the chart speed to the original selection.
5	Return to the normal operating mode	LOWR DISP	to return to normal operating mode. Recycle power to see if the problem is resolved.

ATTENTION If the "FAIL CONFTEST" cannot be cleared in two attempts or continues to recur, contact the Honeywell Technical Assistance Center.

1-800-423-9883 USA
1-800-461-0013 Canada

9.4 Visual Failure Symptoms

Introduction

In addition to the error message prompts, there are visual failure symptoms that can be identified by noting the erratic recorder functions.

Symptoms

Compare your symptoms with those shown in Table 9-7 and refer to the troubleshooting procedure indicated to correct the problem.

Table 9-7 Visual Failure Symptoms

Symptom	Trouble-shooting Procedure
Recorder will not operate	1
Recorder operation is normal but pen trace is incorrect	2
Chart rotates at wrong speed or will not rotate (pen indication correct)	3
Pen remains at high end of range when input signal is low	4
Pen does not move when input signal changes	5
A key does not respond and/or a display does not light	6
Displayed output does not agree with controller output	
Current Proportional Output Type	7
Position Proportional Output Type	8
Single or Dual Relay Output Type	9
Duplex Current/Time or Time/Current Proportional Output Type	10
External Alarm Function does not operate properly	11

9.5 Troubleshooting Procedures

Introduction

The troubleshooting procedures for the Visual Failure Symptoms are listed in numerical order as they appear in Table 9-7. Each procedure lists what to do if you have that particular failure and how to do it or where to find the data needed to accomplish the task. Progressive steps provide aid in finding and fixing the problem.

Equipment needed

You will need the following equipment in order to troubleshoot the symptoms listed in the tables that follow:

- DC Milliammeter – mAdc
- Calibration sources – T/C, mV, Volt, etc.
- Voltmeter

Procedure #1

Table 9-8 explains how to troubleshoot recorder failure symptoms.

Table 9-8 Troubleshooting Recorder Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Check the fuse on the main printed circuit board.	Replace if defective.
2	Check the supply voltage.	Measure the line voltage across J10 on the Main printed circuit board.
3	Check the connections to J10 on the main printed circuit board.	Refer to *subsection 2.6 - Input Wiring Procedures, (Figure 2-9 AC Line Power Wiring).*
4	Check the transformer leadwire connections tc the main printed circuit board.	Refer to Figure 10-5 in *Section 10 - Parts List*
5	Check the system for brown-outs, heavy load switching, etc.; and conformance to installation instructions.	Refer to *Section 2 - Installation.*
6	Replace the transformer.	Disconnect the transformer lead wires from the main printed circuit board. Replace the transformer and tighten the screws. Connect the lead wires to the main printed circuit board.
7	Call Technical Assistance Center	1-800-423-9883 USA 1-800-461-0013 Canada

Continued on next page

Procedure #2

Table 9-9 explains how to troubleshoot a pen trace problem.

WARNING Do not lubricate the plastic gears on the chart and pen motors.

Table 9-9 Troubleshooting Pen Trace Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Check the sensor for the proper type and its ability to function.	Verify the input configuration data and operation of the sensor.
2	Recalibrate the recorder.	Refer to *Section 7 - Input Calibration.* For thermocouple input, be sure to confirm cold-junction temperature calibration.
3	Replace the servo plate assembly.	Refer to the replacement procedure in this section.
4	Call Technical Assistance Center	1-800-423-9883 USA 1-800-461-0013 Canada

Procedure #3

Table 9-10 explains how to troubleshoot a chart rotation problem.

WARNING Do not lubricate the plastic gears on the chart and pen motors.

Table 9-10 Troubleshooting Chart Rotation Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Check the chart installation.	Be sure the drive pin on the hub is in the drive hole on the chart.
2	Check the configured chart speed value and change it, if required.	Refer to *Section 3 - Configuration.*
3	Check the motor cable plug connection at connector J7 on the main printed circuit board.	Visually examine the plug and reset it.
4	Replace the chart motor.	Refer to the replacement procedure in this section.
5	Call Technical Assistance Center	1-800-423-9883 USA 1-800-461-0013 Canada

Continued on next page

Procedure #4

Table 9-11 explains what to do if the pen remains at the high end of range when the input signal is low.

WARNING **Do not lubricate the plastic gears on the chart and pen motors.**

Table 9-11 Troubleshooting Erratic Pen Movement Symptoms

Step	What to do	How to do it or where to find the data
1	Check the sensor and lead wires for continuity. Check the connections.	Replace the sensor lead wires as needed. Tighten the connections.
2	Check the pen and input configuration data.	Refer to *Section 3 - Configuration.*
3	Replace the servo plate assembly.	Refer to the replacement procedure in this section.
4	Call Technical Assistance Center	1-800-423-9883 USA 1-800-461-0013 Canada

Procedure #5

Table 9-12 explains what to do if the pen does not move when the input signal changes.

WARNING **Do not lubricate the plastic gears on the chart and pen motors.**

Table 9-12 Troubleshooting Pen Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Check the sensor and lead wires for continuity. Check the connections.	Replace the sensor lead wires as needed. Verify and tighten the input connections.
2	Check the pen arm for secure mechanical attachment to the servo shaft.	Refer to Table 9-19 Removing and Replacing the Pen Arm.
3	Check the servo cable plug connection (J6) on the main printed circuit board.	Visually examine the plug and reseat it.
4	Replace the servo plate.	Refer to the replacement procedure in this section.
4	Call Technical Assistance Center	1-800-423-9883 USA 1-800-461-0013 Canada

Continued on next page

Procedure #6

Table 9-13 explains what to do if a key does not respond and/or a display does not light.

Table 9-13 Troubleshooting Keyboard and/or Display Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Run a Key Test to check the operation of the keys and displays.	Refer to *Section 5 - Operation* for procedures on running a key test.
2	Replace the membrane switch (keyboard) and /or display printed circuit board as required.	Refer to the replacement procedure in this section.

Procedure #7

Table 9-14 explains what to do if the displayed output does not agree with the current proportional control output.

Table 9-14 Troubleshooting Current Proportional Output Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Be sure the recorder is configured for current output.	Refer to *Section 3 - Configuration.* Make sure OUT ALG selection = CURRENT.
2	Check the field wiring.	Refer to *Section 2 - Installation.*
3	Be sure all the recorder and control related data is correct.	Refer to *Section 3 - Configuration.* Check the tuning, algorithm, and control data.
4	Check the output.	Put the recorder into Manual Mode and raise/lower the output manually from 0% to 100% (4–20 mA). Use a milliammeter at connection J1 on the control output printed circuit board.
5	Recalibrate the current proportional output.	Refer to *Section 8 - Output Calibration.*
6	Replace the control output printed circuit board.	Refer to the replacement procedure in this section.

Continued on next page

Procedure #8

Table 9-15 explains what to do if the displayed output does not agree with the position proportional control output.

Table 9-15 Troubleshooting Position Proportional Output Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Be sure the recorder is configured for position proportional output.	Refer to *Section 3 - Configuration.* Make sure OUT ALG selection = POSITN.
2	Check the field wiring.	Refer to *Section 2 - Installation.*
3	Check the output.	Put the recorder into manual mode and adjust the output manually to drive the motor from 0% to 100%.
4	Check whether the motor drives in both directions. If it does, go to step 5. If the motor drives in one direction only, check the slidewire. If the motor does not drive in either direction, check the motor.	Refer to *Section 8 - Output Calibration* for motor slidewire calibration. Refer to the motor instructions.
5	Check the output voltage to the slidewire.	Put the voltmeter across the slidewire terminals at connector J2 on the control output printed circuit board and check that the slidewire voltage varies with the motor position.
6	Be sure that the output relays are actuating properly. If they are not, check the field wiring, then go to step 4. If they are, go to step 7	Put the recorder into manual mode and adjust the output manually above and below the present value. Listen for the click of the relays. One relay should click when the output is adjusted higher, and the other should click when the output is adjusted lower than the present value. Observe OUT 1 and 2 indicators on the front display.
7	Check the control relay jumper position.	Refer to *Section 3 - Configuration.*
8	Replace the control output printed circuit board.	Refer to Table 9-24 Removing and Replacing the Control Output PCB.
9	Recalibrate the position proportional output.	Refer to *Section 8 - Output Calibration.*

Continued on next page

Procedure #9

Table 9-16 explains what to do if the displayed output does not agree with the single relay or dual relay control output.

Table 9-16 Troubleshooting Relay Output Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Be sure the recorder is configured for relay output.	Refer to *Section 3 - Configuration.* Make sure OUT ALG selection = TIME.
2	Be sure all the recorder and control related data is correct.	Refer to *Section 3 - Configuration* . Check the Tuning, Algorithm, and Control data.
3	Check that the applicable output relay actuates properly. If it does, go to step 4.	Put the recorder into manual mode and adjust the output manually to raise or lower the PV around the setpoint. Listen for the click of the relay as the PV moves in either direction. Observe OUT 1 or 2 indicator on the front display.
4	Check the control relay jumper positions.	Refer to *Section 3 - Configuration.*
5	Check the field wiring.	Refer to *Section 2 - Installation.*
6	Replace the control output printed circuit board.	Refer to the replacement procedure in this section.

Continued on next page

Procedure #10

Table 9-17 explains what to do if the displayed output does not agree with the duplex current/time or time/current proportional control output.

Table 9-17 Troubleshooting Current/Time or Time/Current Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Be sure the recorder is configured for current time/time current output.	Refer to *Section 3 - Configuration.* Make sure OUT ALG selection = TI CUR or CUR TI.
2	Be sure all the recorder and control related data is correct.	Refer to *Section 3 - Configuration.* Check the tuning, algorithm, and control data.
3	Check that the applicable output relay actuates properly. If it does, go to step 4. If it does not check the field wiring; then go to step 5.	Put the recorder into manual mode and adjust the output manually to raise or lower the PV around the setpoint. Listen for the click of the relay as the PV moves in either direction. Observe OUT 1 or 2 indicator on the front display.
4	Check the control relay jumper positions.	Refer to *Section 3 - Configuration.*
5	Check the current proportional output	Put the recorder in manual mode and manually adjust the output from 0 to 100% (4–20 mA). Use a milliammeter across the terminals in connector J1 on the control output printed circuit board to verify the output.
6	Recalibrate the current output.	Refer to *Section 8 - Output Calibration.*
7	Replace the control output printed circuit board.	Refer to the replacement procedure in this section.

Continued on next page

Procedure #11

Table 9-18 explains what to do if the external alarm function does not operate properly.

Table 9-18 Troubleshooting External Alarm Function Failure Symptoms

Step	What to do	How to do it or where to find the data
1	Be sure all the alarm configuration data is correct.	Refer to *Section 3 - Configuration.*
2	Check the applicable alarm relay jumper position.	Refer to *Section 3 - Configuration.*
3	Check the field wiring.	Refer to *Section 2 - Installation.*
4	Check that the applicable alarm relay actuates properly depending on ALARM TYPE configuration selection.	Alarms can be triggered either by: • reconfiguring the value of the trip points (AnSnVAL), or • connecting a signal generator to the input and setting the generator level beyond the trip-point values.

9.6 Replacement Procedures

Introduction

These procedures tell you how to access and replace the following parts in your recorder:

Procedure	Refer to
Pen Arm	Table 9-19
Servo Plate Assembly	Table 9-20
Chart Motor	Table 9-21
Display Printed Circuit Board	Table 9-22
Main Printed Circuit Board	Table 9-23
Control Output Printed Circuit Board	Table 9-24
Keyboard	Table 9-25

Refer to the parts list section for a general orientation regarding the location of components.

WARNING **Remove the power before accessing the components inside the case; failure to do so could result in personal injury.**

Equipment needed

To accomplish the procedures that follow, you will need the following equipment:

- Phillips-head screwdriver,
- flat-bladed screwdriver, and
- small pliers.

Continued on next page

Removing and replacing the pen arm

Follow the steps listed in Table 9-19 to remove and replace the pen arm.

ATTENTION Be sure the shipping sponge is installed on the pen tip whenever the recorder is moved or stored.

Table 9-19 Removing and Replacing the Pen Arm

Step	Action
REMOVING THE PEN ARM	
1	Open the recorder door and press the CHART key. The pen arm will go to its outer limit and stop, and the prompt "CHT HOLD" will appear in the lower display.
2	Remove the power from the recorder.
3	Loosen the slotted capscrew on the right side of the chart plate, and open the chart plate.
4	Disconnect the stylus wire by removing the plug connector from J8 on the main printed circuit board (just above the large capacitor near the bottom of the board). Remove the wire ties from the connecting wires.
5	Remove the pen cover, then remove the screw that fastens the pen arm to the plastic sector gear on the servo shaft and remove the pen arm from the shaft.
REPLACING THE PEN ARM	
6	Place the pen arm on the plastic sector gear and insert the attaching screw (removed in step 5) into the sector gear, but do not tighten it completely.
7	Install a chart paper on the chart plate.
8	Loosen the slotted cap screw on the right side of the chart plate and open the chart plate.
9	From the back of the chart plate, use finger pressure on the plastic sector gear to operate the pen arm toward the edge of the chart paper until the plastic sector gear comes to the limit stop.
10	Rotate the pen arm on the plastic sector gear so that the stylus is at the outer edge of the chart paper, then tighten the screw that attaches the pen arm to the sector gear.
11	Attach the connector plug at the end of the stylus wires to J8 (lower left side of the main printed circuit board). Secure the wires with the wire ties.
12	Close the chart plate, tighten the slotted screw, and close the recorder door.
13	Return the recorder to service as described in the *Section 5 - Operation.*

Continued on next page

Removing and replacing the servo plate assembly

Follow the steps listed in Table 9-20 to remove and replace the servo plate assembly - part number 30754975-503.

Table 9-20 Removing and Replacing the Servo Plate Assembly

Step	Action
1	Open the recorder door and remove the pen arm as described in Table 9-19.
2	Note how the spring is attached to the servo plate and disconnect the spring from the servo plate.
3	Disconnect the cable plug for the pen motor from connector J6 on the main printed circuit board. Remove the cable from the clip on the chart plate.
4	Remove the screws that hold the servo plate to the chart plate, and remove the servo plate.
5	Attach the new servo plate and secure it with the screws. Dress the cable in the clip and connect the plug to connector J6.
6	Replace the pen arm, removed in step 1, as described in Table 9-19.

Removing and replacing the chart motor

Follow the steps listed in Table 9-21 to remove and replace the chart motor - part number 30756113-501.

WARNING **Do not lubricate the plastic gears on the chart and pen motors.**

Table 9-21 Removing and Replacing the Chart Motor

Step	Action
1	Pull up the pen lifter to raise the pen from the chart, and remove the chart.
2	Disconnect the motor cable plug from J7 on the main printed circuit board and remove the cable from the clip on the chart plate.
3	Remove the screws from the chart motor and remove the motor.
4	Pull the hub off the chart motor and push it onto the new motor.
5	Attach and secure the new motor with screws; dress the cable in the clip and connect the plug to J7 on the main printed circuit board.
6	Replace the chart, then push the pen lifter down.

Continued on next page

Removing and replacing the display printed circuit board

Follow the steps listed in Table 9-22 to remove and replace the display printed circuit board - part number 30757571-501.

Table 9-22 Removing and Replacing the Display Printed Circuit Board

Step	Action
1	On the Display printed circuit board, note the location of the ground connection wire; remove the screws from the printed circuit board and remove it.
2	Disconnect the plugs from connectors J2 (main printed circuit board) and J3 (keyboard) on the display printed circuit board as applicable.
3	Ensuring that the ground wire is located as noted in step 1, replace the printed circuit board and secure it and the ground wire with screws.

Removing and replacing the main printed circuit board

Follow the steps listed in Table 9-23 to remove and replace the main printed circuit board - part number 30754999-tab.

Table 9-23 Removing and Replacing the Main Printed Circuit Board

Step	Action
1	First, tag, then disconnect all the cable plugs from their connectors on the main printed circuit board.
2	Remove the nut and leads from the bolt in the lower-left corner of the main printed circuit board.
3	Remove the screws from the main printed circuit board and remove the main printed circuit board from the case.
4	Replace the main printed circuit board and secure it with screws.
5	Replace the leads on the bolt in the lower-left corner of the printed circuit board and tighten the nut. Reconnect the cable plugs, (tagged in step 1) to the connectors on the main printed circuit board.
6	Reconfigure and recalibrate the recorder. Refer to *Section 3 - Configuration*, *Section 7 - Input Calibration*, and *Section 8 - Output Calibration.*

Continued on next page

Removing and replacing the control output printed circuit board

Follow the steps listed in Table 9-24 to remove and replace the control output printed circuit board - part number 30754922-501.

Table 9-24 Removing and Replacing the Control Output PCB

Step	Action
1	Tag and disconnect all the cable plugs from the applicable control output printed circuit board.
2	Note the orientation of the output printed circuit board in the card guides, and unplug it from the motherboard.
3	Compare the position of the relay contact jumpers on the old printed circuit board with those on the new printed circuit board and change as required. Refer to *Section 2 - Installation* for jumper details.
4	Orient the new control output printed circuit board as noted in step 2, slide it into the card guides and press down firmly to seat the connector onto the motherboard.
5	Connect the cable plugs as tagged in step 1 to the connectors on the control output printed circuit board.
6	If the control output is current or position proportional type, you may want to check the calibration. Refer to *Section 8 - Output Calibration.*

Removing and replacing the keyboard

Follow the steps listed in Table 9-25 to remove and replace the keyboard - part number 30754957-501.

Table 9-25 Removing and Replacing the Keyboard

Step	Action
1	Disconnect the keyboard cable plug from connector J3 on the display printed circuit board. Removing the display printed circuit board will facilitate plug removal; refer to Table 9-22 Removing and Replacing the Display Printed Circuit Board.
2	Carefully pry the membrane switch from the front of the chart plate and pull the cable plug through the slot in the chart plate.
3	Feed the cable of the new membrane switch through the slot and press the new membrane switch firmly into place so that the display is visible through the cutout.
4	Connect the keyboard cable plug to connector J3 on the display printed circuit board.

Section 10 – Parts List

10.1 Overview

Introduction

This section provides the replacement parts lists for the DR4500A Truline Recorder. Most parts are supplied on an optimum replacement unit basis; that is, part numbers are given for complete printed circuit boards rather than for individual PCB components.

The figures that follow are exploded views of the DR4500A recorder. Each part is labeled with a key number and the key numbers are listed in tables with associated part number.

Also included for your reference are an Internal Cabling drawing (Figure 10-5) and an Internal Wiring Diagram (Figure 10-6) for options only.

When ordering parts, be sure to specify your recorder's serial and model numbers (on nameplate) as well as the part identification.

What's in this section?

This section contains the following topics:

Topic			See Page
10.1	Overview		197
10.2	Exploded Views		
	Figure 10-1	Door Assembly	198
	Figure 10-2	Chart Plate Assembly	197
	Figure 10-3	Basic Recorder components without options	199 200
	Figure 10-4	Additional Recorder components associated with options	202
10.3	Miscellaneous Hardware Kit Contents		204
10.4	Figure 10-5	Internal Cabling Data	205
10.5	Figure 10-6	Internal wiring Diagram - Options Only	206

10.2 Exploded Views

Door Assembly

Figure 10-1 is an exploded view of the Door Assembly.
Table 10-1 is a list of the associated part numbers.

Figure 10-1 Door Assembly

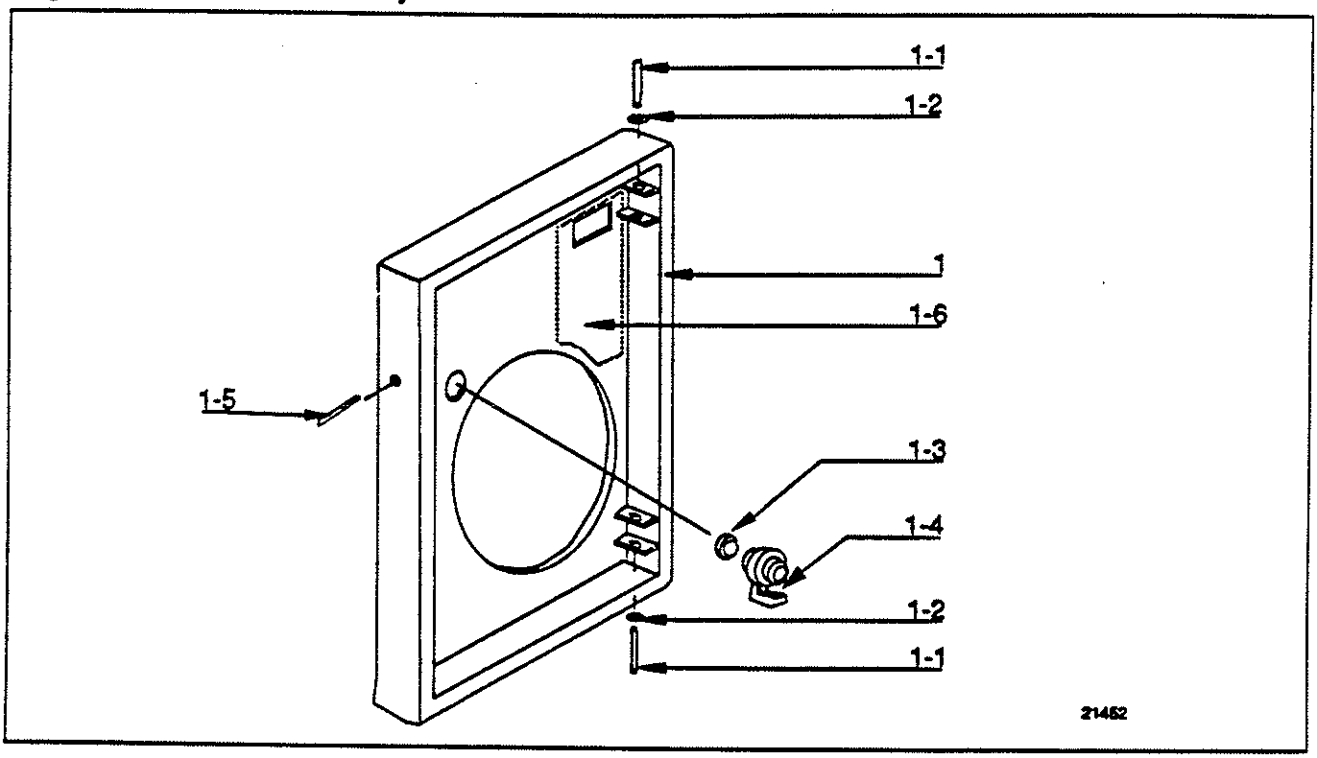


Table 10-1 Door Assembly Parts

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1		Door Assembly			1
	30754955-501	- Blue with glass window and latch			
	30754955-504	- Blue with acrylic window and latch			
	30754955-505	- Gray with glass window and latch			
	30754955-506	- Gray with acrylic window and latch			
	30756548-501	- Heavy duty with glass window/heavy duty latch			
	30756548-502	- Heavy duty with acrylic window/heavy duty latch			
	30756548-503	- HTST with heavy duty latch			
1-1	See Note 1	Hinge Pin			2
1-2	See Note 1	Retaining Ring			2
1-3	See Note 1	Latch Gasket			1
1-4	See Notes 1 & 2	Latch (standard black-plastic push-type without lock)	1	3	1
1-5	See Note 1	Latch Pin			1
1-6	30755136-502	Truline Door Overlay			1

NOTE 1: These parts are also included in the miscellaneous hardware kit 30755980-001.
NOTE 2: For heavy duty knob type, order kit 30756584-001; for latch with lock & key, order kit 30756584-002.

Continued on next page

Chart Plate

Figure 10-2 is an exploded view of the Chart Plate Assembly. Table 10-2 is a list of the associated part numbers.

Figure 10-2 Chart Plate Assembly

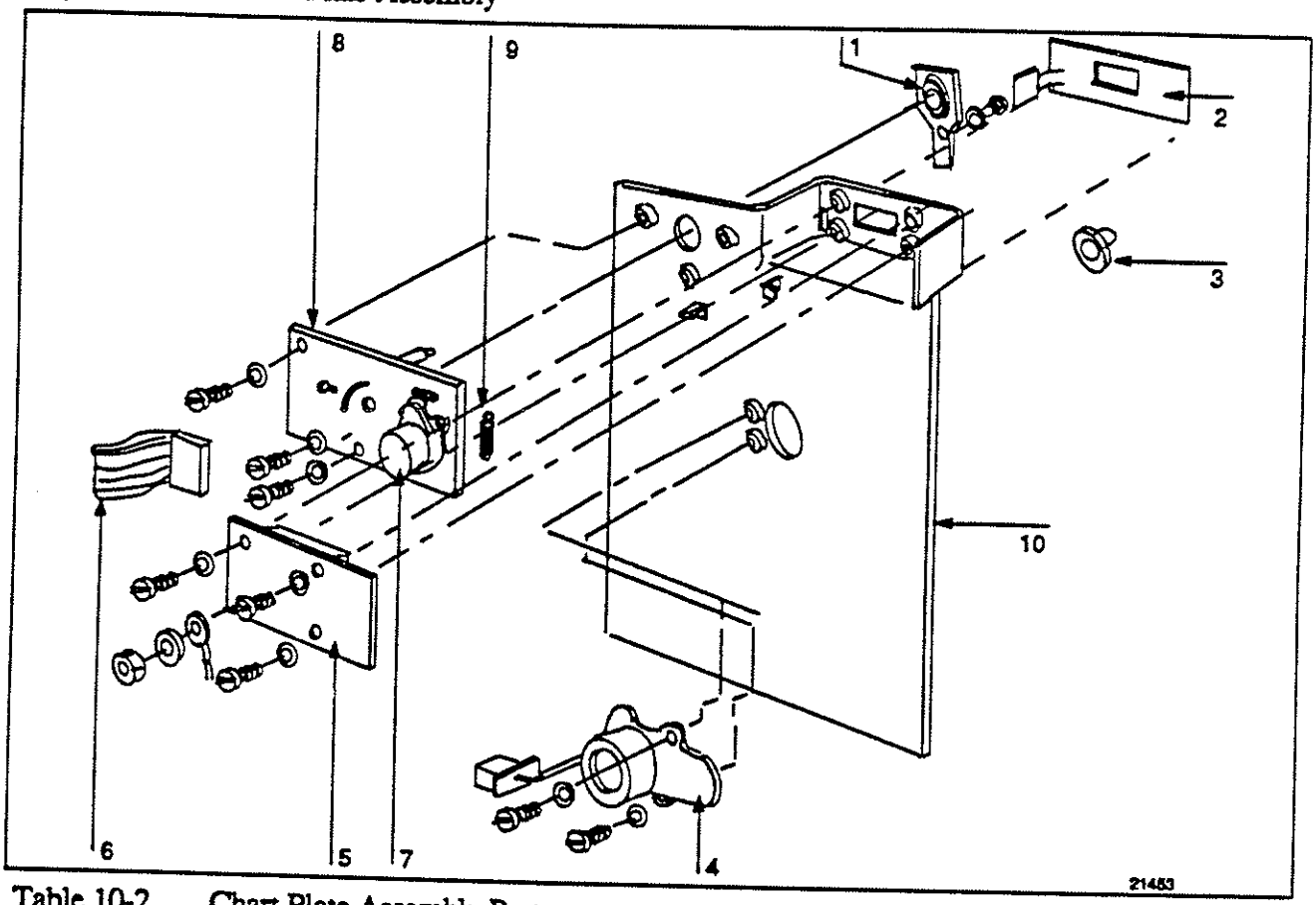


Table 10-2 Chart Plate Assembly Parts

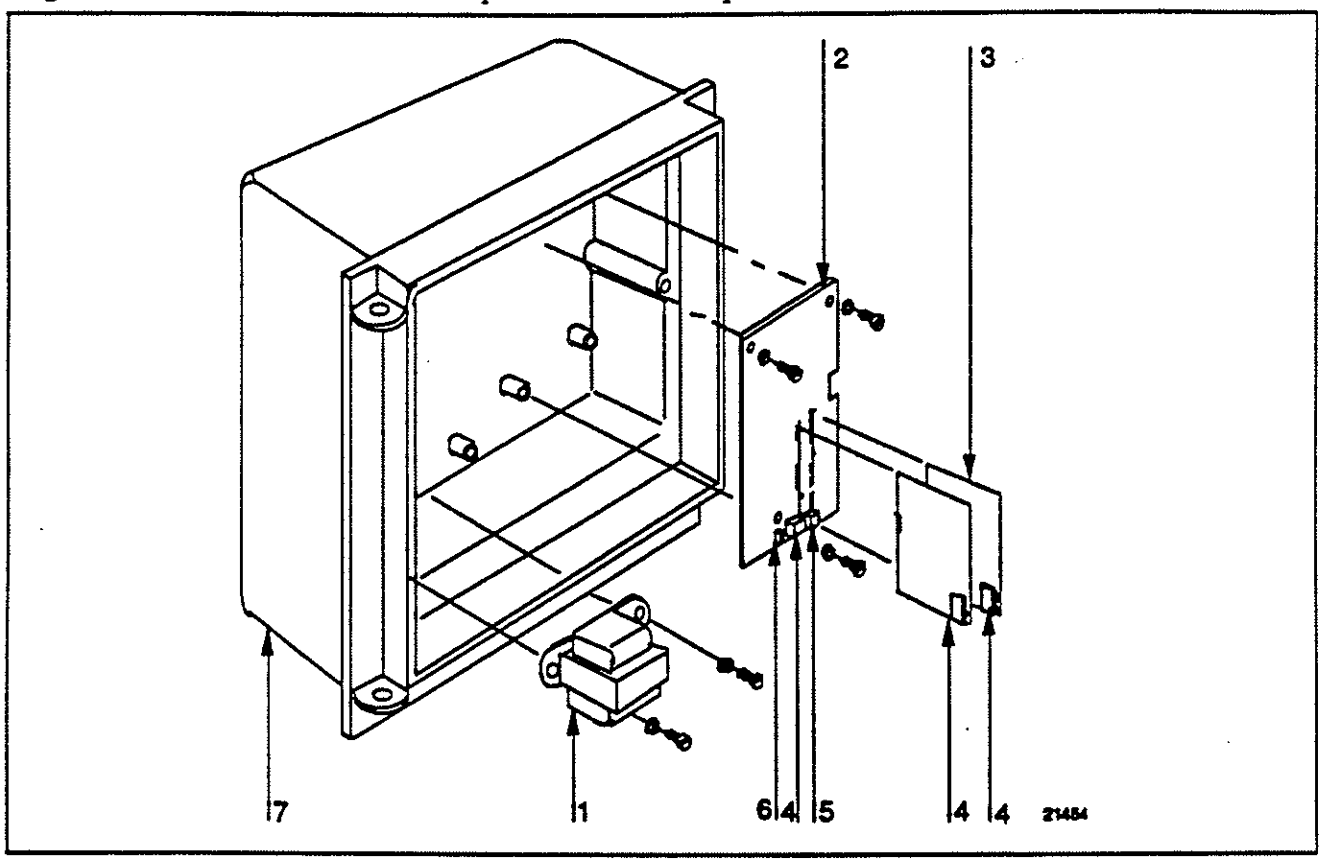
Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1	30756304-501 30756304-502	Truline Pen Arm Assembly (high speed) Truline Pen Arm Assembly (abrasion resistant)	1	5	1
2	30754957-501	Membrane Switch Key Pad	1	5	1
3	(K)30756150-001	Chart Hub Kit (includes 2 hubs)	1	3	2
4	30756113-501	Chart Motor	1	3	1
5	30757571-501	Display PCB (includes key no. 6)	1	5	1
6	See above	Ribbon Cable, Display (included with key no. 5)			
7	See below	Servo Motor Assembly (included with key no. 8)			
8	30754975-503	Servo Plate Assembly (includes key no. 7)	1	2	1
9	(K)30755980-002	Spring, tension			1
10	30754977-503 30754977-504	Chart plate for standard (high speed) pen Chart plate for abrasion resistant pen	1	2	1

Continued on next page

Basic recorder components without options

Figure 10-3 is an exploded view of the basic recorder components. Table 10-3 is a list of the associated part numbers.

Figure 10-3 Basic Recorder Components Without Options



Continued on next page

Basic recorder components without options, continued

Table 10-3 Basic Recorder Parts Without Options

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1	30754982-502	Transformer	1	3	1
2	30757569-502 30757569-503 30757569-504 30757569-505	Main PCB (model DR45AT) Main PCB (model DR45AR) Main PCB (model DR45AW) Main PCB (model DR45AH)	1	5	1
3	(K)30756141-002	Input PCB (input 1, 2, 3, or 4)			1/4
4	See Note 2	3-position connector **			2
5	See Note 2	2-position connector **			1
6		Fuse (Wilkman 19374-K-500 ohm or equivalent)**			1
7	30754924-501	Case			1
		Parts Not Shown			
	See Note 2	Card guides for Input PCBs **			2
	30755232-502	0-10 Vdc Input Divider (input PCBs)			*
	30756461-002	250 ohm Resistor Assembly			*
	30755317-001	Box of 100 12" Truline Chart Paper			
	(K)30755056-501	Mounting Kit			1
	(K)30755134-001 (K)30755134-002	Blue Universal Filler Plate Kit Gray Universal Filler Plate Kit			*
	(K)30755011-001	Filler Panel Kit (for replacing Servoline recorder)			*

NOTE 2: These parts are included with applicable PCB kits, as required.

* As required

** These parts are also included in the miscellaneous hardware kit 30755980-003

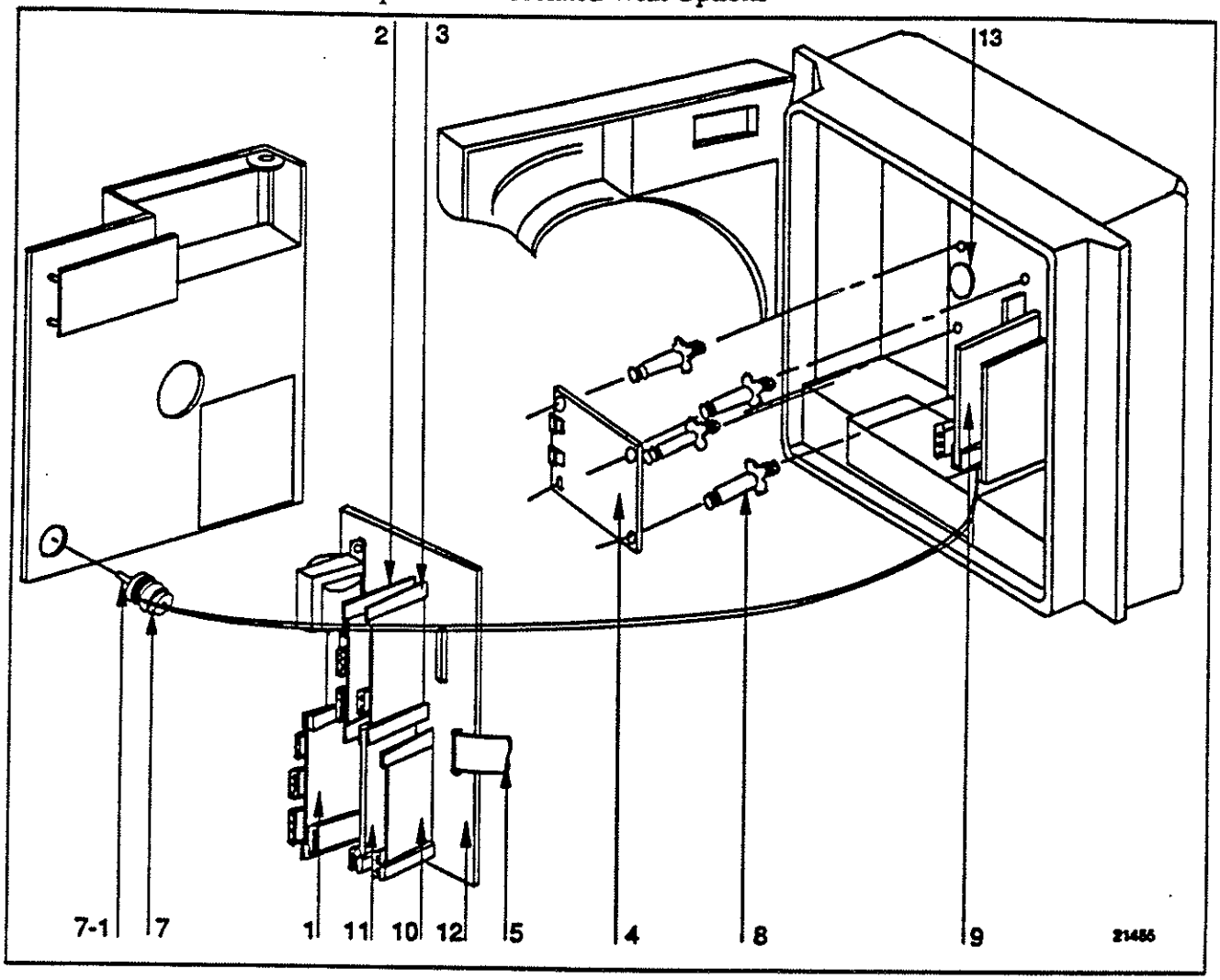
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Additional recorder components associated with options

Figure 10-4 is an exploded view of the recorder components associated with options.

Table 10-4 is a list of the associated part numbers.

Figure 10-4 Recorder Components Associated With Options



Continued on next page

Additional recorder components associated with options, continued

Table 10-4 Recorder Parts Associated With Options

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1	30754922-501 30754922-502	Second Control Output PCB Second Current Output PCB - Current Out Only (Note 4)			1
2	30754922-501 30754922-502	First Control Output PCB First Control Output - PCB - Current Out Only	1	5	1
	30754499-005	Control Output Relay Kit (2 relays per kit)	1	5	2
3	30755009-501 30755009-502	DMCS Communications PCB (DR450T) DMCS Communications PCB (DR45AT)	1	5	1
4	(K)30756140-001	Alarm output/digital input PCB kit			1
5	See Note 3 30755119-501	Ribbon cable (34 conductor)	1	3	1
7	30755127-502	Light accessory kit			1
7-1	(K)30756148-001	Bulb (General Instruments 1828 or equivalent)			1
8	(K)30756140-001	Spacer			4
9, 10, 11	(K)30756141-002	Input PCBs (optional second, third & fourth input)	1	5	1/4
12	30754919-501	Motherboard	1	3	0/1
13		Battery (Duracell DL2450 or equivalent)	1	3	1

Note 3: Part included with alarm output/digital input PCB kit 30756140-001.

Note 4: 30754922-502 Control Output board is used for Table II Options 60 or 66.

10.3 Miscellaneous Hardware Kit Contents

Kit contents

Table 10-5 lis[illegible]e kit contents of miscellaneous hardware kit - part number 30755980-T[illegible]

Table 10-5 [illegible]iscellaneous Hardware Kit

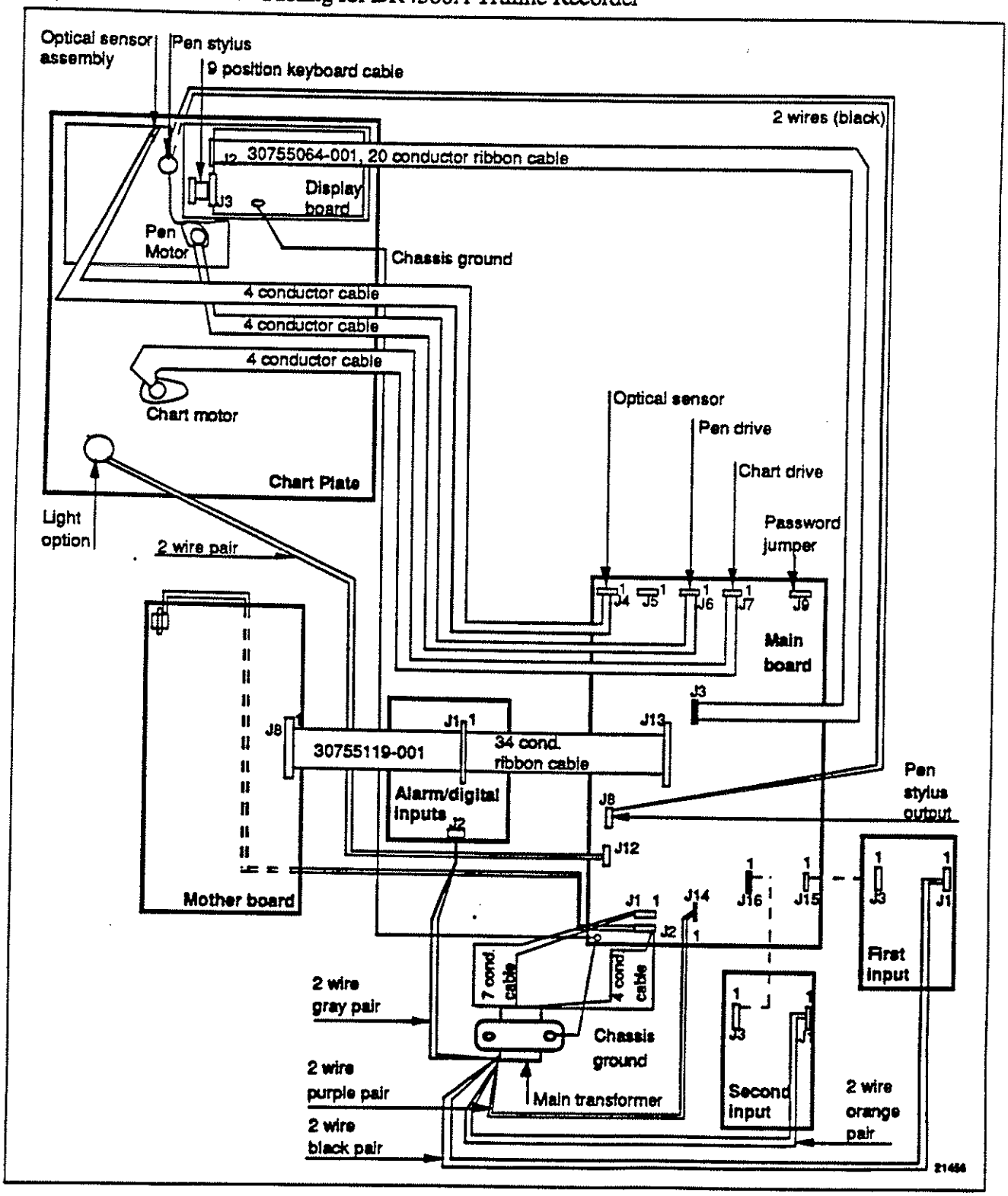
Part Description	Quantity		
	Tab 001	Tab 002	Tab 003
Pen lifter/retainer		1	
Screw 10-32, 3/4" lg.		5	
O-ring		5	
Spring, tension		2	
Hinge pin	2		
Retaining ring	2		
Pen arm #1 (classic)		1	
Pen arm #2 (classic)		1	
Latch without lock	1		
Latch pin	1		
Latch gasket	1		
Card guide			2
4-position connector			2
3-position connector			2
2-position connector			2
Fuse			2

10.4 Internal Cabling Data

View of internal cabling

Figure 10-5 is a view of the internal cabling for the DR4500A Truline Recorder.

Figure 10-5 Internal Cabling for DR4500A Truline Recorder



View of internal option wiring

Figure 10-6 is a view of the internal wiring diagram - options only for the DR4500A Truline Recorder.

Figure 10-6 Internal Diagram for DR4500A Truline Recorder - Options Only

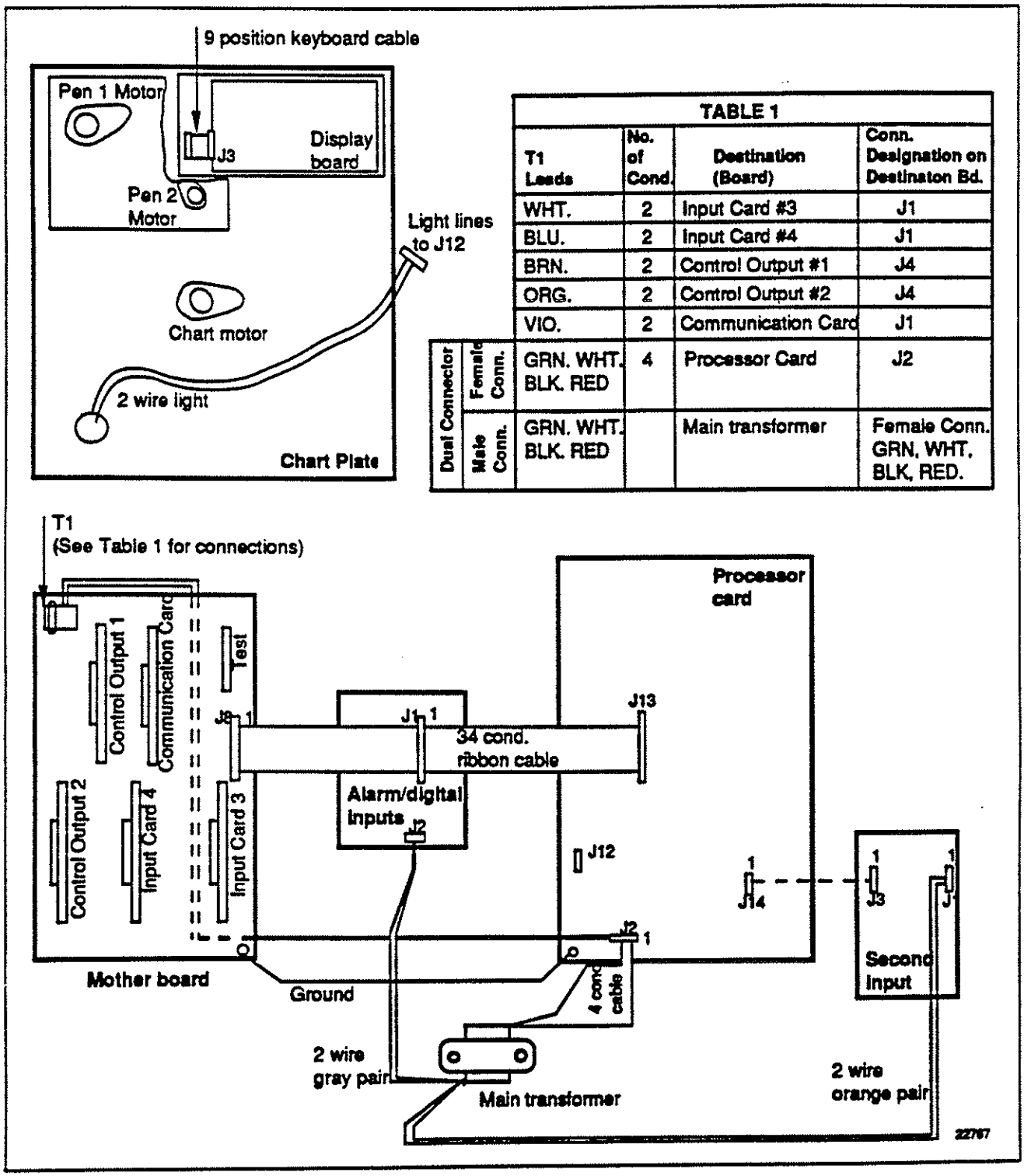


TABLE 1

T1 Leads		No. of Cond.	Destination (Board)	Conn. Designation on Destinaton Bd.
WHT.		2	Input Card #3	J1
BLU.		2	Input Card #4	J1
BRN.		2	Control Output #1	J4
ORG.		2	Control Output #2	J4
VIO.		2	Communication Card	J1
GRN. WHT. BLK. RED	Dual Connector Female Conn.	4	Processor Card	J2
GRN. WHT. BLK. RED	Dual Connector Male Conn.		Main transformer	Female Conn. GRN, WHT, BLK, RED.

Appendix A – Manual Tuning

A.1 Overview

Introduction

When you tune a control output, there are some things to consider:

- Process Characteristics - Gain, Time Constants, etc.
- Desired response - Minimal overshoot

Basically, control tuning consists of determining the appropriate values for the Gain (PB), Rate (Derivative), and Reset (Integral) time tuning parameters (control constants) that will give the control you want. Depending on the characteristics of the deviation of the process variable from the setpoint, the tuning parameters interact to alter the control output and produce changes in the value of the process variable.

Since each parameter responds to a specific characteristic of the deviation, you may not need a combination of all three. It depends on the process characteristics and the desired control response.

Tuning technique

You can estimate a starting point and the tuning parameters required to give the desired control response and with some experience become proficient with this method.

An alternate approach is to rely on a tuning technique. In practice, tuning techniques usually do not give exactly the type of response desired; thus, some final adjustments to the tuning parameters must be made.

However, you should at least obtain a reasonable starting point from which the desired response characteristics can be obtained.

Control tuning procedures

There are three procedures for tuning the control output:

- Time, Position, or Current Proportional simplex control,
- Duplex Time or Current Proportional control, and
- Two sets of tuning constants for single output operation.

The suggested procedures describe how to establish and store values of Gain (PB), Rate, and Reset time constants for your process. You must know the type of control and algorithm your recorder has.

A.2 Time, Position, or Current Proportional Simplex Control

Procedure

The procedure listed in Table A-1 gives you the steps for manually tuning a recorder with Time, Position, or Current proportional simplex control.

Table A-1 Manual Tuning Procedure for Simplex Control

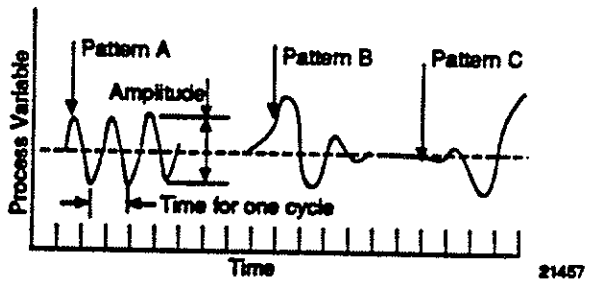
Step	Action
1	In manual mode, adjust the output to bring the PV (Process Variable) near the desired value.
2	Set the rate time to 0 minutes and set the reset time to the maximum value (50.00 minutes) or set repeats/min to the minimum value to minimize reset action. If applicable, set the CYCLE TIME to 4 seconds and DEADBAND to 0.5.
3	Increase GAIN (decrease PB) significantly. Try a factor of 10.
4	Adjust the local setpoint to equal PV and switch to automatic control mode.
5	Increase the setpoint by 5 or 10% and observe the process variable response.
6	If the PV oscillates, continue to step 7. If it does not oscillate, return to the original setpoint and increase GAIN (decrease PB) again by a factor of 2, and repeat step 5.
7	Compare the oscillations with the figure below:  • If the oscillation matches pattern A, go to step 8. • If the oscillation matches pattern B, increase GAIN (decrease PB) by a factor of 2 and repeat steps 4 to 6. • If the oscillation matches pattern C, decrease GAIN (increase PB) by a factor of 0.8 and repeat steps 4 to 6 The amplitude of the cycle is immaterial, but all of the elements of the loop must be within the operating range (that is, the valve must not go full open or closed).
8	Record the current value of GAIN (or PB) and measure and record the value of time for one completed oscillation of PV.

Table A-1 is continued on next page

Procedure, continued

Table A-1 Manual Tuning Procedure for Simplex Control, continued

Step	Action
9	Select the proper set of formulas from Table A-2. Use the values of Gain (or PB) and time (in minutes) in the formulas to arrive at the recorder's tuning parameters settings.
10	Enter the values of GAIN (or PB), RATE, and RESET in minutes (or repeats per minute) into the DR4500A and verify that the PV response is adequate. • If you are using proportional control with manual reset, compare the pen trace with those in Figure A-1 to determine if any further fine tuning is required. • If you are using proportional control plus reset, and/or plus rate, compare the pen traces to those in Figure A-2 to determine if any further fine tuning is required. Make additional trimming adjustments, if necessary, to fine tune the recorder per the guidelines shown in the figures.

Manual tuning formulas

Table A-2 lists the formulas used in the procedure listed in Table A-1.

Table A-2 Manual Tuning Formulas

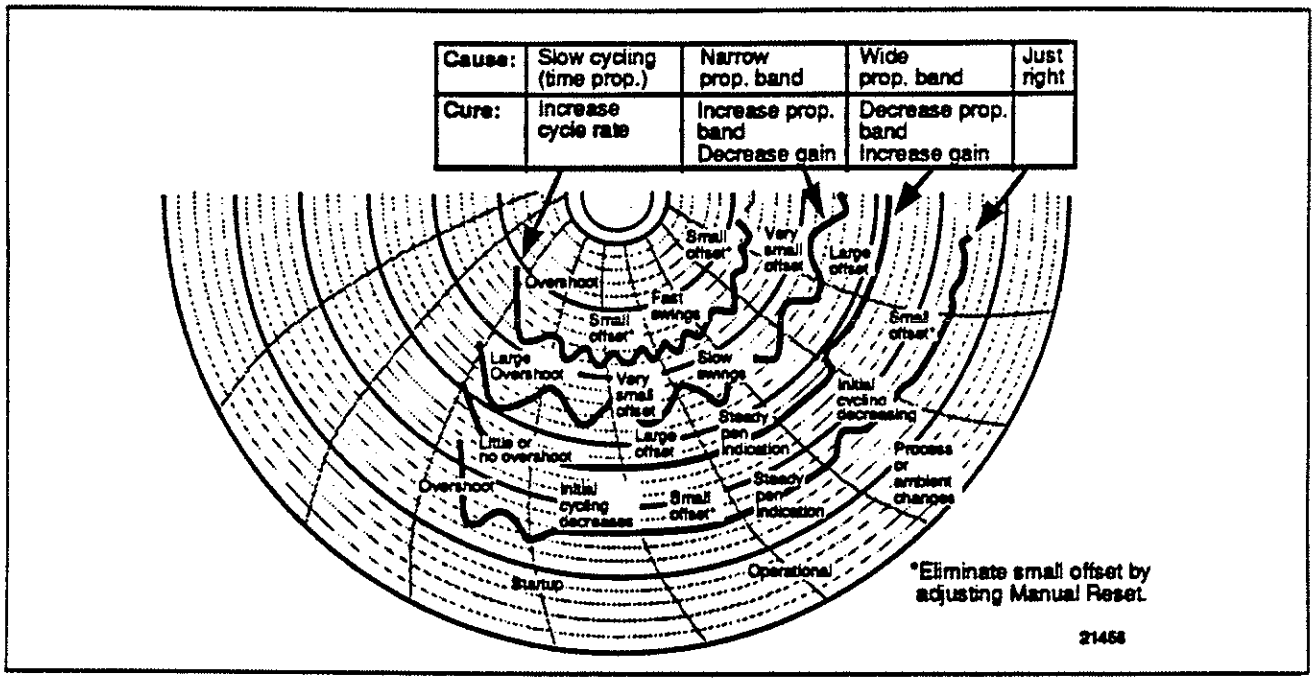
	Units	
	GAIN and RESET TIME in Minutes / Repeat	% PROPORTIONAL BAND and RESET ACTION in Repeats / Minutes
Proportional (P) only	GAIN = Measured Gain x 0.5 RESET TIME = 50.00 (minimum reset) RATE = 0	%PB = Measured PB x 2 RESET ACTION = 0.02 (repeats/minute) RATE = 0
Proportional + Reset (PI) (No Rate)	GAIN = Measured Gain x 0.5 RESET TIME = $\frac{\text{Measured Time}}{1.2}$ (M/R) RATE = 0	%PB = Measured PB x 2.2 RESET ACTION = $\frac{1.2}{\text{Measured Time}}$ (R/M) RATE = 0
Proportional + Reset + Rate (PID)	GAIN = Measured Gain x 0.6 RESET TIME = $\frac{\text{Measured Time}}{2}$ RATE = $\frac{\text{Measured Time}}{8}$	%PB = Measured PB x 1.7 RESET ACTION = $\frac{2}{\text{Measured Time}}$ RATE = $\frac{\text{Measured Time}}{8}$

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Pen traces (proportional plus manual reset)

Figure A-1 shows the pen traces identifying the need for tuning constant adjustment (proportional plus manual reset)

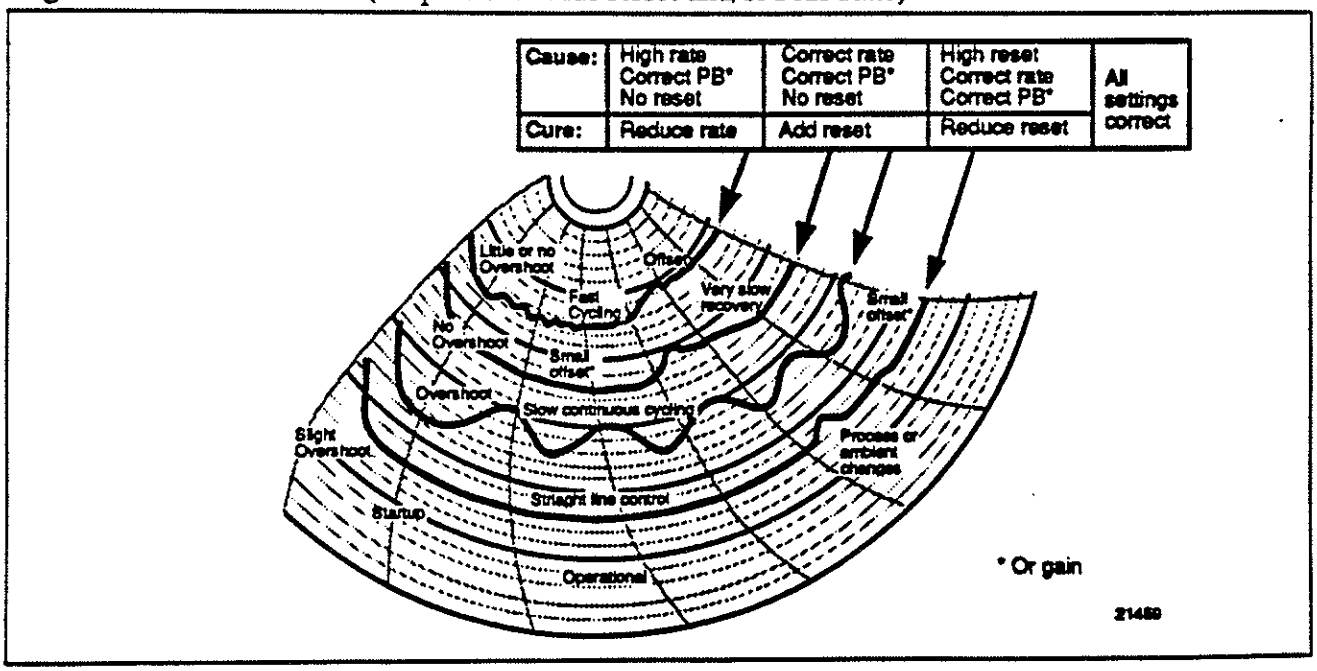
Figure A-1 Pen Traces (Proportional Plus Manual Reset)



Pen traces (proportional plus reset and/or plus rate)

Figure A-2 shows the pen traces identifying the need for tuning constant adjustment (proportional plus reset and/or plus rate)

Figure A-2 Pen Traces (Proportional Plus Reset and/or Plus Rate)



A.3 Time Proportional Duplex or Current Proportional Duplex Control

Introduction

For HEAT/COOL applications.
Tune the control output with the output above 50% for heat and below 50% for cool.

HEAT/COOL prompts

The "TUNING" function prompts for HEAT/COOL are:

HEAT	COOL
GAIN	GAIN2
RESET	RESET2
RATE	RATE2
CYCLE	CYCLE2

Introduction

You can use two sets of tuning constants for single output types and tune each set separately.

TWO SETS prompts

The "TUNING" function prompts for two sets are:

PID SET 1	PID SET 2
GAIN	GAIN2
RESET	RESET2
RATE	RATE2
CYCLE	CYCLE2

Appendix B – How to Apply Digital Instrumentation in Severe Electrical Noise Environments

B.1 Overview

Guideline overview

Products that incorporate digital technology provide recognized performance advantages over conventional analog instrumentation used for process control. These advantages can result in better product uniformity and greater overall efficiency when used correctly.

There are, however, certain guidelines regarding installation and wiring which must be carefully followed in order to achieve this performance. In addition to the traditional precaution of the separation of signal and power wiring in separate conduits, other measures must be taken to minimize the effects of electromagnetic interference (EMI) and radio frequency interference (RFI) on the operation of the equipment. Otherwise, if high level, short duration, noise spikes are permitted to enter the digital equipment, the noise can be transferred into the system's logic networks and can be misinterpreted as signal data, resulting in erroneous system operation and other unpredictable responses.

What's in this section

This section contains the following information:

Topic		See Page
B.1	Overview	213
B.2	Potential Noise Sources	214
B.3	Prevention Methods	215
B.4	Recommended Wiring Practices	216
B.5	Power Source Considerations	218
B.6	Noise Suppression at the Source	219

Overview

Noise can enter electronic equipment via three methods of coupling, namely:

- capacitive (or electrostatic),
- inductive (or magnetic), and
- impedance.

Capacitive and inductive coupling

Capacitive and inductive coupling have the same essential effect — they couple current or voltage, without any actual connection of the two circuits. Impedance coupling requires a connection between the two circuits. Typical noise-generating sources that could affect electronic equipment through capacitive and inductive coupling include:

- relay coils,
- solenoids,
- AC power wires — particularly at or above 100 Vac,
- current carrying cables,
- thyristor field exciters, and
- radio frequency transmissions.

Impedance-coupled noise

Impedance-coupled noise may enter by way of the lines used to power the digital equipment or by way of improper grounding. Most power lines, at typical industrial locations, are far from noise-free. The noise on them can be generated in many ways, but are nearly always associated with switching circuits of some nature.

These include:

- large relays,
- contactors,
- motor starters,
- business and industrial machines,
- power tools,
- HID (high intensity discharge) lights, and
- silicon controlled rectifiers (SCRs) that are phase-angled fired.

These devices generate noise by lowering the line voltage during energization when large currents are drawn for short periods of time.

Continued on next page

B.3 Prevention Methods

Introduction

There are three ways to prevent electrical noise from interfering with the operation of the electronic digital equipment.

- Built-in noise rejection
- Separation of signal and power lines
- Noise suppression at source

Built-in noise rejection

The first method is to design the digital equipment with a high degree of noise rejection built-in. This includes housing the equipment in a case that provides shielding, liberal use of noise rejection filters and opto-isolators, and the use of noise suppressors on potential noise sources within the equipment itself. This, of course, is the responsibility of the manufacturer who usually performs extensive laboratory and field testing of newly-designed digital equipment to insure the adequacy of its immunity to noise. As a minimum requirement, the equipment should be able to pass the tests outlined in the IEEE Standard 472-1974 *(Surge Withstand Capacity Tests)*.

Signal and power line separation

The second method is to prevent noise from getting on the signal and power lines that are connected to the equipment. This is achieved by proper separation and shielding of those lines. In some cases, separate power lines or special power line regulation or filtering may be required for satisfactory electronic digital equipment operation. It is the responsibility of the installer to follow good wiring practices.

Suppression at the source

The third prevention method is to suppress the noise at its source. This is the most effective but also the most difficult because it is not easy to identify all of the potential noise sources in a typical industrial installation. Therefore, "suppression" is usually a last resort for those extreme situations where the other methods are insufficient by themselves. See *subsection B-6 Noise Suppression at the Source* which follows.

General rules

- All wiring must conform to local codes and practices.
- Wires carrying similar types of signals (Table B-1) may be bundled together, but bundles with different types of signals must be kept separated to prevent inductive or capacitive coupling.

Wire bundling

Table B-1 shows what wiring should be bundled together to prevent inductive or capacitive coupling.

Table B-1 External Wiring

Wire Function		Bundle No.	Are Shielded Twisted Wires Recommended?
No.	Type		
1 2 3	HIGH VOLTAGE Line Power Earth Ground Line Voltage Digital I/O	1	NO
4 5	ANALOG I/O Process Variable RTD Thermocouple dc Millivolts Low level (<100V) 4-20 mA dc 1-5 Vdc	2	YES
6 7	DIGITAL I/O Low Voltage (<100V) Computer Interface	3	YES

Continued on next page

Additional rules

Please observe these additional rules for wire bundling:

- For distances over five (5) feet, and when shielding is recommended, use a separate metal tray or conduit for each bundle. Where conduits or trays are not practical, use twisted wires with a metal overbraid and provide physical separation of at least one foot.
- Tray covers must be in continuous contact with the side rails of the trays.
- When unlike signal levels must cross, either in trays or conduits, they should cross at a 90-degree angle and at a maximum spacing. Where it is not possible to provide spacing, a grounded steel barrier or grid should be placed between the unlike levels at the crossover points.
- Trays containing low level wiring should have solid bottoms and sides. Tray covers must be used for complete shielding. Tray cover contact with side rails must be positive and continuous to avoid high reluctance air gaps, which impair shielding. Trays for low level cables should be metal and solidly grounded.
- Wires containing low level signals should not be routed near any of the following:
  - contactors,
  - motors,
  - generators,
  - radio transmitters, or
  - wires carrying high current that is being switched on and off.
- Use a 12-gage (or heavier) insulated stranded wire for the ground connection. Attach it firmly to a proven good earth ground such as a metal stake driven into the ground.
- All shields should be grounded at one end only — preferably the instrument end.

Operate within limits

The AC power for the digital electronic equipment must be within the voltage and frequency limits specified for that equipment. Attempts to operate outside the specified limits will result in no performance. For those installations where the supply voltage will not stay within the specified limits, a ferroresonant transformer, for voltage resolution, should be used.

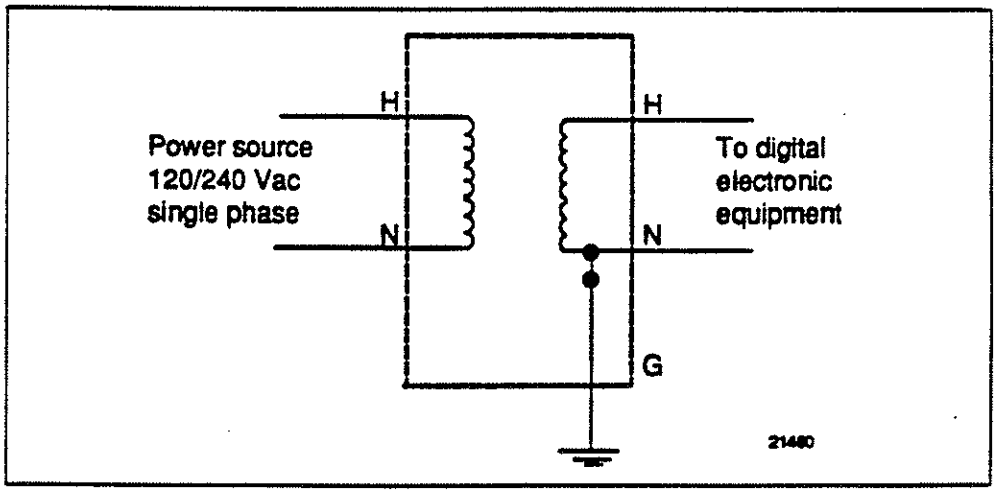
Independent AC source

For protection against noise, the AC source for the digital electronic equipment should be independent of all other loads especially when switching loads are involved. For example, it should not provide power for air-conditioning, convenience outlets, lighting, motors, or similar noise-generating devices. To obtain electrical isolation (see Figure B-1) a separate transformer is required to supply power to the digital equipment. For additional noise and transient rejection, shielded primary and secondary windings may be required. And, if necessary, power line filters may be added to attenuate noise signals that have a higher frequency than the power line frequency.

Transformer for digital equipment

Figure B-1 is an illustration of a separate transformer required to supply power to digital equipment.

Figure B-1 Transformer for Digital Equipment



B.6 Noise Suppression at the Source

Introduction

Generally speaking, when good wiring practices are used with well-designed digital electronic equipment, no further noise protection is necessary. However, in some severe electrical environments, the magnitude of the electrical noise is so great that it must be suppressed at the source. In most control cabinets, the main sources of noise are motor starters, contactors, relays, and switching gear. For this reason, many manufacturers of these devices supply "surge suppressors" which mount directly on the noise source, (for example, on the coil of a control relay or motor starter).

For those devices that do not have accessory "surge suppressors," resistance-capacitance (RC) circuits and/or voltage limiters such as metal varistors may be added when and where needed. This can be broken down into two categories, namely inductive loads (for example, a relay switch in series with a relay coil) and contacts.

Inductive coils

Metal Oxide Varistors (MOVs) are recommended for transient suppression in inductive coils. An MOV is connected in parallel with the coil and is as close as physically possible to the coil (see Figure B-2). MOV devices (listed in Table B-2) are recommended for general purpose applications.

Table B-2 lists part numbers for recommended MOV devices.

Table B-2 MOV Devices

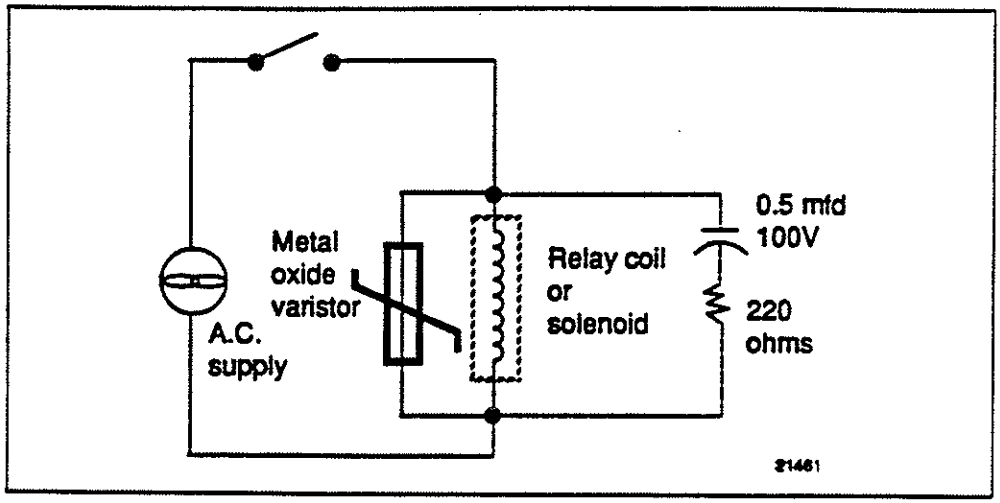
Part Number	30732481-001	30732481-002
Maximum AC	130V	275V
Energy Pulse Rating	10 Joules	15 Joules
Supplier (General Electric)	V130LA10A	V275LA15A

Continued on next page

Inductive coils, continued

Figure B-2 is an illustration of transient suppression in inductive coils.

Figure B-2 Transient Suppression in Inductive Coils



Additional protection may be provided by adding an RC circuit in parallel with the MOV. This consists of a 220-ohm resistor in series with a 0.5 microfarad, 1000V capacitor. The power rating of the resistor will depend on the voltage rating of the coil (see Table B-3).

Table B-3 Coil Voltage vs Resistor Voltage Rating

Coil Voltage	Resistor Voltage Rating
115V	1/4 Watt
230V	1 Watt
460V	3 Watt
550V	5 Watt

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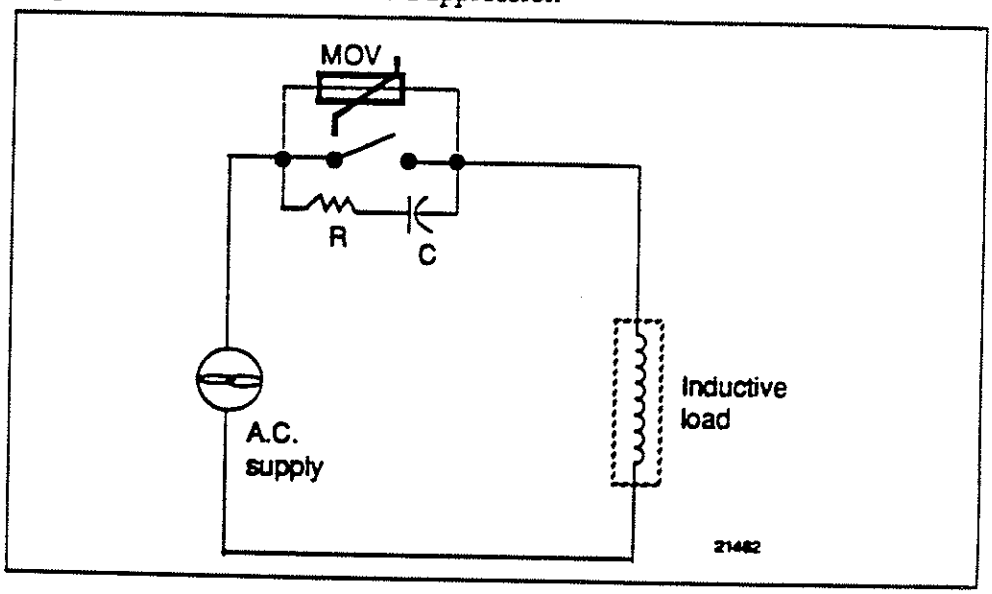
Contacts

When a contact interrupts an inductive load, a certain amount of energy is stored in the load. An MOV or RC circuit in parallel with the load provides a place where this energy may be dissipated. However, if there is no MOV or RC circuit, the energy may create a visible electrical arc across the open contacts. This, in turn, results in electrical noise as well as damage to the contacts.

One way to eliminate this arc is to connect a resistor and capacitor across the contacts (see Figure B-3). A combination of 47 ohms and 0.1 microfarads (1000 Vdc) is recommended for circuits up to 3 amps and 300 Vac. For voltages above 2000 Vac, an MOV across the contact may be added for extra protection.

Figure B-3 is an illustration of a resistor and capacitor connected across a contact to eliminate electrical noise.

Figure B-3 Contact Noise Suppression



For large load currents, a rule of thumb is to size the capacitor so that the number of microfarads equals the number of amperes in the load current, and the resistor has the same resistance value as the load. The objective is to eliminate the visible arc.

Either discrete resistors and capacitors or packaged RC networks may be used. An RC network (47 ohms and 0.1 microfarad) is available from Honeywell as part number 30371852-001. Similar RC networks are available from Electrocube Inc. (part number RG1782-3) and from Industrial Condensor Corporation.

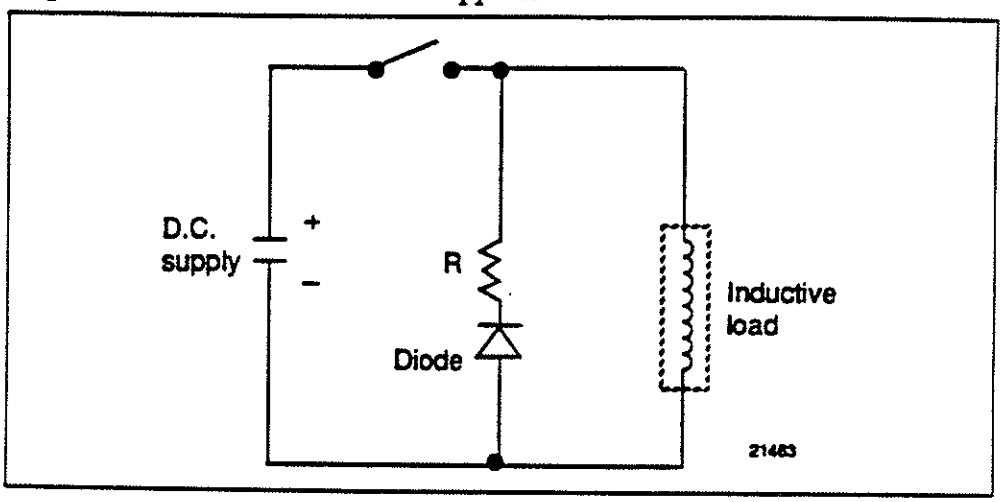
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Contacts, continued

In DC circuits, the power dissipation under steady state condition can be eliminated by placing a diode (in series with a resistor) in parallel with the load (see Figure B-4). The value of R should be less than or equal to the DC resistance of the inductive load.

Figure B-4 is an illustration of DC load noise suppression.

Figure B-4 DC Load Noise Suppression



Appendix C – Model DR45AR

C.1 Overview

Introduction

If the key number for your recorder is DR45AR, it is a relay expansion model Truline recorder that can have up to six alarm relay outputs and include Fo calculation function. While its basic functions are identical to the standard (DR45AT) Truline recorder, it does have some unique hardware, wiring and configuration features. This section provides the data pertinent to these unique features as a supplement to the standard Truline in this product manual.

What's in this section

The table below lists the topics that are covered in this section.

Topic		See Page
C.1	Overview	223
C.2	Hardware Identification	224
C.3	Additional Wiring Information	226
C.4	Prompt Hierarchy Changes	230
C.5	Fo Reset Configuration	232
C.6	Options Configuration	233
C.7	Alarms Configuration	235
C.8	Event Message Configuration	239
C.9	Operations Addition	243
C.10	Configuration Worksheet Additions	244

C.2 Hardware Identification

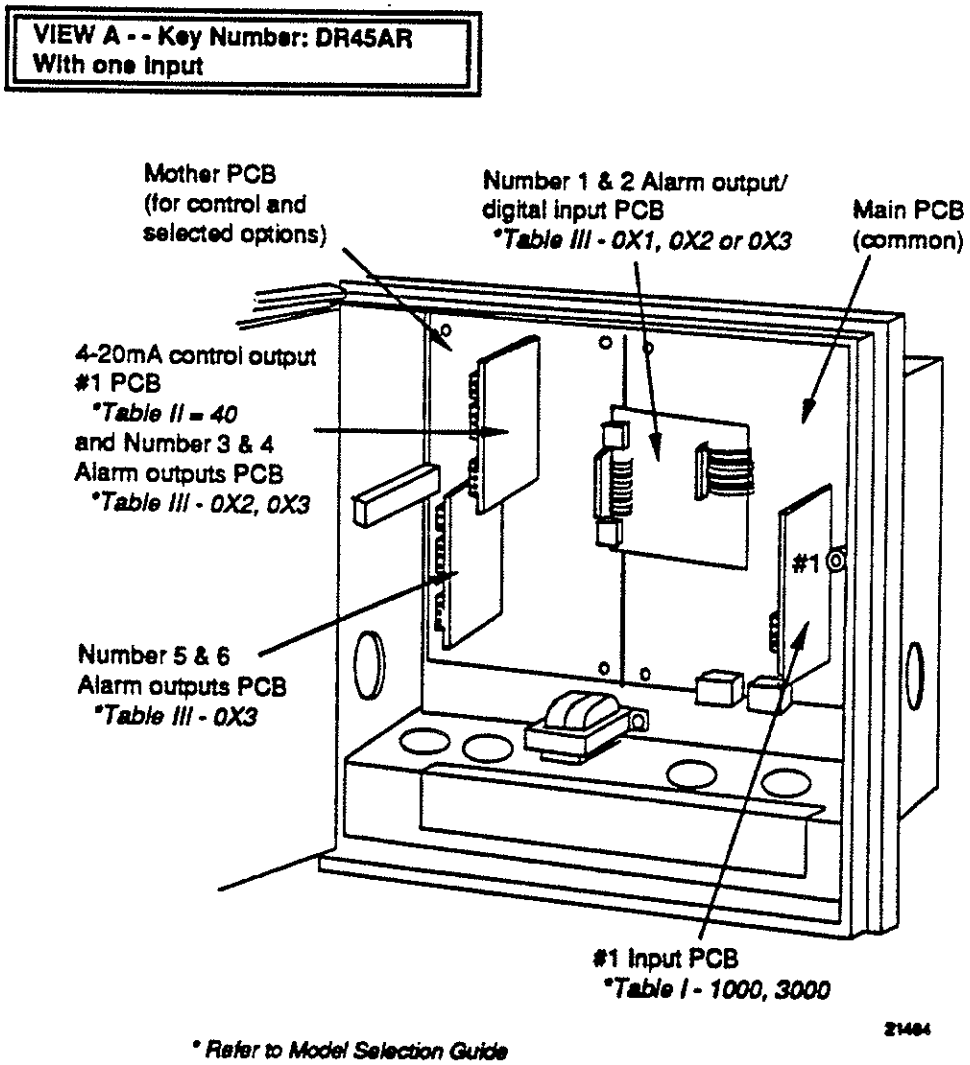
Introduction

Figures C-1 (DR45AR with one input) and C-2 (DR45AR with two to four inputs) identify the hardware components of the DR45AR model versus "Table" selections.

DR45AR with one input

Figure C-1 identifies the hardware components of the DR45AR with one input.

Figure C-1 DR45AR With One Input

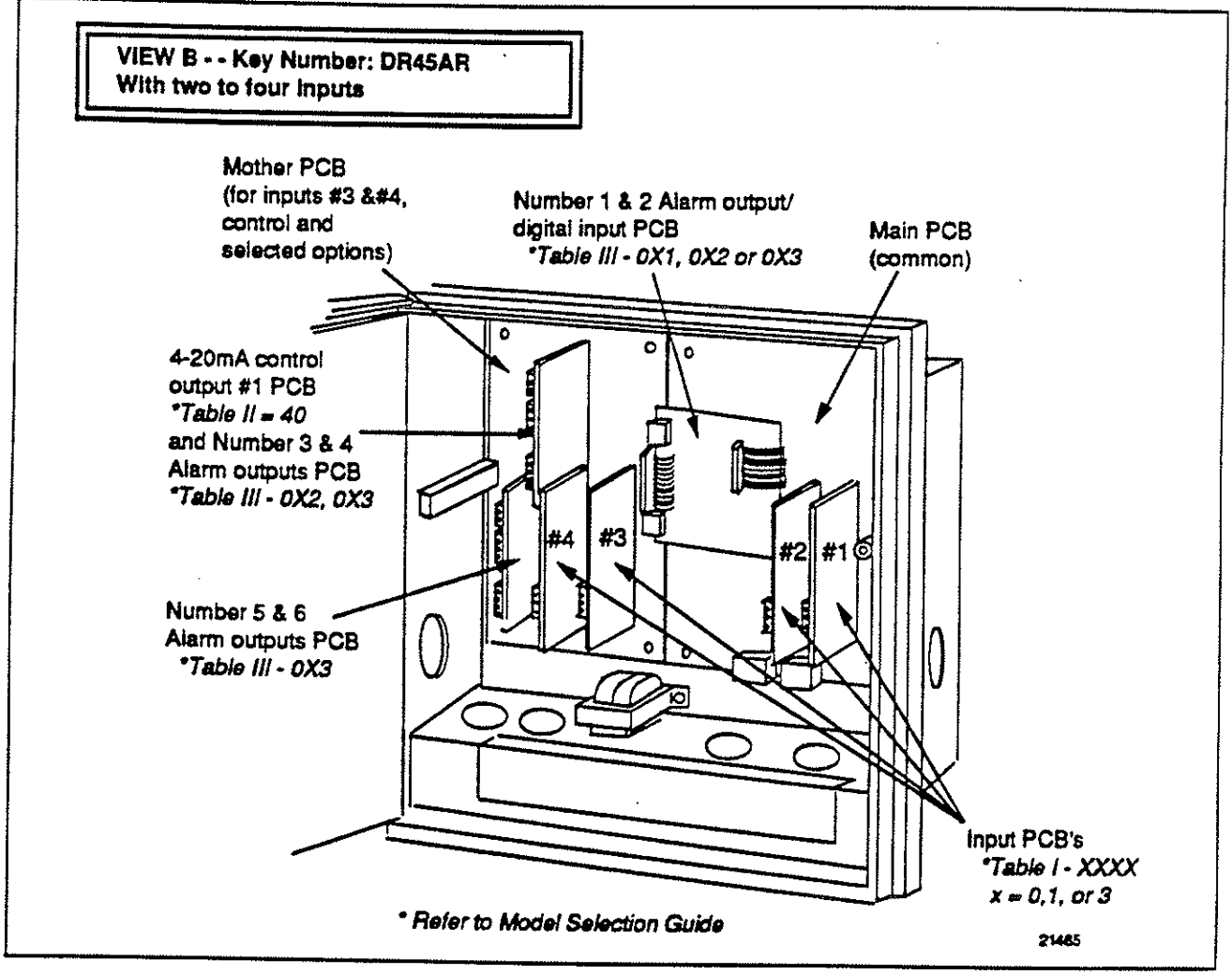


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DR45AR with two to four inputs

Figure C-2 identifies the hardware components of the DR45AR with two to four inputs.

Figure C-2 DR45AR With Two to Four Inputs



C.3 Additional Wiring Information

Introduction

In addition to the Alarm 1 and 2 output wiring diagrams in this manual, the DR45AR has the ability to provide for Alarm outputs 3, 4, 5, and 6. Follow the procedures listed below to wire No. 3 and No. 4 Alarm Outputs and No. 5 and No. 6 Alarm Outputs.

Alarms 3 and 4 output wiring

You can wire #3 and #4 Alarm Outputs.

The prerequisites are:

- Model Number - Model Table 3 = 002

Refer to Figure C-3 and follow the procedure in Table C-1 to wire Alarm 3 and 4 outputs.

Table C-1 Alarm #3 or #4 Output Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J5 on the 4-20 mA control output printed circuit board to wire relays #3 and #4. Refer to Figure C-3 for location.
3	Remove the unwired plug from J5.
4	Locate jumper position W2/W3 and W4/W5 below connector J5 on the printed circuit board. Note that you may want to remove the plug-in output printed circuit board for better access to jumpers. Be sure to tag and remove all the plug connections to the printed circuit boards before removing it. Position the jumpers as shown for the desired relay contact action and reinstall the printed circuit board.
5	Run the alarm output wires through the desired knockout.
6	Strip 1/4-inch maximum of insulation from the end of each wire.
7	Loosen the screws in plug J5 terminals and position the plug as you would to plug it into J5.
8	Insert the wires for the alarm devices into the appropriate screw clamps as shown. Refer to Figure C-3. Tighten the screws to secure the wires.
9	Install the wired plug into J5.

Continued on next page

Alarm 5 and 6 output wiring

You can wire #5 and #6 Alarm outputs.

The prerequisites are:

- Model Number - Model Table 3 = 003

Refer to Figure C-3 and follow the procedure in Table C-2 to wire Alarm 5 and 6 outputs.

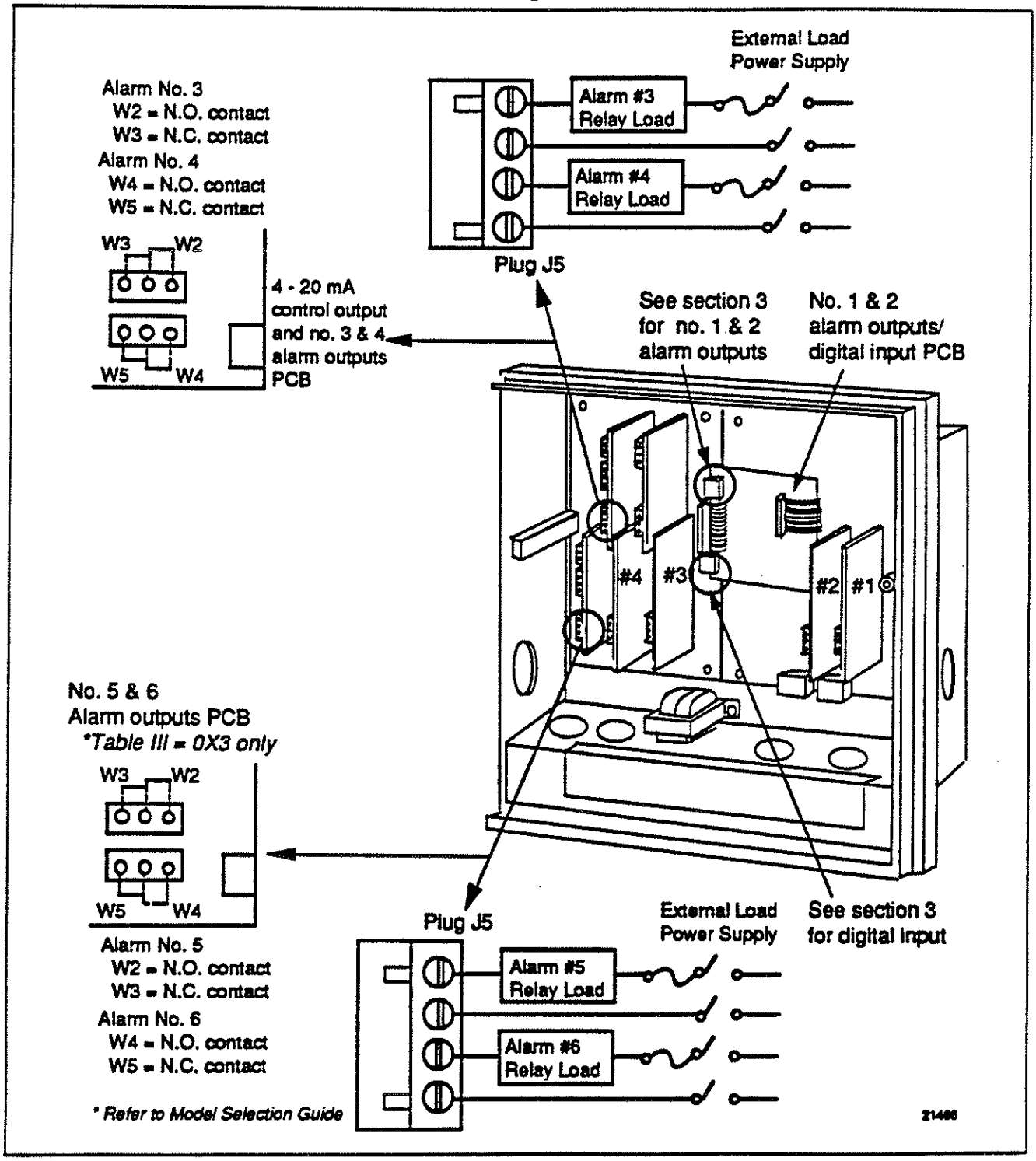
Table C-2 Alarm #5 or #6 Output Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate connector J5 on the 4-20 mA control output printed circuit board to wire relays #5 and #6. Refer to Figure C-3 for location.
3	Remove the unwired plug from J5.
4	Locate jumper position W2/W3 and W4/W5 below connector J5 on the printed circuit board. Note that you may want to remove the plug-in output printed circuit board for better access to jumpers. Be sure to tag and remove all the plug connections to the printed circuit boards before removing it. Position the jumpers as shown for the desired relay contact action and reinstall the printed circuit board.
5	Run the Alarm output wires through the desired knockout.
6	Strip 1/4-inch maximum of insulation from the end of each wire.
7	Loosen the screws in plug J5 terminals and position the plug as you would to plug it into J5.
8	Insert the wires for the alarm devices into the appropriate screw clamps as shown. Refer to Figure C-3. Tighten the screws to secure the wires.
9	Install the wired plug into J5.

Continued on next page

Alarm output #3, 4, 5, and 6 wiring

Figure C-3 Alarm Output #3, 4, 5, and 6 Wiring



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C.4 Prompt Hierarchy Changes

Introduction

Figure C-4 lists all the changes and additions to the standard prompt hierarchy and reflect the prompts shown in the DR45AR.

Figure C-4 Prompt Hierarchy Changes

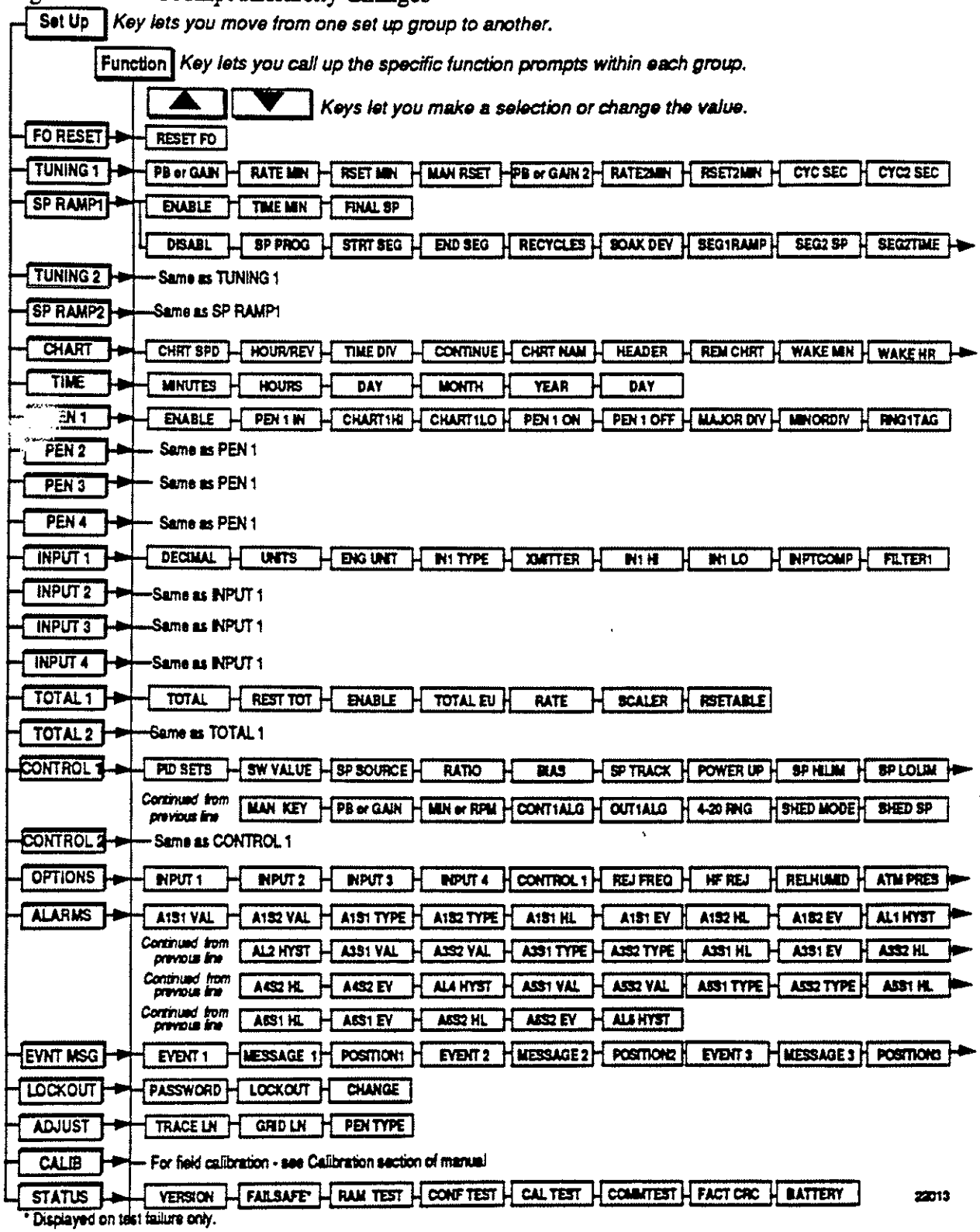
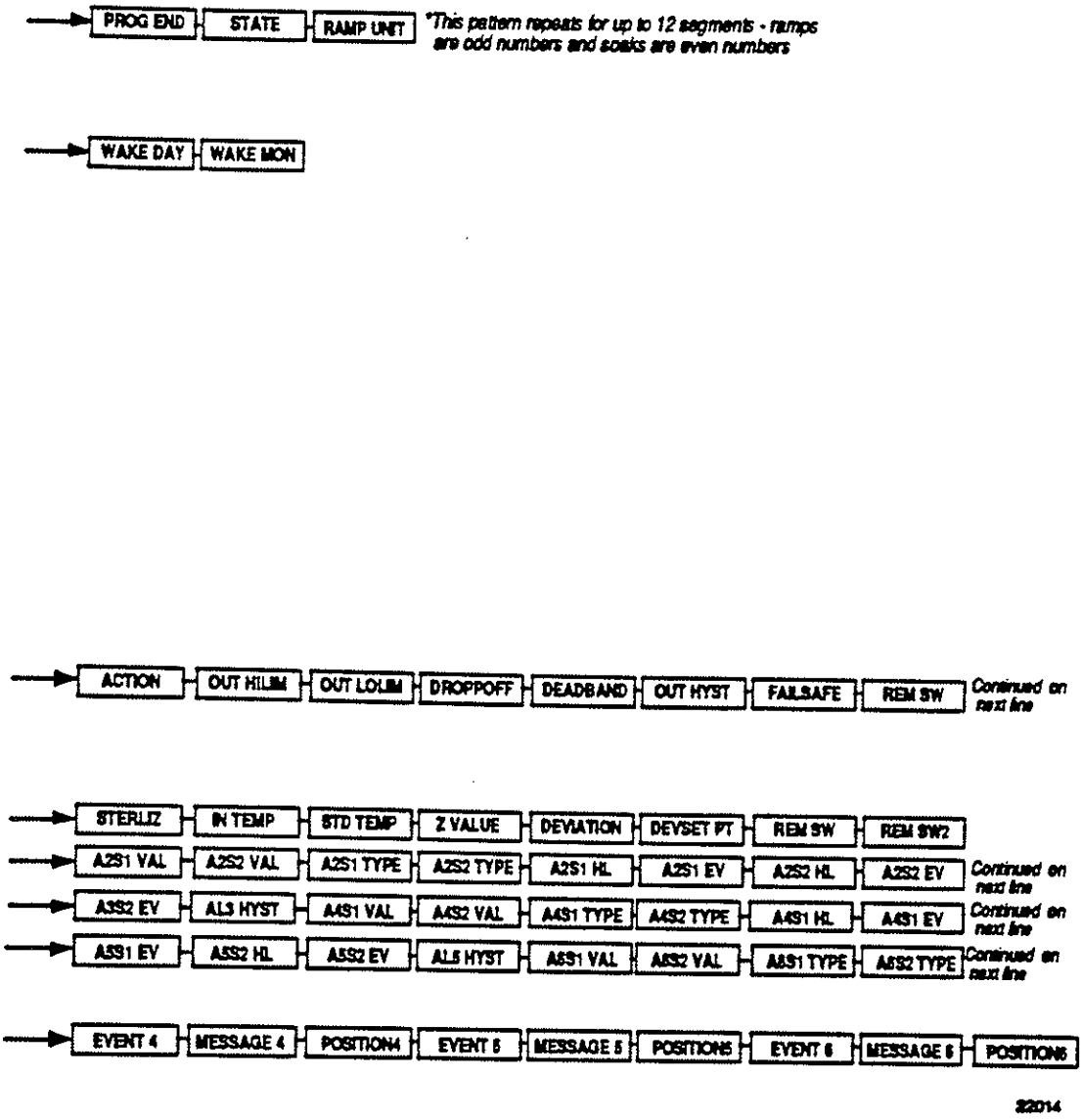


Figure C-4 Prompt Hierarchy Changes, Continued



C.5 Fo Reset Configuration

Introduction

This SET UP group is specific to Model DR45AR. It allows you to reset the Fo sterilization calculation.

Accessing Fo reset prompts

Press the [SET UP] key until you see:

Upper Display
SET UP

Lower Display
FO RESET

Press the [FUNC] key to call up the Fo Reset function prompt that will allow you to reset the Fo sterilization calculation. The function prompt for the Fo Reset group is listed in Table C-3.

Function prompts

Table C-3 lists the function prompt in the "Fo RESET" Set Up group for model DR45AR.

Table C-3 Fo RESET Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
RESET Fo	Reset Fo Sterilization Calculation (REM SW or REM SW2 under "OPTIONS" group must be configured for "FO RST".)	NO YES	

C.6 Options Configuration

Introduction

For Model DR45AR there are several additions to be added to Table 3-11 Options Group Function Prompts (from Section 3). They cover additional options that are only available with this model number.

Table 4-9 on the next page shows the additions made for Model DR45AR in the options group definitions.

Table 3-11 Options Group Function Prompts, continued from Section 3

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
STERILIZ	Fo Sterilization Time	YES NO	
IN TEMP	Input for Product Temperature	INPUT 1 INPUT 2 INPUT 3 INPUT 4	
STDTEMP	Standard Reference Temperature	0.1 to 9999	
Z VALUE	Thermal Resistance	0.1 to 9999	
REM SW	Remote Switching	NONE TO MAN (from AUTO) TO LSP (from REMOTE) TO 2SP (from LSP) TO DIR (from REV) TO HOLD (from RUN) FO RST	
REM SW2	Remote Switching - digital input 2	NONE FO RST	

Continued on next page

Table 4-9 Option Group Definitions, continued from Section 4 - Table 4-9

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
STERILIZ	YES (activates Fo sterilization calculation) NO	**Fo STERILIZATION TIME** - This function computes equivalent sterilization time by accumulating lethality rates for a product over each 1/3 or 2/3 second scan interval of the recorder using this equation: $Ts = Ts_{(n-1)} + dt \times 10^{\frac{(t-Tb)}{z}}$ Where: Ts = sterilization time in minutes $Ts_{(n-1)}$ = previous sterilization time dt = time interval (1/3 or 2/3 second) Note: 1/3 second if less than 3 configured inputs; 2/3 second if greater than 2 configured inputs. Tb = standard reference temperature (configurable) t = product (input) temperature (°F or °C) z = thermal resistance (configurable) Only applicable if Model Table II is 40, Model Table III is 0X3, and Model Table IV is F.
INTEMP	INPUT 1 INPUT 2 INPUT 3 INPUT 4	**INPUT FOR PRODUCT TEMPERATURE** - selects which input will supply product temperature for sterilization calculation.
STDTEMP	0.1 to 9999	**STANDARD REFERENCE TEMPERATURE** - selects a reference temperature constant for sterilization calculation -- usually 250°F or 121°C.
Z VALUE	0.1 to 9999	**THERMAL RESISTANCE** - selects a thermal resistance constant for sterilization calculation -- usually 18°F or 10°C.
REM SW	NONE TO MAN (from AUTO) TO LSP (from REMOTE) TO 2SP (from LSP) TO DIR (from REV) TO HOLD (from RUN) FO RST	**REMOTE SWITCHING** - allows you to select an action to be initiated by remote contact closure through digital input . NONE - No Selection TO MAN - switch to manual mode from automatic TO LSP - switch to local setpoint from remote TO 2SP - switch to 2nd setpoint from local setpoint TO DIR - switch to direct output action from reverse TO HOLD - put ramp/soak program in hold FO RST - reset sterilization calculation.
REM SW2	NONE FO RST	**REMOTE SWITCHING DIGITAL 2 INPUT** - allows you to select remote contact closure through digital 2 input to reset sterilization calculation or not.

C.7 Alarms Configuration

Introduction

For the Alarm Group Function Prompts for Model DR45AR, Table C-4 gives you the prompts that are specific for that model. Use the table in place of Table 3-12 in the manual.

Function prompts

Table C-4 lists all the function prompts in the "Alarms" Set Up group for model DR45AR.

Table C-4 Alarms Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A1S1 VAL	Alarm 1, Setpoint 1 Value	Value in engineering units –999.0 to 9999	90
A1S2 VAL	Alarm 1, Setpoint 2 Value	Value in engineering units –999.0 to 9999	90
A1S1TYPE	Alarm 1, Setpoint 1 Type	NONE (no alarm) IN 1 (Input 1) IN 2 (Input 2) IN 3 (Input 3) IN 4 (Input 4) RH STERIL (Fo sterilization time) DEV (Loop 1 Deviation) OUT (Loop 1 Output) EV1ON (SP Programming-Loop 1) EV1OFF (SP Programming-Loop 1)	NONE
A1S2TYPE	Alarm 1, Setpoint 2 Type	Same as A1S1TYPE	NONE
A1S1 H L	Alarm 1, Setpoint 1 State	LO HI	HI
A1S1 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 1	BEGIN END	
A1S2 H L	Alarm 1, Setpoint 2 State	LO HI	HI
A1S2 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 2	BEGIN END	
AL1 HYST	Alarm 1 Hysteresis	0.0 to 100.0% of span or full output.	

Table C-4 is continued on next page

Function prompts, continued

Table C-4 Alarms Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A2S1TYPE	Alarm 2, Setpoint 1 Type	Same as A1S1TYPE	NONE
A2S2TYPE	Alarm 2, Setpoint 2 Type	Same as A1S1TYPE	NONE
A2S1 VAL	Alarm 2, Setpoint 1 Value	Value in engineering units –999.0 to 9999	90
A2S2 VAL	Alarm 2, Setpoint 2 Value	Value in engineering units –999.0 to 9999	90
A2S1 H L	Alarm 2, Setpoint 1 State	LO HI	HI
A2S1 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 1	BEGIN END	
A2S2 H L	Alarm 2, Setpoint 2 State	LO HI	HI
A2S2 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 2	BEGIN END	
AL2 HYST	Alarm 2 Hysteresis	0.0 to 5.0 % of output or span as appropriate	0.1
A3S1 VAL	Alarm 3, Setpoint 1 Value	Value in engineering units –999.0 to 9999	90
A3S2 VAL	Alarm 3, Setpoint 2 Value	Value in engineering units –999.0 to 9999	90
A3S1TYPE	Alarm 3, Setpoint 1 Type	Same as A1S1TYPE	NONE
A3S2TYPE	Alarm 3, Setpoint 2 Type	Same as A1S1TYPE	NONE
A3S1 H L	Alarm 3, Setpoint 1 State	LO HI	HI
A3S1 EV	SP Programming Event Alarm State for Alarm 3, Setpoint 1	BEGIN END	

Table C-4 is continued on next page

Function prompts, continued

Table C-4 Alarms Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A3S2 H L	Alarm 3, Setpoint 2 State	LO HI	HI
A3S2 EV	SP Programming Event Alarm State for Alarm 3, Setpoint 2	BEGIN END	
AL3 HYST	Alarm 3 Hysteresis	0.0 to 100.0% of span or full output.	
A4S1TYPE	Alarm 4, Setpoint 1 Type	Same as A1S1TYPE	NONE
A4S2TYPE	Alarm 4, Setpoint 2 Type	Same as A1S1TYPE	NONE
A4S1 VAL	Alarm 4, Setpoint 1 Value	Value in engineering units –999.0 to 9999	90
A4S2 VAL	Alarm 4, Setpoint 2 Value	Value in engineering units –999.0 to 9999	90
A4S1 H L	Alarm 4, Setpoint 1 State	LO HI	HI
A4S1 EV	SP Programming Event Alarm State for Alarm 4, Setpoint 1	BEGIN END	
A4S2 H L	Alarm 4, Setpoint 2 State	LO HI	HI
A4S2 EV	SP Programming Event Alarm State for Alarm 4, Setpoint 2	BEGIN END	
AL4 HYST	Alarm 4 Hysteresis	0.0 to 5.0 % of output or span as appropriate	0.1
A5S1TYPE	Alarm 5, Setpoint 1 Type	Same as A1S1TYPE	NONE
A5S2TYPE	Alarm 5, Setpoint 2 Type	Same as A1S1TYPE	NONE
A5S1 VAL	Alarm 5, Setpoint 1 Value	Value in engineering units –999.0 to 9999	90
A5S2 VAL	Alarm 5, Setpoint 2 Value	Value in engineering units –999.0 to 9999	90
A5S1 H L	Alarm 5, Setpoint 1 State	LO HI	HI
A5S1 EV	SP Programming Event Alarm State for Alarm 5, Setpoint 1	BEGIN END	

Continued on next page

Function prompts, continued

Table C-4 Alarms Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A5S2 H L	Alarm 5, Setpoint 2 State	LO HI	HI
A5S2 EV	SP Programming Event Alarm State for Alarm 5, Setpoint 2	BEGIN END	
AL5 HYST	Alarm 5 Hysteresis	0.0 to 5.0 % of Output or Span as appropriate	0.1
A6S1TYPE	Alarm 6, Setpoint 1 Type	Same as A1S1TYPE	NONE
A6S2TYPE	Alarm 6, Setpoint 2 Type	Same as A1S1TYPE	NONE
A6S1 VAL	Alarm 6, Setpoint 1 Value	Value in engineering units –999.0 to 9999	90
A6S2 VAL	Alarm 6, Setpoint 2 Value	Value in engineering units –999.0 to 9999	90
A6S1 H L	Alarm 6, Setpoint 1 State	LO HI	HI
A6S1 EV	SP Programming Event Alarm State for Alarm 6, Setpoint 1	BEGIN END	
A6S2 H L	Alarm 6, Setpoint 2 State	LO HI	HI
A6S2 EV	SP Programming Event Alarm State for Alarm 6, Setpoint 2	BEGIN END	
AL6 HYST	Alarm 6 Hysteresis	0.0 to 5.0 % of output or span as appropriate	0.1

C.8 Event Message Configuration

Introduction

This SET UP group is specific to Model DR45AR. It allows you to specify an event message to be printed on a designated area of the chart when triggered by a specific selectable actuation.

Accessing event message prompts

Press the SET UP key until you see:

Upper Display
SET UP

Lower Display
EVNT MSG

Press the FUNC key to call up the first event message parameter for configuration. The function prompts for the Event Message groups are listed in Table C-5.

Function prompts

Table C-5 lists all the function prompts in the "Event Message" Set Up group for model DR45AR.

Table C-5 Event Message Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
EVENT 1	Event 1 Trigger	NONE EXTSW1 EXTSW2 ALARM1 ALARM2 ALARM3 ALARM4 ALARM5 ALARM6	
MESSAGE1	Message for Event 1 (up to six characters)	0 to 9 A to Z + – / (blank)*	
POSITON1	Chart Position for Message 1 Printing	0 to 100%	

* For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can be changed only when it is highlighted.

Table C-5 is continued on next page

Function prompts, continued

Table C-5 Event Message Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
EVENT 2	Event 2 Trigger	NONE EXTSW1 EXTSW2 ALARM1 ALARM2 ALARM3 ALARM4 ALARM5 ALARM6	
MESSAGE2	Message for Event 2 (up to six characters)	0 to 9 A to Z + – / (blank)*	
POSITON2	Chart Position for Message 2 Printing	0 to 100%	
EVENT 3	Event 3 Trigger	NONE EXTSW1 EXTSW2 ALARM1 ALARM2 ALARM3 ALARM4 ALARM5 ALARM6	
MESSAGE3	Message for Event 3 (up to six characters)	0 to 9 A to Z + – / (blank)*	
POSITON3	Chart Position for Message 3 Printing	0 to 100%	

* For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can be changed only when it is highlighted.

Table C-5 is continued on next page

Function prompts, continued

Table C-5 Event Message Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
EVENT 4	Event 4 Trigger	NONE EXTSW1 EXTSW2 ALARM1 ALARM2 ALARM3 ALARM4 ALARM5 ALARM6	
MESSAGE4	Message for Event 4 (up to six characters)	0 to 9 A to Z + – / (blank)*	
POSITON4	Chart Position for Message 4 Printing	0 to 100%	
EVENT 5	Event 5 Trigger	NONE EXTSW1 EXTSW2 ALARM1 ALARM2 ALARM3 ALARM4 ALARM5 ALARM6	
MESSAGE5	Message for Event 5 (up to six characters)	0 to 9 A to Z + – / (blank)*	
POSITON5	Chart Position for Message 5 Printing	0 to 100%	

* For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can be changed only when it is highlighted.

Table C-5 is continued on next page

Function prompts, continued

Table C-5 Event Message Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
EVENT 6	Event 6 Trigger	NONE EXTSW1 EXTSW2 ALARM1 ALARM2 ALARM3 ALARM4 ALARM5 ALARM6	
MESSAGE6	Message for Event 6 (up to six characters)	0 to 9 A to Z + – / (blank)*	
POSITON6	Chart Position for Message 6 Printing	0 to 100%	

* For alphanumeric entries, the display will cycle, from left to right, with highlighting (increased brightness) of each digit. The value of each digit can be changed only when it is highlighted.

C.9 Operations Additions

Introduction

In addition to the standard operating functions in this manual the additions listed below appear if you have model DR45AR.

Viewing F_O sterilization display

Add the following prompt to Table 5-5 Lower Display Key Parameter Prompts.

Prompt	Description
F_O	F_O sterilization time in the lower display with the appropriate input in the upper display

Digital input (REM SW) prompt selection

Add the following selections to Table 5-21 Digital Input Option Action on Contact Closure.

REM SW selections	Display indication	Action on contact closure*
F_O RST	None	Resets F_O sterilization calculation – if F_O RESET prompt is enabled.

C.10 Configuration Worksheet Additions

Configuration additions In addition to the Configuration worksheet items that are listed in *Section 3 - Configuration*. the following parameters also appear in Model DR45AR.

Group Prompt	Function Prompt	Value or Selection
FO RESET	RESET FO	
OPTIONS	INPUT 1	
	INPUT 2	
	INPUT 3	
	INPUT 4	
	CONTROL 1	
	CONTROL 2	
	REJ FREQ	
	HF REJ	
	RELHUMID	
	ATMPRES	
	DEVIATION	
	DEVSETPT	
	ComSTATE	
	Com ADDR	
	SHEDTIME	
	UNITS	
	STERILIZ	
	IN TEMP	
	STD TEMP	
	Z VALUE	
	REMSW	
	REM SW2	
ALARMS	A1S1 VAL	
	A1S2 VAL	
	A1S1TYPE	
	A1S2TYPE	
	A1S1 H L	
	A1S1 EV	
	A1S2 H L	
	A1S2 EV	
	AL 1 HYST	
	A2S1 VAL	
	A2S2 VAL	
	A2S1TYPE	
	A2S2TYPE	
	A2S1 H L	
	A2S1 EV	
	A2S2 H L	
	A2S2 EV	
	AL 2 HYST	
	A3S1 VAL	
	A3S2 VAL	
	A3S1TYPE	
	A3S2TYPE	
	A3S1 H L	
	A3S1 EV	
	A3S2 H L	
	A3S2 EV	
	AL 3 HYST	

Group Prompt	Function Prompt	Value or Selection
ALARMS	A4S1 VAL	
	A4S2 VAL	
	A4S1TYPE	
	A4S2TYPE	
	A4S1 H L	
	A4S1 EV	
	A4S2 H L	
	A4S2 EV	
	AL 4 HYST	
	A5S1 VAL	
	A5S2 VAL	
	A5S1TYPE	
	A5S2TYPE	
	A5S1 H L	
	A5S1 EV	
	A5S2 H L	
	A5S2 EV	
	AL 5 HYST	
	A6S1 VAL	
	A6S2 VAL	
	A6S1TYPE	
	A6S2TYPE	
	A6S1 H L	
	A6S1 EV	
	A6S2 H L	
	A6S2 EV	
	AL 6 HYST	
EVNT MSG	EVENT 1	
	MESSAGE 1	
	POSITON 1	
	EVENT 2	
	MESSAGE 2	
	POSITON 2	
	EVENT 3	
	MESSAGE 3	
	POSITON 3	
	EVENT 4	
	MESSAGE 4	
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COMPANY

JZ

A DIVISION OF
KOCH ENGINEERING

SPECIFICATION

THERMOCOUPLES AND THERMOWELLS

SPEC.NO. 5

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.:4

1. Complete Assembly ■ Other:
   MFR. & Model No. TSC #494-3647-18-K

ELEMENT

   MFR. & Model No.
2. ISA Type "K" Wire Size 14 AWG
3. Sheathed: 5/16" O.D. Material 310 S.S
   Exposed □ Grounded □ Ungrounded ■
   Enclosed □ Beaded Insulators □ Spring Loaded □
4. Nipple Size Dimension "N" 6" Union ■
5. Packed Connector

HEAD

6. Screwed-Cap & Chain ■ Others :
7. Material: CAST IRON Conduit Conn. 3/4"
8. Terminal Block: Single ■ Duplex □

WELL OR TUBE

9. Material 99.5% ALUMINA
10. Construction: Tapered □ Straight ■
    Drilled □ Built-Up □ Closed End Tube ■
11. Dimension: MFR. STD. □ O.D. 11/16" I.D. 7/16"
12. Connections: Process 1.0" INT.
13. Style: Screwed □ Flanged □

Rev.	Tag No.	Well Dimes. "U"	Well Dimes. "T"	Element Length	Single Duplex	Type	Gage	Service	JZ Part No.
	TE-101	18"		MFG. STD.	SINGLE	K	14	HIGH STACK TEMP. SHUT-DOWN TSH-101	022963
	TE-201A	18"		MFG. STD.	SINGLE	K	14	TEMP. CONTROL TIC-201	022963
	TE-201B	18"		MFG. STD.	SINGLE	K	14	TEMP. CONTROL TIC-201	022963

Notes: SHIP LOOSE

MOUNT: SKID □ FIELD ■ OTHER □

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JZ

A DIVISION OF
KOCH ENGINEERING

SPECIFICATION
PRESSURE CONTROL VALVES AND REGULATORS

SPEC.NO. 6

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

QTY.: 1

	1	Tag. No.		PCV-608	
	2	Service		PILOT GAS	
	3	Line No./Vessel No.			
	4	Line Size/Sched. No.		1/2"	
	5	Function		REGULATOR	
BODY	6	Type of Body			
	7	Body Size	Port Size	1/2"	1/4"
	8	Guiding	No. Of Ports		
	9	End Conn. & Rating		1/2"	
	10	Body Material		ALUMINUM	
	11	Packing Material		BRASS	
	12	Lubricator	Isolating Valve		
	13	Seal Type			
	14	Trim Form			
	15	Trim Material		NITRILE	
	16	Seat Material		NITRILE	
	17	Required Seat Tightness			
	18	Max. Allow.,Sound Level dBA			
ACTUATOR	19	Type of Actuator			
	20	Pilot			
	21	Supply to Pilot			
	22	Self Cont.	Ext. Conn.		
	23	Diaphragm Material			
	24	Diaphragm Rating			
	25	Spring Range	PSIG	5-35	
	26	Set Point	PSIG	10	
	27				
ACCESSORIES	28	Filt. Reg.	Supply Gage		
	29	Line Strainer			
	30	Housing Vent			
	31	Internal Relief			
	32				
	33				

	34	FLOW UNITS		LIQUID		STEAM		GAS					
	35	Fluid		PROPANE									
	36	Quant. Max	C	30 SCFH									
	37	Quant. Oper.	C										
	38	Valve C	Valve FL										
	39	Norm. Inlet Press.	∆ P	15 PSIG									
SERVICE	40	Max. Inlet Press.	PSIG	250									
	41	Max. Shut Off ∆ P											
	42	Temp. Max.	Operating	150 °F									
	43	Oper. sp. gr.	Mol. Wt.	1.52									
	44	Oper. Visc.	% Flash										
	45	% Superheat	% Solids										
	46	Vapor Press.	Crit. Press.										
	47	Predicted Sound Level dBA											
SHIPMENT	48	Manufacturer		FISHER									
■ SKID MOUNT	49	Model No.		#64-27									
□ SHIP LOOSE	50	JZ Part No.		016414									

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JOHN ZINK COMPANY
A DIVISION OF KOCH ENGINEERING

SPECIFICATION
SOLENOID VALVES

SPEC.NO. 7
S.O.NO. BF -A0012224
PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK
CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL
INQ.:
JZ.PO.NO:
CUST.PO.NO.:
QTY.: 1

GENERAL	1	Tag. No.			FV-609									
	2	Service			PILOT GAS									
	3	Line No./Vessel No.												
	4	Quantity			1									
VALVE BODY	5	Type												
	6	Size: Body	Port		1/2" SCRD	3/4"								
	7	Rating	Type Conn.		50 PSIG @	125 °F								
	8	Material -- Body			ALUMINUM									
	9	Material -- Seat			BUNA N									
	10	Material -- Diaphragm			BUNA N									
	11	Operation Direct/Pilot			DIRECT									
	12	Packless or Type Packed												
	13	Manual Re-Set			NO									
	14	Manual Operator												
	15													
	16													
WHEN DE-ENERGIZED	17	2-Way Valve Opens/Close				CLOSES								
	18	3-Way												
	19	Vent Port Opens/Close												
	20	Press Port Opens/Close												
	21	4-Way												
	22	Press to Cyl.1 / Cyl.2												
	23	Exh. from Cyl.1 / Cyl.2												
	24													
	25													
SOLENOID	26	Enclosure			NEMA 4,7									
	27	Voltage / HZ			120 VAC	60 HZ								
	28	Style of Coil												
	29	Single or Double Coil												
	30													
	31													
SERVICE CONDITIONS	32	Fluid			PROPANE									
	33	Qty. Maximum			30 SCFH									
	34	Oper. Diff. Min / Max			0	50								
	35	Allow. Diff. Min / Max												
	36	Temp. Norm / Max. Degree°F				125								
	37	Oper. sp. gr.			1.52									
	38	Oper. Viscosity												
	39	Required Cv												
	40	Valve Cv			4.4									
	41													
	42													
	43													
	44	Manufacturer			ASCO									
	45	Model Number			EF8215G20									
	46	John Zink Part Number			012004									

Notes:

MOUNT: SKID ■ FIELD □ OTHER □

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A DIVISION OF
KOCH ENGINEERING

SPECIFICATION
MANUAL BALL VALVE

SPEC.NO. 8

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

GENERAL	Manufacturer	WATTS
	Model No.	C7000
	Port Type	Reduced ■ Full Port □
	Process Connection	NPT ■ Socket Weld □ Flanged □ ANSI Other: SCREWED
MATERIALS		
	Body	CARBON STEEL
	Ball	CARBON STEEL
	Stem	CARBON STEEL
	Seal / Seat	TFE/TFE
	Packing	TFE
	Handle	

QTY	TAG	Nominal Size INCH	Op. Press. PSI	Op. Temp. ° F	Service	JZ Part No.
1	HV-606	1/2	10	80	PILOT PRESSURE INDICATOR (PROPANE)	012635
1	HV-610	1/2	10	80	PILOT MANUAL SHUT-OFF (PROPANE)	012635

Notes:

MOUNT: PANEL □ SKID ■ FIELD □ OTHER □

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KOCH ENGINEERING

SPECIFICATION

PRESSURE GAGES

SPEC.NO. 9

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

1. Type: Direct Reading ■ 3-15 lb Receiver □
   Other:
2. Mounting: Surface □ Local ■ Flush □
3. Dial: Diameter 4 1/2" Color WHITE
4. Case: Cast Iron □ Aluminum □ Phenol ■
   Other:
5. Ring: Screwed □ Hinged □ Slip □ Std □
   Other:
6. Blow-out Protection: None □ Back □ Disc □
   Solid Front □ Other:
7. Lens: Glass □ Plastic □ OTHER:
8. Options: Syphon □ Material
   Snubber □
   Pressure Limit Valve □
   Movement Damping □
9. Nominal Accuracy Required

10. MFR. & Model No. U.S. GAUGE 1982
11. Press. Element: Bourdon ■ Bellows □
    Other:
12. Element Mtl: Bronze □ Steel □ 316 SS
    Other:
13. Socket Mtl: Bronze □ Steel ■ SS
    Other:
14. Connection-NPT: 1/4 in. □ 1/2 in. ■ Other:
    Bottom ■ Back □
15. Movement: Bronze □ SS ■ Nylon □
    Other:
16. Diaphragm Seal
    MFG Type
    Wetted Part Mtl. Other Mtl.
    Fill Fluid
    Process Conn. Gage Conn.
    JOHN ZINK P/N

Rev.	Quan.	Tag No.	Range PSIG	Oper.Press. PSIG	Service	JZ PART No.
	1	PI-612	0-30	10	PILOT GAS	030373

Notes:

MOUNT: PANEL □ SKID □ FIELD ■ OTHER □

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KOCH ENGINEERING

DIFFERENTIAL PRESSURE INSTRUMENTS

10

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL | TAG.NO. : PDSL-203

INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.: 1

GENERAL	1	Service	DIFFERENTIAL PRESSURE
	2	Function	Record ☐ Indicate ☐ Control ■ Blind ☐ Trans ☐ Integ ☐ Other:
	3	Case	MFR STD ■ Nom Size 3.5"XS" Color: MFR STD ■ Other:
	4	Mounting	Flush ☐ Surface ■ Yoke ☐ Other:
	5	Enclosure Class	General Purpose ☐ Weather Proof ■ Explosion-Proof ■ Class 1
			For Use in intrinsically Safe System. ☐ Other:
	6	Power Supply	117 V 60Hz ■ Other ac dc ☐ Volts
	7	Chart	12 in Circ. ☐ Other Range Time Marks
	8	Chart Drive:	24 hr Other: Elec. ☐ Spring ☐ Other:
	9	Scales	Type Range 1 2 3
XMTR	10	Transmitter Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
			For Receiver See Spec . Sheet
CONTROLLER	11	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P ☐ PI ☐ PD ☐ PID ☐ If ☐ Df ☐ Is ☐ Ds ☐
			Other:
	12	Action	On Meas. Increase Output: Increase ☐ Decrease ☐
	13	Auto-Man Switch	None ☐ MFR STD ☐ Other:
	14	Set Point Adj.	Manual ☐ External ■ Remote ☐ Other:
	15	Manual Reg.	None ☐ MFR STD ☐ Other:
	16	Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
UNIT	17	Service	Flow ☐ Level ☐ Diff. Pressure ■ Other:
	18	Element Type	Diaphragm ■ Bellows ☐ Mercury ☐ Other:
	19	Material	Body CAST ALUMINUM Element FLUORSILICONE RUBBER
	20	Rating	Overrange Body Rating 10 psig
	21	Diff. Range	Fixed ■ Adj. Range Set At 0.5" W.C.
	22		Elevation Suppression
	23	Process Data	Fluid AIR Max. Temp. AMBIENT Max. Press. ATMOSPHERE
	24	Process Conn.	1/2 in. NPT ☐ Other: 1/8" NFT
OPTIONS	25	Alarm Switches	Quantity 1 Form SPDT Rating
	26	Function	Meas. Var. ■ Deviation ☐ Contact to on Incr. Meas.
	27	Options	Pressure Element ☐ Range Material
			Temp. Element ☐ Range Type
			Filt. Reg. ☐ Sup. Gage ☐ Output Gage ☐ Charts
			Valve Manifold
			Cond. Pots ☐ Adj. Damp ☐ Integral Sq. Rt. Ext. ☐
			Integrator
			Other:
	28	MFR & Model No.	DWYER 1950-1

Notes: PDSL-203 SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	JZ PART NO.: 024372
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JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION

MISCELLANEOUS INSTRUMENTS

PURGE AIR BLOWER

SPEC.NO. 11

S.O.NO. BF -A0012224

LOCATION: NEW YORK CITY, NEW YORK

FACILITY: PHELHAM BAY LANDFILL

CUSTOMER: BRECO

TAG.NO. : BL-202

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

QTY.: 1

TAG/ITEM	DESCRIPTION
BL-202	AMERICAN FAN COMPANY PURGE AIR BLOWER
	MODEL: #SC-800, ARRANGEMENT 4-FM
	1750 RPM @ .5BHP
	DUTY: 700 CFM @ 1.7" W.C. STATIC PRESSURE @ 100 °F
	@ .071 DENSITY
	MOTOR: 3/4 HP, 1800 RPM, TEFC, Z30/460 VAC, 3 PHASE, 60 HZ,
	56-C FRAME
	ACCESORIES: OUTLET FLANGE, INLET SCREEN, 50% CUT-OFF DAMPER, DRAIN

NOTES: BL-202 SHIP LOOSE

JZ PART NO. 303553

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JOHN ZINK COMPANY
A DIVISION OF KOCH ENGINEERING

SPECIFICATION
ACTUATED CONTROL DAMPER

SPEC.NO. 12
S.O.NO. BF -A0012224
PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL
INQ.: | JZ.PO.NO: | CUST.PO.NO.:

GENERAL	Manufacturer	AMERICAN WARMING AND VENTILATING DAMPER
	Model No.	#VC-412 OPPOSED BLADE
	Process Connection	NPT ☐ Socket Weld ☐ Flange ☐ ANSI Other:
	Type	Round ☐ Rectangular ☐
	Dimensions	I.D.■ O.D.☐ 48"W X 40"H
MATERIAL	Body	
	Blade	
	Shaft	
	Shaft Bearing	
	Packing	
	Seal	
	Max. Cv	
	Accessories	
ACTUATOR	Manufacturer	HONEYWELL (SUPPLY TO THE DAMPER MFG. BY J.Z.) 201625
	Model No.	#M7284A-1009
	Type	Pneumatic ☐ Electrical ■
	Supply	PSIG 120 Volts
	Input Signal	PSIG 4-20 mA.DC
	Output	PSIG
	Action	Spring-Return ☐ Double-Acting ☐

QTY	TAG	Nominal Size INCH	Op. Press. PSIG	Op. Temp. °	Service	JZ Part No.
1	TCV-201A	48"WIDEX40"HIGH	AMBIENT		ACTUATED AIR DAMPER	020557

Notes: ENCLOSURE: NEMA 4 DAMPER TO BE OPEN @ 4 mA INPUT, CLOSED @ 20 mA
TCV-201A SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase:	/ /
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JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION
MANUAL DAMPER

SPEC.NO. 13

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.:

GENERAL	Manufacturer	AMERICAN WARMING AND VENTILATING DAMPER
	Model No.	#VC-412 OB-HG
	Process Connection	NPT ☐ Socket Weld ☐ Flange ☐ ANSI Other:
	Type	Round ☐ Rectangular ☐
	Dimensions	I.D.■ O.D.☐ 48"W X 40"H
MATERIAL	Body	
	Blade	
	Shaft	
	Shaft Bearing	
	Packing	
	Seal	
	Max. Cv	
	Accessories	

QTY	TAG	Nominal Size INCH	Op. Press. PSIG	Op. Temp. °	Service	JZ Part No.
1	TCV-201B	48"WIDEX40"HIGH	AMBIENT		MANUAL DAMPER	*-013

Notes: ACTUATOR: MANUAL QUAD PLATE AND HANDLE ATTACHED/THIS DAMPER IS HINGED ON ONE SIDE
TCV-201B SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 1 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 1 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE: 07/10/1995	APP: CL	Shipment Promise Date: / /

JZ401.12 ADOPTED FROM ISA-20-1975

CL 07-26-1995 10:51:25

JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION

FLASH-BACK ARRESTER

SPEC.NO. 14

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

FACILITY: PHELHAM BAY LANDFILL

CUSTOMER: BRECO

TAG.NO. : FA-104

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

QTY.: 1

GENERAL	Manufacturer	VAREC
	Model No.	5010-0-1
	Flame Check ☐ / Flame Arrester ■	
	Process Connection	NPT ☐ Socket Weld ☐ Flanged ■ FF ANSI Other:
	DRAIN CONNECTION	1/2-IN NPT
MATERIALS	Housing	ALUMINUM
	Element	ALUMINUM

QTY	TAG	Nominal Size INCH	Op. Press. IN-W.C.	Op. Temp. ° F	Service	JZ Part No.
1	FA-104	10-IN			LAND FILL GAS	400810

Notes:

MOUNT: SKID ☐ FIELD ■ OTHER ☐ SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE: APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 2 DATE: APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 3 DATE: APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 4 DATE: APP:	Shipment Promise Date: / /

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A DIVISION OF KOCH ENGINEERING

SPECIFICATION

POTENTIOMETER INSTRUMENTS

TEMPERATURE CONTROLLER

SPEC.NO. 15

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BREED

FACILITY: PHELHAM BAY LANDFILL | TAG.NO.: TIC-201

INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.: 1

GENERAL	1	Service	TEMPERATURE CONTROLLER
	2	Function	Record ☐ Indicate ■ Control ■ Blind ☐ Transmit ☐
			Other:
	3	Type	Auto Bal. ■ Manl Bal ☐ Filter ☐ Other:
	4	Case	MFR STD ■ Nom Size Color: MFR STD ☐ Other:
	5	Mounting	Flush ■ Surface ☐ Rack ☐ Multi-case ☐ Other:
			For Multiple Case, See Spec. Sheet
	6	Enclosure Class	Gen Purpose ■ Weather Proof ☐ Explosion-Proof ☐ Class Other:
	7	Power Supply	117 V 60Hz ■ Other:
	8	Chart	Strip ☐ Circ ☐ Time Marks ☐ Range No.
			Chart Speed: Change Gears
	9	Scales	Type Range 1 2
	10	Printout	No. of Points Sec Per Point Full Travel Speed
			Print Character and Color Point Select ☐
	11	Selector Switches	No. and Form In Case ☐ External ☐
			Switch Cabinet Specs
XMTR	12	Trans Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
			Input-Output Isolation ☐ For Receiver See Sheet
CONTROLLER	13	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P ☐ PI ☐ PD ☐ PID ■ If ☐ Df ☐ Is ☐ Ds ☐
			Other: RANGE: 0 TO 2, 400 °F
	14	Action	On Meas. Increase Output: Increases ☐ Decreases ■
	15	Auto-Man Switch	None ☐ MFR STD ■ Specify:
	16	Set Point Adj.	Manual ■ External ■ Remote ☐ Specify: 1400 °F
	17	Manual Reg.	None ☐ MFR STD ☐ Other:
	18	Output	4-20 mA ■ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
INPUT	19	Thermocouple Type	J(IC) ☐ K(CA) ■ T(CC) ☐ E(CHR-CON) ☐ Other:
			Ref Junction Comp ☐ Lead Resistance (Galv)
	20	Other Input	Resistance Temp Sensor ☐ Calibration
			Other: DIGITAL INPUT (2)
ALARMS	21	Alarm Switches	Quantity 2 Form SPDT 5 AMPS @ 120 VACR
	22	Function	Meas. Var. ■ Deviation ☐ Contacts to OPEN Measure BELOW S.P.
			Other:
	23		Front Adj. Back Adj.
OPTIONS	24	T/C Burnout Drive	None ☐ Upscale ■ Downscale ☐
	25	Accessories	Case Illuminator ☐
			Filter Reg. ☐ Other: AUXILIARY OUTPUT: (4-20mA)
	26	MFR & Model No.	HONEYWELL DC300K-E-203-10-0A00

Notes: CONTROL ACTION:REVERSE, CONTROLLER RANGE: 0-2400 °F, ALARM CONTACTS TO CLOSE ABOVE SETPOINT

TIC-201 MOUNTED IN PNL-101

UL LABLE REQUIRED

JZ PART NO. 404054

MOUNT: PANEL ■ SKID ☐ FIELD ☐ OTHER ☐

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 1 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 1 DATE:	APP:	Quotation Att'd: Yes No
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Honeywell

UDC 3000 Universal Digital Controller Product Manual

51-52-25-07C
9/94

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Rev. C

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Honeywell
Industrial Automation and Control
Automation College
1100 Virginia Drive
Fort Washington, Pa 19034

About This Publication

How this manual is organized

This Product Manual is divided into 12 sections numbered 1 through 12. These sections contain all the information you need to configure, operate, monitor, and troubleshoot your controller.
To find information quickly, use the comprehensive Table of Contents in the front of the manual and the Index located in the back of the manual.

Warranty

The device described herein has been manufactured and tested for correct operation and is warranted as follows:

The UDC3000 Universal Digital Controller carries a two year warranty. This warranty includes immediate technical assistance via a toll free telephone number and complete replacement of the controller, if necessary.

Technical Assistance

If you encounter a problem with your UDC3000 controller, review all the configuration data under the Set-up groups to verify that your selections are consistent with your application; i.e. Inputs, Outputs, Alarms, Limits, etc. If the problem persists after checking the above, you can get technical assistance by dialing

1-800-423-9883 USA
1-800-461-0013 Canada

An engineer will discuss your problem with you. Please have your complete model number, serial number, and Software version available. The model and serial numbers can be found on the chassis nameplate. The software version can be viewed under Setup Group "Status." See Table 9-2.

If it is determined that a hardware problem exists, a replacement controller or part will be shipped with instructions for returning the defective unit. Do not return your controller without authorization from Honeywell's Technical Assistance Center or until the replacement has been received.

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Acronyms

3PSTEP	3 Position Step Control
DMCS	Distributed Manufacturing Control System
EMI	electromagnetic interference
HID	high intensity discharge
MOVs	Metal Oxide Varistors
NC	normally closed
NO	normally open
PID	Proportional, Integral, and Derivative
RC	resistance-capacitance
RFI	radio frequency interference
RH	Relative Humidity
RTD	Resistance Thermometer Device
SCRs	Silicon controlled rectifiers
UDC	Universal Digital Controller

Parameters

2IN	Input 2
2SP	Local Setpoint 2
A1S1 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 1
A1S1 VAL	Alarm 1, Setpoint 1
A1S1TYPE	Alarm 1, Setpoint 1 Type
A1S2 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 2
A1S2 HL	Alarm 1, Setpoint 2 State
A1S2 VAL	Alarm 1, Setpoint 2
A1S2TYPE	Alarm 1, Setpoint 2 Type
A2S1 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 1
A2S1 HL	Alarm 2, Setpoint 1 State
A2S1 VAL	Alarm 2, Setpoint 1
A2S1TYPE	Alarm 2, Setpoint 1
A2S2 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 2
A2S2 HL	Alarm 2, Setpoint 2 State
A2S2 VAL	Alarm 2, Setpoint 2
A2S2TYPE	Alarm 2, Setpoint 2 Type
ACTION	Control Output Direction
ADAPTIVE	Adaptive Tune
AL HYST	Alarm Hysteresis
AT ERROR	Adaptive Tune Error codes
AUTO	Lower display automatically displays setpoint value in engineering units
AUTO MAN	Manual/Auto Key Lockout
AUX OUT	Auxiliary Output Representation
BAUD	Baud Rate
BIAS IN1	Input 1 Bias
CAL MTR	suggests that the controller be calibrated
CAL TEST	Calibration test failure
Com ADDR	Communications Station Address
ComSTATE	Communications Option State
CONF ERR	configuration error
CONFTEST	Configuration test failure
CONT ALG	Control Algorithm
CSP	Computer Setpoint Override
CYC SEC	Cycle Time
CYC2 SEC	Cycle Time 2 (Cool)

DEADBAND ..... Output Relay Deadband
DEV ..... Deviation
DIG 1 COM ..... Digital Input 1 Combinations
DIG 2 COM ..... Digital Input 2 Combinations
DIG IN 1 ..... Digital Input 1 selections
DIG IN 2 ..... Digital Input 2 selections
DROPOFF ..... Controller Dropoff Value
DUPLEX ..... Duplex Operation
E E FAIL ..... Unable to write to non-volatile memory
EMSSIV ..... Emissivity
END SEG ..... End Segment Number
EU/HR DN ..... Rate Down Value
EU/HR UP ..... Rate Up Value
FACT CRC ..... Factory Calibration Cyclic Redundancy test
FAILSAFE ..... Controller in Failsafe
FAILSAFE ..... Failsafe Output Value
FILTER 1 ..... Input 1 Filter
FILTER2 ..... Input 2 Filter
FINAL SP ..... Single Setpoint Final Setpoint
GAIN ..... Gain
GAIN2 ..... Gain 2
IN1 HI ..... Input 1 High Range Value
IN1 LO ..... Input 1 Low Range Value
IN1 TYPE ..... Input 1 Actuation Type
IN2HI ..... Input 2 High Range Value
IN2LO ..... Input 2 Low Range Value
INP1 RNG ..... Input 1 Out of Range
INP1FAIL ..... Two consecutive failures of Input 1 integration
INP2 RNG ..... Input 2 Out of Range
INP2FAIL ..... Two consecutive failures of Input 2 integration
KPG ..... Process Gain
LOCKOUT ..... Configuration Lockout
LOOPBACK ..... Local Loop Back
MAN ..... Lower display automatically indicates output in %.
MAN RSET ..... Manual Reset
MINorRPM ..... Reset Units
OUT ALG ..... Output Algorithm
OUT HYST ..... Output Relay Hysteresis
OUT ..... Output Value
OUT RATE ..... Output Change Rate
OUTHILIM ..... High Output Limit
OUT ..... Low Output Limit
PARITY ..... Parity
PBorGAIN ..... Proportional Band or Gain Units
PCT/MIN ..... Output Rate
PCT/MIN ..... Output Rate
PID SETS ..... Tuning Parameter Sets
PIDSETX ..... Tuning Parameter Set
POS ..... Motor Position
PROG END ..... Program Termination State
PROP BD ..... Proportional Band
PROP BD2 ..... Proportional Band 2
PV LIMIT ..... PV Out of Range
PWR FREQ ..... Power Line Frequency

RAM TEST ..... RAM test failed
RAMPUNIT ..... Engineering units for ramp segments
RAMPXXOM ..... Minutes remaining in Setpoint Ramp
RATE MIN ..... Rate in Minutes
RATE2MIN ..... Rate 2 in Minutes
RECYCLES ..... Number of Program Recycles
RLY TYPE ..... Output Relay Type
RSET MIN ..... Reset in minutes/repeat
RSET RPM ..... Reset in repeats/minute
RSET2MIN ..... Reset 2 in minutes/repeat
RSET2RPM ..... Reset 2 in repeats/minute
RSP ..... Remote Setpoint
RSP SRC ..... Remote Setpoint Source
RUN HOLD ..... Run/Hold key
RV LIMIT ..... Remote Variable Out of Range
SECURITY ..... Security Code
SEG 1 rate ..... Segment #1 Ramp Rate
SEG1 ramp ..... Segment #1 Ramp Time
SHED SP ..... Shed Setpoint Recall
SHEDMODE ..... Shed Controller Mode and Output Level
SHEDTIME ..... Shed Time
SOAK DEV ..... Guaranteed Soak Deviation Value
SP CHANG ..... Setpoint Change
SP HILIM ..... Setpoint High Limit
SP ..... Local Setpoint 1
SP LOLIM ..... Setpoint Low Limit
SP PROG ..... Setpoint Programming
SP PROG ..... Setpoint Ramp/Soak Programming
SP RAMP ..... Setpoint Ramp selection
SP RAMP ..... Single Setpoint Ramp
SP RATE ..... Setpoint Rate
SP SEL ..... Setpoint Select
SP SOURC ..... Local Setpoint Source
SP TRACK ..... Local Setpoint Tracking
SPn ..... Setpoint Now
STATE ..... Program state at program end
STRT SEG ..... Start Segment Number
SW FAIL ..... Auto Cal never performed.
SW FAIL ..... Position Proportional slidewire input failure
SW VALUE ..... Automatic Switchover Value
TIME MIN ..... Single Setpoint Ramp Time
UNITS ..... Communication Units
XMITTER ..... Transmitter Characterization
XMITTER2 ..... Transmitter Characterization Input 2

References

Publication Title	Publication Number
UDC3000 Limit Controller	51-52-25-09
UDC3000/UDC5000/UDC6000 RS422/485 Communications Option Manual	51-51-25-35
UDC3000 DMCS Communications Option Section of the Gateway Manual	82-50-10-23

Section 1 – Overview

1.1 Introduction

Function

The UDC3000 Universal Digital Controller is a microprocessor-based stand alone controller. It combines the highest degree of functionality and operating simplicity offered in a 1/4 DIN size controller.
With a typical accuracy of ±0.20% of span, the UDC3000 is an ideal controller for regulating temperature and other process variables in numerous heating and cooling applications, in metal working, food, and pharmaceuticals, and testing and environmental work.

Easy to read displays

The dedicated vacuum fluorescent displays with English prompts make the operator interface easy to read, understand and operate.
Programmed sequences of displays assure quick and accurate entry of all configurable parameters.

Easy to operate

Simple keystrokes let you select input and range configuration, set the operating parameters that meet your process control needs now, and change them later to meet new ones.
The tactile keyboard provides positive operator feedback. Self diagnostics, fault tolerant design and keyboard security provide maximum assurance of trouble-free operation.

Mount anywhere

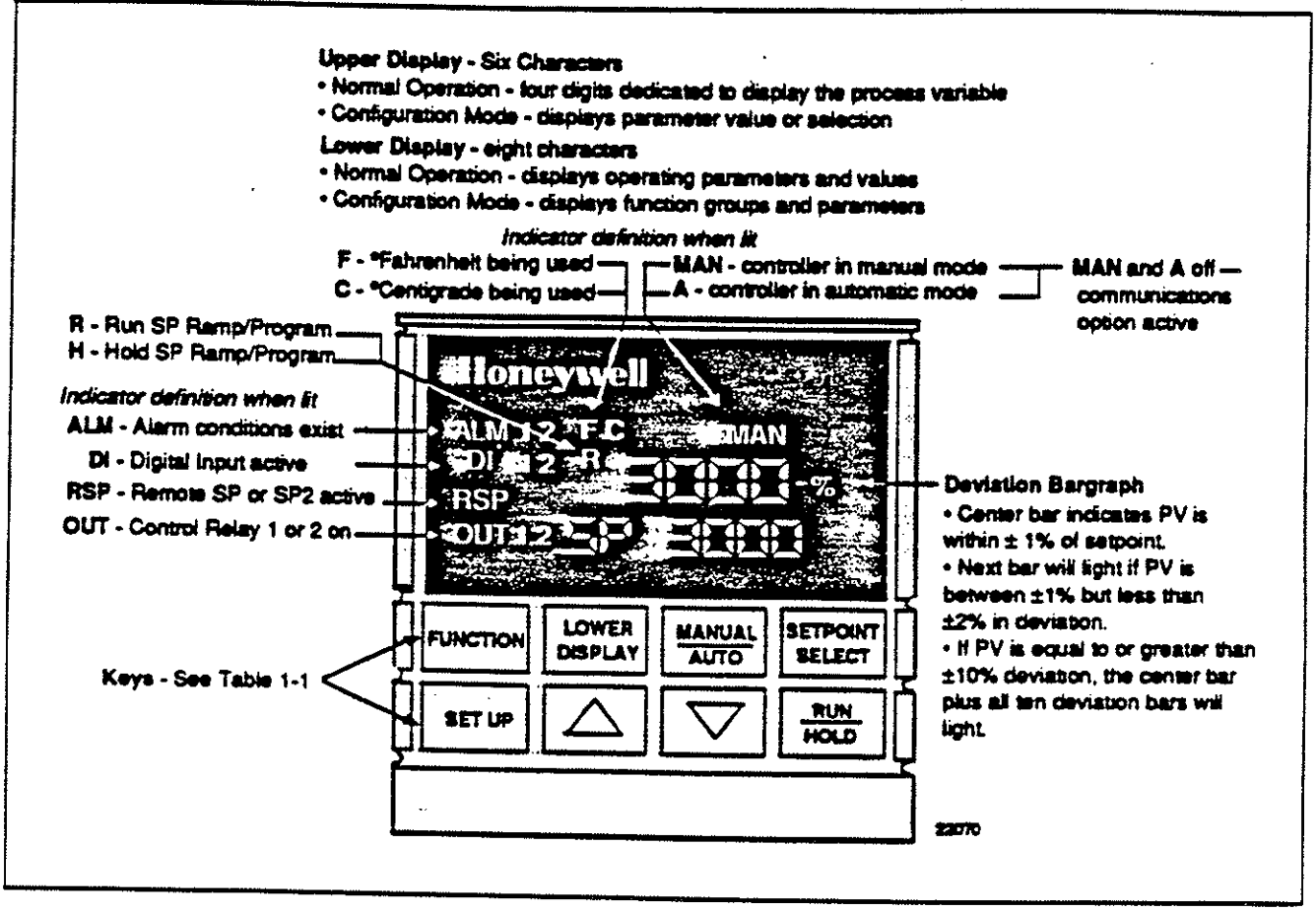
The UDC is environmentally hardened and can be mounted virtually anywhere in plant or factory; on the wall, in a panel, or even on the process machine. It withstands ambient temperatures up to 55°C and resists the effects of vibration and mechanical shock.

1.2 Operator Interface

Displays and Indicators

Figure 1-1 shows the operator interface and defines the displays and indicators. The function of the keys is shown in Table 1-1.

Figure 1-1 Operator Interface Displays and Indicators



Continued on next page

Function of keys

Table 1-1 shows each key on the operator interface and defines its function.

Table 1-1 Function of Keys

Key	Function
SET UP	• Places the controller in the Configuration Set Up group select mode. Sequentially displays Set Up groups and allows the FUNCTION key to display individual functions in each Set Up group.
FUNCTION	• Used in conjunction with the SET UP key to select the individual functions of a selected Configuration Set Up group. • Used during field calibration procedure.
LOWER DISPLAY	• Selects an operating parameter to be shown in the lower display: SP = Local Setpoint 1 2SP = Local Setpoint 2 RSP = Remote Setpoint 2IN = Input 2 DEV = Deviation RAMPXXOM = Minutes remaining in Setpoint Ramp PIDSETX = Tuning Parameter Set X=1 or 2 OUT = Output Value* CSP = Computer Setpoint Override SPn = Setpoint Now (for setpoint rate) POS = 3 Position Step motor position when slidewire is connected * or estimated 3 Position Step motor position when no slidewire exists.
MANUAL AUTO	• Alternately selects: AUTO Lower display automatically displays setpoint value in engineering units. MAN Lower display automatically indicates output in %.
SETPOINT SELECT	• Alternately selects Local Setpoint 1 and Remote Setpoint or between the two local setpoints.
RUN HOLD	• Alternate action switch initiates or holds the Setpoint Ramp or Setpoint Program. • Restores the original value or selection if you do not want to enter a change you are making to a parameter.
▲	• Increases the setpoint, output, or configuration values displayed.
▼	• Decreases the setpoint, output, or configuration values displayed.

Section 2 – Installation

2.1 Overview

Introduction

Installation of the UDC 3000 Controller consists of mounting and wiring the controller according to the instructions given in this section. Read the pre-installation information, check the model number interpretation and become familiar with your model selections, then proceed with installation.

What's in this section?

This section contains the following information:

Topic	See Page
2.1 Overview	5
Pre-installation Information	6
Operating Limits	6
2.2 Model Number Interpretation	7
2.3 Mounting	8
Physical Considerations	8
Overall Dimensions	8
Mounting Procedure	9
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Taking Electrical Noise Precautions	10
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Solid State	17
Open Collector	18
Current Output	19
Position Proportional Output	20
Auxiliary Output	21
Digital Inputs	22
Communications	23
RS422/485	23
DMCS	24
2.6 Control and Alarm Relay Contact Information	25

Continued on next page

Pre-Installation Information

If the controller has not been removed from its shipping carton, inspect the carton for damage and remove the controller. Inspect the unit for any obvious shipping damage and report any damage due to transit to the carrier.
Make sure a bag containing mounting hardware is included in the carton with the controller.
Check that the model number shown on the inside of the case agrees with what you have ordered.

Operating limits

We recommend that you review and adhere to the operating limits listed in Table 2-1 when you install your controller.

Table 2-1 Operating Limits

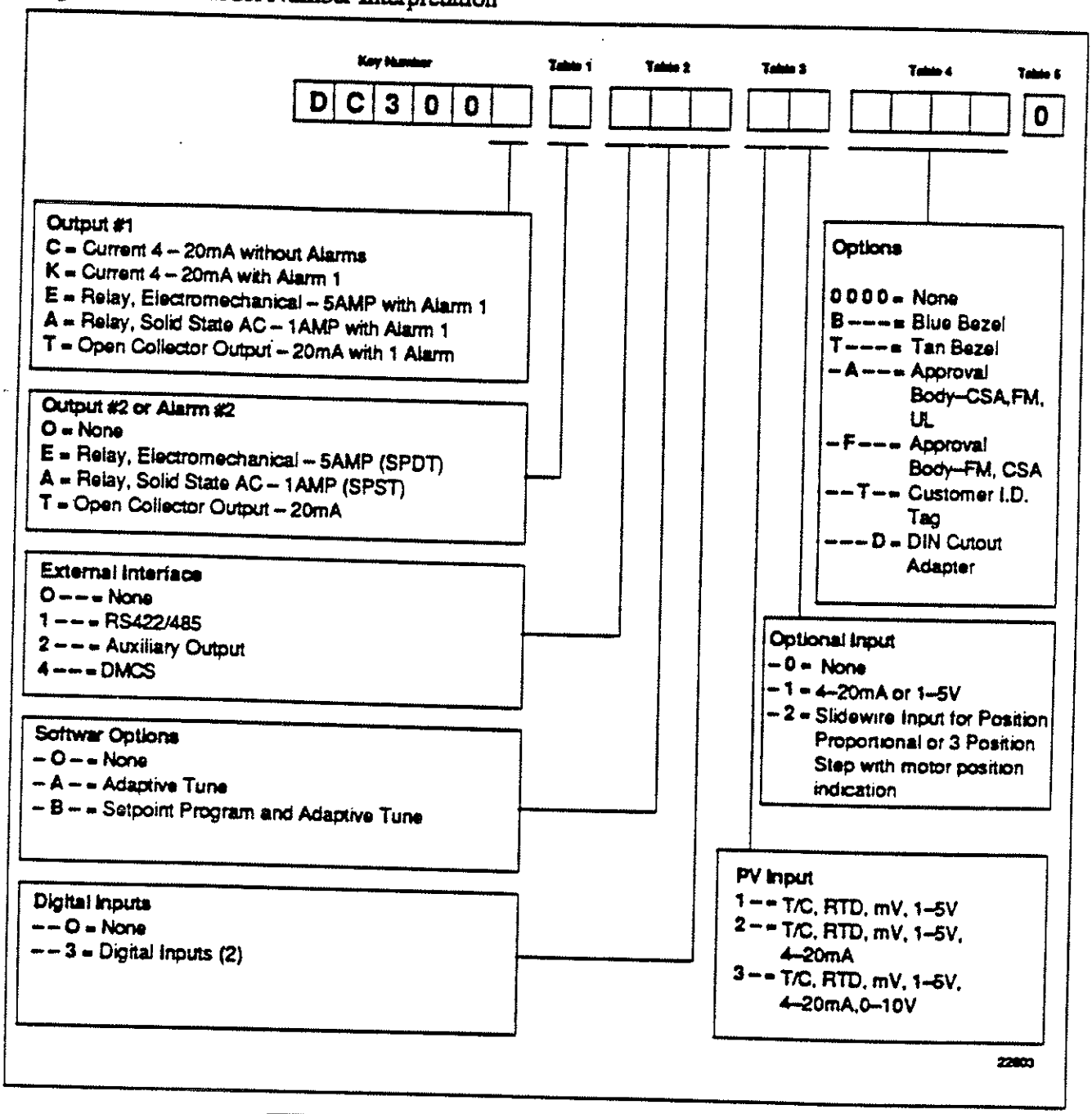
Condition	Specifications
Ambient Temperature	32 to 131°F (0 to 55°C)
Relative Humidity	5 to 90% RH at 40°C (104°F)
Vibration Frequency Acceleration	 0 to 200Hz 0.2g
Mechanical Shock Acceleration Duration	 5g 30ms
Power	90 to 264 Vac 50/60 Hz (CSA models rated to 250V Maximum)
Power Consumption	18VA Maximum

2.2 Model Number Interpretation

Model number

The model number interpretation is shown in Figure 2-1. Write the model number into the spaces provided and compare it to the model number interpretation. This information will also be useful when you wire your controller.

Figure 2-1 Model Number Interpretation



2.3 Mounting

Physical considerations

The controller can be mounted on either a vertical or tilted panel using the mounting kit supplied. Adequate access space must be available at the back of the panel for installation and servicing activities.

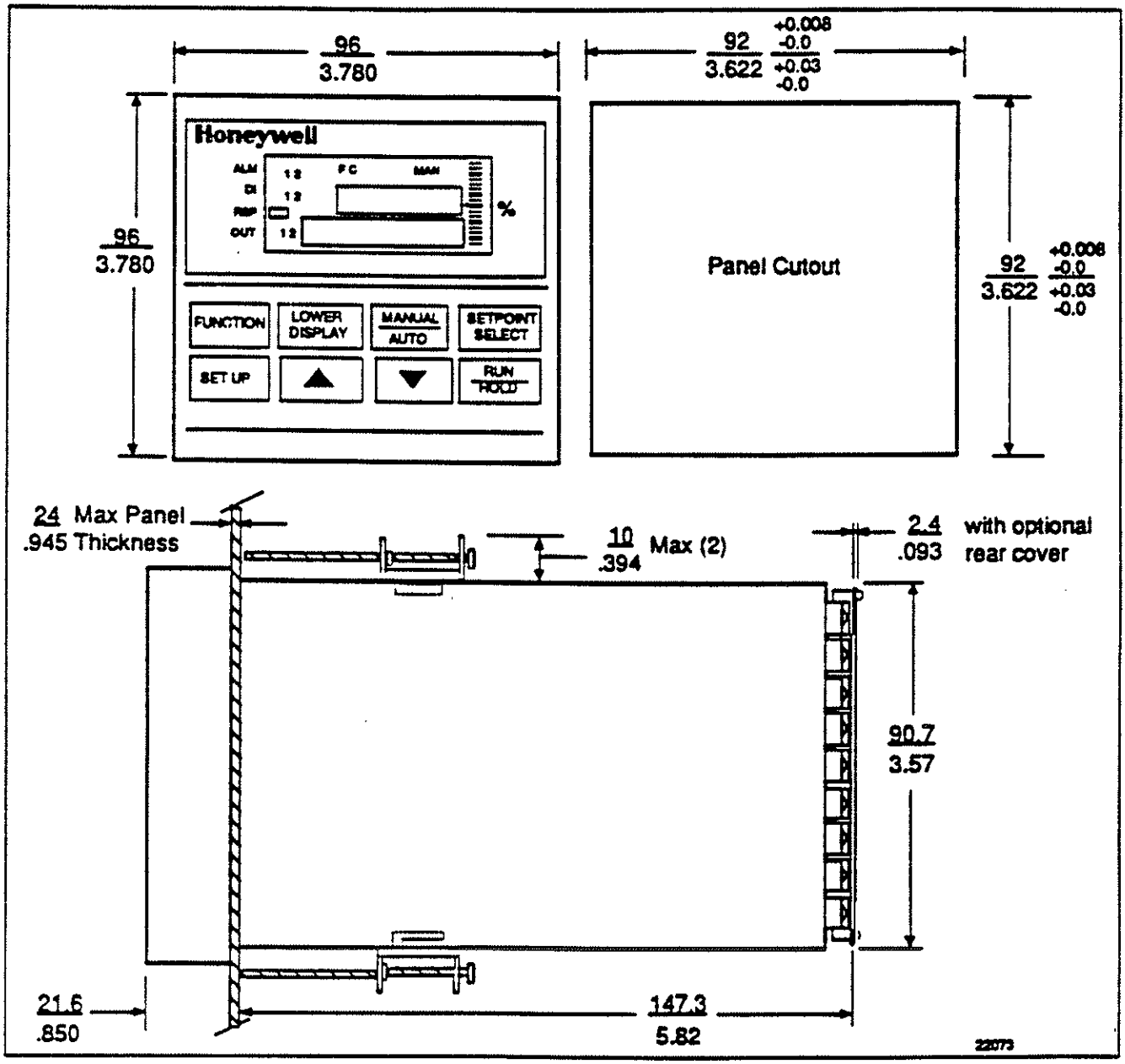
The overall dimensions and panel cutout requirements for mounting the controller are shown in Figure 2-2.

The controller's mounting enclosure must be grounded according to CSA standard C22.2 No. 0.4 or Factory Mutual Class No. 3820 paragraph 6.1.5.

Overall dimensions

Figure 2-2 shows the overall dimensions for mounting the controller.

Figure 2-2 Dimensions



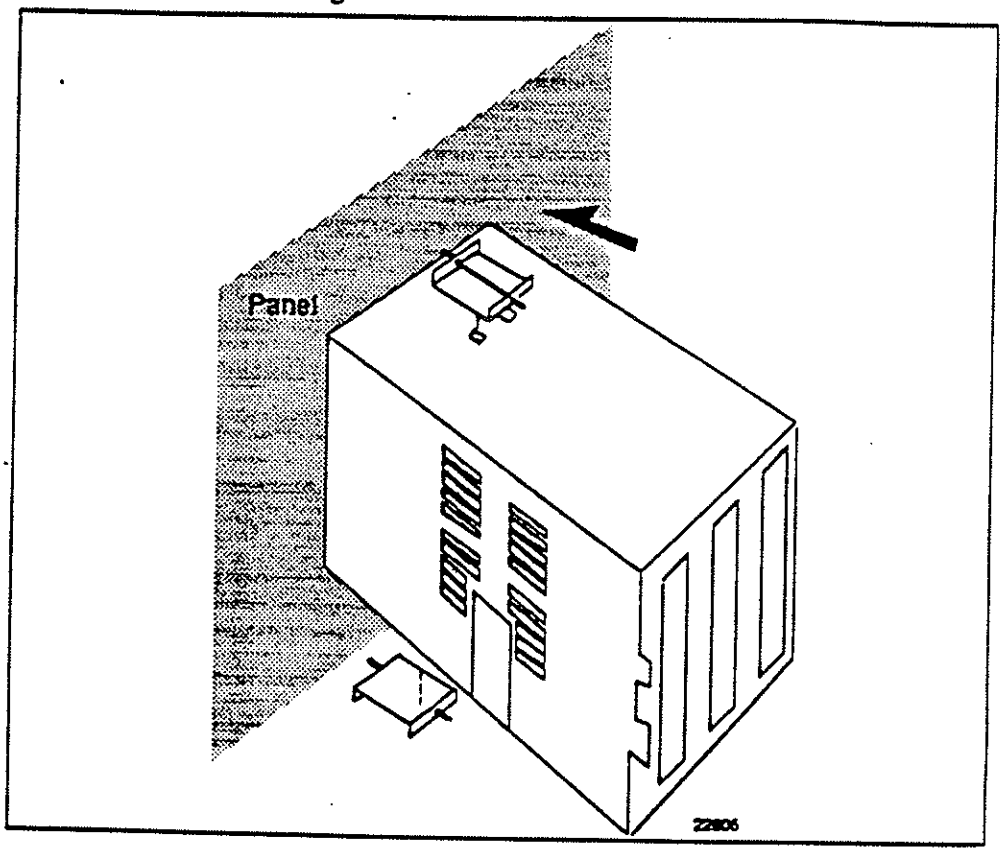
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Mounting method

Before mounting the controller, refer to the nameplate on the inside of the case and make a note of the model number. It will help later when selecting the proper wiring configuration.

Figure 2-3 shows you the mounting method for the UDC3000 controller.

Figure 2-3 Mounting Method



Mounting procedure

Refer to Figure 2-3 and follow the procedure below to mount the controller.

Step	Action
1	Mark and cut out the controller hole in the panel according to the dimension information in Figure 2-2.
2	Remove the screw cover and loosen the screw on the front of the controller. Pull the chassis out of the case.
3	Orient the case properly and slide it through the panel hole from the front.
4	Remove the mounting kit from the shipping container, and install the kit as follows: • Install the screws into the threaded holes of the clips. • Insert the prongs of the clips into the two holes in the top and bottom of the case. • Tighten both screws to secure the case against the panel. • Carefully slide the chassis assembly into the case, press to close and tighten the screw. Replace the screw cover.

Taking electrical noise precautions

Electrical noise is composed of unabated electrical signals which produce undesirable effects in measurements and control circuits.

Digital equipment is especially sensitive to the effects of electrical noise. Your controller has built-in circuits to reduce the effect of electrical noise from various sources. If there is a need to further reduce these effects:

- Separate External Wiring - separate connecting wires into bundles (see Table 2-2) and route the individual bundles through separate conduits or metal trays.
- Use Suppression Devices - for additional noise protection, you may want to add suppression devices at the external source. Appropriate suppression devices are commercially available.

NOTE For additional noise information, refer to *Section 12* .

Permissible wire bundling

Table 2-2 shows which wire functions should be bundled together.

Table 2-2 Permissible Wiring Bundling

Bundle No.	Wire Functions
1	• Line power wiring • Earth ground wiring • Control relay output wiring • Line voltage alarm wiring
2	Analog signal wire, such as: • Input signal wire (thermocouple, 4 to 20 mA, etc.) • 4-20mA output signal wiring • Slidewire feedback circuit wiring • Digital input signals • Communications
3	• Low voltage alarm relay output wiring • Low voltage wiring to solid state type control circuits

Continued on next page

Identify your wiring requirements

To determine the appropriate diagrams for wiring your controller, refer to the model number interpretation in this section. The model number of the controller can be found on the inside of the case.

Wiring the controller

Using the information contained in the model number, select the appropriate wiring diagrams from the figures listed below and wire the controller accordingly.

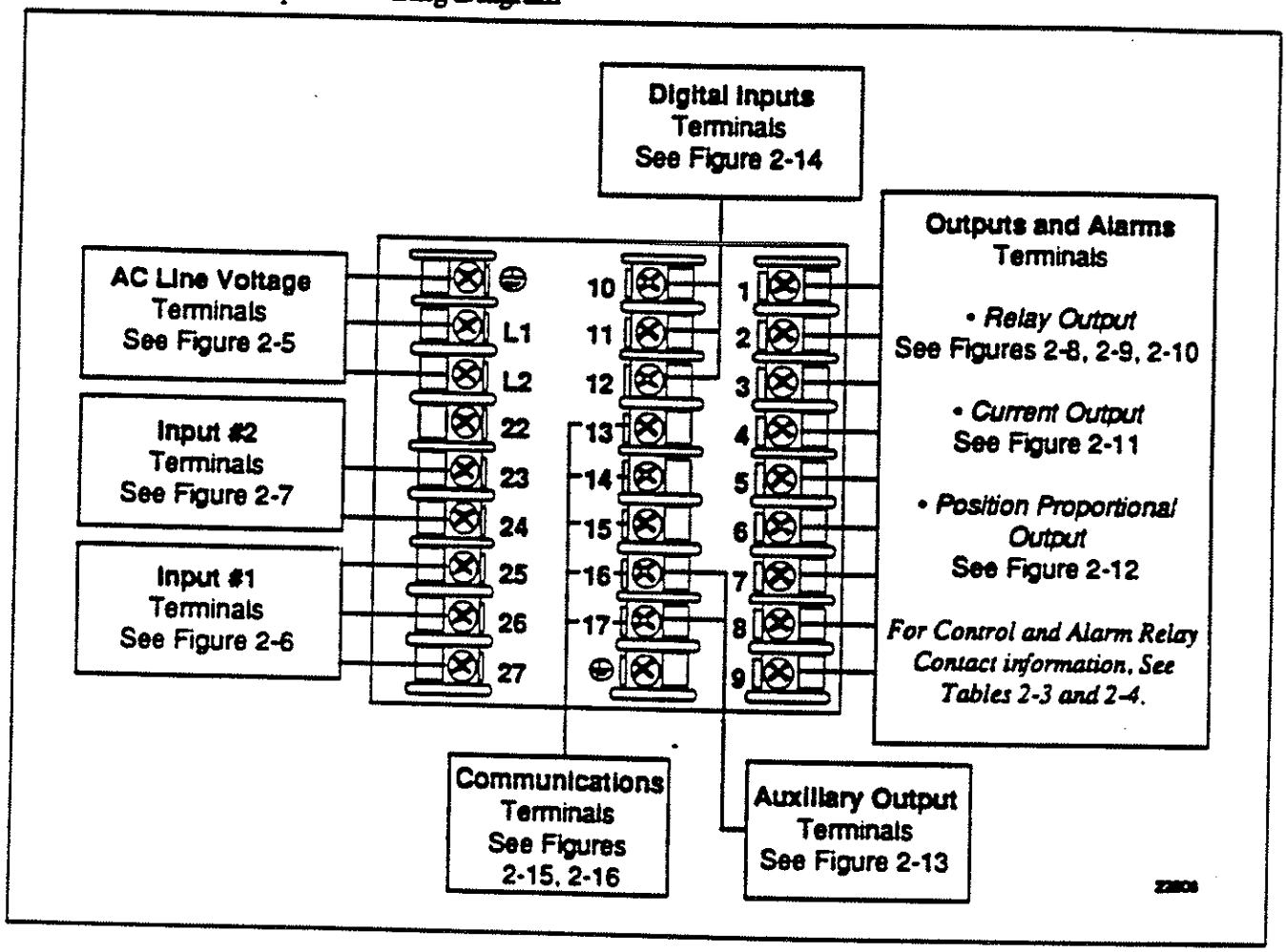
Wiring Requirements	Figure
Composite Wiring Diagram	2-4
Line Power 90–264 Vac	2–5
Input #1 Wiring	2–6
Input #2 Wiring	2–7
Relay Output • Electromechanical Relay Output • Solid State Relay Output • Open Collector Output	 2–8 2–9 2–10
Current Output	2–11
Position Proportional Output	2–12
Auxiliary Output wiring	2–13
Communications Wiring • RS422 • DMCS	 2–14 2–16
Digital Inputs Wiring	2–17

2.5 Wiring Diagrams

Composite wiring diagram

Figure 2-4 is a composite wiring diagram of the UDC3000 controller. It identifies the terminal designations and their functions. Refer to the individual diagrams listed to wire the controller according to your requirements.

Figure 2-4 Composite Wiring Diagram

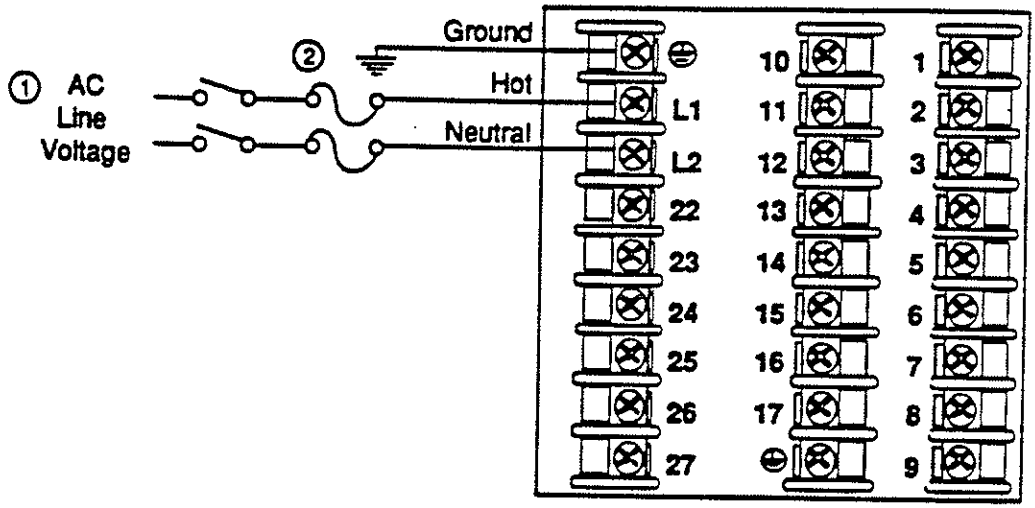


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Line voltage wiring

Figure 2-5 shows the wiring connections for the line voltage.

Figure 2-5 Line Voltage Wiring



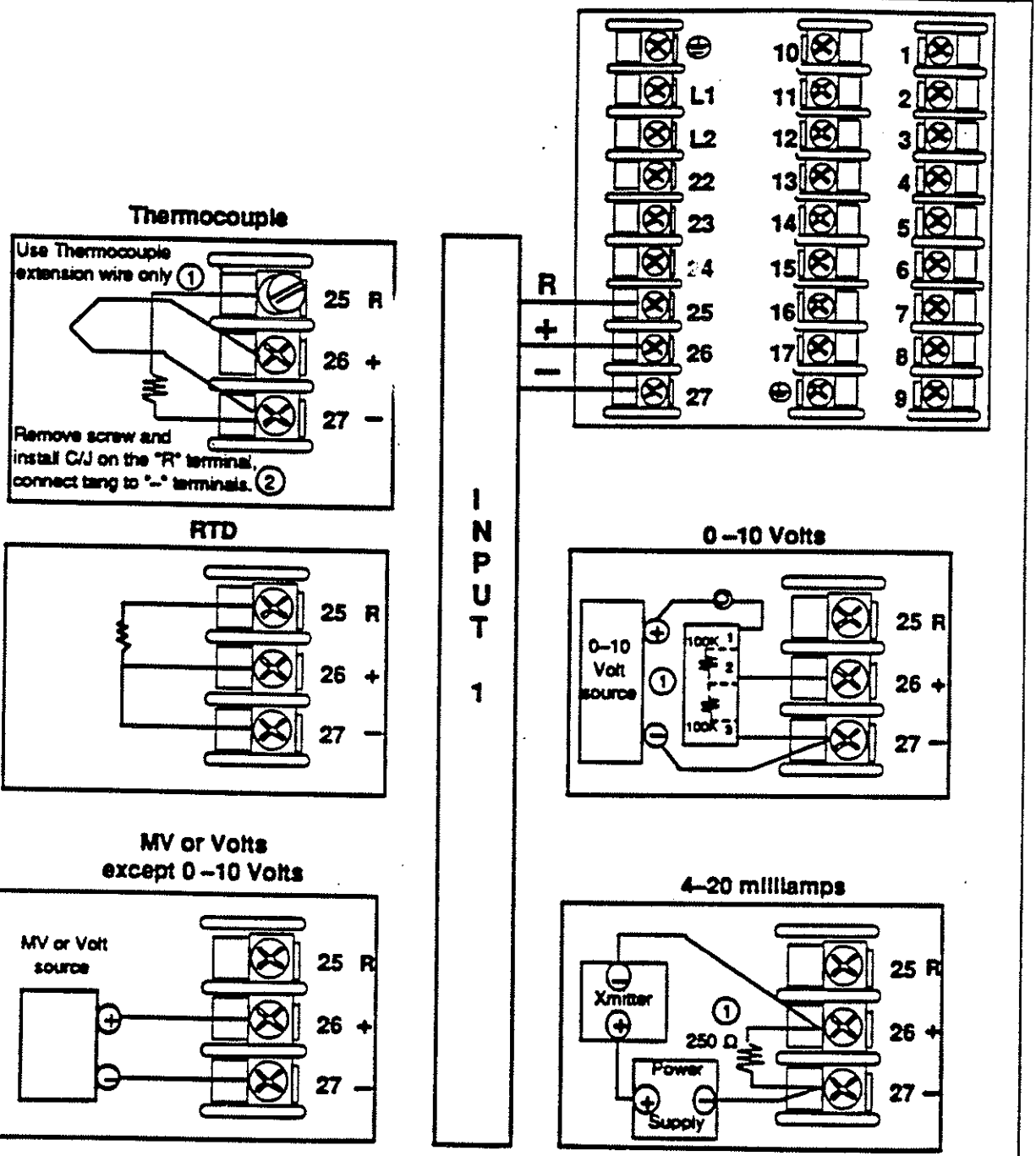
① AC Line Voltage, 90-264 Volts Ground separately and directly to earth. Ground using 12 gauge stranded wire.

② External Slow Blow fuses or circuit breakers must be rated at 1/2 Amp, 250Vac

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Input #1 connections Figure 2-6 shows the wiring connections for Input #1.

Figure 2-6 Input #1 Connections



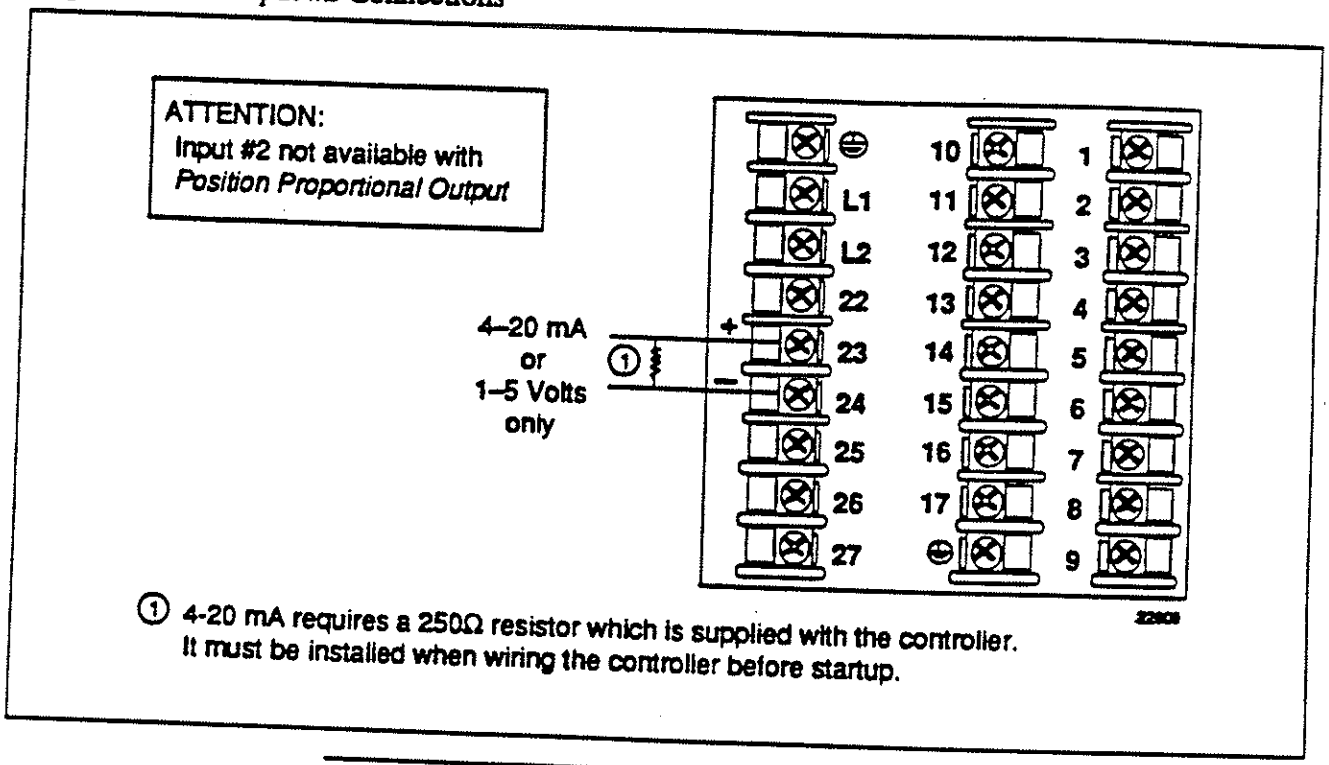
① The 250Ω load resistor for 4-20mA or the Voltage divider for 0–10 Volts or the 500 Ohm C/J compensation resistor are supplied with the controller when the input is specified. These items must be installed when you wire the controller before startup.

② When installing the cold junction (Part number 30757088-001) for a T/C input, remove the screws from terminals 25 and 27, and install the assembly into place.

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Input #2 connections Figure 2-7 shows the wiring connections for Input #2.

Figure 2-7 Input #2 Connections



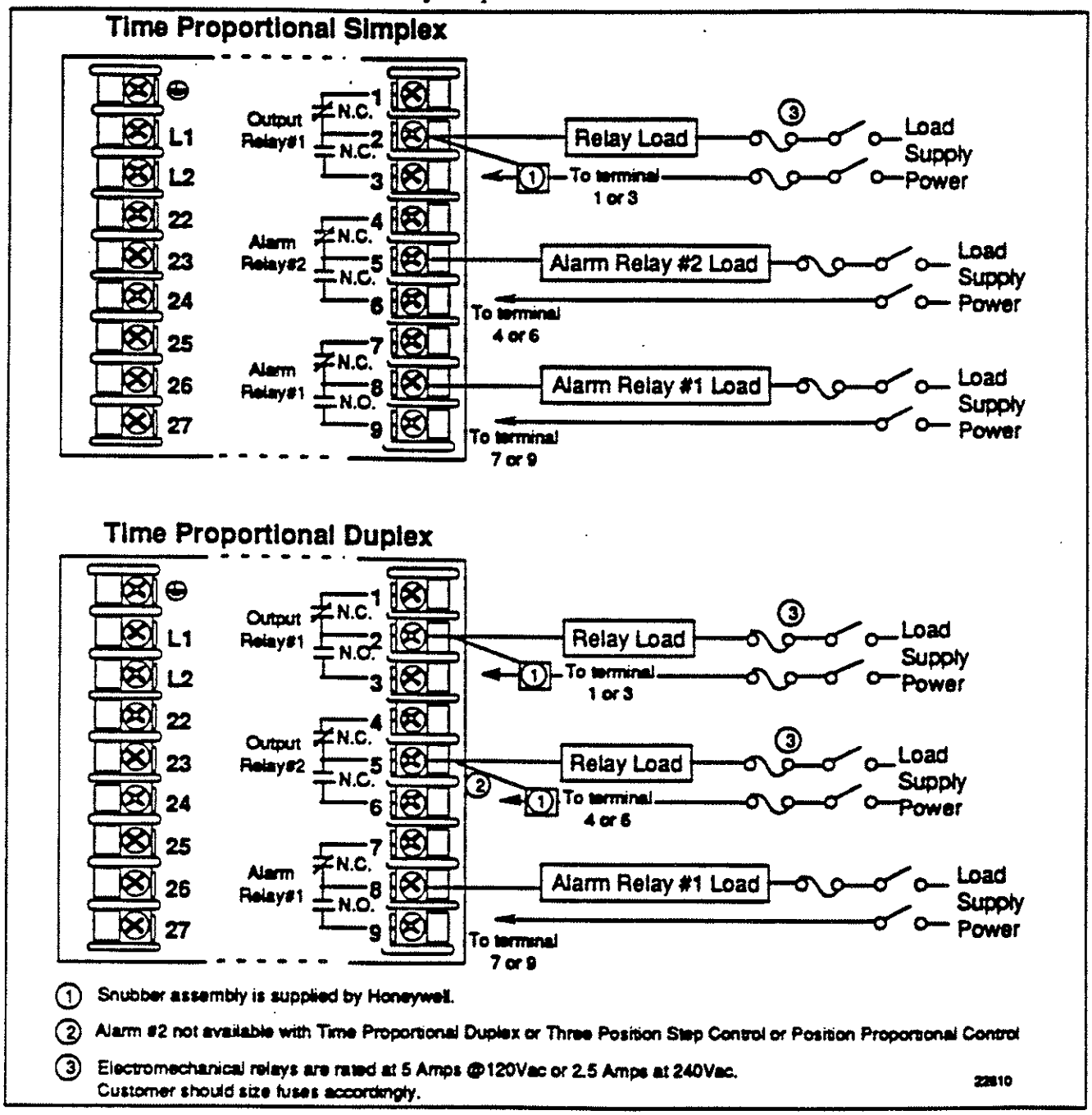
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Relay output

There are three types of relay outputs available on the UDC3000.
- Electromechanical Relay Output – Figure 2-8
- Solid State Relay Output – Figure 2-9
- Open Collector Output – Figure 2-10

The Alarm wiring connections are the same for all three outputs.
For Control and Alarm Relay Contact Information, see Tables 2-3 and 2-4.
Figure 2-8 shows the Output and Alarm wiring connections for models with Electromechanical Relay Output.

Figure 2-8 Electromechanical Relay Output



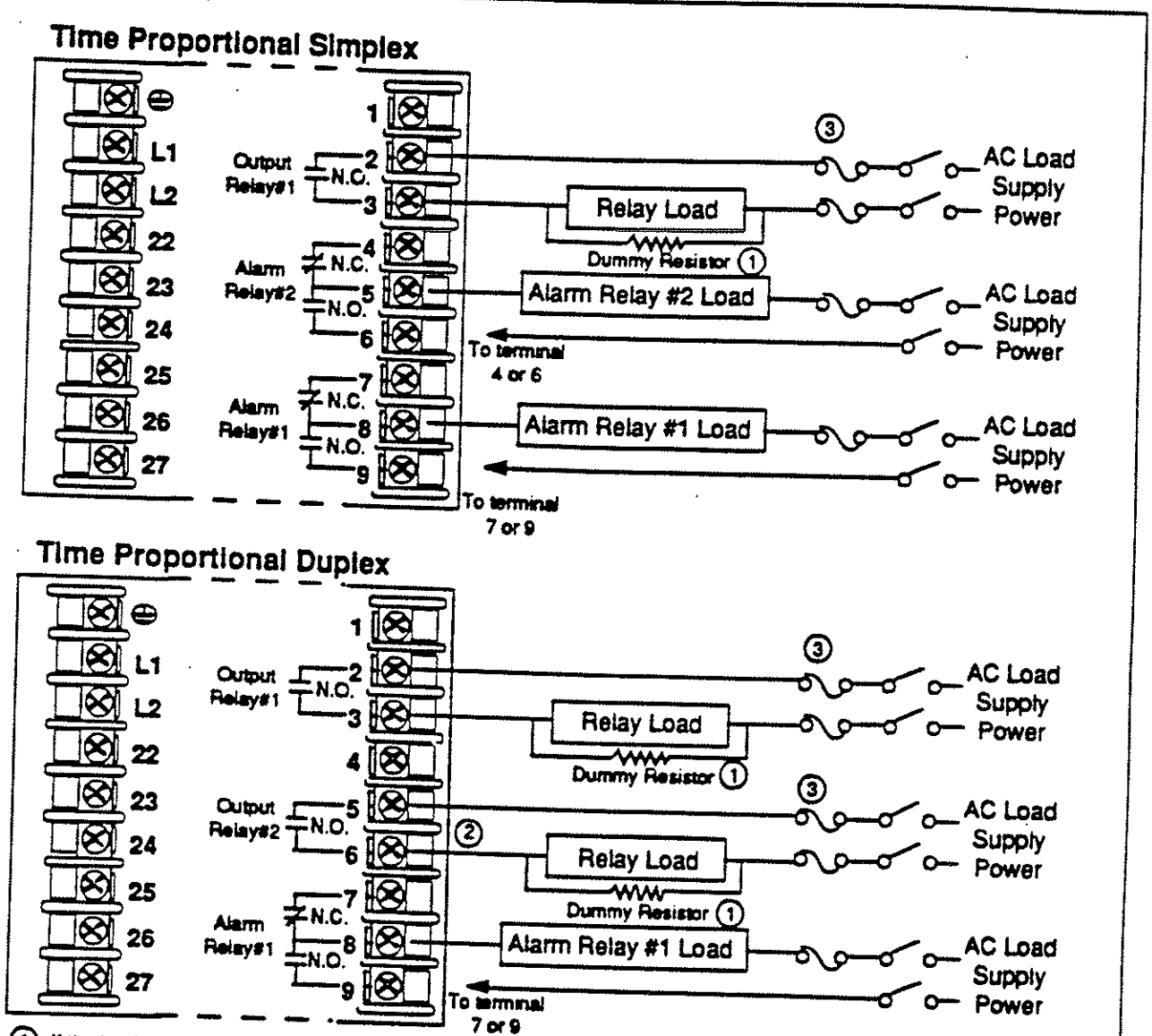
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Relay output (continued)

Figure 2-9 shows the Output and Alarm wiring connections for models with Solid State Relay Output.

For Control and Alarm Relay Contact information, see Tables 2-3 and 2-4.

Figure 2-9 Solid State Relay Output



(1) If the load current is less than the minimum rated value of 20mA, there may be a residual voltage across both ends of the load even if the relay is turned off. Use a dummy resistor as shown to counteract this. The total current through the resistor and the load current must exceed 20mA.

(2) Alarm #2 not available with Time Proportional Duplex or Three Position Step Control or Position Proportional control.

(3) Solid State relays are rated at 0.5 Amps. Customer should size fuses accordingly.

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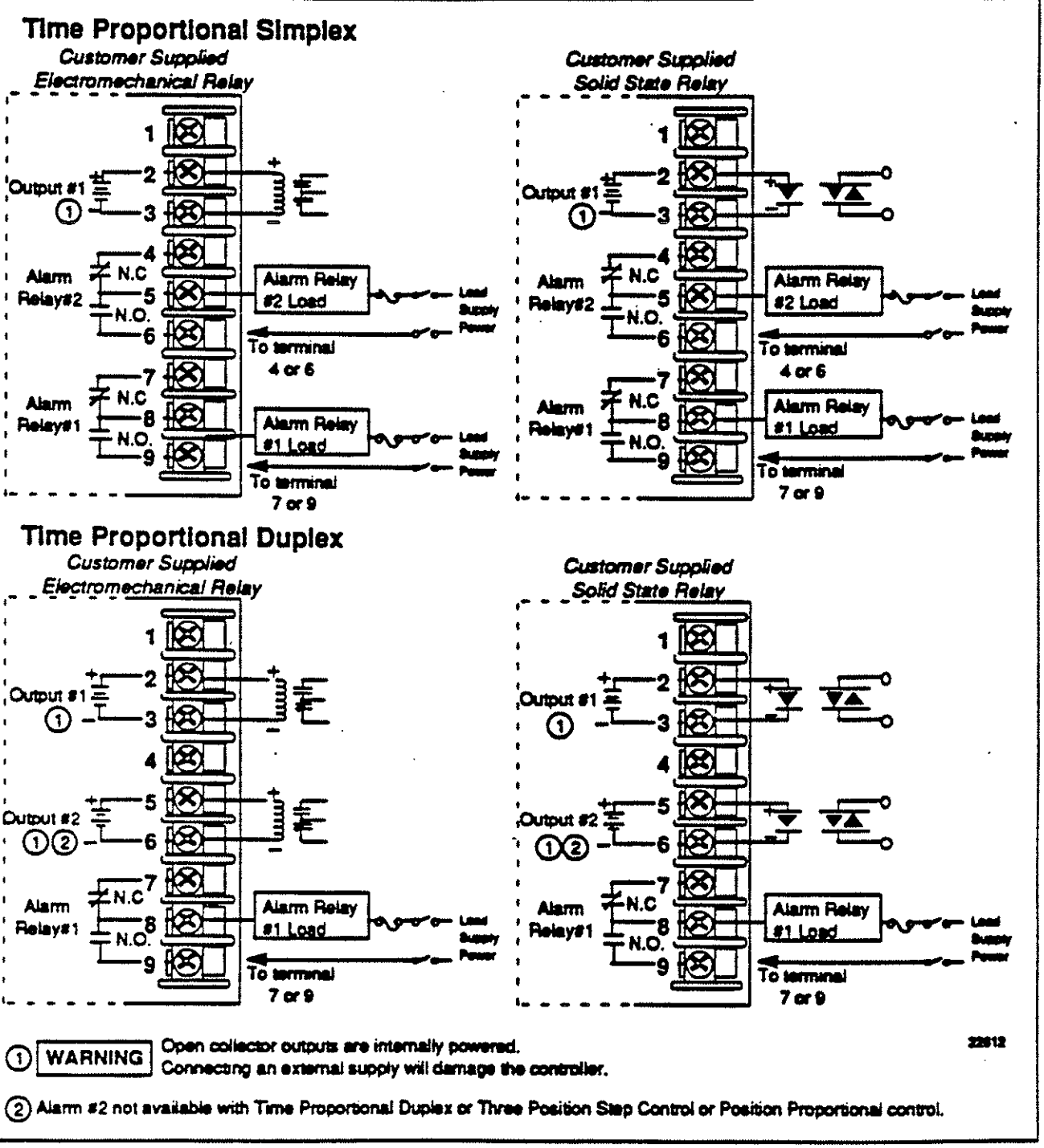
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Relay Output (continued)

Figure 2-10 shows the Output and Alarm wiring connections for models with Open Collector Output.

For Control and Alarm Relay Contact information, see Tables 2-3 and 2-4.

Figure 2-10 Open Collector Output



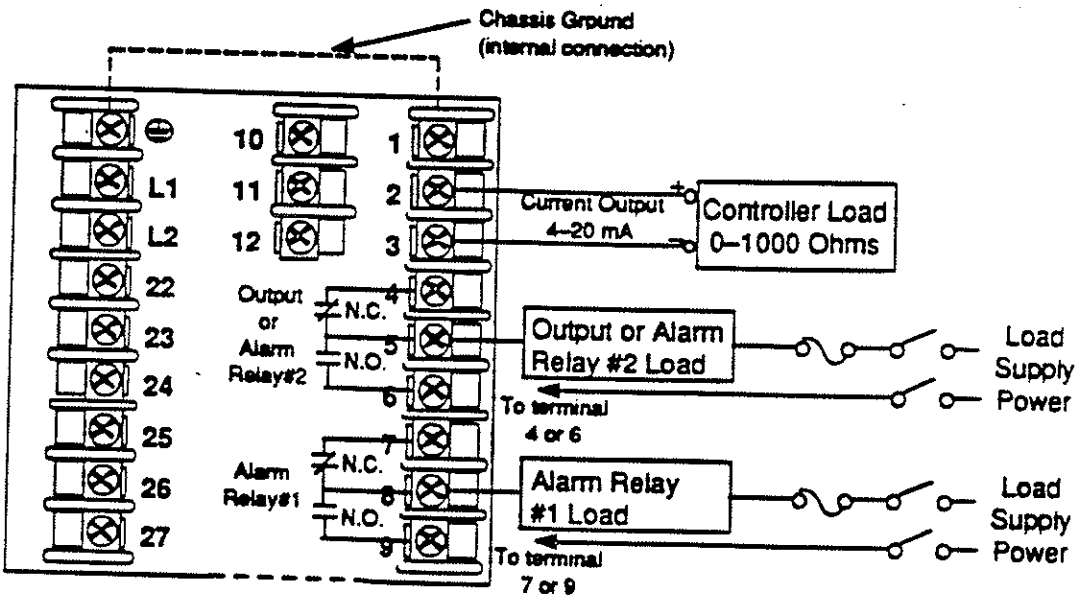
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Current output connections

Figure 2-11 shows the Output and Alarm wiring connections for models with Current Output.

For Control and Alarm Relay Contact information, see Tables 2-3 and 2-4.

Figure 2-11 Current Output, Current /Time Duplex, and Time/Current Duplex



Continued on next page

Position proportional output connections

Figure 2-12 shows the Output and Alarm wiring connections for models with Position Proportional Output.

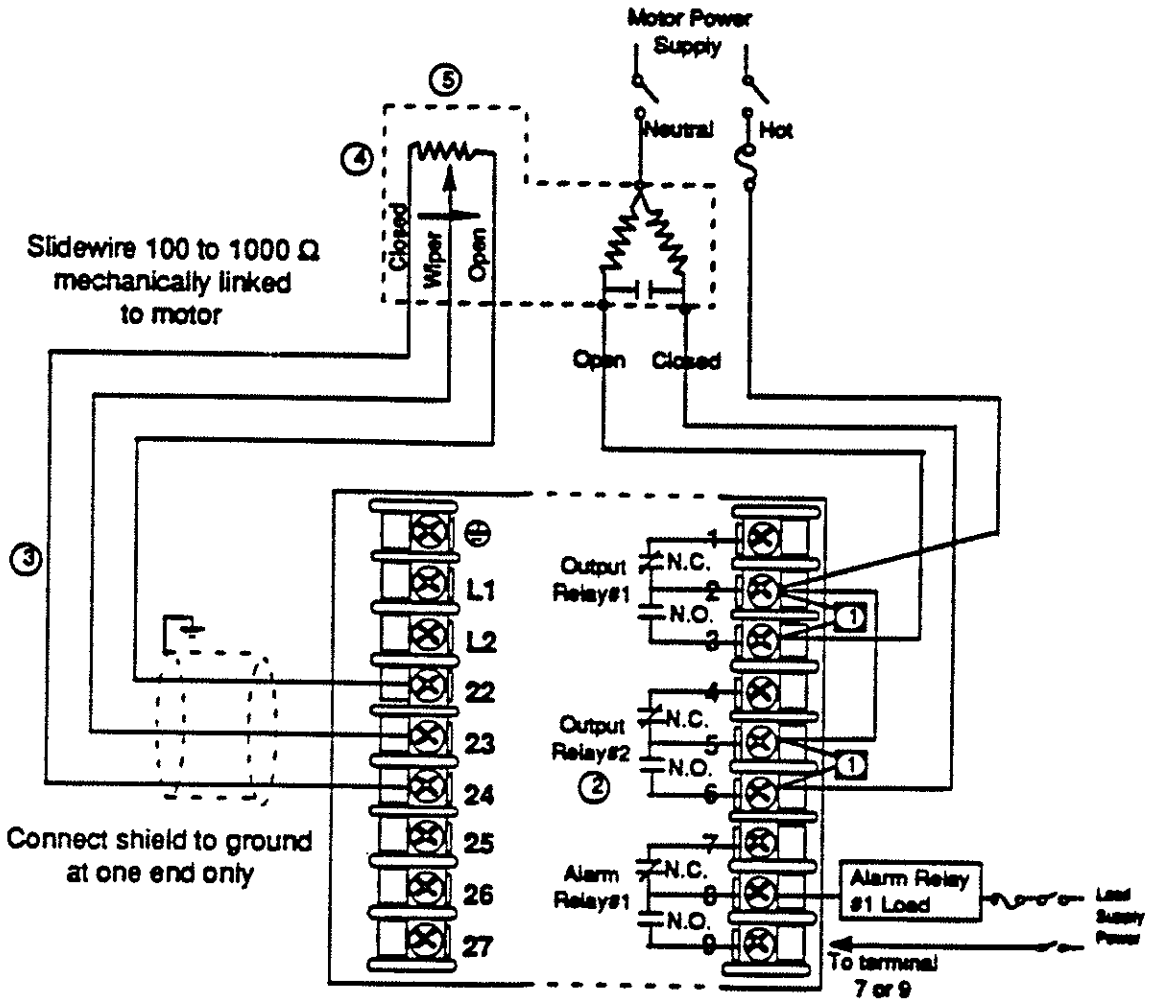
For Control and Alarm Relay Contact information, see Tables 2-3 and 2-4.

Calibration

Position Proportional Output or *Three Position Step* models must have the output calibrated after installation (see *Section 8—Position Proportional Output Calibration*) to ensure that the displayed output (slidewire position) agrees with the actual final control element position.

Three Position Step models only require that the motor time be entered. Full calibration is not required.

Figure 2-12 Position Proportional Output or Three Position Step



① Snubber assemblies supplied by Honeywell for electromechanical relays only.

② Alarm #2 not available with Time Proportional Duplex, Position Proportional output or Three Position Step control

③ Do not run slidewire cable in the same conduit as AC power.

④ Electrical noise suppression may be required. *Refer to Section 12.*

⑤ Slidewire input not required for 3 Position Step control but can be used for motor position indication.

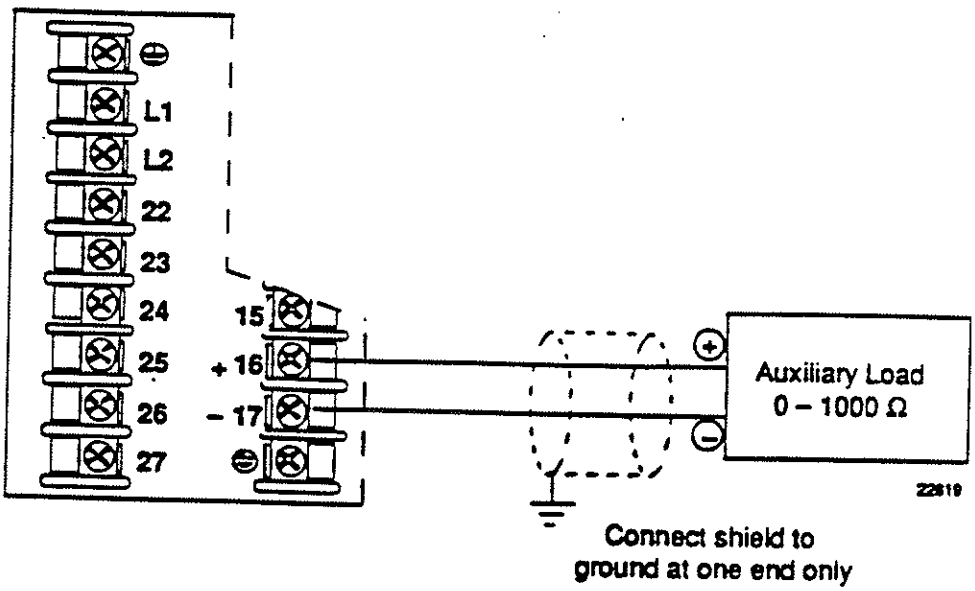
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Auxiliary output connections

Figure 2-13 shows the wiring connections for the Auxiliary Output option.

Figure 2-13 Auxiliary Output Connections

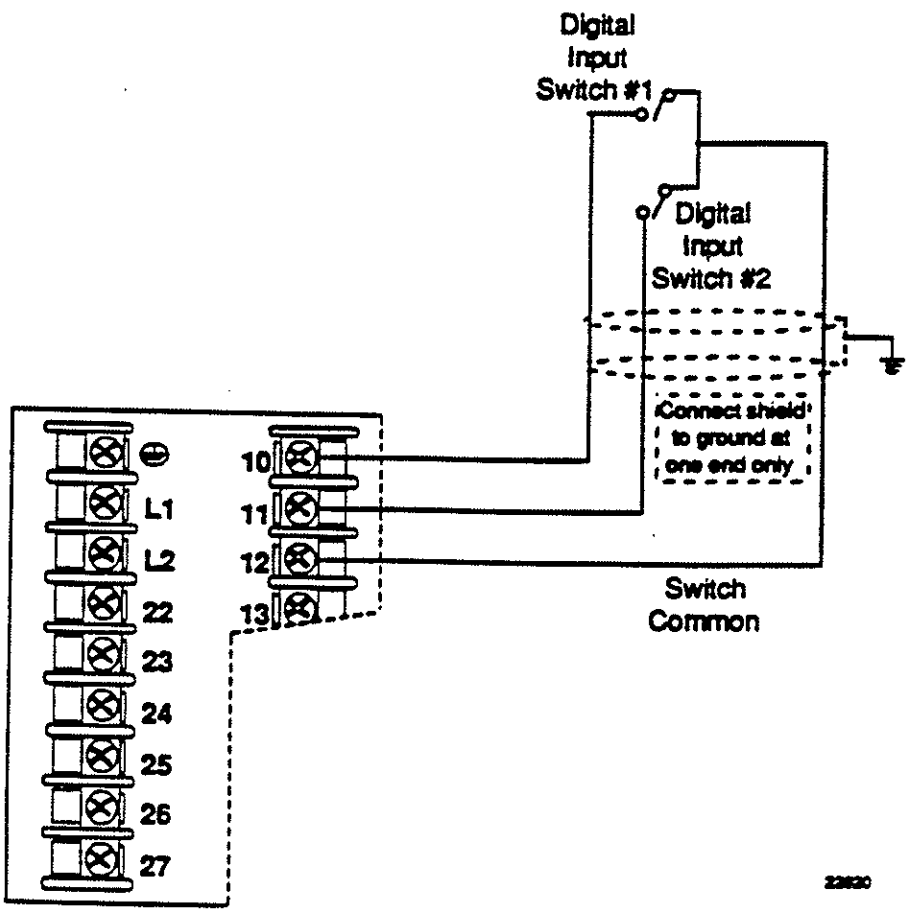


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Digital inputs connections

Figure 2-14 shows the wiring connections for the Digital Inputs option.

Figure 2-14 Digital Inputs Connections

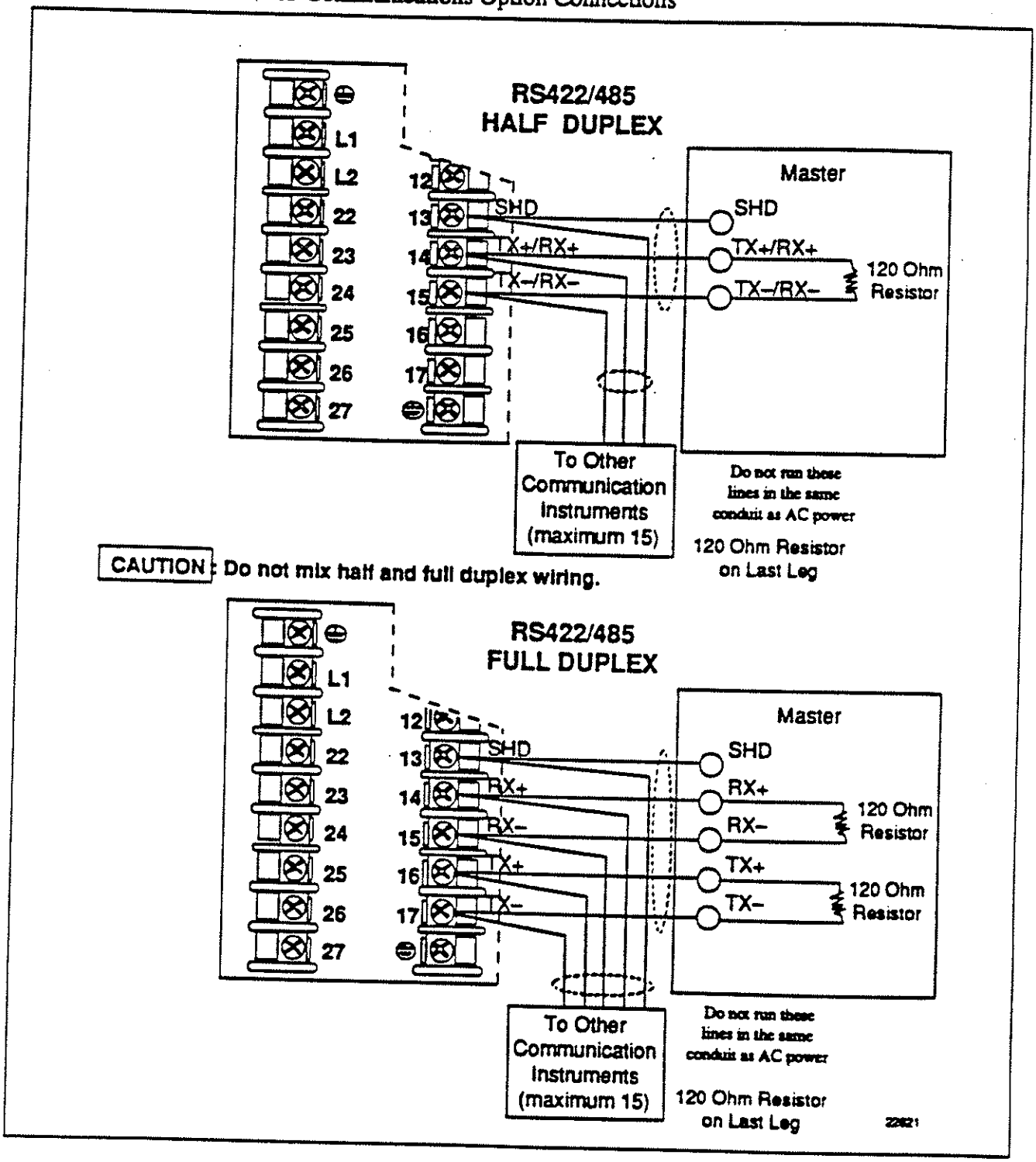


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Communications option connections

There are two types of Communications option available:
- RS422/485 - Figure 2-15 (also refer to Document # 51-51-25-35)
- DMCS - Figure 2-16 (also refer to Document # 82-50-10-23)

Figure 2-15 RS422/485 Communications Option Connections

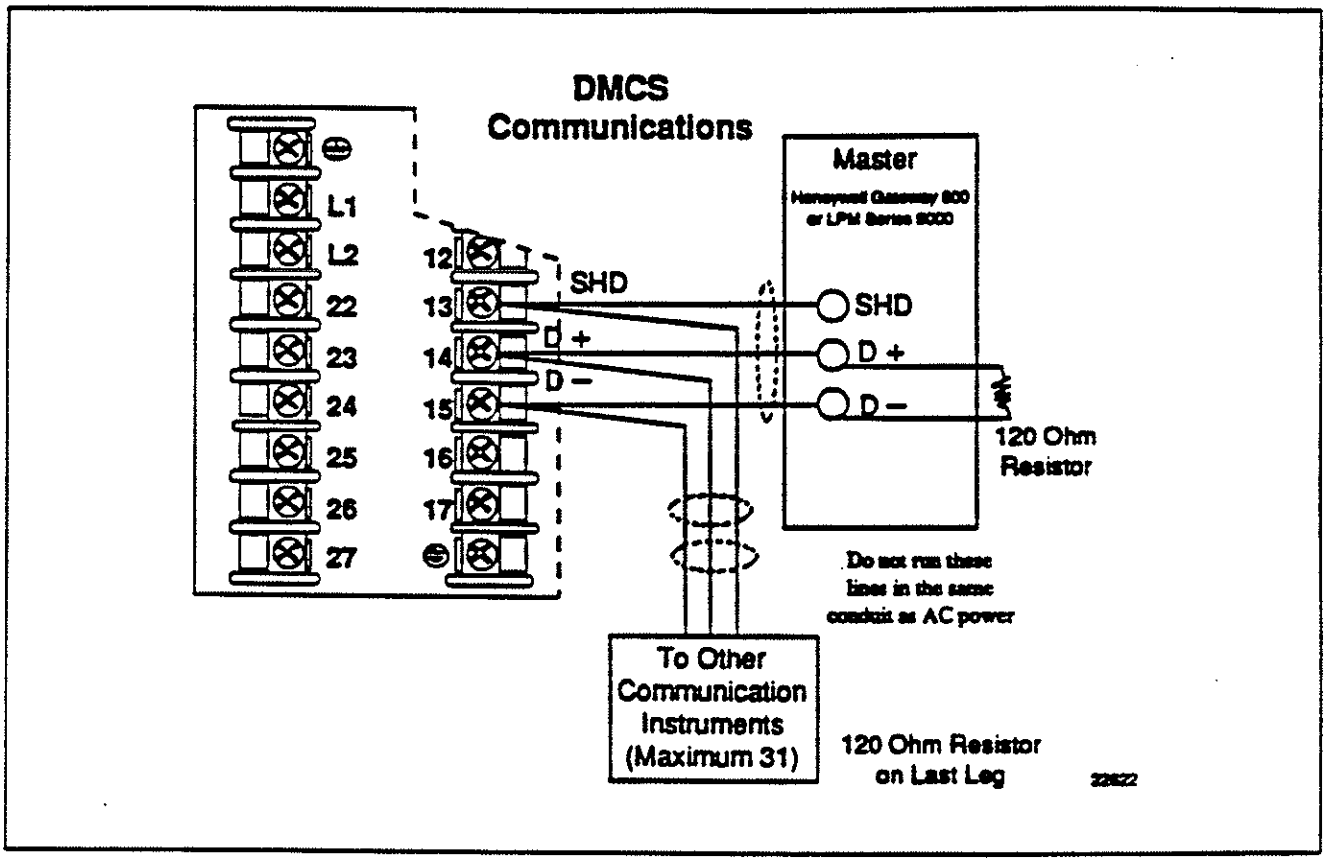


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Communications option connections (continued)

Figure 2-16 shows the wiring connections for the DMCS Communications Option. (also refer to Document # 82-50-10-23)

Figure 2-16 DMCS Communications Option Connections



2.6 Control and Alarm Relay Contact Information

Control Relays

Table 2-3 lists the Control Relay Contact information.

ATTENTION Control relays operate in the standard control mode. i.e. Energized when output state is on.

Table 2-3 Control Relay Contact Information

Unit Power	Control Relay Wiring	Control Relay Contact	#1 or #2 Output Indicator Status
Off	N.O.	Open	Off
	N.C.	Closed	
On	N.O.	Open Closed	Off On
	N.C.	Closed Open	Off On

Alarm Relays

Table 2-4 lists the Alarm Relay Contact information.

ATTENTION Alarm relays are designed to operate in a failsafe mode. i.e. De-energized during alarm state. This results in alarm actuation when power is OFF or when initially applied, until the unit completes self diagnostics. If power is lost to the unit, the alarms will function.

Table 2-4 Alarm Relay Contact Information

Unit Power	Alarm Relay Wiring	Variable NOT in Alarm State		Variable in Alarm State	
		Relay Contact	Indicators	Relay Contact	Indicators
Off	N.O.	Open	Off	Open	Off
	N.C.	Closed		Closed	
On	N.O.	Closed	Off	Open	On
	N.C.	Open		Closed	

Section 3 – Configuration

3.1 Overview

Introduction

Configuration is a dedicated operation where you use straightforward keystroke sequences to select and establish (configure) pertinent control data best suited for your application.

What's in this section?

The table below lists the topics that are covered in this section.

Topic		See Page
3.1	Overview	27
3.2	Configuration Prompts	28 & 29
3.3	How to Get Started	30
3.4	Configuration Tips	31
3.5	Configuration Procedure	32
3.6	Tuning Parameters Setup Group	34
3.7	Setpoint Ramp/Program Setup Group	36
3.8	Adaptive Tune Setup Group	37
3.9	Algorithm Data Setup Group	38
3.10	Input 1 Parameters Setup Group	39
3.11	Input 2 Parameters Setup Group	41
3.12	Control Parameters Setup Group	42
3.13	Options Parameters Setup Group	44
3.14	Communications Parameters Setup Group	45
3.15	Alarms Parameters Setup Group	46
3.16	Calib Group	48
3.17	Status Group	48
3.18	Configuration Record Sheet	49

Prompts

To assist you in the configuration process, there are prompts that appear in the upper and lower displays. These prompts let you know what group of configuration data (Set Up prompts) you are working with and also, the specific parameters (Function prompts) associated with each group.

Figure 3-1 shows you an overview of the prompt hierarchy. As you will see, the configuration data is divided into 10 main Set Up groups plus prompts for calibration and prompts that show the status of the continuous background tests that are being performed.

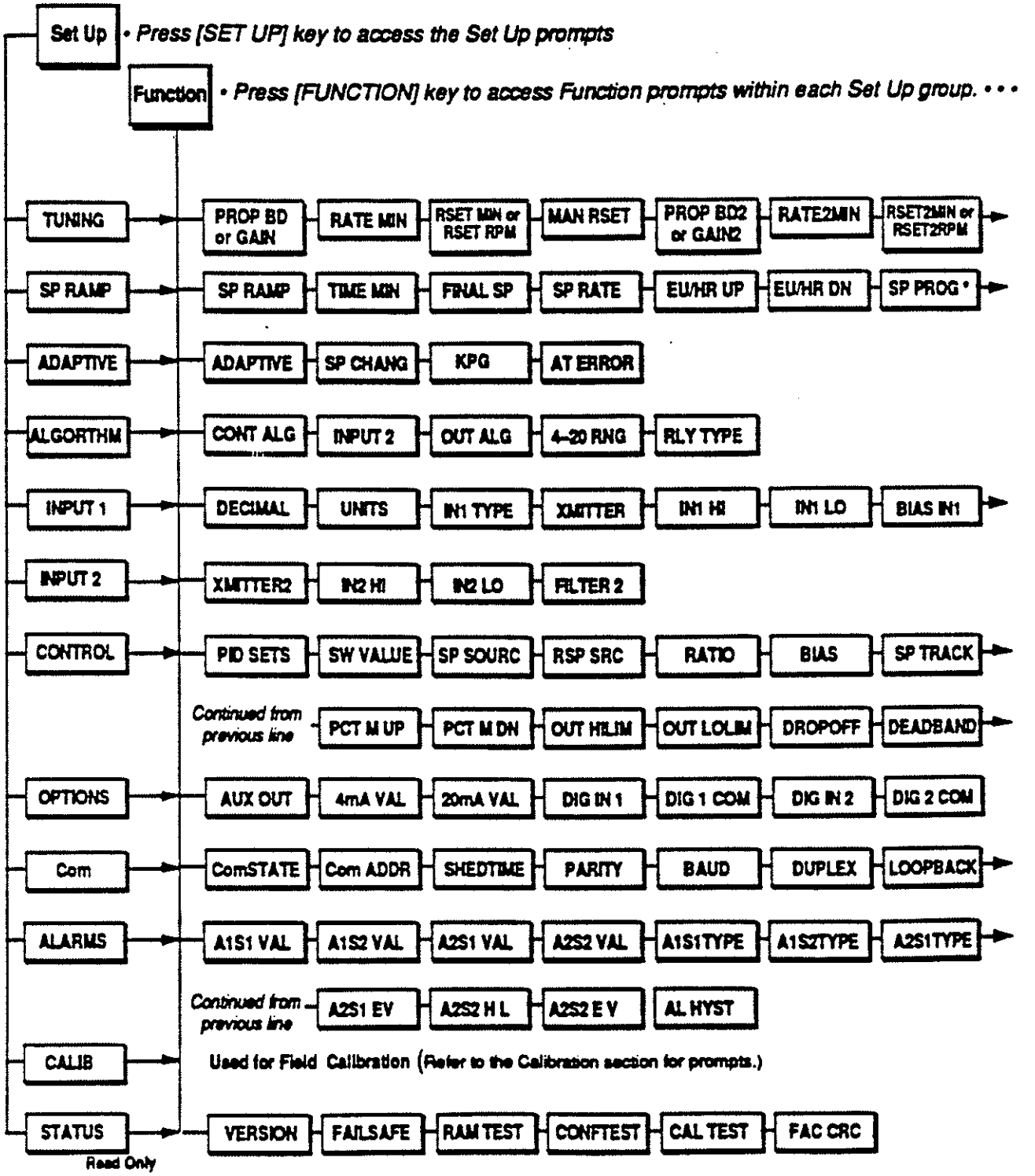
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3.2 Configuration Prompts

Diagram: prompt hierarchy

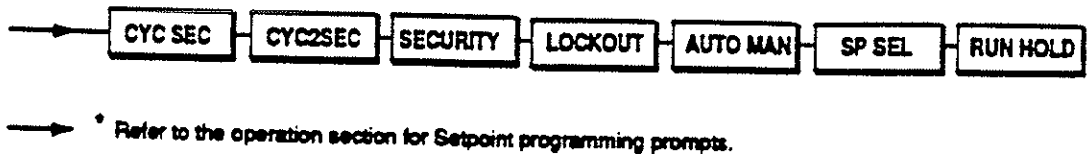
Figure 3-1 shows an overview of the UDC3000 Set Up prompts and their associated Function prompts. - Read from left to right.

Figure 3-1 Overview of UDC3000 Prompt Hierarchy



Continued on next page

• • • Press [▲] or [▼] to change the value or selection of the Function prompt.



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3.3 How To Get Started

Read the configuration tips	Read "*Configuration Tips*" shown on the next page. These tips will help you to easily and quickly accomplish the tasks at which you will be working when you configure your controller.
Read configuration procedure	Read "*Configuration Procedure*". This procedure tells you how to access the Set Up groups, and the Function parameters within each of these groups that are shown in the Prompt Hierarchy in Figure 3-1.
Set Up groups	The Set Up groups and Function parameters are listed in the order of their appearance. The list includes the name of the prompt, the range of setting or selections available, and the factory setting.
Parameter explanations or definitions	If you need a detailed explanation of any prompt listed, refer to *Section 4 – Configuration Parameter Definitions*. This section lists the Set Up and Function prompts, the selections or range of settings that you can make for each, plus a detailed explanation or definition of each parameter
Configuration record sheet	Located on the last page of this section is a "*Configuration Record Sheet*". When you make your configuration selections, record them on this sheet. Then you will have a record of how the controller was configured.

3.4 Configuration Tips

Introduction

Listed below in Table 3-1 are a few tips that will help you enter the configuration data more quickly.

Table 3-1 Configuration Tips

Function	Tip
Displaying Groups	Use the [Set Up] key to display the Set Up groups. The group titles are listed in this section in the order that they appear in the controller.
Displaying Functions	Use the [Function] key to display the individual parameters under each group. The prompts are listed in the order of their appearance in each group.
Scrolling	To get to a Set Up group prompt more quickly, hold the [Set Up] key in. To get to a Function prompt more quickly, hold the [Function] key in. The display will scroll through the parameters. [ATTENTION] The prompting scrolls at a rate of 2/3 seconds when the [Set Up] or [Function] key is held in. Also, [▲] [▼] keys will move group prompts forward or backward at a rate twice as fast.
Changing values quickly	When Changing the value of a parameter, you can adjust a more significant digit in the upper display by holding in one key [▲] or [▼], and pressing the other [▲] or [▼] at the same time. The adjustment will move one digit to the left. Press the key again and you will move one more digit to the left.
Restoring to the original value	When you change the value or selection of a parameter while in Set Up mode and decide not to enter it, press [Run/Hold] once, the original value or selection will be recalled.
Exiting SET UP mode	To exit Set Up mode, press the [Lower Display] key. This returns the display to the same state it was in immediately preceding entry into the Set Up mode.
Timing out from Set Up mode	If you are in Set Up mode and do not press any keys for one minute, the controller will time out and revert to the mode and display that was being used prior to entry into Set Up mode.
Key Error	When a key is pressed and the prompt "KEY ERROR" appears in the lower display, it will be for one of the following reasons: • parameter not available • not in Set Up mode, press [SET UP] key first • key malfunction, do keyboard test (operation) • Individual key locked out

3.5 Configuration Procedure

Introduction

Each of the Set Up groups and their functions are pre-configured at the factory.
The factory settings are shown in the Set Up group tables that follow this procedure.
If you want to change any of these selections or values, follow the procedure in Table 3-2. This procedure tells you the keys to press to get to any Set Up group and any associated Function parameter prompt.
If you need a detailed explanation of any prompt, refer to *Section 4 – Configuration Parameter Definitions.*

Procedure

Follow the procedure listed in Table 3-2 to access the Set Up groups and Function prompts.
ATTENTION The prompting scrolls at a rate of 2/3 seconds when the Set Up or Function key is held in. Also, [▲] [▼] keys will move group prompts forward or backward at a rate twice as fast.

Table 3-2 Configuration Procedure

Step	Operation	Press	Result
1	Select Set Up mode	SET UP	Upper Display: SET UP — Lets you know you are in the configuration mode and a Set Up group title is being displayed in the lower display. Lower Display: TUNING — This is the first Set Up group title.
2	Select any Set Up group	SET UP	Successive presses of the Set Up key will sequentially display the other Set Up group titles shown in the prompt hierarchy in figure 3-1. You can also use the [▲] [▼] keys to scan the Set Up groups in both directions. Stop at the Set Up group title which describes the group of parameters you want to configure. Then proceed to the next step.
3	Select a Function Parameter	FUNCTION	Upper Display: 1.0 — Shows you the current value or selection for the first function prompt of the particular Set Up group that you have selected. Lower Display: GAIN — Shows the first Function prompt within that Set Up group. Example displays show Set Up group "Tuning", Function prompt "Gain" and the value selected.

Continued on next page

Procedure (continued)

Table 3-2 Configuration Procedure, continued

Step	Operation	Press	Result
4	Select other Function Parameters	FUNCTION	Successive presses of the Function Key will sequentially display the other function prompts of the Set Up group you have selected. Stop at the function prompt that you want to change, then proceed to the next step.
5	Change the value or selection	▲ or ▼	These keys will increment or decrement the value or selection that appears for the function prompt you have selected. See "Configuration Tips" for instructions to increase or decrease value quickly. Change the value or selection to meet your needs. If the display flashes, you are trying to make an unacceptable entry.
6	Enter the value or selection	FUNCTION or SET UP	This key selects another function prompt. This key selects another Set Up group. The value or selection you have made will be entered into memory after another key is pressed.
7	Exit Configuration	LOWER DISPLAY	This exits configuration mode and returns the controller to the same state it was in immediately preceding entry into the Set Up mode. It stores any changes you have made.

3.6 Tuning Parameters Set Up Group

Introduction

The Tuning Set Up group contains the Function parameters that will allow your controller to respond correctly to changes in process variable or setpoint.

You can start with predetermined values but you will have to watch your process to determine how to modify them.

If you have the Adaptive Tune option, this will automatically select Gain, Rate, and Reset values.

Set this group last

Because this group contains functions that have to do with Security and Lockout, it is best to configure this group last, after all the other configuration data has been loaded.

Continued on next page

Function prompts

Table 3-3 lists all the function prompts in the Tuning Set Up group. How the "Algorithm" and "Control" Set Up groups are configured determines which prompts will appear.

Table 3-3 Tuning Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
PROP BD or GAIN	Proportional Band, or Gain	0.1 to 9999% 0.1 to 9999	1.0
RATE MIN	Rate in Minutes	0.08 to 10.00 minutes	0.00
RSET MIN	Reset in minutes/repeat	0.00 to 50.00	1.0
RSET RPM	Reset in repeats/minute	0.00 to 50.00	1.0
MAN RSET	Manual Reset	–100 to 100% Output	0.0
PROP BD2 or GAIN 2	Proportional Band 2, or Gain 2	0.1 to 9999% 0.1 to 9999	5.0
RATE2MIN	Rate 2 in Minutes	0.08 to 10.00 minutes	0.00
RSET2MIN	Reset 2 in minutes/repeat	0.00 to 50.00	0.2
RSET2RPM	Reset 2 in repeats/minute	0.00 to 50.00	0.2
CYC SEC	Cycle Time (Heat) Electromechanical Relays	1 to 120 seconds	20.0
CYC2 SEC	Cycle Time 2 (Cool) Electromechanical Relays	1 to 120 seconds	20.0
CYC SX3	Cycle Time(Heat) Solid State Relays	1 to 120 (1/3 second increments) 1 = .33 Sec. 120 = 40 Sec	20.0
CYC2SX3	Cycle Time(Cool) Solid State Relays	1 to 120 (1/3 second increments) 1 = .33 Sec. 120 = 40 Sec	20.0
SECURITY	Security Code	1 to 4095	
LOCKOUT	Configuration Lockout	NONE CALIB +CONF +VIEW MAX	CALIB
AUTO MAN	Manual/Auto Key Lockout	DISABLE ENABLE	ENAB
SP SEL	Setpoint Select Key Lockout	DISABLE ENABLE	ENAB
RUN HOLD	Run/Hold key Lockout	DISABLE ENABLE	ENAB

3.7 SP Ramp/Program Set Up Group

Single Setpoint Ramp

The Setpoint Ramp Set Up group contains the Function parameters that let you to configure a single set point ramp to occur between the current local setpoint and a final setpoint over a time interval (SP RAMP).

Setpoint rate

The Setpoint Ramp Set Up group also contains the function parameters that let you configure a specific rate of change for any Local Setpoint change (SP RATE). It includes selections for Rate Up and Rate Down.

Setpoint Program

Also included under this group are prompts for configuring a Setpoint program (SP PROG). The prompts and instructions for Setpoint programming are in the *Operation* section.

Function prompts

Table 3-4 lists all the function prompts in the SP RAMP Set Up group.

Table 3-4 SP Ramp Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
SP RAMP	Single Setpoint Ramp Selection	DISABLE ENABLE	DISABL
TIME MIN	Single Setpoint Ramp Time	0 to 255 minutes	3
FINAL SP	Single Setpoint Final Setpoint	Enter a value within the setpoint limits	
SP RATE	Setpoint Rate	DISABLE ENABLE	DISABL
EU/HR UP	Rate Up Value (SP Rate Enabled)	0 to 9999 in Units per Hour	
EU/HR DN	Rate Down Value (SP Rate Enabled)	0 to 9999 in Units per Hour	
SP PROG	Setpoint Programming	DISABLE ENABLE	DISABL

3.8 Adaptive Tune Set Up Group

Adaptive Tune

Adaptive Tune continuously adjusts the PID parameters in response to setpoint changes. You can select tuning on minimum setpoint changes of 5% up to 15% span. Perform adaptive tuning after you have configured the controller.
Adaptive Tune does not work with 3 Position Step Control algorithm.

Function prompts

Table 3-5 lists all the function prompts in the "ADAPTIVE" Set Up group.

Table 3-5 Adaptive Tune Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
ADAPTIVE *	Adaptive Tune	DISABLE SPoNLY	Disabl
SP CHANG	Setpoint Change	5 to 15% Input Span	10
KPG	Process Gain	0.01 to 50.00 (Normally Read Only)	1.0
AT ERROR	Adaptive Tune Error codes	Read Only NONE OUT LIM ID FAIL ABORT	

* ADAPTIVE TUNE DOES NOT WORK WITH 3 POSITION STEP CONTROL ALGORITHM

3.9 Algorithm Data Set Up Group

Introduction

This data deals with various algorithms residing in the controller: Control Algorithm and Output algorithms, enabling the Second Input or the Current Duplex range, and selecting the type of relay.

Function prompts

Table 3-6 lists all the function prompts in the "ALGORITHM" Set Up group.

Table 3-6 Algorithm Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
CONT ALG	Control Algorithm	ON-OFF* PID A PID B PD+MR 3PSTEP*	PID A
INPUT 2	Input 2	ENABLE DISABLE	Disabl
OUT ALG**	Output Algorithm	TIME CURRNT POSITN TIME D CUR D CUR TI TI CUR	Depends on model
4–20RNG	Current Duplex Range (CUR D)	100PCT (FULL) 50 PCT (SPLIT)	50PCT
RLY TYPE*	Output Relay Type	MECHAN SOL ST	MECHAN

* For Time Proportional only. Prompt appears only if LOCKOUT=NONE
** Selections are model dependent. For example, current output models cannot be configured for Time Proportioning Simplex Output.

3.10 Input 1 Parameters Set Up Group

Introduction

This data deals with various parameters required to configure Input 1.

Function prompts

Table 3-7 lists all the function prompts in the "INPUT 1" Set Up group.

Table 3-7 Input 1 Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
DECIMAL	Decimal Point Location	XXXX None XXX.X One XX.XX Two	XXXX
UNITS	Temperature Units	DEG F DEG C NONE	NONE
IN1 TYPE	Input 1 Actuation Type	B TC E TC H E TC L J TC H J TC L K TC H K TC L NNM TC H NNM TC L NIC TC R TC S TC T TC H T TC L W TC H W TC L 100 PT 100 LO 500 PT RADIAM 4-20mA 0-10mV 10-50m 1-5 V 0-10V	0-10mV
XMITTER	Transmitter Characterization	B TC E TC H E TC L J TC H J TC L K TC H K TC L NNM TC H NNM TC L NIC TC R TC S TC T TC H T TC L W TC H W TC L 100 PT 100 LO 500 PT RADIAM LINEAR SQROOT	LINEAR
IN1 HI	Input 1 High Range Value (Linear Inputs only	–999.9 to 999. or –999 to 9999 in engineering units	1000
IN1 LO	Input 1 Low Range Value (Linear Inputs only)	–999.9 to 999. or –999 to 9999 in engineering units	0

Continued on next page

Function prompts, continued

Table 3-7 lists all the function prompts in the "INPUT 1" Set Up group.

Table 3-7 Input 1 Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
BIAS IN1	Input 1 Bias	-999.9 to 9999.	0
FILTER 1	Input 1 Filter	0 to 120 seconds	0
BURNOUT	Burnout Protection	NONE UP DOWN	NONE
EMISSIV	Emissivity	0.01 to 1.00	0
PWR FREQ	Power Line Frequency	60 Hz 50 Hz	60 Hz
LANGUAGE	Prompt Language	ENGLIS FRENCH GERMAN SPANIS ITALAN	ENGLIS

3.11 Input 2 Parameters Set Up Group

Introduction

This data deals with various parameters required to configure Input 2. This only appears when input 2 in the "Algorithm" Group is enabled.

Function prompts

Table 3-8 lists all the function prompts in the INPUT 2 Set Up group.

Table 3-8 Input 2 Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
XMITTER2	Transmitter Characterization	B TC E TC H E TC L J TC H J TC L K TC H K TC L NNM TC H NNM TC L NIC TC R TC S TC T TC H T TC L W TC H W TC L 100 PT 100 LO 500 PT RADIAM LINEAR SQROOT	LINEAR
IN2 HI	Input 2 High Range Value	–999.9 to 999. or –999 to 9999 in engineering units (Adjustable for linear inputs only)	1000
IN2 LO	Input 2 Low Range Value	–999.9 to 999. or –999 to 9999 in engineering units (Adjustable for linear inputs only)	0
FILTER 2	Input 2 Filter	0 to 120 seconds 0 = No Filter	0

3.12 Control Parameters Set Up Group

Introduction

This data deals with various parameters required to effectively control your process.

Function prompts

Table 3-9 lists all the function prompts in the "CONTROL" Set Up group.

Table 3-9 Control Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
PID SETS	Tuning Parameter Sets	1 ONLY 2KEYBD 2PV SW 2SP SW	1 ONLY
SW VALUE	Automatic Switchover Value	Value in Engineering Units	0.00
SP SOURC	Local Setpoint Source	1 LOCAL 2 LOCAL	1 LOCAL
RSP SRC	Remote Setpoint Source	NONE IN 2	NONE
RATIO	Ratio	–20.00 to 20.00	1.0
BIAS	Bias	–9999 to 9999 in engineering units	0
SP TRACK	Local Setpoint Tracking	NONE PV RSP	NONE
POWER UP	Power Up Recall	MANUAL A LSP A RSP AM SP AM LSP	MANUAL
PWR OUT	Power Up Output	LAST F'SAFE ATTENTION This prompt will appear only if "3PSTEP" is selected at Set Up group "ALGORITHM", function prompt "CONT ALG".	LAST
SP HILIM	Setpoint High Limit	0 to 100% of span input in engineering units with decimal place.	1000
SP LOLIM	Setpoint Low Limit	0 to 100% of span input in engineering units with decimal place.	1000
ACTION	Control Output Direction	DIRECT REVERSE	REVERSE

Table continued on next page

Function prompts, continued

Table 3-9 lists all the function prompts in the "CONTROL" Set Up group.

Table 3-9 Control Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
OUT RATE	Output Change Rate ATTENTION Does not apply to 3 Position Step Control algorithm.	ENABLE DISABLE	DISABL
PCT/M UP	Output Rate Up Value	0 to 9999% / minute	0
PCT/M DN	Output Rate Down Value	0 to 9999% / minute	0
OUTHILIM	High Output Limit	–5.0 to 105.0% of output	100.0
OUTLOLIM	Low Output Limit	–5.0 to 105.0% of output	0
DROPOFF	Controller Dropoff Value	–5.0 to 105.0% of output	0.0
DEADBAND	Output Relay Deadband	*Current Proportional Duplex or Time Proportional Duplex:* –5.0 to 25.0% *Position Proportional or Three Position Step:* 0.5 to 5.0%	2.0
OUT HYST	Output Relay Hysteresis	0.0 to 5.0%	0.5
FAILSAFE	Failsafe Output Value *For 3Pos. Step Control:* 100PCT 0PCT	Set within the range of the output limits. *For 3Pos. Step Control:* **100PCT** - Set motor position to 100% output position **0PCT** - Set motor position to 0% output position	0.0
MAN OUT	Power-up Manual Mode Output Preset Value	0.0 to 100.0%	0.0
AUTO OUT	Power-up Automatic Mode Output Preset Value	0.0 to 100.0%	0.0
PBorGAIN	Proportional Band or Gain Units	PB PCT GAIN	GAIN
MINorRPM	Reset Units	RPM MIN	MIN

3.13 Options Set Up Group

Introduction

This data deals with various options that are available with your controller. If your controller does not have any of these options the prompts will not appear.

Function prompts

Table 3-10 lists all the function prompts in the "Options" Set Up group.

Table 3-10 Options Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
AUX OUT	Auxiliary Output Representation	DISABL IN 1 IN 2 PV DEV OUTPUT SP	DISABL
4mA VAL	Auxiliary Output Low Scaling Factor	Low scale value to represent 4 mA. Value in % for output. All other in Engineering units.	0
20mA VAL	Auxiliary Output High Scaling Factor	High scale value to represent 20 mA. Value in % for output. All other in Engineering units.	0
DIG IN 1	Digital Input 1 selections	NONE To MAN To LSP To 2SP To DIR To HOLD ToPID2 PV 2IN To RUN To BEGN STOP I MAN FS To LOCK To A OUT	NONE
DIG1 COM	Digital Input 1 Combinations	DISABL +PID2 +TO DIR +TO SP2 +DISAT	DISABL
DIG IN 2	Digital Input 2 selections	Same as DIG IN 1	NONE
DIG 2 COM	Digital Input 2 Combinations	Same as DIG1 COM	DISABL

3.14 Communications Group

Introduction

This data deals with the Communications option that is available with your controller. This option allows the controller to be connected to a host computer via a RS422 or DMCS bus.

If your controller does not have this option the prompts will not appear.

Function prompts

Table 3-11 lists all the function prompts in the "Com" Set Up group.

Table 3-11 Com Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
ComSTATE	Communications Option State	DISABL DMCS RS422	DISABL
Com ADDR	Communications Station Address	1 to 99	0
SHEDTIME	Shed Time	1 to 255 sample periods	0
PARITY (RS422 Only)	Parity	ODD EVEN	ODD
BAUD (RS422 Only)	Baud Rate	300 4800 600 9600 1200 19200 2400	300
DUPLEX (RS422 Only)	Duplex Operation	HALF FULL	
SHEDMODE (DMCS Only)	Shed Controller Mode and Output Level	LAST TO MAN FSAFE ToAUTO	LAST
SHED SP (DMCS Only)	Shed Setpoint Recall	TO LSP TO CSP	TO LSP
UNITS	Communication Units	PERCNT ENG	PERCNT
LOOPBACK	Local Loop Back	DISABL ENABLE	DISABL

3.15 Alarms Set Up Group

Introduction

This data deals with the Alarms function that is available with your controller.

There are two alarms available. Each alarm has two setpoints.

You can configure each of these two setpoints to alarm on one of nine events and you can configure each setpoint to alarm High or Low.

You can also configure the two setpoints to alarm on the same event and to alarm both high and low, if desired.

Function prompts

Table 3-12 lists all the function prompts in the "Alarms" Set Up group.

Table 3-12 Alarms Group Function Prompts

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A1S1 VAL	Alarm 1, Setpoint 1 Value	Value in Engineering Units	90
A1S2 VAL	Alarm 1, Setpoint 2 Value	Value in Engineering Units	10
A2S1 VAL	Alarm 2, Setpoint 1 Value	Value in Engineering Units	95
A2S2 VAL	Alarm 2, Setpoint 2 Value	Value in Engineering Units	5
A1S1TYPE	Alarm 1, Setpoint 1 Type	NONE IN 1 (Input 1) IN 2 (Input 2) PV (Process Variable) DEV (Deviation) OUTPUT SHED (Communications) EVON(SP Programming) EVOFF(SP Programming)	NONE
A1S2TYPE	Alarm 1, Setpoint 2 Type	Same as A1S1TYPE	NONE
A2S1TYPE	Alarm 2, Setpoint 1 Type	Same as A1S1TYPE	NONE
A2S2TYPE	Alarm 2, Setpoint 2 Type	Same as A1S1TYPE	NONE
A1S1 H L	Alarm 1, Setpoint 1 State	LO HI	HI
A1S1 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 1	BEGIN END	

Table continued on next page

Function prompts, continued

Table 3-12 lists all the function prompts in the "Alarms" Set Up group.

Table 3-12 Alarms Group Function Prompts, continued

Function Prompt (Lower Display)	Function Name	Selections or Range of Setting (Upper Display)	Factory Setting
A1S2 H L	Alarm 1, Setpoint 2 State	LO HI	LO
A1S2 EV	SP Programming Event Alarm State for Alarm 1, Setpoint 2	BEGIN END	
A2S1 H L	Alarm 2, Setpoint 1 State	LO HI	HI
A2S1 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 1	BEGIN END	
A2S2 H L	Alarm 2, Setpoint 2 State	LO HI	LO
A2S2 EV	SP Programming Event Alarm State for Alarm 2, Setpoint 2	BEGIN END	
AL HYST	Alarm Hysteresis	0.0 to 5.0 % of Output or Span as appropriate	0.1

3.16 Calib Group

Calibration data	The prompts used here are for field calibration purposes. Refer to *Section 7 – Calibration* in this manual for complete information and instructions.

3.17 Status Group

Status Test Data	The prompts used here are read only. They are used to determine the reason for a controller failure. Refer to *Section 9 – Troubleshooting* in this manual for complete information.

3.18 Configuration Record Sheet

Keep a record

Enter the value or selection for each prompt on this sheet so you will have a record of how your controller was configured.

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TUNING	PROP BD		1.0
	or		
	GAIN		1.0
	RATE MIN		0.00
	RSET MIN		1.0
	or		
	RSET RPM		1.0
	or		
	MAN RSET		0.0
	PROP BD2		1.0
	or		
	GAIN 2		1.0
	RATE2MIN		0.00
	RSET2MIN		1.0
	or		
	RSET2RPM		1.0
	CYCSEC		20.0
	CYC2SEC		20.0
	SECURITY		0
	LOCKOUT		CALIB
	AUTO MAN		ENAB
	SP SEL		ENAB
	RUN HOLD		ENAB
SP RAMP	SP RAMP		DISABL
	TIME MIN		3
	FINAL SP		—
	SP RATE		DISABL
	EU/HR UP		—
	EU/HR DN		—
	SP PROG		DISABL
ADAPTIVE	ADAPTIVE		DISABL
	SP CHANG		10
	KPG		1.0
ALGORITHM	CONT ALG		PID A
	INPUT 2		DISABL
	OUT ALG		—
	4–20RNG		50PCT
	RLY TYPE		MECHAN
INPUT 1	DECIMAL		XXXX
	UNITS		NONE
	IN1 TYPE		0—10mV
	XMITTER		LINEAR
	IN1 HI		1000
	IN1 LO		0
	BIAS IN1		0
	FILTER 1		1
	BURNOUT		NONE
	EMISSIV		0
	PWR FREQ		60HZ
	LANGUAGE		ENGLIS
INPUT 2	XMITTER 2		LINEAR
	IN2 HI		1000
	IN2 LO		0
	FILTER 2		1

Group Prompt	Function Prompt	Value or Selection	Factory Setting
CONTROL	PID SETS		1 ONLY
	SW VALUE		0.00
	SP SOURC		1 LOCAL
	RSP SRC		NONE
	RATIO		1.0
	BIAS		0
	SP TRACK		NONE
	POWER UP		MANUAL
	SP HILIM		1000
	SP LOLIM		0
	ACTION		REVERSE
	OUT RATE		DISABL
	PCT/M UP		0
	PCT/M DN		0
	OUT HILIM		100.0
	OUT LOLIM		0
	DROPOFF		0.0
	DEADBAND		2.0
	OUT HYST		0.5
	FAILSAFE		0.0
	MAN OUT		0.0
	AUTO OUT		0.0
	PBorGAIN		GAIN
	MINorRPM		MIN
OPTIONS	AUX OUT		DISABL
	4mA VAL		0
	20mA VAL		0
	DIG IN 1		NONE
	DIG IN 2		NONE
Com	ComSTATE		DISABL
	Com ADDR		0
	SHEDTIME		0
	PARITY		ODD
	BAUD		300
	DUPLEX		—
	LOOPBACK		DISABL
	SHEDMODE		LAST
	SHED SP		TO LSP
	UNITS		PERCNT
ALARMS	A1S1 VAL		90
	A1S2 VAL		10
	A2S1 VAL		95
	A2S2 VAL		5
	A1S1TYPE		NONE
	A1S2TYPE		NONE
	A2S1TYPE		NONE
	A2S2TYPE		NONE
	A1S1 H L		HI
	A1S1 EV		—
	A1S2 H L		LO
	A1S2 EV		—
	A2S1 H L		HI
	A2S1 EV		—
	A2S2 H L		LO
	A2S2 EV		—
	AL HYST		0.1

Section 4 – Configuration Prompt Definitions

4.1 Overview

Introduction

This section provides information for all the user configurable parameters listed in the configuration section. If you aren't familiar with these parameters, this section gives you the parameter prompt, the selection or range of setting that you can make, and a definition of how each parameter setting affects controller performance. It will also refer you to any other prompts that might be affected by your selection.

What's in this section?

The table below lists the topics that are covered in this section. They are listed in the order of their appearance in the controller.

	Topic	See Page
4.1	Overview	51
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4.2 Tuning Parameters Set Up Group

Introduction

Tuning consists of establishing the appropriate values for the tuning constants you are using so that your controller responds correctly to changes in process variable and setpoint. You can start with pre-determined values but you will have to watch the system to see how to modify them. Adaptive Tune feature automatically selects Gain, Rate, and Reset.

Set this group last

Because this group contains functions that have to do with security and lockout, we recommend that you configure this group last, after all the other configuration data has been loaded.

Tuning group prompts

Table 4-1 lists all the function prompts in the Tuning setup group and their definitions.

Table 4-1 Tuning Group Prompt Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PROP BD or GAIN	0.1 to 999.9% or 0.1 to 9999	**PROPORTIONAL BAND** is the percent of the range of the measured variable for which a proportional controller will produce a 100% change in its output. **GAIN** is the ratio of output change (%) over the measured variable change (%) that caused it. $G = \frac{100\%}{PB\%}$ where PB is the proportional band (in %) If the PB is 20%, then the Gain is 5. Likewise, a 3% change in the error signal (SP-PV) will result in a 15% change in the controller's output due to proportional action. If the Gain is 2, then the PB is 50%. Defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. The selection of Prop. Band or Gain is made in the control parameter group under prompt "PBorGAIN."
RATE MIN	0.08 to 10.00 minutes 0.08 or less = OFF	RATE action affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster. Defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.

Continued on next page

Table 4-1 Tuning Group Prompt Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
RSET MIN or RSET RPM	0.00 to 50.00	**RSET MIN** = RESET IN MINUTES / REPEAT **RSET RPM** = RESET IN REPEATS PER MINUTE **RESET** adjusts the controller's output in accordance with both the size of the deviation (SP-PV) and the time it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional action is repeated/minute. Used with control algorithm PID-A or PID-B. Defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. The selection of minutes per repeat or repeats per minute is made in the control parameters group under prompt "MINorRPM."
MAN RSET	–100 to +100 (in % output)	**MANUAL RESET** is only applicable if you have control algorithm PD WITH MANUAL RESET. Because a proportional controller will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint.
PROP BD2 or GAIN 2	0.1 to 999.9% or 0.1 to 999.9	**PROPORTIONAL BAND 2** or **GAIN 2, RATE 2,** and **RESET 2** parameters are the same as previously described for "Heat" except that they refer to the cool zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent.
RATE2MIN	0.08 to 10.00 minutes 0.08 or less = OFF	
RSET2MIN RSET2RPM	0.02 to 50.00	
CYC SEC	1 to 120 seconds	**CYCLE TIME (HEAT)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications. Electromechanical relays
CYC2 SEC	1 to 120 seconds	**CYCLE TIME 2 (COOL)** is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for 2nd set of PID constants. Electromechanical relays
CYC SX3	1 to 120 (1/3 second increments) 1 = .33 sec./120 = 40 sec.	**CYCLE TIME (HEAT)** - same as above except for solid state relays. Algorithm prompt "RLY TYPE", selection "SOL ST"
CYC2 SX3	1 to 120 (1/3 second increments) 1 = .33 sec./120 = 40 sec	**CYCLE TIME 2 (COOL)** same as above except for solid state relays. Algorithm prompt "RLY TYPE", selection "SOL ST"

Continued on next page

Table 4-1 Tuning Group Prompt Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SECURITY	0001-4095	**SECURITY CODE** – The level of keyboard lockout may be changed in the set up mode. Knowledge of a security code may be required to change from one level to another. Select this number here, copy it, and keep it in a secure location. Entering "0" disables the security code feature. NOTE: The Security Code is for keyboard entry only and is not available via communications. Can only be changed if "LOCKOUT" selection is "NONE".
LOCKOUT		**LOCKOUT** applies to one of the functional groups: Configuration, Calibration, Tuning, Adaptive Tune. **DO NOT CONFIGURE UNTIL ALL CONFIGURATION IS COMPLETE.**
	NONE	No Lockout – all groups read/write. Allows individual key lockout.
	CALIB	**CALIB** – All are available for read/write except for the Calibration and Keyboard Lockout groups.
	+CONF	**+CONF** – Tuning, SP Ramp, and Adaptive Tune groups are read/write. All other groups are read only. Keyboard Lockout and Calibration groups are not available.
	+VIEW	**+VIEW** – Tuning and Setpoint Ramp parameters are read/write. No other parameters are viewable.
	MAX	**MAX** – Tuning and Setpoint Ramp parameters are available for read only. No other parameters are viewable
AUTO MAN		**MANUAL/AUTO KEY LOCKOUT** – Allows you to disable the Manual/Auto key.
	DISABL ENABLE	Disable Enable
		Can only be viewed if "LOCKOUT" is configured for "NONE".
SP SEL		**SETPOINT SELECT KEY LOCKOUT** – Allows you to disable the Setpoint Select key.
	DISABL ENABLE	Disable Enable
		Can only be viewed if "LOCKOUT" is configured for "NONE".
RUN HOLD		**RUN/HOLD KEY LOCKOUT** – Allows you to disable the Run/Hold key.
	DISABL ENABLE	Disable Enable
		Can only be viewed if "LOCKOUT" is configured for "NONE".

4.3 Setpoint Ramp/Program Set Up Group

Introduction

A single setpoint ramp can be configured to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes.
There is also a configurable rate of change for any local setpoint change.
You can also configure a 12 segment program from a Ramp/Soak profile.
You can start and stop the ramp/program using the RUN/HOLD key.

Setpoint Ramp/ Rate/Program group prompts

Table 4-2 lists all the function prompts in the Setpoint Ramp/Rate/Program setup group and their definitions.

Table 4-2 Setpoint Ramp/Rate/Program Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP RAMP	ENABLE DISABL	SINGLE SETPOINT RAMP — Make selection to enable or disable the setpoint ramp function. Make sure you configure a ramp time and a final setpoint value. "SP RATE" and "SP PROG" must be disabled. ENABLE SETPOINT RAMP — Allows you to start the setpoint ramp (in automatic mode). DISABLE SETPOINT RAMP — Disables the setpoint ramp.
TIME MIN	0 to 255 minutes	SETPOINT RAMP TIME — Enter the number of minutes desired to reach the final setpoint. A ramp time of "0" implies and immediate change of setpoint.
FINAL SP	Within SP limits	SETPOINT RAMP FINAL SETPOINT — Enter the value desired for the final setpoint. The controller will operate at the setpoint set here when ramp is ended.
SP RATE	ENABLE DISABL	SETPOINT RATE — Lets you configure a specific rate of change for any local setpoint change. "SP RAMP" and "SP PROG" must be disabled. ENABLE SETPOINT RATE — allows the SP rate feature DISABLE SETPOINT RATE — disables the setpoint rate
EU/HR UP	0 to 9999 in Engineering Units per hour	RATE UP — Value for SP Rate selection
EU/HR DN	0 to 9999 in Engineering Units per hour	RATE DOWN — Value for SP Rate selection
SP PROG (option)	ENABLE DISABL	SETPOINT RAMP/SOAK PROGRAM Available only with controllers that contain this option. For reasons of convenience, the information for the prompts when SP PROG is enabled are included in *Section 6 — Setpoint Programming Option.* "SP RAMP" and "SP RATE" must be disabled.

4.4 Adaptive Tune Set Up Group

Introduction

Adaptive Tune continuously adjusts the PID parameters in response to setpoint changes. Also, it can be used during start-up without prior initialization or process knowledge.

Adaptive Tune group prompts

Table 4-3 lists all the function prompts in the Adaptive Tune setup group and their definitions.

Table 4-3 Adaptive Tune Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
ADAPTIVE		**ADAPTIVE TUNE**
	DISABL	**DISABLE ADAPTIVE TUNE** – Disables the Adaptive Tune function.
	SPoNLY	**SETPOINT ONLY** – This selection tunes on setpoint changes only. It employs time domain analysis to accelerate line out at any desired setpoint without prior initialization or process knowledge. SP Only is the recommended start-up mode - to be used when no knowledge of the process tuning values is available. In the Start-up mode, and after enabling ADAPTIVE, the operator simply lines out the process variable in manual mode, selects the desired SP value and switches to automatic mode.
SP CHANG	5 to 15%	**SETPOINT CHANGE** - The minimum setpoint change that will result in re-tuning must be configured between 5% and 15%: i.e. If the range is 0 to 2400 and 5% is configured, re-tuning will occur if the setpoint change is 120 or larger.
KPG	0.01 to 50.00	**PROCESS GAIN** – This is the Gain of the process being tuned. It is automatically calculated during tuning process. This is normally a READ only value. It should only need to be changed if the controller fails to identify the process. In this case, set the value to algebraic value of PV in percent, divided by output in percent while in the manual mode. **ATTENTION** Note you must disable Adaptive tune to change tuning constant values from the keyboard.

Continued on next page

Table 4-3 Adaptive Tune Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
AT ERROR		ADAPTIVE TUNE ERROR STATUS – When an error is detected in the Adaptive Tune process, an error prompt will appear.
	NONE	NO ERRORS
	OUTLIM	OUTPUT GREATER OR LESS THAN OUTPUT LIMITS – Output set insufficiently to get Setpoint value.
	IDFAIL	IDENTIFICATION PROCESS FAILED – An illegal value for Gain, Rate, or Reset was calculated.
	ABORT	CURRENT ADAPTIVE TUNE PROCESS ABORTED – caused by one of the following conditions: • changing to manual mode • digital input detected • In heat region of output and a cool output calculated or vice versa.

4.5 Algorithm Data Set Up Group

Introduction

This data deals with various algorithms in the controller: Control algorithm, Output algorithm, Enabling the second input, or the Current Duplex range.

Algorithm group prompts

Table 4-4 lists all the function prompts in the Algorithm setup group and their definitions.

Table 4-4 Algorithm Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT ALG		The **CONTROL ALGORITHM** lets you select the type of control that is best for your process.
	ON-OFF	**ON/OFF** is the simplest control type. The output can be either ON (100%) or OFF (0%). The Process Variable (PV) is compared with the setpoint (SP) to determine the sign of the error (ERROR = PV-SP). The ON/OFF algorithm operates on the sign of the error signal. In Direct Acting Control, when the error signal is positive, the output is 100%; and when the error signal is negative, the output is 0%. If the control action is reverse, the opposite is true. An adjustable overlap (Hysteresis Band) is provided between the on and off states. Other prompts affected: "OUT HYST" **DUPLEX ON/OFF** is an extension of this algorithm when the output is configured for Duplex. It allows the operation of a second ON/OFF output. There is a deadband between the operating ranges of the two inputs and an adjustable overlap (hysteresis) of the on and off states of each output. Both Deadband and Hysteresis are separately adjustable. With no relay action the controller will read 50%. Other prompts affected: "OUT HYST" and "DEADBAND"
	PID A NOTE: PID A should not be used for Proportional only action. i.e. no integral (reset) action. Instead, use PD+MR with rate set to 0.	**PID A** is normally used for three-mode control. This means that the output can be adjusted somewhere between 100% and 0%. It applies all three control actions — Proportional (P), Integral (I), and Derivative (D) — to the error signal. Proportional (Gain) — regulates the controller's output in proportion to the error signal (the difference between Process Variable and Setpoint). Integral (Reset) -- regulates the controller's output to the size of the error and the time the error has existed. (The amount of corrective action depends on the value of proportional Gain.) Derivative (Rate) -- regulates the controller's output in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional Gain.)

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Table 4-4 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT ALG continued	PID B	PID B Unlike the PID-A equation, the controller gives only an integral response to a setpoint change, with no effect on the output due to the gain or rate action, and it gives full response to PV changes. Otherwise controller action is as described for the PID-A equation. See note on PID-A.
	PD+MR	PD WITH MANUAL RESET is used whenever integral action is not wanted for automatic control. The equation is computed with no integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the controller output. Switching between manual and automatic mode will not be bumpless. If you select PD with Manual Reset you can also configure the following variations • PD (Two Mode) control, • P (Single Mode) control. Set Rate(D) and/or Reset Time(I) to 0. Other prompts affected: "MAN RSET"
	3PSTEP	The THREE POSITION STEP algorithm allows the control of a valve (or other actuator), with an electric motor driven by two controller relay outputs; one to move the motor upscale, the other downscale without a feedback slidewire linked to the motor shaft. The deadband and hysteresis are adjustable in the same manner as the duplex output algorithm. The Three Position Step Control algorithm provides an output display (OUT) which is an estimated motor position since the motor is not using any feedback. Although this output indication is only an approximation, it is "corrected " each time the controller drives the motor to one of its stops (0% or 100%). It avoids all the control problems associated with the feedback slidewire (wear, dirt, noise). When operating in this algorithm, the estimated "OUT" display is shown to the nearest percent (i.e. no decimal). Refer to the Operation section for motor position displays. As a customer configurable option, when a second input board is installed, the motor slidewire can be connected to the controller. The actual slidewire position is then shown on the lower display as "POS". This value is used for display only, it is not used in the 3 Position Step algorithm. To configure this option, set the Input 2 Enable/Disable prompt shown next to "DISABLE". Calibrate the slidewire. Other prompts affected: "DEADBAND"

Continued on next page

Table 4-4 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
INPUT 2	ENABLE DISABLE	INPUT 2 algorithm allows you to enable or disable the second input. Appears only when input 2 is ordered.
OUT ALG		The OUTPUT ALGORITHM lets you select the type of output you want. Not applicable with Control Algorithm prompt "3PSTEP." *Selections are model dependent. For example, current output models cannot be configured for Time Proportioning Simplex Output.*
	TIME	RELAY SIMPLEX — Type of output using one SPDT relay. Its normally open (NO) or normally closed (NC) contacts are selected when wiring the rear terminals. Other prompts affected: "OUT HYST"
	CURRNT	CURRENT SIMPLEX — Type of output using one 2 to 20 mA signal that can be fed into a positive or negative grounded load of 0 to 1000 ohms. The signal can be recalibrated for any desired range from 2 to 20 mA for 0 to 100% output.
	POSITN	POSITION PROPORTIONAL SIMPLEX — Type of output using two SPDT relays and a motor which has a 100 to 1000 ohms feedback slidewire. Other prompt affected: "DEADBAND"
	TIME D	RELAY DUPLEX — Type of output using two SPDT relays. Its normally open (NO) or normally closed (NC) contacts are selected when wiring the rear terminals (see Installation section). Other prompts affected: "DEADBAND"
	CUR D	CURRENT DUPLEX is similar to current simplex but provides a second current output if Auxiliary output is used. The second output is usually scaled so that zero and span correspond with 0% and 50% output (cool zone). When the output is 0 to 50%, the controller uses tuning parameter set #2, when the output is 50 to 100% it uses set #1. NOTE: Auxiliary Output must be configured for "OUTPUT." Other prompts affected: "DEADBAND", "4-20RNG".
	CUR TI	CURRENT/RELAY DUPLEX (RELAY = HEAT) is a variation of duplex with current active for 0 to 50% output (tuning set 2) and relay#2 is active 50 to 100% output (tuning set 1). Other prompts affected: "4-20 RNG," "DEADBAND"
	TI CUR	RELAY CURRENT DUPLEX (RELAY = COOL) is similar to "CUR-TI" except that current is active for 50 to 100% and relay #2 is active for 0 to 50%. Other prompts affected: "4-20 RNG," "DEADBAND"

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Table 4-4 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
4-20 RNG		CURRENT DUPLEX RANGE ALGORITHM — Used with Output Algorithm selections "CUR-D," "CUR-TI", or "TI-CUR." For "CUR-TI" and "TI-CUR", this should be set to "50 PCT".
	50 PCT	CURRENT DUPLEX RANGE (SPLIT) For "CUR D" this enables the normal control current output to provide heat control and the Auxiliary output to provide cool control. To enable this, the auxiliary output must be: • Selected for Output • Auxiliary current output is scaled as desired for 0-50% controller output (4mA set to 50; 20mA set to 0). • Deadband for this configuration only applies to the current output. Auxiliary output must have Deadband scaled in. For example: If a 2% Deadband is desired, then enter a "2.0" for the "Deadband" selection in the Control Algorithm Group. This will apply Deadband to the Current Output. In the "Options" group, set the Auxiliary Output "4mA" selection to "49.0" and the "20mA" selection to 0.0. Other prompts affected: "AUX OUT"
	100PCT	CURRENT DUPLEX RANGE (FULL) enables the normal control current output to provide duplex heat and cool control over 0 - 100% of the controller output. The PID heat parameters apply when the controller output is greater than 50% and the PID cool parameters apply when the controller output is less than 50%.
RLY TYPE		RELAY TYPE – For Time Proportional only
	MECHAN	ELECTROMECHANICAL RELAY – This selection allows cycle times of from 1 to 120 seconds.
	SOL ST	SOLID STATE RELAY OR OPEN COLLECTOR OUTPUT – This selection allows cycle times of 0.333 seconds through 40.0 seconds in 0.333 second increments. ATTENTION Lockout must be set to "NONE" to view this prompt.

4.6 Input 1 Parameters Set Up Group

Introduction

These are the parameters required for input 1; temperature units, decimal location, actuation, transmitter characterization, high and low range values in engineering units, filter, burnout, emissivity, and power line frequency.

Input 1 group prompts

Table 4-5 lists all the function prompts in the Input 1 setup group and their definitions.

Table 4-5 Input 1 Group definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DECIMAL		DECIMAL POINT LOCATION – This selection determines where the decimal point appears in the display.
	XXXX XXX.X XX.XX	None One Place Two Places
		NOTE: Auto-ranging will occur when one decimal position has been selected and the value increases above 999.9 but auto-ranging *will not* similarly occur when two decimal positions are selected.
UNITS		TEMPERATURE UNITS – This selection will be indicated on the annunciator. What display of temperature do you want:
	DEG F DEG C NONE	Degrees Fahrenheit Degrees Celsius None

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Table 4-5 Input 1 Group definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
IN1 TYPE		**INPUT 1 ACTUATION TYPE** -- This selection determines what actuation you are going to use for input one.
	B TC	B thermocouple 0 to 3300°F -18 to 1815°C
	E TC H	E thermocouple high -454 to 1832°F -270 to 1000°C
	E TC L	E thermocouple low -200 to 1100°F -129 to 593°C
	J TC H	J thermocouple high 0 to 1600°F -18 to 871°C
	J TC L	J thermocouple low 20 to 770°F -7 to 410°C
	K TC H	K thermocouple high 0 to 2400°F -18 to 1316°C
	K TC L	K thermocouple low -20 to 1000°F -29 to 538°C
	NNM H	NiNiMo thermocouple high 32 to 2500°F 0 to 1371°C
	NNM L	NiNiMo thermocouple low 32 to 1260°F 0 to 682°C
	NIC TC	Nicrosil-Nisil thermocouple 0 to 2372°,F -17.8 to 1300°C
	R TC	R thermocouple 0 to 3100°F -18 to 1704°C
	S TC	S thermocouple 0 to 3100°F -18 to 1704°C
	T TC H	T thermocouple high -300 to 700°F -184 to 371°C
	T TC L	T thermocouple low -200 to 500°F -129 to 260°C
	W TC H	W5W26 thermocouple high 0 to 4200°F -18 to 2316°C
	W TC L	W5W26 thermocouple low 0 to 2240°F -18 to 1227°C
	100 PT	100 Ohm-RTD -300 to 1200°F -184 to 649°C
	500 PT	500 Ohm-RTD -300 to 1200°F -184 to 649°C
	100 LO	100 Ohm RTD low 0 to 300°F -18 to 149°C
	RADIAM	Radiamatic (RH) 1400 to 3400°F 760 to 1871°C
	4-20mA	4 to 20 Milliamps
	0-10mV	0 to 10 Millivolts
	10-50m	10 to 50 Millivolts
	1-5 V	1 to 5 Volts
	0-10 V	0 to 10 Volts

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Table 4-5 Input 1 Group definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
XMITTER	Select one from the columns below B TC / S TC E TC H / T TC H E TC L / T TC L J TC H / W TC H J TC L / W TC L K TC H / 100 PT K TC L / 500 PT NNM H / 100 LO NNM L / RADIAM NIC TC / LINEAR R TC / SQROOT	**TRANSMITTER CHARACTERIZATION** — This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. NOTE: Prompt only appears when a linear actuation is selected at prompt "IN1 TYPE". FOR EXAMPLE: If input 1 is a 4 to 20 mA signal, but the signal represents a type "K" thermocouple; select "K TC H" and the controller will characterize the 4 to 20 mA signal so that it is treated as a type "K" thermocouple input (high range). Parameter definitions are the same as shown in Lower Display Prompt "IN1 TYPE"
IN1 HI	–999.9 to 9999. or –999 to 9999 in Engineering units	**INPUT 1 HIGH RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. Scale the #1 input signal to the display value you want for 100%. EXAMPLE: Actuation (Input) = 4 to 20 mA Process Variable = Flow Range of Flow = 0 to 250 Gal/Min High Range display value = 250 Then 20 mA = 250 Gal/Min The control setpoint will be limited by the range of units selected here.
IN1 LO	–999.9 to 999. or –999 to 9999 in Engineering units	**INPUT 1 LOW RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or Square Root transmitter characterization. Scale the #1 input signal to the display value you want for 0%. See example on previous page. The control setpoint for Input 1 will be limited by the range of units selected here.
BIAS IN1	–999.9 to 9999	**BIAS ON INPUT 1** — Bias is used to compensate the input for drift of an input value due to deterioration of a sensor, or some other cause. Select the bias value you want on input one.

Continued on next page

Table 4-5 Input 1 Group definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
FILTER 1	0 to 120 seconds No filter = 0	FILTER FOR INPUT ONE — A software digital filter is provided for input 1 to smooth the input signal. You can configure the first order lag time constant from 1 to 120 seconds. If you do not want filtering, enter 0.
BURNOUT		BURNOUT PROTECTION (SENSOR BREAK) provides most input types with upscale or downscale protection if the input fails. 1-5V, 0-10V, or 4-20mA inputs require no burnout or "NONE" selection.
	NONE	NO BURNOUT — Pre-configured Failsafe output applied if failed input is detected. Error message "INPUT1 FAIL" is flashed on the lower display intermittently every 10 seconds.
	UP	UPSCALE BURNOUT will make the PV signal increase to full scale when a sensor fails, and flash "INPUT1 FAIL" on the lower display intermittently every 10 seconds. The controller remains in Automatic control mode and adjusts the controller output signal in response to the full scale PV signal developed by the Burnout circuitry.
	DOWN	DOWNSCALE BURNOUT will make the PV signal decrease to the lower range value when a sensor fails, and flash "INPUT1 FAIL" on the lower display intermittently every 10 seconds. The controller remains in Automatic control mode and adjusts the controller output signal in response to the zero percent PV signal developed by the Burnout circuitry.
		NOTE: For no Burnout, i.e. "None," to function properly on a 4-20MA input, there must be a dropping resistor directly across the *input* terminals (i.e., not remote), then the unit can detect the "zero" voltage that occurs when the 4-20 mA line is opened.
EMISSIV	0.01 to 1.00	EMISSIVITY is a correction factor applied to the Radiamatic input signal that is the ratio of the actual energy emitted from the target to the energy which would be emitted if the target were a perfect radiator. Available only for "Radiamatic" inputs.
PWR FREQ	60 Hz 50 Hz	POWER LINE FREQUENCY — select whether your controller is operating at 60 Hz or 50 Hz. 60 HERTZ 50 HERTZ
LANGUAGE	ENGLISH FRENCH GERMAN SPANISH ITALIAN	

4.7 Input 2 Parameters Set Up Group

Introduction

These are the parameters required for input 2; actuation, transmitter characterization, high and low range values in engineering units, filter, and burnout.

Input 2 group prompts

Table 4-6 lists all the function prompts in the Input 2 setup group and their definitions.

Table 4-6 Input 2 Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
XMITTER2		TRANSMITTER CHARACTERIZATION — This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. FOR EXAMPLE: If input 2 is a 4 to 20 mA signal, but you want the signal to represent a type "K" thermocouple; select " K TC H" and the controller will characterize the 4 to 20 mA signal so that it is treated as a type "K" thermocouple input.
	B TC	B Type Thermocouple
	E TC H	E Type Thermocouple High
	E TC L	E Type Thermocouple Low
	J TC H	J Type Thermocouple High
	J TC L	J Type Thermocouple Low
	K TC H	K Type Thermocouple High
	K TC L	K Type Thermocouple Low
	NNM H	NiNiMo Type Thermocouple High
	NNM L	NiNiMo Type Thermocouple Low
	NIC TC	Nicrosil Nisil Thermocouple
	R TC	R Type Thermocouple
	S TC	S Type Thermocouple
	T TC H	T Type Thermocouple High
	T TC L	T Type Thermocouple Low
	W TC H	W5W26 Type Thermocouple High
	W TC L	W5W26 Type Thermocouple Low
	100 PT	100 Ohm–RTD
	500 PT	500 Ohm–RTD
	100 LO	100 Ohm RTD Low
	RADIAM	Radiamatic (RH)
	LINEAR	Linear Range
	SQROOT	Square Root

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Table 4-6 Input 2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
IN2 HI	–999.9 to 999. or –999 to 9999 in Engineering units	**INPUT 2 HIGH RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root actuations only. Scale the #2 input signal to the display value you want for 100%. This is what you want 20mA or 5 volts to represent. EXAMPLE: Same as input one.
IN2 LO	–999.9 to 999. or –999 to 9999 in Engineering units	**INPUT 2 LOW RANGE VALUE** in engineering units, for linear or Square Root characterization only. Scale the #2 input signal to the display value you want for 0%. This is what you want 4mA or 1 volt to represent. EXAMPLE: Same as input one.
FILTER 2	0 to 120 seconds No filter = 0	**FILTER FOR INPUT TWO** — A software digital filter is provided for input 2 to smooth the input signal. You can configure the first order lag constant from 1 to 120 seconds. If you do not want filtering, enter 0.

4.8 Control Parameters Set Up Group

Introduction

The functions listed in this group deal with how the UDC 3000 will contro' the process including: Number of tuning parameter sets, Setpoint source, Ratio, Bias, Tracking, Power-up recall, Setpoint limits, Output direction and limits, Deadband and Hysteresis.

Control group prompts

Table 4-7 lists all the function prompts in the Control setup group and their definitions.

Table 4-7 Control Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PID SETS		**NUMBER OF TUNING PARAMETER SETS** — This selection lets you choose one or two sets of tuning constants (gain, rate, and reset).
	1 ONLY	**ONE SET ONLY** — Only one set of tuning parameters is available. Configure the values for: Gain (proportional band) Rate Reset Time Cycle Time (if time proportional is used)
	2KEYBD	**TWO SETS KEYBOARD SELECTABLE** — Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs. Press LOWR DISP key until you see "PID SET1" or "PID SET2" to switch between sets. Configure the values for: Gain, Rate , Reset, Cycle Time Gain #2, Rate #2, Reset#2, Cycle#2 Time
	2PV SW	**TWO SETS PV AUTOMATIC SWITCHOVER** — When the process variable is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle Time. The active PID SET can be read in the lower display. When the process variable is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain #2, Rate #2, Reset #2, and Cycle #2 Time. The active PID SET can be read in the lower display. Other prompts affected: SW VALUE
	2SP SW	**TWO SETS SP AUTOMATIC SWITCHOVER** — When the setpoint is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle. When the setpoint is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain #2, Rate #2, Reset #2, and Cycle #2. Other prompts affected: SW VALUE

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Table 4-7 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SW VALUE	Value in engineering units	AUTOMATIC SWITCHOVER VALUE —This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #2 to Set #1. Only appears when PID SETS selections "2PV SW" or "2SP SW" are selected.
SP SOURC	1LOCAL 2LOCAL	SETPOINT SOURCE — This selection determines what your setpoint source will be; One local or Two local. Toggled by the "SETPOINT SELECT" key. LOCAL SETPOINT — The setpoint entered from the keyboard. TWO LOCAL SETPOINTS — This selection lets you switch between two local setpoints. Mutually exclusive with Remote setpoint.
RSP SRC	NONE IN 2	REMOTE SETPOINT — A signal is brought in through the input 2 terminals and used as the control setpoint. Ratio and Bias can be applied to the remote setpoint. Mutually exclusive with 2 Local setpoints Other prompts affected: RATIO, BIAS NONE - No remote setpoint IN 2 - RSP using second input (Input 2 must be enabled)
RATIO	–20.00 to 20.00	RATIO — Used when input 2 operates as a remote setpoint, prompt "REMOTE." This ratio value can be applied to the remote setpoint. It establishes the correct relationship between the remote setpoint and the input 2 signal applied according to the formula below...(under Bias). Input 2 must be enabled.
BIAS	–9999 to 9999 (Engineering Units)	BIAS — Used when input 2 operates as a remote setpoint (prompt "REMOTE"). Bias, together with ratio, establishes the correct relationship between the remote setpoint and the input 2 signal applied according to the formula: REMOTE SETPOINT = IN2 VALUE (RATIO) + BIAS NOTE: IN2 VALUE = Actual (engineering units) All values must be within configured setpoint high and low limits. Input 2 must be enabled.

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Table 4-7 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP TRACK		SETPOINT TRACKING — The local setpoint can be configured to track either PV or RSP as listed below:
	NONE	NO TRACKING — If local setpoint tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made.
	PV	LSP (LOCAL SETPOINT) TRACKS PV IN MANUAL
	RSP	LSP (LOCAL SETPOINT) TRACKS RSP (REMOTE SETPOINT) IN AUTO — If configured, when the controller transfers out of remote setpoint, the last value of the remote setpoint (RSP) is inserted into the local setpoint.
POWER UP		POWER UP CONTROLLER MODE RECALL — This selection determines which mode and setpoint the controller will use when the controller restarts after a power loss. Select one from below:
	MANUAL	MANUAL, LSP — At power-up, the controller will use *manual* mode with the local setpoint displayed.
	A LSP	AUTOMATIC, LOCAL SETPOINT — At power-up, the controller will return to the *automatic* mode and will use the local setpoint for control.
	A RSP	AUTOMATIC, REMOTE SETPOINT — At power-up, the controller will return to the *automatic* mode and will use the remote setpoint for control.
	AM SP	LAST MODE/LAST SETPOINT
	AM LSP	LAST MODE/LAST LOCAL SETPOINT
PWR OUT		POWER UP OUTPUT SELECTION (for 3P Step control only)—This selection determines what position the motor will be in when powered up.
	LAST	LAST—At power up in automatic mode, the motor position will be the last one prior to power down. When the unit goes into FAILSAFE, it will stay in automatic mode; motor will not be driven to the configured Failsafe position.
	F'SAFE	F'SAFE—At power up in manual mode, the motor will be driven to either the 0% or 100% output position; whichever is selected at prompt "FAILSAFE". When the unit goes into FAILSAFE, it will go to manual mode; motor will be driven to the configured Failsafe position.
SP HILIM	0 to 100% of span input in engineering units with decimal place	SETPOINT HIGH LIMIT* — This selection prevents the local and remote setpoints from going above the value selected here. The setting must be equal or less than the upper range of input 1 and input 2. Input 2, when configured for remote setpoint, will be restricted to this upper limit.

*The Local Setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and the SP HILIM is changed to 1200, the new Local Setpoint will be 1200.

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Table 4-7 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP LOLIM	0 to 100% of span input in engineering units with decimal place	SETPOINT LOW LIMIT* — This selection prevents the local and remote setpoints from going below the value selected here. The setting must be equal or greater than the lower range of input 1 and input 2. Input 2, when configured for remote setpoint, will be restricted to this lower limit.
ACTION	DIRECT REVRSE	CONTROL OUTPUT DIRECTION — In what direction do you want the controller output to go when the process variable increases. DIRECT ACTING CONTROL — The controller's output increases as the process variable increases. REVERSE ACTING CONTROL — The controller's output decreases as the process variable increases.
OUT RATE	DISABL ENABLE	OUTPUT CHANGE RATE - Enables or Disables the Output Change Rate. The maximum rate is set at Prompt "PCT/M UP" or "PCT/M DN" shown below. ATTENTION Does not apply to 3 Position Step Control. Disable Enable
PCT/M UP	0 to 9999%/minute	OUTPUT RATE UP VALUE - This selection limits the rate at which the output can change upward. Enter a value in percent/minute. Appears only if "OUT RATE" is enabled. "0" means no output rate applied.
PCT/M DN	0 to 9999%/minute	OUTPUT RATE DOWN VALUE - This selection limits the rate at which the output can change downward. Enter a value in percent/minute. Appears only if "OUT RATE" is enabled. "0" means no output rate.
OUTHILIM	–5.0 to 105.0% of output	HIGH OUTPUT LIMIT — This is the highest value of output beyond which you do not want the controller automatic output to exceed. Use 0 to 100% for time proportional output type.
OUTLOLIM	–5.0 to 105.0% of output	LOW OUTPUT LIMIT — This is the lowest value of output below which you do not want the controller automatic output to exceed. Use 0 to 100% for time proportional output type.
DROPOFF	–5 to 105.0% of output	CONTROLLER DROPOFF VALUE — Select an output value that below which the controller output will dropoff to the low output limit value set in prompt "OUT LOLIM." DROPOFF is not displayed if On-Off or 3 Position Step is configured.

*The Local Setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and the SP HILIM is changed to 1200, the new Local Setpoint will be 1200.

Continued on next page

Table 4-7 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DEADBAND		DEADBAND is an adjustable gap between the operating ranges of output 1 and output 2 in which neither output operates (positive value) or both outputs operate (negative value). It is the difference between the nominal trip points of relay 1 and 2.
	-5.0 to 25.0% 0.5 to 5.0%	Time Duplex or Current Duplex Position Proportional and Three Position Step
OUT HYST	0.0 to 5.0% of PV span	HYSTERESIS (OUTPUT RELAY ONLY) is an adjustable overlap of the ON/OFF states of each control output. This is the difference between the value of the process variable at which the control outputs energize and the value at which they de-energize. Only applicable for ON-OFF control.
FAILSAFE	0 to 100%	FAILSAFE OUTPUT VALUE — The output level used when you have Communications SHED or when NO BURNOUT is configured and input 1 fails.
		For 3 Position Step Control
	100PCT 0 PCT	100PCT-Motor position set to 100% output position 0 PCT-Motor position set to 0% output position
MAN OUT	0 to 100%	POWER UP PRESET MANUAL OUTPUT — At power -up, the controller will go to manual, and the Output value set here.
AUTO OUT	0 to 100%	POWER UP PRESET AUTOMATIC OUTPUT — At power -up, the controller will begin its automatic control at the Output value set here.
PBorGAIN		PROPORTIONAL BAND UNITS — Select one of the following for the Proportional (P) term of the PID algorithm:
	PB PCT	PROPORTIONAL BAND — Selects units of percent proportional band for the P term of the PID algorithm. Where: $PB\% = \frac{100\%ES}{GAIN}$
	GAIN	GAIN selects the unitless term of gain for the P term of the PID algorithm. Where: $GAIN = \frac{100\%ES}{PB\%}$
MINorRPM		RESET UNITS — Selects units of minutes or repeat per minutes for the I term of the PID algorithm. 20 Repeats per Minute = 0.05 Minutes per Repeat.
	RPM	REPEATS PER MINUTE — The number of times per minute that the proportional action is repeated by reset.
	MIN	MINUTES PER REPEAT — The time between each repeat of the proportional action by reset.

4.9 Options Set Up Group

Introduction

Configure the remote mode switch (Digital Inputs) to a specific contact closure response, or configure the Auxiliary Output to be a specific selection with desired scaling.

Table 4-8 lists all the function prompts in the Option setup group and their functions.

Table 4-8 Option Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
AUX OUT		**AUXILIARY OUTPUT SELECTION** provides an mA output representing any of six control parameters. The display for auxiliary output viewing will be in engineering units for Input 1, Input 2, Process Variable, Deviation, and Setpoint. Output will be displayed in percent. Other prompts affected by these selections: "4mA VAL" and "20mA VAL."
	DISABL	**NO AUXILIARY OUTPUT**
	IN 1	**INPUT 1** — This represents the configured range of input 1. FOR EXAMPLE: Type "J" Thermocouple (0 to 1600°F) 0°F display = 0% output 1600°F display = 100% output
	IN 2	**INPUT 2** represents the value of the configured range of input 2.
	PV	**PROCESS VARIABLE** — Represents the value of the Process Variable. PV = Input 1 + Bias
	DEV	**DEVIATION (PROCESS VARIABLE MINUS SETPOINT)** — Represents –100 to +100% of the selected PV span in engineering units. FOR EXAMPLE: Type "T" Thermocouple PV range = –300 to +700°F PV span = 1000°F Deviation Range = –1000 to +1000°F If PV = 500°F and SP = 650°F then Deviation Display = –150°F Auxiliary Output = 42.5% NOTE: A deviation of 0°F yields an auxiliary output of 50%.
	OUTPUT	**OUTPUT** — Represents the displayed controller output in percent (%). Cannot be used with 3 Position Step Control.
	SP	**SETPOINT** — Represents the value of the setpoint in units of PV.

Continued on next page

Table 4-8 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
4mA VAL	Low Scale Value within the range of the selected variable to represent 4 mA	AUXILIARY OUTPUT LOW SCALING FACTOR — Use a value in engineering units for: Input 1, Input 2, Process Variable, Deviation, and Setpoint. Use value in percent (%) for Output. (Output can be between –5 and +105%.)
20mA VAL	High Scale Value within the range of the selected variable to represent 20 mA	AUXILIARY OUTPUT HIGH SCALING FACTOR — Use a value in engineering units for: Input 1, Input 2, Process Variable, Deviation,* and Setpoint. Use a value in percent (%) for Output. (Output can be between –5 and +105%.) *When Deviation is selected, only one operating parameter will be entered. This value represents the deviation level that will produce 20 mA output. Zero deviation will produce a center scale (12 mA) output. A negative deviation equal in magnitude to the Auxiliary Output High Value will produce a low end (4 mA) output.
DIG IN 1 DIG IN 2		DIGITAL INPUT SELECTIONS — All selections are available for either Input. The controller returns to its original state when contact opens, except when overruled by the keyboard.
	NONE	NO DIGITAL INPUT SELECTIONS
	To MAN	TO MANUAL — Contact closure puts the controller into manual mode. Contact open returns controller to former mode unless AUTO/MAN key is pressed while digital input is active.
	To LSP	TO LOCAL SETPOINT — Contact closure puts the controller into local setpoint 1. When contact opens, the controller returns to former operation local or remote setpoint unless Setpoint Select key is pressed while digital input is active.
	To 2SP	TO LOCAL SETPOINT TWO — Contact closure puts the controller into local setpoint 2.
	To DIR	TO DIRECT ACTION — Contact closure selects direct controller action.
	ToHOLD	TO HOLD — Contact closure suspends Setpoint Program or Setpoint Ramp. Contact open runs program.
	ToPID2	TO PID2 — Contact closure selects PID Set 2.

Continued on next page

Table 4-8 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG IN 1 DIG IN 2 continued		
	PV 2IN	PV = INPUT 2-Contact Closure selects PV = Input 2.
	To RUN	RUN — Contact closure starts a stopped SP Program. Left character blinks "R"
	ToBEGN	EXTERNAL PROGRAM RESET — Contact closure resets SP Program back to the beginning of the first segment in the Program. Program cycle number is not affected.reopening switch has no effect NOTE: Once the last segment of the setpoint program has timed out, the controller enters the mode of action specified in the configuration data and the program cannot be reset back to the beginning of the first segment by digital input closure.
	STOP I	INHIBIT INTEGRAL (RESET) — Contact closure disables PID Integral (Reset) action.
	MAN/FS	MANUAL FAILSAFE – Unit goes to Manual Mode, output goes to the Failsafe value.
	To LOCK	KEYBOARD LOCKOUT — Contact closure disables all keys. Lower display shows "LOCKED" if a key is pressed.
	To A OUT	AUTOMATIC OUTPUT — Contact closure sends output to the value set at Control prompt "AUTO OUT".
DIG 1 COM DIG 2 COM		DIGITAL INPUT COMBINATIONS SELECTIONS — All selections are available can be combined with either Input.
	DISABLE	DISABLES INPUT COMBINATIONS
	+PID2	ANY DIGITAL INPUT SELECTION PLUS TO PID2 — Contact closure selects PID Set 2.
	+To DIR	ANY DIGITAL INPUT SELECTION PLUS TO DIRECT ACTION — Contact closure selects direct controller action.
	+ToSP2	ANY DIGITAL INPUT SELECTION PLUS TO LOCAL SETPOINT TWO — Contact closure puts the controller into local setpoint 2.
	+DISAT	ANY DIGITAL INPUT SELECTION PLUS DISABLE ADAPTIVE TUNE — Contact closure disables Adaptive Tune process.

4.10 Communications Set Up Group

Introduction

This option allows the controller to be connected to a host computer via a RS422/485 or DMCS bus. Fifteen units can be configured over this link. The controller looks for messages from the computer at regular intervals. If these messages are not received within the configured shed time, the controller will SHED from the communications link and return to stand alone operation. The device address, parity, and baud rate are configurable. You can also set the SHED output mode and setpoint recall, and communication units.

Communications group prompts

Table 4-9 lists all the function prompts in the Communications setup group and their definitions.

Table 4-9 Communications Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
ComSTATE	RS-422/485 DMCS DISABL	COMMUNICATIONS SELECTION RS-422/485 — Allows RS422/485 communication prompts. DMCS — Allows DMCS communication prompts. DISABL — Disables the communications option.
Com ADDR	1 to 99 (RS422) 1 to 99 (DMCS)	COMMUNICATIONS STATION ADDRESS — This is a number that is assigned to a controller that is to be used with the communications option.
SHEDTIME	0 to 255	SHED TIME — The number that represents how many sample periods there will be before the controller sheds from communications. Each period equals 1/3 seconds or 0 = No shed.
PARITY (RS422/485 only)	 ODD EVEN	PARITY pertains to the use of a self-checking code employing binary digits in which the total number of ONE's (or ZERO's) in each permissible code expression is either ODD or EVEN. ODD PARITY EVEN PARITY
BAUD (RS422/485 only)	 300 600 1200 2400 4800 9600 19200	BAUD RATE is the transmission speed in bits per second. 300 BAUD 600 BAUD 1200 BAUD 2400 BAUD 4800 BAUD 9600 BAUD 19200 BAUD

Continued on next page

Table 4-9 Communications Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DUPLEX **(RS422/485 only)**	HALF FULL	**DUPLEX** - Transmission Type **HALF DUPLEX** - Two wires **FULL DUPLEX** - Four wires
LOOPBACK	ENABLE DISABL	**LOCAL LOOPBACK** tests the communications hardware. **ENABLE** — Allows loopback test. The UDC goes into Loopback mode in which it sends and receives its own message. The UDC displays "PASS" or "FAIL" in the upper display and "LOOPTEST" in the lower display as long as the test is running. The UDC will go into manual mode. The test will run until the operator disables it here. **DISABLE** - disables the Loopback test.
SHEDMODE **(DMCS only)**	LAST TO MAN FSAFE ToAUTO	**SHED CONTROLLER MODE AND OUTPUT LEVEL** — determines the mode of local control you want when the controller is shed from the communications link. **LAST** -SAME MODE AS BEFORE SHED - The controller will return to the same mode (manual or automatic) that it was in before shed. **TO MAN** — TO MANUAL MODE BUMPLESS OUTPUT - The controller will return to manual mode at the same output level that it had before shed. **FSAFE** — TO MANUAL MODE, FAILSAFE OUTPUT - The controller will return to manual mode at the output value selected at "CONTROL" prompt "FAILSAFE". **ToAUTO** — To automatic mode.
SHED SP **(DMCS only)**	TO LSP TO CSP	**SHED SP** — Shed setpoint (DMCS only). **TO LSP** — Controller will use last local SP used. **TO CSP** — Controller will use computer setpoint.
UNITS	PERCNT ENG	**COMMUNICATION UNITS** — This selection determines how the controller values are expressed during communications. **PERCENT OF SPAN** **ENGINEERING UNITS**

4.11 Alarms Set Up Group

Introduction

An alarm is an indication that an event that you have configured (for example—Process Variable) has exceeded one or more alarm limits. There are two alarms available. Each alarm has two setpoints. You can configure each of these two setpoints to alarm on various controller parameters.

There are two alarm output selections, High and Low. You can configure each setpoint to alarm either High or Low. These are called single alarms.

You can also configure the two setpoints to alarm on the same event and to alarm both high and low. A single adjustable Hysteresis of 0.0% to 5.0% is configurable for the alarm setpoint.

See Table 2-4 in the Installation section for Alarm relay contact information.

Alarms group prompts

Table 4-10 lists all the function prompts in the Alarms setup group and their definitions.

Table 4-10 Alarms Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S1 VAL	Value in Engineering Units	**ALARM 1 SETPOINT 1 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A1S1TYPE" to actuate. The value depends on what the setpoint has been configured to represent. NO setpoint is required for Communications SHED. For SP Programming the value is the segment number for which the event applies.
A1S2 VAL	Value in Engineering Units	**ALARM 1 SETPOINT 2 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A1S2TYPE" to actuate. The details are the same as "A1S1 VAL".
A2S1 VAL	Value in Engineering Units	**ALARM 2 SETPOINT 1 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A2S1TYPE" to actuate. The details are the same as "A1S1 VAL".
A2S2 VAL	Value in Engineering Units	**ALARM 2 SETPOINT 2 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A2S2TYPE" to actuate. The details are the same as "A1S1 VAL".

Continued on next page

Table 4-10 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S1TYPE		**ALARM 1 SETPOINT 1 TYPE** — Select what you want Setpoint 1 of Alarm 1 to represent. It can represent the Process Variable, Deviation, Input 1, Input 2, Output, and if you have a model with communications, you can configure the controller to alarm on SHED. If you have setpoint programming, you can alarm when a segment goes ON or OFF.
	NONE	**NO ALARM**
	IN 1	**INPUT 1**
	IN 2	**INPUT 2**
	PV	**PROCESS VARIABLE**
	DEV	**DEVIATION**
	OUTPUT	**OUTPUT** (cannot be used with 3 Position Step control)
	SHED	**SHED FROM COMMUNICATIONS**
	EV ON	**EVENT ON (SP PROGRAMMING)**
	EV OFF	**EVENT OFF (SP PROGRAMMING)**
A1S2TYPE	Same as A1S1 TYPE	**ALARM 1 SETPOINT 2 TYPE** — Select what you want Setpoint 2 of Alarm 1 to represent. The selections are the same as A1S1TYPE.
A2S1TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 1 TYPE** — Select what you want Setpoint 1 of Alarm 2 to represent. The selections are the same as A1S1TYPE. NOTE: Not applicable with Relay Duplex or Position Proportional outputs.
A2S2TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 2 TYPE** — Select what you want Setpoint 2 of Alarm 2 to represent. The selections are the same as A1S1TYPE. NOTE: Not applicable with Relay Duplex or Position Proportional outputs.
A1S1 H L		**ALARM 1 SETPOINT 1 STATE** — Select whether you want the alarm type chosen in Prompt "A1S1TYPE" to alarm High or Low or the beginning or end of a segment in setpoint Ramp/Soak programming.
	HI	**HI ALARM**
A1S1 EV	LO	**LO ALARM**
	BEGIN	**BEGIN (SP PROGRAMMING)**
	END	**END (SP PROGRAMMING)**

Continued on next page

Table 4-10 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S2 H L A1S2 EV	HI LO BEGIN END	**ALARM 1 SETPOINT 2 STATE** — Select whether you want the alarm type chosen in Prompt "A1S2TYPE" to alarm High or Low or the beginning or end of a segment in setpoint Ramp/Soak programming. **HI ALARM** **LO ALARM** **BEGIN (SP PROGRAMMING)** **END (SP PROGRAMMING)**
A2S1 H L A2S1 EV	HI LO BEGIN END	**ALARM 2 SETPOINT 1 STATE** — Select whether you want the alarm type chosen in Prompt "A2S1TYPE" to alarm HIGH or LOW or the beginning or end of a segment in setpoint Ramp/Soak programming. **HI ALARM** **LO ALARM** **BEGIN (SP PROGRAMMING)** **END (SP PROGRAMMING)**
A2S2 H L A2S2 EV	HI LO BEGIN END	**ALARM 2 SET POINT 2 STATE** — Select whether you want the alarm type chosen in Prompt "A2S2TYPE" to alarm HIGH or LOW or the beginning or end of a segment in setpoint Ramp/Soak programming. **HI ALARM** **LO ALARM** **BEGIN (SP PROGRAMMING)** **END (SP PROGRAMMING)**
AL HYST	0.0 to 5.0% of span or full output as appropriate	**ALARM HYSTERESIS** — A single adjustable hysteresis is provided on alarms such that when the alarm is OFF it activates at exactly the alarm setpoint; when the alarm is ON, it will not deactivate until the variable is 0.0% to 5.0% away from the alarm setpoint. Configure the hysteresis of the alarms based on INPUT signals as a % of input range span. Configure the hysteresis of the alarm based on OUTPUT signals as a % of the full scale output range.

4.12 Calibration Data

Introduction

The prompts used here are for field calibration purposes. Refer to *Section 7 – Calibration* in this manual for complete information.

4.12 Status Test Data

Introduction

The prompts used here are for determining the reason for a controller failure. Refer to the *Section 9 – Troubleshooting* in this manual for complete information.

Section 5 – Operation

5.1 Overview

Introduction

This section gives you all the information necessary to monitor and operate your controller. Review the Operator Interface shown in "Monitoring" to make sure you are familiar with the indicator definitions. The key functions are listed in *Section 1 - Overview*.

What's in this section?

This section contains the following topics:

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5.3	How to Enter a Security Code	86
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5.2 How to Power Up The Controller

Apply power

When power is applied, the controller will run three diagnostic tests. All the displays will light and then the controller will go into automatic mode.

Diagnostic tests

Table 5-1 lists the three diagnostic tests.

Table 5-1 Power Up Diagnostic Tests

Prompt on Lower Display	Condition
RAM TEST	Check RAM
CONFTEST	Check Non-volatile memory
CAL TEST	Check Calibration

Test failures

If one or more of these tests fail, the controller will go to the Fail-safe Manual Mode, and "FAILSAFE" will flash in the lower display.

If the output type is Position Proportional, and AUTO-CAL has never been done, a prompt "CALMTR" will appear suggesting that the controller be calibrated.

Troubleshooting

Refer to "STATUS TESTS" in *Section 9 - Troubleshooting* to identify and correct the problem.

Continued on next page

Check the displays and keys

Use the procedure in Table 5-2 to run the display and key test.

Table 5-2 Procedure for Testing the Displays and Keys

Press	Result
SET UP and hold in, then FUNCTION at the same time	The controller will run a display test. All the displays will light for 8 seconds, then the displays will look like this: Upper Display: KEYS Lower Display: TRY ALL
Press each key to see if it works	When the key is pressed, the lower display will indicate the name of the key pressed.

Key Pressed	Lower Display
FUNCTION	FUNCTION
LOWER DISPLAY	LWR DISP
MANUAL/AUTO	AUTO MAN
SETPOINT/SELECT	SP SEL
▲	INCRMENT
▼	DECRMENT
RUN/HOLD	RUN HOLD
▲ + ▼	INCRDECR
FUNCTION+SETUP	FUNC SU

If no key is presses for 20 seconds, the test will time out and the controller will go into control mode.

If any test fails, go to "Controller Failure Symptoms" in *Section 9 - Troubleshooting*.

Key error

When a key is pressed and the prompt "KEY ERROR" appears in the lower display, it will be for one of the following reasons:

- parameter not available,
- not in Set Up mode, press [SET UP] key first,
- Key malfunction, do keyboard test.

5.3 Enter a Security Code

Introduction

The LOCKOUT feature in the UDC3000 is used to inhibit changes (via keyboard) of certain functions or parameters by unauthorized personnel. There are different levels of LOCKOUT depending on the level of security required. These levels are:

NONE
CALIBRATE
+CONF
+VIEWING
MAXIMUM

See *Section 4 - Configuration Definitions* for details.

Security code numbers

The level of keyboard lockout may be changed in the Set Up mode. However, knowledge of a security code number (1 to 4095) may be required to change from one level of lockout to another.
When a controller leaves the factory, it has a security code of 0 which permits changing from one lockout level to another without entering any other code number.

Procedure

If you require the use of a security code, select a number from 0001 to 4095 and enter it when the lockout level is configured as "NONE".
Thereafter, that selected number must be used to change the lockout level from something other than "NONE".

CAUTION Write the number on the Configuration Record Sheet in the configuration section so you will have a permanent record.

Use the procedure in Table 5-3 to enter a security code.

Table 5-3 Procedure for Entering a Security Code

Step	Press	Action
1	SET UP	Until you see Upper Display: SET UP Lower Display: TUNING
2	FUNCTION	Until you see Upper Display: 0 Lower Display: SECURITY
3	▲ or ▼	to enter a four digit number in the upper display (1 to 4095) This will be your security code.

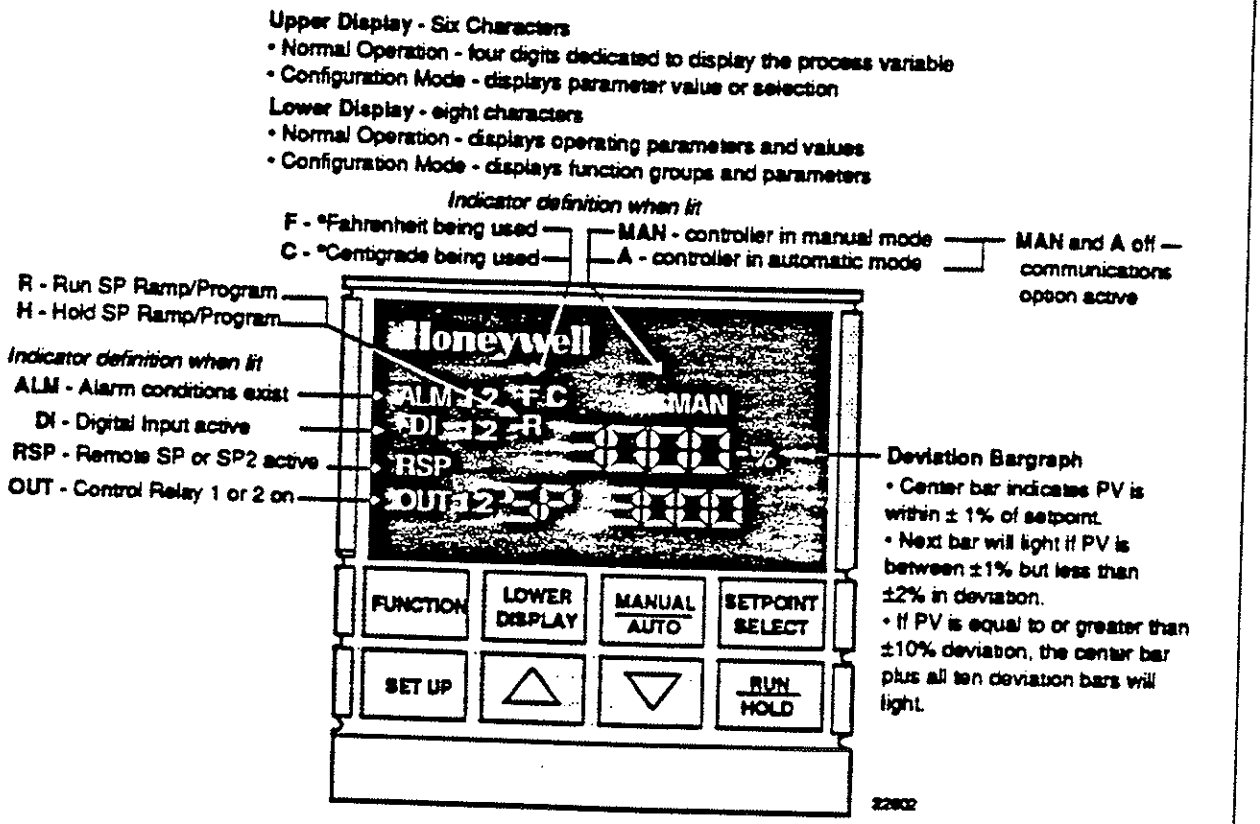
5.4 Monitoring Your Controller

Operator Interface

The indicators and displays on the Operator Interface let you see what is happening to your process and how the controller is responding.

Figure 5-1 is a view of the Operator interface. A description of the displays and indicators is included.

Figure 5-1 Operator Interface



Decimal point position

In each display, when no decimal place is configured, the right-most character is blank.

When a single decimal position has been configured and values greater than 1000 are displayed, the right-most character is blank but the decimal point will be lit.

Continued on next page

Viewing the operating parameters

Press the LOWER DISPLAY key to scroll through the operating parameters listed in Table 5-4.
The lower display will show only those parameters and its value that apply to your specific model and the way in which it was configured.

Table 5-4 Lower Display Key Parameter Prompts

Prompt	Description
SP **	Local Setpoint 1
2SP **	Local Setpoint 2 (where remote setpoint does not apply)
RSP	Remote Setpoint (when available)
2IN	Input 2
DEV	PV deviation from setpoint (±999.9 maximum)
ZZRAXX.XX	Time remaining in Setpoint Ramp ZZ = Segment Number XX.XX = Hrs/Minutes
ZZSKXX.XX	Time remaining in Setpoint Soak ZZ = Segment Number XX.XX = Hrs/Minutes
PIDSETX **	Tuning Parameter Set X=1 or 2
OUT **	Output Value in Percent (%); also 3PStep estimated motor position when no slidewire exists
CSP	Computer Setpoint (when setpoint is in override)
SPN	Setpoint Now (for setpoint rate)
POS	3 Position Step motor position when slidewire is connected

**You can press ▲ or ▼ to change the value of this parameter.

Continued on next page

Diagnostic error messages

The UDC3000 performs background tests to verify data and memory integrity. If there is a malfunction, an error message will be displayed.

In the case of more than one simultaneous malfunctions, only the one with the highest priority will appear on the lower display.

A list of error messages is contained in Table 5-5.

If any of these error messages occur, refer to *Section 9 - Troubleshooting* for information to correct the failure.

Table 5-5 Error Messages

Prompt	Description
EE FAIL	Unable to write to non-volatile memory
FAILSAFE	Failsafe
INP1FAIL	Two consecutive failures of input 1 integration
INP2FAIL	Two consecutive failures of input 2 integration
SW FAIL	Position Proportional slidewire input failure
CONF ERR	Low limit greater than high limit for PV, SP, Reset or Output
INP1 RNG	Input 1 out-of-range Linear: ±10% out-of-range Characterized: ±1% out-of-range
INP2 RNG	Input 2 ±10% out-of-range
PV LIMIT	PV ±10% out-of-range
RV LIMIT	Remote Variable out-of-range Note: RV = (input 1 x ratio) + bias

5.5 Start Up Procedure

Procedure

The Start-up procedure is given in Table 5-6.

Table 5-6 Procedure for Starting Up the Controller

Step	Operation	Press	Action
1	Select manual mode	MANUAL AUTO	until "MAN" indicator is ON. The controller is in manual mode.
2	Adjust the output	▲ or ▼	to adjust the output value and ensure that the final control element is functioning correctly. Upper Display ← shows the PV value. Lower Display ← shows OUT and the output value in %.
3	Tune the controller	SET UP	Make sure the controller has been configured properly and all the values and selections have been recorded on the Configuration Record Sheet. To tune your controller manually, see Section 11 - Appendix B Refer to Set Up group "TUNING" to ensure that the proper selections for PROP BD or GAIN, RATE MIN, and RSET MIN or RSET RPM have been entered. For controllers with ADAPTIVE TUNE, see the procedure in this section.
4	Enter the local setpoint	LOWER DISPLAY	Upper Display ← shows the PV Value. Lower Display ← SP and the local setpoint value
		▲ or ▼	To adjust the local setpoint to the value at which you want the process variable maintained. The local setpoint cannot be changed if the Setpoint Ramp function is enabled. "H" or "R" appears in the upper display.
5	Select Automatic Mode	MANUAL AUTO	until "A" indicator is ON. The controller is in Automatic mode. The controller will automatically adjust the output to maintain the process variable at setpoint, if the controller is properly tuned.

5.6 Operating Modes

Available modes

The controller can operate in any of three basic modes:

- Manual
- Automatic with Local Setpoint
- Automatic with Remote Setpoint

Manual and Automatic with Local set point are standard features and Automatic with Remote Setpoint is optional.

Mode definitions

Table 5-7 lists the three modes and their definitions.

Table 5-7 Operating Mode Definitions

Operating Mode	Definition
MANUAL	When switched to manual mode, the controller holds its output at the last value used during automatic operation and stops adjusting the output for changes in setpoint or process variable. Instead, you adjust the output by changing the value shown in the lower display. See *"Selecting Modes"*.
AUTOMATIC with LOCAL SETPOINT	In automatic local mode, the controller will operate from the local setpoint and automatically adjust the output to maintain the setpoint at the desired value. In this mode you can adjust the setpoint. See 5.7 - *"Setpoints"*.
AUTOMATIC with REMOTE SETPOINT	In automatic remote mode, the controller will operate from the setpoint measured at input 2. Adjustments are available to ratio this input and add a constant bias before it is applied to the control equation. See *Section 3 - Configuration, Set up group "Control"*.

What happens when you change modes

Table 5-8 explains what happens to the controller when you switch from one mode to another.

Table 5-8 Changing Operating Modes

Mode Change	Description
Manual to Automatic Local Setpoint	The local setpoint is usually the value previously stored as the local setpoint. PV Tracking is a configurable feature which modifies this. When it is selected, the local setpoint value tracks the process variable value continuously while in manual. LSP=PV at the moment you switch from manual to automatic. LSP holds at this one value.
Manual or Auto Local to Automatic Remote SP	The second input value with Ratio and Bias applied is used to calculate the control setpoint.
Automatic Remote SP to Manual or Auto Local Setpoint	If configured for Local Setpoint Tracking, when the UDC transfers out of remote setpoint, the last value of the control setpoint is inserted into the local setpoint. If LSP tracking is not configured, the local setpoint will not be altered when the transfer is made.

Continued on next page

Selecting Manual or Automatic mode

An alternate action switch places the controller in Automatic or Manual mode of operation.

Switching between manual and automatic will be bumpless, except when PD+MR algorithm is selected.

Table 5-9 includes procedures for selecting automatic or manual mode and changing the output while in manual.

Table 5-9 Procedure for Selecting Automatic or Manual Mode

Step	Operation	Press	Action
1	Selecting Automatic Mode	MANUAL AUTO	until "A" indicator is ON. The controller regulates its output to maintain the PV at the desired setpoint. Upper Display shows the PV value. Lower Display shows SP and the setpoint value. The deviation bargraph indicates the PV deviation from the setpoint.
2	Selecting Manual Mode	MANUAL AUTO	until "MAN" indicator is ON. The controller holds its output at the last value used during automatic operation and stops adjusting the output for changes in setpoint or process variable. Upper Display shows the PV value. Lower Display shows OUT and the output value in (%). The deviation bargraph indicates the PV deviation from the setpoint.
3	Adjust the Output in Manual Mode	▲ or ▼	to adjust the output value while in manual mode. Upper Display shows the PV value. Lower Display shows OUT and the output value in %.
4	Return to Automatic Mode	MANUAL AUTO	The "A" indicator will appear indicating Automatic mode.

Continued on next page

Position Proportional Backup mode

This feature provides for Position Proportional models to automatically change to a Three Position Step algorithm if the slidewire input signal fails. This will maintain control of your process.

"IN2 RNG" or "SWFAIL" will flash in the lower display and the "OUT" display will show a estimated motor position WITHOUT a decimal point.

5.7 Setpoints

Introduction

You can configure the following setpoints for the UDC3000 controller.

- A single local setpoint
- 2 local setpoints
- A local setpoint and a remote setpoint (Remote setpoint is an option)

These setpoint can be toggled by the SETPOINT/SELECT key.

Selecting the local setpoint source

Use the procedure in table 5-10 to select a single local setpoint source or two local setpoints.

Table 5-10 Procedure for Selecting the Local Setpoint Source

Step	Operation	Press	Action
1	Enter Set Up mode	SET UP	until the displays read: Upper Display: SET UP Lower Display: CONTROL
2	Display Local Setpoint Source selections	FUNCTION	until the displays read: Upper Display: ← Setpoint source selections Lower Display: SP SOURC 1 LOCAL 2 LOCAL
3	Select the desired source	▲ or ▼	to select the desired setpoint source in the upper display.
4	Return to control	LOWER DISPLAY	The controller will assume normal control.

Changing the local setpoints

Use the procedure in Table 5-11 to change either of the local setpoint value.

Table 5-11 Procedure for Changing the Local Setpoints

Step	Operation	Press	Action
1	Select the setpoint	LOWER DISPLAY	until you see Upper Display: ← The PV value Lower Display: ← SP or 2SP and the local setpoint value
2	Change the value	▲ or ▼	to change the local setpoint to the value at which you want the process maintained. The deviation bargraph indicates PV deviation from setpoint.

Continued on next page

Enabling (or disabling) the remote setpoint

Use the procedure in Table 5-12 to enable the remote setpoint source as Input 2.

Table 5-12 Procedure for Enabling (or disabling) the Remote Setpoint

Step	Operation	Press	Action
1	Select Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: CONTROL
2	Select the Remote Setpoint Source Prompt	FUNCTION	Until you see: Upper Display: ◄ Lower Display: RSP SRC The Remote Setpoint source selection none - not used In 2 - Input 2 as RSP
3	Change selection	▲ or ▼	to enable or disable the remote setpoint.
4	Return to normal operation	LOWER DISPLAY	This will return the controller to normal operation.

Switching between setpoints

You can switch between Local and Remote setpoints or between two Local setpoints when configured. Use the procedure in Table 5-13 to switch between setpoints.

Table 5-13 Procedure for Switching Between Setpoints

Step	Operation	Press	Action
1	Switch between Setpoints	SETPOINT SELECT or LOWER DISPLAY	alternately select Local setpoint 1 and Remote setpoint or switch between the 2 Local Setpoints. or until you see the desired setpoint indicated ATTENTION "KEY ERROR" will appear in the lower display if the remote setpoint or 2nd local setpoint is not configured as a setpoint source, or if you attempt to change the setpoint while a setpoint ramp is enabled.
2	Change the Local setpoint value	▲ or ▼	The REMOTE setpoint cannot be changed at the keyboard.

Continued on next page

Setpoint selection indication

Table 5-14 shows how the indicators react and what the displays show for each type of setpoint.

Table 5-14 Setpoint Selection Indication

	Using Local Setpoint	Using Remote Setpoint	Using 2nd Local Setpoint
RSP Indicator	OFF	ON	ON
Upper Display	PV	PV	PV
Lower Display	SP and the Local Setpoint Source	RSP and Remote Setpoint Value	SP2 and the 2nd Local Setpoint Value

5.8 Setpoint Rate

Configuration

You can configure a Setpoint Ramp Rate that will apply to any Local setpoint change immediately.

Refer to the Configuration Section to enable the ramp and set an upscale or downscale rate value.

Make sure SP RAMP and SP PROG are disabled.

Operation

When a Local setpoint change is made, the controller will ramp from the original setpoint to the new one at the rate specified. This changing (current) setpoint can be viewed on the lower display.

Press the LOWER DISPLAY key until you see SPn and the setpoint value in the lower display.

5.9 Single Setpoint Ramp

Configuring the setpoint ramp

You can configure a single setpoint ramp to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes. You can RUN or HOLD the ramp at any time.

Procedure

Table 5-15 lists the procedure for configuring the Setpoint Ramp parameters. The procedure for SP Program is in *Section 6 – Setpoint Programming Option.*

Table 5-15 Procedure for Configuring a Setpoint Ramp

Step	Operation	Press	Action
1	Select SP RAMP Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: SP RAMP
2	Select the Setpoint Ramp function	FUNCTION	Until you see: Upper Display: dISAbL Lower Display: SP RAMP
3	Enable Setpoint Ramp	▲	Until you see: Upper Display: ENABLE Lower Display: SP RAMP NOTE: You cannot change the current local setpoint if the setpoint ramp function is enabled. Make sure SP RATE and SP PROG are disabled.
4	Set the Ramp Time	FUNCTION	Until you see: Upper Display: ← The ramp time in minutes Lower Display: TIME MIN
		▲ or ▼	to change the upper display value to the number of minutes in which you want the final setpoint to be reached. Setting Range = 1 to 255 minutes NOTE: Entering "0" will imply an immediate step change to the final SP.
5	Set the Final Setpoint value	FUNCTION	Upper Display: ← The Final Setpoint value Lower Display: FINAL SP
6		▲ or ▼	to change the upper display value to the desired final setpoint value. Setting Range = within the setpoint limits

Continued on next page

Running the setpoint ramp

Running a Setpoint Ramp includes starting, holding, viewing the ramp time, ending the ramp and disabling it.

Procedure

Table 5-16 lists the procedure for running the Setpoint Ramp.

Table 5-16 Procedure for Running a Setpoint Ramp

Step	Operation	Press	Action
1	Put the controller into Automatic mode	MANUAL AUTO	until "A" indicator is ON and you will see: Upper Display ← H and the PV value Lower Display ← SP and the present setpoint value
2	Set Start SP	▲ or ▼	until the start setpoint value you desire is indicated in the lower display: Upper Display ← H and the PV value Lower Display ← SP and the start setpoint value
3	Start the Ramp	RUN HOLD	You will see: Upper Display ← R and the PV value Lower Display ← SP and a changing setpoint value NOTE: The value in the lower display will be increasing or decreasing toward the final setpoint value. The PV value in the upper display will also change.
4	Hold the Ramp at the current value	RUN HOLD	This holds the ramp at the current setpoint value. Press again to continue run. A "KEY ERROR" prompt will appear if [RUN/HOLD] key is pressed while "SP RAMP" is disabled.
5	View the remaining ramp time	LOWER DISPLAY	Until you see: Upper Display ← R or H and the PV value Lower Display ← RAMP XXXm (Time remaining)

Procedure continued on next page

Procedure, continued

Table 5-16 Procedure for Running a Setpoint Ramp, continued

Step	Operation	Press	Action
6	End the Ramp		When the final setpoint is reached, the "R" changes to "H" in the upper display and the controller operates at the new setpoint. ATTENTION Anytime the local setpoint is different from the final setpoint value and the RUN/HOLD key is pressed - the ramp will start again.
7	Disable the setpoint ramp function	SET UP	Until you see: Upper Display SET UP Lower Display SP RAMP
		FUNCTION	You will see: Upper Display ENABLE Lower Display SP RAMP
		▲	Until you see: Upper Display dISPbL Lower Display SP RAMP
8	Return to normal operating mode	LOWER DISPLAY	

5.10 Using Two Set of Tuning Constants

Introduction

You can use two set of tuning constants for single output types and choose the way they are to be switched.
The sets can be:

- Keyboard selected
- Automatically switched when a predetermined Process Variable value is reached.
- Automatically switched when a predetermined Setpoint value is reached.

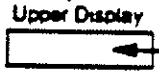
The following procedures show you how to:

- Select two sets
- Set the switch-over value
- Set tuning constant value for each set
- Switch between two sets via the keyboard (without automatic switch-over)

Select two sets

The procedure in Table 5-17 tells you how to select two sets.

Table 5-17 Procedure for Selecting Two Set of Tuning Constants

Step	Operation	Press	Action
1	Select Control Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: CONTROL
2	Select PID SETS function	FUNCTION	Until you see: Upper Display:  Available selections are listed below Lower Display: PIDSETS 1 ONLY - 1 set of constants 2 KEYBD - 2 sets, keyboard selectable 2 PVSW - 2 sets, auto switch at PV value 2 SPSW - 2 sets, auto switch at SP value
		▲ or ▼	to select the type of PID SET.

Continued on next page

Set switch-over value

If you select 2 PVSW or 2 SPSW, you must set a value at which the sets will switch over.
The procedure in Table 5-18 shows you how to set this value.

Table 5-18 Procedure for Setting Switchover Values

Step	Operation	Press	Action
1	Select Switchover value function	FUNCTION assuming you are still in Set Up group "CONTROL"	Until you see: Upper Display: ____ ← The switchover value Lower Display: SW VALUE
		▲ or ▼	to select the switch-over value.in the upper display.

Set Tuning constant values for each set

There are specific tuning constant that must be set for each set. The procedure in Table 5-19 shows you how to access these constants and change their values.

Table 5-19 Procedure for Setting Tuning Constant Values

Step	Operation	Press	Action
1	Select Tuning Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: TUNING
2	Select the tuning constants	FUNCTION	to successively display the following constants: Upper Display: ____ ← The tuning constant value Lower Display: ____ ← PROP BD or GAIN* RATE* RSET* PROP BD2 or GAIN2** RATE 2** RSET2**
		▲ or ▼	To change the value of any of the above listed prompts in the lower display.

*PIDSET1 – will be used when PV or SP, whichever is selected, is greater than the switchover value.
**PIDSET2 – will be used when PV or SP, whichever is selected, is less than the switchover value.

Continued on next page

Switch between two sets via the keyboard (without automatic switch-over)

This procedure is operational only if 2 PID SETS was configured at "CONTROL" set up group.

The procedure in Table 5-20 shows you how to switch from one set to another.

Table 5-20 Procedure for switching PID SETS from the Keyboard

Step	Operation	Press	Action
1	Access the PID set display	LOWER DISPLAY	Until you see: Upper Display The PV value Lower Display PIdSETX X= 1 or 2
		▲ or ▼	to change PID SET 1 to PID SET 2 or vice versa. You can use Adaptive Tune on each set.

5.11 Alarm Setpoints

Introduction

An alarm consists of a relay contact and an operator interface indication. The alarm relay is de-energized if Setpoint 1 or Setpoint 2 is exceeded.

The alarm relay is energized when the monitored value goes into the allowed region by more than the hysteresis.

The relay contacts can be wired for normally open (NO)-*energized* or normally closed (NC) de-energized at the rear terminals. See *Section 2 - Installation (Table 2-4)* for alarm relay contact information.

There are four alarm setpoints, two for each alarm.

The type and state (High or Low) is selected during configuration. See *Section 3 - Configuration* for details.

The procedure for displaying and changing the alarm setpoints is listed in Table 5-21.

Procedure for displaying the alarm setpoints

Table 5-21 Procedure for Displaying or Changing the Alarm Setpoints

Step	Operation	Press	Action
1	Access the Alarm Set Up group	SET UP	Until you see: Upper Display: SET UP Lower Display: ALARMS
2	Access the Alarm Setpoint Values	FUNCTION	to successively display the alarm setpoints and their values. Their order of appearance is shown below. Upper Display → The alarm setpoint value Lower Display A1S1 VAL = (Alarm 1, Setpoint 1 value) A1S2 VAL = (Alarm 1, Setpoint 2 value) A2S1 VAL = (Alarm 2, Setpoint 1 value) A2S2 VAL = (Alarm 2, Setpoint 2 value)
		▲ or ▼	to change any alarm setpoint value you select in the upper display.
3	Return to normal operation	LOWER DISPLAY	

5.12 Three Position Step Control Algorithm

Introduction

The Three Position Step Control algorithm allows the control of a valve (or other actuator) with an electric motor driven by two controller output relays; one to move the motor upscale, the other to move it downscale, without a feedback slidewire linked to the motor shaft. Adaptive Tune does not function with this algorithm

Estimated motor position

The Three Position Step control algorithm provides an output display ("OUT") which is an estimated motor position since the motor is not using any feedback.

Although this output indication is only accurate to a few percent, it is corrected each time the controller drives the motor to one of its stops (0% or 100%).

It avoids all the control problems associated with the feedback slidewire (wear, dirt, noise).

When operating in this algorithm, the estimated "OUT" display is shown to the nearest percent (i.e. no decimal).

Accurate motor position

In the event that an accurate and repeatable indication in motor position is required, Position Proportional model's slidewire input can be used to read the motor position and display it on the lower display as "POS" while still operating in the Three Position Step control mode.
The slidewire must be calibrated for this to operate correctly.

Displaying the motor position

Table 5-22 list the procedure for displaying the motor position.

Table 5-22 Procedure for Displaying the 3PSTEP Motor Position

Step	Operation	Press	Action
1	Access the displays	LOWER DISPLAY	Until you see: Upper Display → The PV value Lower Display POS = 3PStep motor position with slidewire connected or OUT = Estimated 3PStep motor position when no slidewire exists

Power up output

When the controller powers up after a power outage, the position of the motor will correspond to whatever was configured at set up group prompt "CONTROL", function prompt "PWR OUT", selection LAST or FAILSAFE. Refer to Subsection4.8, Table 4-7 for definition of each selection.

5.13 Digital Input Option (Remote Switching)

Introduction

The Digital Input option detects the state of external contacts for either of two inputs. On contact closure, the controller will respond according to how each digital input is configured.
Make your selection under Set Up group "OPTION", function group prompt "DIG IN1" or "DIG IN2". See *Section 3 - Configuration* .

Action on closure

Table 5-23 lists the configuration prompt selections, the "Action on Closure", and the display indication for each selection available.

Table 5-23 Digital Input Option Action on Contact Closure

DIG IN1 or DIG IN2 selections	Display indication	Action on contact closure*
None	DI 1 2 always off*	No Digital Input selection
To MAN	"MAN" blinks	Puts the controller into manual mode Contact open returns the controller to former mode unless AUTO/MAN key is pressed while digital input is active.
To LSP		Puts the controller into local setpoint 1. When contact opens, the controller returns to former operation, local or remote setpoint, unless the SETPOINT/SELECT key is pressed while digital input is active.
To 2SP	"RSP BLOCK" blinks	Puts the controller into local setpoint 2.
To DIR	None	Selects direct controller action.
ToHOLD	"H" blinks	Suspends setpoint program or setpoint ramp. Contact open runs the program or ramp.
ToPID2	PID2 in lower display	Selects PID2
PV 2IN		Selects the PV to equal Input 2.
To RUN	"R" indicator blinks	Starts a stopped SP Program.
ToBEGN		Resets the Setpoint Program back to the beginning of the first segment in the program. The output goes to failsafe, manual mode.
STOP I		Disable PID (I) Integral action.
MANFS		Unit goes to Manual Mode, output goes to the Failsafe value.
To LOCK	"LOCKED" when key pressed	Disables all keys
To A OUT		output goes to value set at control prompt "AUTO OUT"

*The Digital Input Annunciator will always show the Digital Input status.

Keyboard operation

If a particular mode or parameter is selected by the contact closure, using the keyboard to select the same parameter will ensure that the selected mode will be maintained after the remote digital switch is re-opened.

5.14 Adaptive Tune (Accutune™)

Introduction

Adaptive Tune will continually adjust the Gain or Proportional Band (P), Reset (I), and Rate (D) tuning constants in response to setpoint changes.

Adaptive Tune handles all Local and Computer Setpoint changes.

How it works

Adaptive Tune uses time domain analysis, and the rule based expert system techniques to identify the two most dominant process lags plus any dead time.

It then automatically readjusts the PID parameters as necessary. It does this while controlling to setpoint in automatic (closed loop) control mode.

These calculated PID values can be changed, if desired, by disabling Adaptive Tune and entering different values.

Tuning can be aborted by pushing [Manual] key to return to manual mode.

Setpoint changes

During start-up, or whenever the setpoint changes, Adaptive Tune employs time domain analysis to tune the process at any desired setpoint without any prior initialization or process knowledge.

Rules and regulations

The following is a list of rules and regulations for Adaptive Tune.
Adaptive Tune:

- can tune on all Local or Computer setpoints except ramping setpoints
- will work only for algorithms PID-A or PID-B selections, i.e. it will NOT work with ON/OFF or Three Position Step control algorithms.
- is done in automatic mode
- can be monitored or reconfigured over Honeywell's communication network
- can be disabled via Digital Inputs.
- can be aborted by going to manual mode.

When a setpoint Adaptive Tune is in progress, a large "T" appears in the upper display. During this time, no changes to the configuration parameters, including the setpoint, are permitted.

Continued on next page

Configuration

Before starting Adaptive Tune you must

- enable the Adaptive Tune feature
- set the minimum value of setpoint change in % of span that will result in re-tuning.

Procedure

Use the procedure in Table 5-24 to configure these items.

Table 5-24 Procedure for Configuring Adaptive Tune Parameters

Step	Operation	Press	Action
1	Select Adaptive Tune Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: RcRPT TUE
2	Select the type of Adaptive Tune	FUNCTION	You will see: Upper Display: ← DISABLE, SP ONLY Lower Display: ADAPTIVE DISABLE - Adaptive Tune disabled SP ONLY - Adaptive Tune will occur on setpoint changes only
		▲ or ▼	until the desired selection appears in the upper display.
3	Enter the setpoint change value	FUNCTION	until you see Upper Display: ← Range: ±5 to 15% of PV Span Lower Display: SP CHANGE This is the minimum setpoint change value on which re-tuning will occur. Example: If the range is 0 to 2000, and 5% is configured here, re-tuning will occur if the setpoint change is 100 or larger.
		▲ or ▼	until the desired range appears in the upper display.

Table continued on next page

Configuration, continued

Table 5-24 Procedure for Configuring Adaptive Tune Parameters, continued

Step	Operation	Press	Action
4	Verify or change the process Gain value	FUNCTION	You will see: Upper Display Range: 0.01 to 50.00 Lower Display KPC The Process Gain Value is normally a READ only value. It should only be changed if the controller fails to identify the process. In this case, set the value to the algebraic value of PV in percent, divided by output in percent, as displayed while in manual mode.
		▲ or ▼	until the desired range appears in the upper display.

Start-up mode

At start-up, SP ADAPT tuning is used. The procedure for start-up is listed in Table 5-25.

Table 5-25 Procedure for Using Adaptive Tune at Start-up

Step	Operation	Press	Action
1	Put the controller into manual mode	MANUAL AUTO	Until the MAN indicator is ON. You will see: Upper Display the PV value Lower Display OUT XXX
		▲ or ▼	to adjust the output value in the lower display, so that the PV lines out at least 10% of PV range and much lower than the normal setpoint setting.
2	Let PV stabilize		Allow the PV to stabilize (stop changing). Depending on the response time of the process, you may have to wait a while for the PV value to line out. Watch the displays for a stable condition.

Table continued on next page

Start-up mode, continued

Table 5-25 Procedure for Using Adaptive Tune at Start-up, continued

Step	Operation	Press	Action
3	Adjust the setpoint	LOWER DISPLAY	Until you see: Upper Display ◄— the PV value Lower Display SP XXXX
		▲ or ▼	to adjust the setpoint value in the lower display to the desired setpoint at which you plan to operate after Adaptive Tune is completed
4	Start SP ADAPT tuning	MANUAL AUTO	The controller will switch to automatic mode and the process will start to move toward the setpoint and will line out with the proper tuning constants. A large "T" appears on the left side of the upper display to indicate that (SP ADAPT) Adaptive tune is in progress. You will see: Upper Display T XXXX ◄— the PV value Lower Display SP XXXX ◄— the setpoint value

SP ADAPT (after Start-up)

SP ADAPT will occur whenever the controller is in automatic mode and a setpoint change occurs which is greater than the previously configured minimum setpoint change value.

The controller will delay using any setpoint changes for 30 seconds to enable it to calculate whether to "SP ADAPT" or not. But, if the controller is toggled between LSP1 and LSP2 or if any other key (such as LOWER/DISPLAY) is pressed, the setpoint change is immediate.

A large "T" is displayed in the upper display whenever SP ADAPT mode is in progress. During this time, no changes to the configuration parameters, including the setpoint, are permitted.

Aborting Adaptive Tuning

If it is necessary to stop or abort the tuning, press the Manual/Auto key to return to Manual mode. This will cause an immediate abort of tuning.

Also, Adaptive Tune can be temporarily disabled by properly configuring a digital input.

Continued on next page

Re-Tuning

The controller will evaluate current tuning as SP changes occur. When re-tuning is required, the controller operates in automatic mode controlling to new "intermediate" tuning constants until PV lines out within approximately 0.2% span of SP.

At that point, the "T" disappears and "Final" tuning values are entered and used until re-tuning occurs again. The controller never goes into manual and does not bump the output to evaluate tuning requirements.

Note that if re-tuning was not required, no changes will be made; but, the "T" will still occur to indicate that Adaptive Tune algorithm is measuring the process response.

Error code accessing procedure

When an error is detected in the Adaptive tune process, the message "AT ABORT" will appear in the lower display.

Access function prompt "AT ERROR" to determine what is causing the error. This procedure is listed in Table 5-26.

Table 5-26 Procedure for Accessing Adaptive Tune Error Codes

Step	Operation	Press	Action
1	Select Adaptive Tune Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: ReAPT tUE
2	Go to Error Code prompt	FUNCTION	You will see: Upper Display: ◄ An error code Lower Display: AT ERROR Table 5-27 lists all the Adaptive tune error codes and their definitions.

Continued on next page

Error codes

Table 5-27 lists the Adaptive Tune error codes and their definitions.

Table 5-27 Adaptive Tune Error Code Definitions

Lower Display Prompt	Upper Display Error Code	Code Definition
AT ERROR		**ADAPTIVE TUNE ERROR STATUS** — When an error is detected in the Adaptive Tune process, an error prompt will appear.
	NONE	**NO ERRORS**
	OUTLIM	**OUTPUT GREATER OR LESS THAN OUTPUT LIMITS** - Output set insufficiently to get Setpoint value.
	IDFAIL	**IDENTIFICATION PROCESS FAILED** - An illegal value for Gain, Rate, or Reset was calculated
	ABORT	**CURRENT ADAPTIVE TUNE PROCESS ABORTED** - caused by one of the following conditions: • changing to manual mode • Digital input detected • In heat region of output and a cool output calculated or vice versa.

Section 6 – Setpoint Ramp/Soak Programming Option

6.1 Overview

What is programming?

The term "programming" is used here to identify the process for selecting and entering the individual ramp and soak segment data needed to generate the required setpoint versus time profile (also called a program).

A segment is a ramp or soak function which together make up a setpoint program. Setpoint Ramp/Soak Programming lets you configure 6 ramp and 6 soak segments to be stored for use as one program or several small programs. You designate the beginning and end segments to determine where the program is to start and stop.

Review program data and configuration

While the procedure for programming is straightforward, and aided by prompts, we suggest that you read *"Program Contents"* in this section as well as *"Section 3 - Configuration"* before doing the setpoint programming.

Fill out the worksheet

Draw a Ramp/Soak Profile on the worksheet provided and fill in the information for each segment. This will give you a record of how the program was developed.

What's in this section

The table below lists the topics that are covered in this section.

	Topic	See Page
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What you will configure

Basically, you will configure all the data that is relevant to each ramp and soak segment for a given setpoint versus time profile. The controller will prompt you through the sequence of segments and associated functions.

Ramp segments

A ramp segment is the time it will take to change the setpoint to the next setpoint value in the program.

Ramps are odd number segments. Segment #1 will be the initial ramp time.

Ramp time is determined in either:

TIME* - Hours:Minutes Range = 0-99hrs:59 min.

or

RATE* - EU/MIN or EU/HR Range = 0 to 999

* This selection of time or rate is made at prompt "RAMP UNIT"

Set this prompt before entering any Ramp.

ATTENTION Entering "0" will imply an immediate step change in setpoint to the next soak.

Soak segments

A soak segment is a combination of soak setpoint (value) and a soak duration (time).

Soaks are even number segments.

Segment 2 will be the initial soak value and soak time.

The soak setpoint range value must be within the setpoint high and low range limits in engineering units.

SOAK TIME is the duration of the soak and is determined in:

TIME - Hours:Minutes RANGE = 0-99hrs:59 min.

Start segment number

This designates the number of the first segment.

Range = 1 to 11

End segment number

This designates the number of the last segment. It must be a soak segment (even number).

Range = 2 to 12

Recycle number

This number allows the program to recycle a specified number of times from beginning to end.

Range = 0 to 99

Continued on next page

Guaranteed Soak

Each soak segment can have a deviation value of from 0 to ±99 which guarantees the value for that segment.

Guaranteed soak segment values >0 guarantee that the segments process variable is within the ± deviation for the configured soak time. Whenever the ± deviation is exceeded, soak timing is frozen.

There are no guaranteed soaks whenever the deviation value is configured to 0, i.e., soak segments start timing soak duration as soon as the soak setpoint is first reached, regardless of where the process variable remains relative to the soak segment.

The value is the number in engineering units, above or below the setpoint, outside of which the timer halts. The range is 0 to ± 99.

The decimal location corresponds to input 1 decimal selection.

Program state

This selection determines the program state after completion.

The selections are:

DISABL = Program is disabled

HOLD = Program on hold

Program termination state

This function determines the status of the controller upon completion.

The selections are:

LAST SP = controls to last setpoint and last control mode

F SAFE = Manual mode, Failsafe Output

ATTENTION If power is lost during a program, upon power-up the controller will be in hold and the setpoint value will be the setpoint value prior to the beginning of the setpoint program. The program is placed in hold at the beginning of the first segment in the program.

Ramp unit

This determines the engineering units for the ramp segments.

The selections are:

TIME = Hours:Minutes

RATE = EU/MIN or EU/HR

ATTENTION This selection cannot be changed while a program is in operation.

ATTENTION

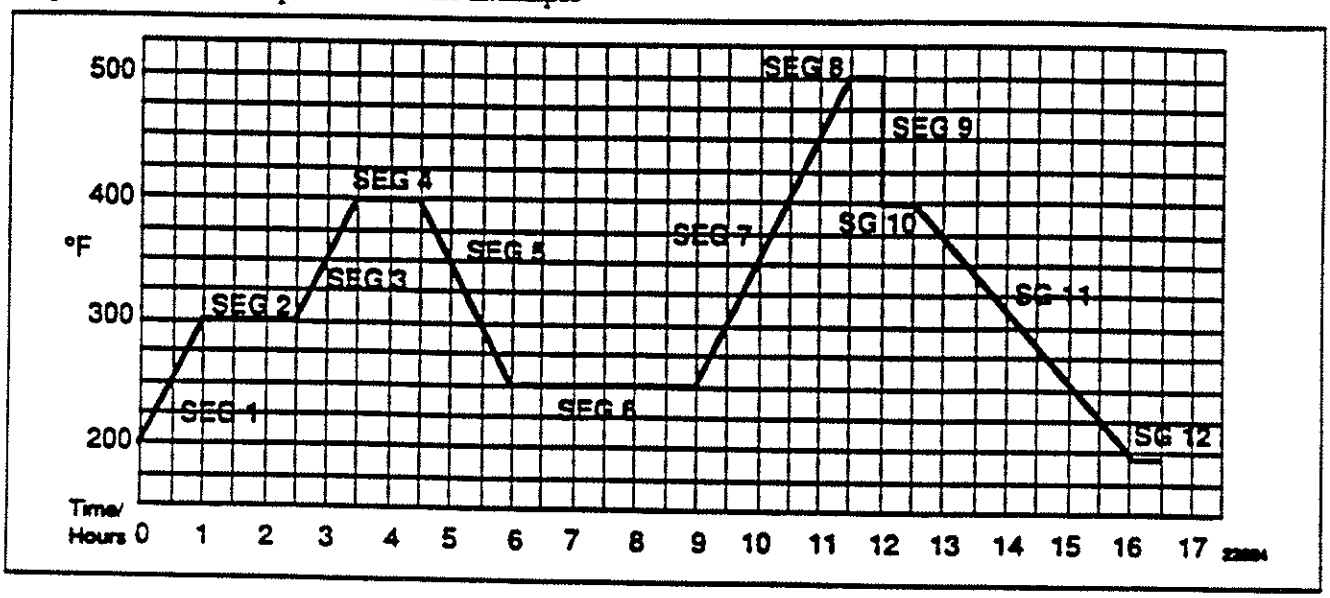
Accutune will not function during Setpoint programming.

6.3 Drawing a Ramp/Soak Profile

Ramp/Soak Profile example

Before you do the actual configuration, we recommend that you draw a Ramp/Soak profile in the space provided on the "*Program Record Sheet*" (Figure 6-2) and fill in the associated information.
An example of a Ramp/Soak Profile is shown in Figure 6-1.

Figure 6-1 Ramp/Soak Profile Example



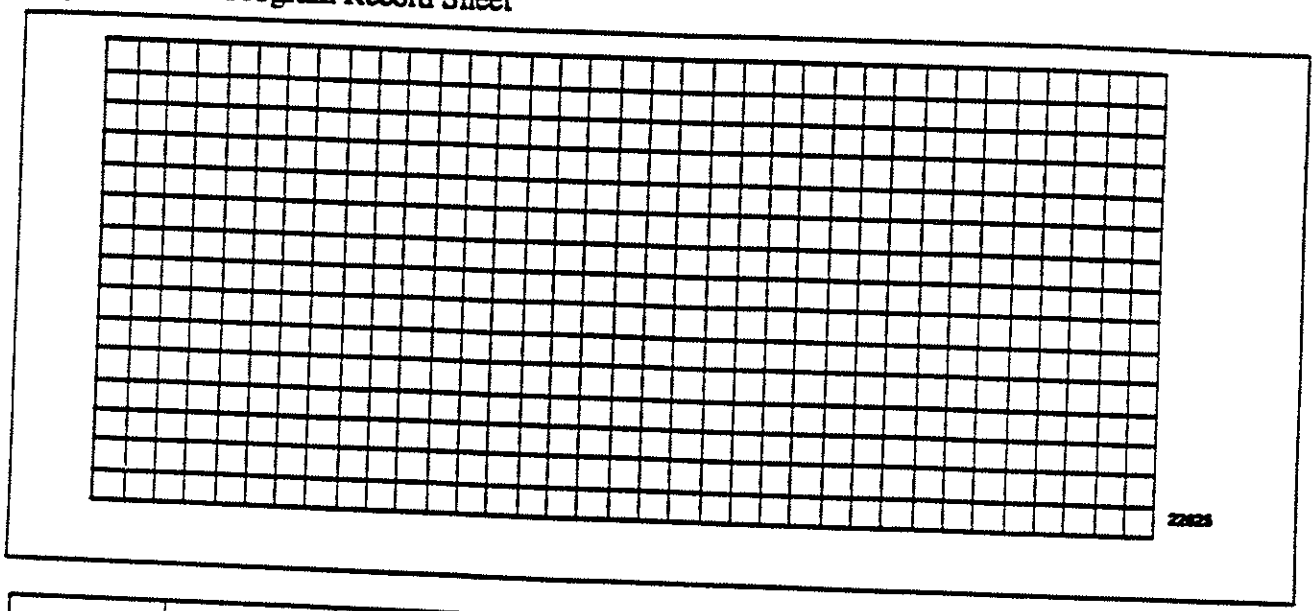
Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg.		1	SEG7RAMP	Ramp Time	7	2hrs:30min.
END SEG	End Seg.		12	SEG8 SP	Soak SP	8	500
RECYCLES	Number of Recycles		2	SEG8TIME	Soak Time	8	0hr.:30 min.
SOAK DEV	Deviation Value		0	SEG9RAMP	Ramp Time	9	0
SEG1RAMP	Ramp Time	1	1 hr.	SG10 SP	Soak SP	10	400
SEG2 SP	Soak SP	2	300	SG10 TIME	Soak Time	10	0hr.:30 min.
SEG2TIME	Soak Time	2	1hr.:30 min.	SG11RAMP	Ramp Time	11	3hrs:30min.
SEG3RAMP	Ramp Time	3	1hr.	SG12 SP	Soak SP	12	200
SEG4 SP	Soak SP	4	400	SG12TIME	Soak Time	12	0hr.:30 min.
SEG4TIME	Soak Time	4	1 hr.	STATE	Controller State at end		HOLD
SEG5RAMP	Ramp Time	5	1hr.:30 min.	PROG END	Controller Status		LAST SP
SEG6 SP	Soak SP	6	250	RAMP UNIT	Engr. Unit for Ramp		TIME
SEG6TIME	Soak Time	6	3hrs.:0min.				

Continued on next page

Program Record Sheet

Draw your ramp/soak profile on the record sheet shown in Figure 6-2 and fill in the associated information in the blocks provided. This will give you a permanent record of your program and will assist you when entering the Setpoint data.

Figure 6-2 Program Record Sheet



Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg.			SEG7RAMP	Ramp Time	7	
END SEG	End Seg.			SEG8 SP	Soak SP	8	
RECYCLES	Number of Recycles			SEG8TIME	Soak Time	8	
SOAK DEV	Deviation Value			SEG9RAMP	Ramp Time	9	
SEG1RAMP	Ramp Time	1		SG10 SP	Soak SP	10	
SEG2 SP	Soak SP	2		SG10 TIME	Soak Time	10	
SEG2TIME	Soak Time	2		SG11RAMP	Ramp Time	11	
SEG3RAMP	Ramp Time	3		SG12 SP	Soak SP	12	
SEG4 SP	Soak SP	4		SG12TIME	Soak Time	12	
SEG4TIME	Soak Time	4		STATE	Program Controller State		
SEG5RAMP	Ramp Time	5		PROG END	Controller Status		
SEG6 SP	Soak SP	6		RAMP UNIT	Engr. Unit for Ramp		
SEG6TIME	Soak Time	6					

6.4 Entering the Setpoint Program Data

Introduction

The procedure listed in table 6-1 tells you what keys to press and what prompts you will see when entering the setpoint program data. Follow the prompt hierarchy listed in table 6-2 when selecting the functions for setpoint programming.

ATTENTION Make sure SP RAMP and SP RATE are disabled first.

Table 6-1 Setpoint Program Data Entry Procedure

Step	Action	Press	Result
1	Select SP PROG Group	SET UP until you see	Upper Display: SET UP Lower Display: SP PROG
2	Select the functions	FUNCTION	This accesses the function prompts and enables Setpoint Programming. Upper Display → The current value for each prompt is shown Lower Display → The individual function prompts within the setpoint program group are shown. Successive presses of the [FUNCTION] key will sequentially display all the functions and their values or selections. Follow the prompt hierarchy shown in table 6-2.
3	Change the value or selection of a function prompt	▲ or ▼	This changes the value or selection in the upper display. If the display blinks, you are trying to select an unacceptable value.
4	Enter Value or selection into memory	FUNCTION	This enters the value or selection and goes to another prompt. Repeat steps 3 and 4 for each function you want to change.
5	Exit configuration	LOWER DISPLAY	This exits from the configuration mode.

Alarms on the Setpoint Program

You can configure an event to go ON or OFF at the beginning or end of any segment. Refer to *Section 3 - Configuration* under *"Alarms Parameters Group"* for details.

Continued on next page

Prompt Hierarchy

Table 6-2 lists all the function prompts for Setpoint Program data configuration in the order of their appearance.
Follow the procedure in table 6-1 to transfer the data from your setpoint Ramp/Soak profile into the controller.
All parameters may be changed while the program is disabled or in HOLD.

Table 6-2 Prompt Hierarchy and Available Selections

Prompt	Definition	Value or Selection (use ▲ or ▼)
SP RAMP	Setpoint Ramp selection	*Selections*: DISABLE **SP RAMP must be disabled to allow Setpoint Programming.**
SP RATE	Setpoint Rate of Change	*Selections*: DISABLE **SP RATE must be disabled to allow Setpoint Programming.**
SP PROG	Setpoint Ramp/Soak Programming	*Selections*: ENABLE DISABLE **SP PROG must be enabled to view the remaining prompts.**
STRT SEG	Start Segment Number	*Enter Value*: 1 to 11
END SEG	End Segment Number	*Enter Value*: 2 to 12 Always end in a soak Segment (2,4,.....12)
RECYCLES	Number of Program Recycles	*Enter Value*: 0 to 99 recycles
SOAK DEV	Guaranteed Soak Deviation Value	*Enter Value*: 0 to ± 99 The number selected will be 0 to 99± from setpoint.
SEG1RAMP or SEG1RATE	Segment #1 Ramp Time Segment #1 Ramp Rate	*Enter Value*: Ramp Time = 0-99hrs:0-59min, or Ramp Rate = Engineering units/min or Engineering units/hr **Select TIME, EU/MIN, or EU/HR at prompt "RAMP UNIT".** **All ramps will use the same selection.**
SEG2 SP	Segment #2 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits
SEG2TIME	Segment #2 Soak Duration	*Enter Value*: 0-99hrs:0-59min
SEG3RAMP or SEG3RATE	Segment #3 Ramp Time Segment #3 Ramp Rate	*Enter Value*: Ramp Time = 0-99hrs:0-59min, or Ramp Rate = EU/MIN or EU/HR
SEG4 SP	Segment #4 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits
SEG4TIME	Segment #4 Soak Duration	*Enter Value*: 0-99hrs:0-59min

Continued on next page

Prompt Hierarchy (continued)

Table 6-2 Prompt Hierarchy and Available Selections, continued

Prompt	Definition	Value or Selection (use ▲ or ▼)
SEG5RAMP or SEG5RATE	Segment #5 Ramp Time Segment #5 Ramp Rate	*Enter Value*: Ramp Time = 0-99hrs:0-59min, or Ramp Rate = EU/MIN or EU/HR
SEG6 SP	Segment #6 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits
SEG6TIME	Segment #6 Soak Duration	*Enter Value*: 0-99hrs:0-59min
SEG7RAMP or SEG7RATE	Segment #7 Ramp Time Segment #7 Ramp Rate	*Enter Value*: Ramp Time = 0-99hrs:0-59min, or Ramp Rate = EU/MIN or EU/HR
SEG8 SP	Segment #8 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits
SEG8TIME	Segment #8 Soak Duration	*Enter Value*: 0-99hrs:0-59min
SEG9RAMP or SEG9RATE	Segment #9 Ramp Time Segment #9 Ramp Rate	*Enter Value*: Ramp Time = 0-99hrs:0-59min, or Ramp Rate = EU/MIN or EU/HR
SG10 SP	Segment #10 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits
SG10TIME	Segment #10 Soak Duration	*Enter Value*: 0-99hrs:0-59min
SG11RAMP or SG11RATE	Segment #11 Ramp Time Segment #11 Ramp Rate	*Enter Value*: Ramp Time = 0-99hrs:0-59min, or Ramp Rate = EU/MIN or EU/HR
SG12 SP	Segment #12 Soak Setpoint Value	*Enter Value*: Within the Setpoint limits
SG12TIME	Segment #12 Soak Duration	*Enter Value*: 0-99hrs:0-59min
STATE	Program state at program end	*Selections:* DISABLE HOLD(hold mode)
PROG END	Program Termination State	*Selections*: LAST SP - Hold at last setpoint in the program F SAFE - Manual mode/Failsafe output
RAMPUNIT	Engineering units for ramp segments	*Selections*: TIME EU/MIN EU/HR

6.5 Run/Monitor the Program

Introduction

Make sure all the "SP PROG" function prompts under the Set Up group "SP RAMP" have been configured with the required data.
An "H" will appear in the upper display indicating that the program is in the HOLD state.

Run/Monitor functions

Table 6-3 lists all the functions required to run and monitor the program.

Table 6-3 Run/Monitor Functions

Function	Press	Result
Set the Local Setpoint	SETPOINT SELECT	You will see Upper Display Local Setpoint Value Lower Display SP
	▲ or ▼	To set the Local Setpoint value to where you want the program to start out.
Run State	RUN HOLD	Initiates the setpoint program. An "R" appears in the upper display indicating that the program is running.
Hold State	RUN HOLD	Holds the setpoint program. An "H" appears in the upper display indicating that the program is in the HOLD state. The setpoint holds at the current setpoint.
External Hold		If Remote Switching (Digital Input Option) is present on your controller, contact closure places the controller in the HOLD state, if the setpoint program is running. The "H" in the upper display will blink. ATTENTION The keyboard takes priority over external switch for the RUN/HOLD function. Contact reopening runs program.
Changing a Segment while in Hold	▲ or ▼	These keys will operate and allow you to change the segment number while in HOLD. If a different segment is selected, it will be started at the beginning when placed in RUN. If the original segment is brought back, it will continue from the point placed in HOLD. NOTE: changing a segment number may affect the alarms/events.

Continued on next page

Run/Monitor functions (continued)

Table 6-3 Run/Monitor Functions, continued

Function	Press	Result
External Program Reset		If Remote Switching (Digital Input Option) is present on your controller, contact closure resets the SP Program back to the start of the first segment. Program cycle number is not affected. Reopening the contact has no effect.
	RUN HOLD	restarts the Setpoint Program
Viewing the present ramp or soak segment number and time	LOWER DISPLAY until you see	Upper Display "R" and the PV value Lower Display For Ramp segments: #RA XX.XX Ramp Time - Hours:Minutes or Ramp Rate - Degrees/Minute Indicates Ramp segment Segment Number (odd only) For Soak segments: #SK XX.XX Time remaining in segment in Hrs:Minutes including current partially completed minute Indicates Soak segment Segment Number (even only)
Viewing the number of cycles left in the program	LOWER DISPLAY until you see	Upper Display "R" and the PV value Lower Display RECYC XX Remaining Cycles 0 to 99 This number includes the current partially completed cycle.

Continued on next page

Run/Monitor functions (continued)

Table 6-3 Run/Monitor Functions, continued

Function	Press	Result
End Program		When the final segment is completed, the "R" in the upper display either changes to "H" if configured for HOLD state, or disappears if configured for disable of setpoint programming. The controller operates at the last setpoint in the program in automatic or will be in manual mode at the failsafe output.

Power-up state

The program will be placed in HOLD mode at the beginning of the program at the local Setpoint value prior to the beginning of the program.

Section 7 – Input Calibration

7.1 Overview

Introduction

This section describes the field calibration procedures for Input 1 and Input 2.
Every UDC3000 controller contains all input actuation ranges fully factory calibrated and ready for configuration to range by the user.
However these procedures can be implemented if the factory calibration of the desired range is not within specifications.
Note that the field calibration will be lost if a change in input type configuration is implemented at a later time. The original factory calibration data remains available for later use after a field calibration is done.

What's in this section

This section contains the following topics:

	Topic	See Page
7.2	Minimum and maximum range values	126
7.3	Preliminary Information • Disconnect the field wiring • Equipment needed	127 127 128
7.4	Input 1 Set Up Wiring • Thermocouple inputs using an ice bath • Thermocouple inputs using a precision resistor • RTD (Resistance Thermometer Device) inputs • Radiamatic, Millivolts, or Volts except 0-10 Volts inputs • 0 to 10 Volts input • 4-20 Milliamps input	129 129 130 131 132 133 134
7.5	Input 1 Calibration Procedure	135
7.6	Input 2 Set Up Wiring • 4-20 Milliamps input • 1 to 5 Volts input	137 137 138
7.7	Input 2 Calibration Procedure	139

Calibration steps

Use the following steps when calibrating an input.

Step	Action
1	Find the minimum and maximum range values for your PV input range from Table 7-1.
2	Disconnect the field wiring and find out what equipment you will need to calibrate. DO NOT remove external resistor assemblies (if present).
3	Wire the calibrating device to your controller according to the Set Up wiring instructions for your particular input.
4	Follow the calibration procedure given for Input #1 or Input #2.

7.2 Minimum and Maximum Range Values

Select the range values

You should calibrate the controller for the minimum (0%) and Maximum (100%) range values of your particular sensor.
If you have a two input controller, calibrate each input separately.
Select the Voltage or Resistance equivalent for 0% and 100% range values from Table 7-1. Use these value when calibrating your controller.

Table 7-1 Voltage and Resistance Equivalents for 0% and 100% Range Values

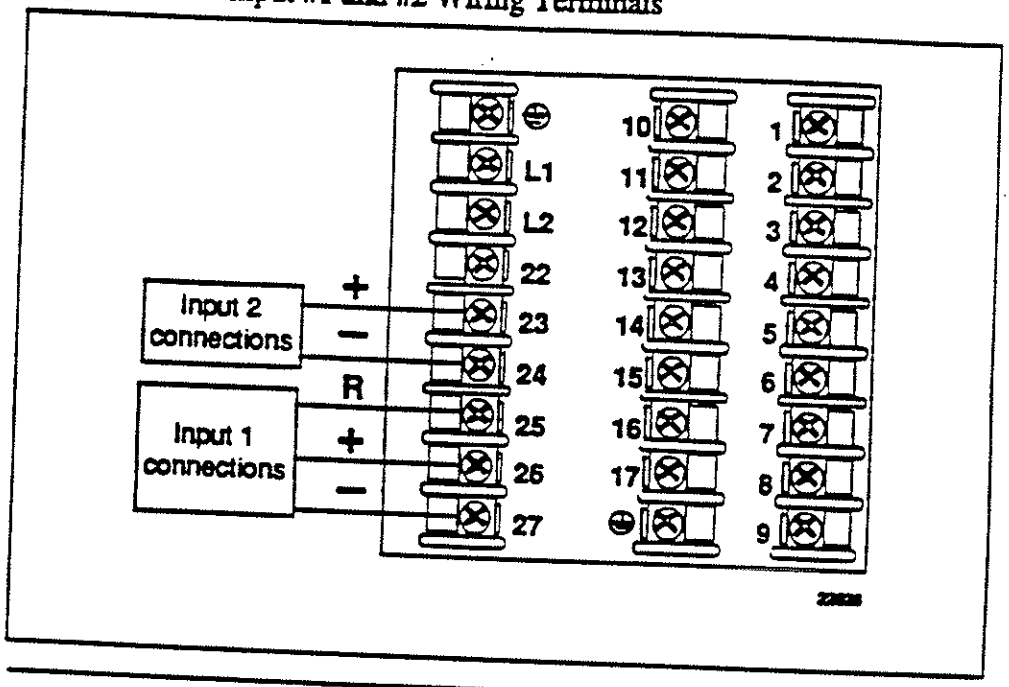
Sensor Type	PV Input Range		Range Values	
	°F	°C	0%	100%
B Thermocouple	0 to 3300	–18 to 1815	–0.010 mV	13.763 mV
E Thermocouple	-454 to 1832	–270 to 1000	–9.835 mV	76.358 mV
E (low) Thermocouple	-200 to 1100	–129 to 593	–6.471 mV	44.547 mV
J Thermocouple	0 to 1600	–18 to 871	–0.885 mV	50.059 mV
J (low) Thermocouple	20 to 770	–7 to 410	–0.334 mV	22.397 mV
K Thermocouple	0 to 2400	–18 to 1316	–0.692 mV	52.939 mV
K (low) Thermocouple	–20 to 1000	–29 to 538	–1.114 mV	22.251 mV
NINIMoly T/C	32 to 2500	0 to 1371	–0.001 mV	71.330 mV
NINIMoly (low) T/C	32 to 1260	0 to 682	–0.001 mV	31.820 mV
Nicrosil Nisil T/C	0 to 2372	–18 to 1300	–0.461 mV	47.502 mV
R Thermocouple	0 to 3100	–18 to 1704	–0.089 mV	20.275 mV
S Thermocouple	0 to 3100	–18 to 1704	–0.092 mV	17.993 mV
T Thermocouple	-300 to 700	–184 to 371	–5.341 mV	19.095 mV
T (low) Thermocouple	-200 to 500	–129 to 260	–4.149 mV	12.572 mV
W5W26 T/C	0 to 4200	–18 to 2316	–0.234 mV	37.066 mV
W5W26 (low) T/C	0 to 2240	–18 to 1227	–0.234 mV	22.277 mV
RTD (IEC=0.00385)				
100 Ohms	-300 to 1200	–184 to 649	25.18 Ω	329.16 Ω
100 Ohms (low)	0 to 300	–18 to 149	93.03 Ω	156.90 Ω
500 Ohms	-300 to 1200	–184 to 649	125.90 Ω	1645.80 Ω
Radiamatic (RH)	1400 to 3400	760 to 1871	0.99 mV	57.12 mV
Milliamps	4 to 20 mA		4 mA	20 mA
Millivolts	0 to 10 mV		0 mV	10 mV
	10 to 50 mV		10 mV	50 mV
Volts	1 to 5 Volts		1 Volt	5 Volts
	0 to 10 Volts		0 Volts	10 Volts

Disconnect the field wiring

Depending on which input (#1 or #2) you are going to calibrate, tag and disconnect any field wiring connected to the input terminals on the rear of the controller.

Figure 7-1 shows the wiring terminal designations for Input #1 and Input #2.

Figure 7-1 Input #1 and #2 Wiring Terminals



Continued on next page

Equipment needed

Table 7-2 lists the equipment you will need to calibrate the specific types of inputs that are listed in the table. You will need a screwdriver to connect these devices to your controller.

Table 7-2 Equipment Needed

Type of Input	Equipment Needed
Thermocouple Inputs (Ice Bath)	• A calibrating device with ±0.02% accuracy for use as a signal source such as a millivolt source. • Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the controller input. • Two insulated copper leads for connecting the thermocouple extension wire from the ice baths to the precision calibrator. • Two containers of crushed ice.
Thermocouple Inputs (Precision Resistor)	• A calibrating device with ±0.02% accuracy for use as a signal source such as a millivolt source. • Two insulated copper leads for connecting the calibrator to the controller. • A precision 500 ohm resistor ±0.1% connected across input #1 terminals 25(R) and 27(–).
RTD (Resistance Thermometer Device)	• A decade box, with ±0.02% accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1400 Ohms with a resolution of 0.1 ohm. • Three insulated copper leads for connecting the decade box to the controller.
Milliampere, Millivolt, Volts, and Radiamatic	• A calibrating device with ±0.02% accuracy for use as a signal source. • Two insulated copper leads for connecting the calibrator to the controller. • Place current source at zero before switching ON. • Do not switch current sources OFF/ON while connected to the UDC3000 input.

7.4 Input #1 Set Up Wiring

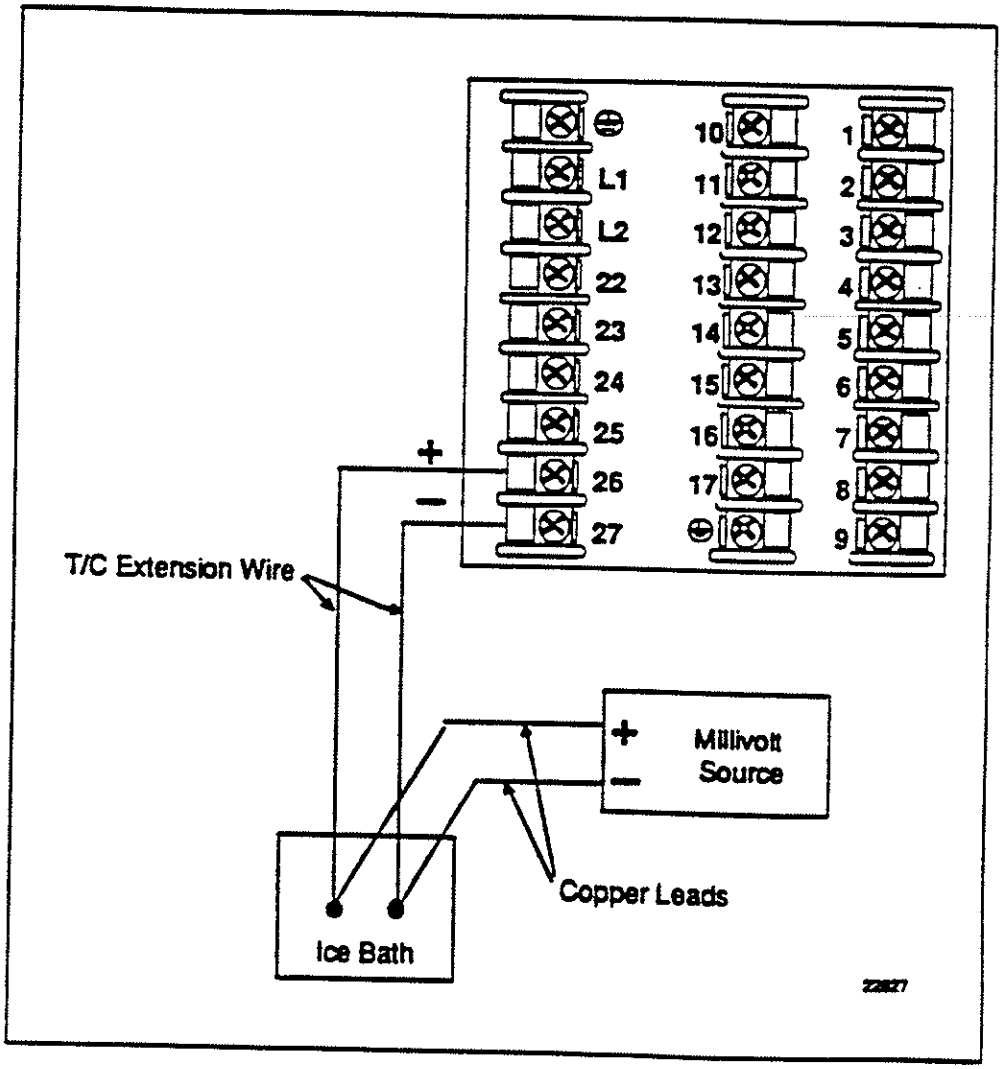
Thermocouple inputs using an ice bath

Refer to Figure 7-2 and wire the controller according to the procedure given in Table 7-3.

Table 7-3 Set Up Wiring Procedure for Thermocouple Inputs Using An Ice Bath

Step	Action
1	Connect the copper leads to the calibrator.
2	Connect a length of thermocouple extension wire to the end of each copper lead and insert the junction points into the ice bath.
3	Connect the thermocouple extension wires to the terminals for input #1. See Figure 7-2.

Figure 7-2 Wiring Connections for Thermocouple Inputs Using an Ice Bath



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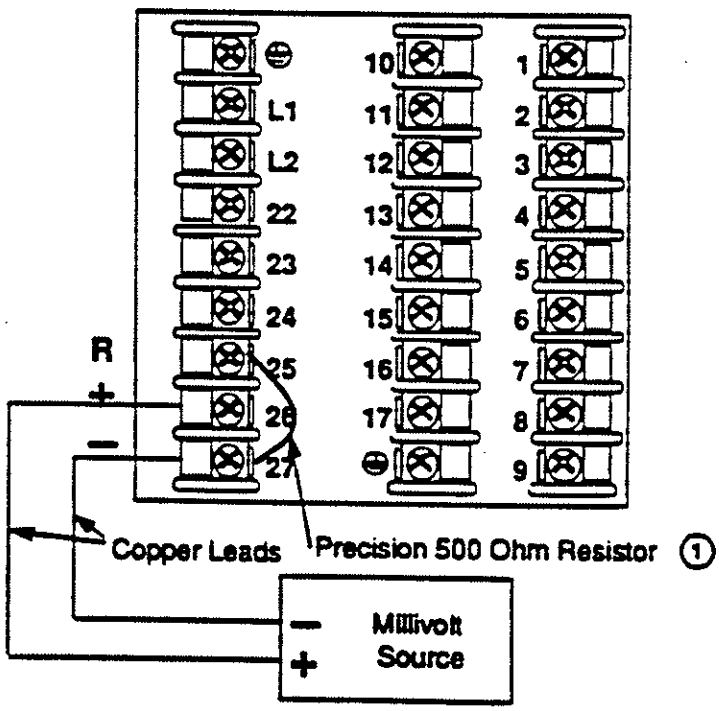
Thermocouple Inputs using a precision resistor

Refer to Figure 7-3 and wire the controller according to the procedure given in table 7-4.

Table 7-4 Set Up Wiring Procedure for Thermocouple Inputs Using a Precision Resistor

Step	Action
1	Connect the copper leads to the calibrator.
2	Disconnect the cold junction resistor.
3	Install a 500 Ohm precision resistor across terminal 25(R) and terminal 27(—). See figure 7-3.
4	Subtract the millivolt value for 77°F (25°C) from the zero and span value for your range (see Table 7-1 for zero and span values) and use the adjusted value when calibrating.

Figure 7-3 Wiring Connections for Thermocouple Inputs Using a Precision Resistor



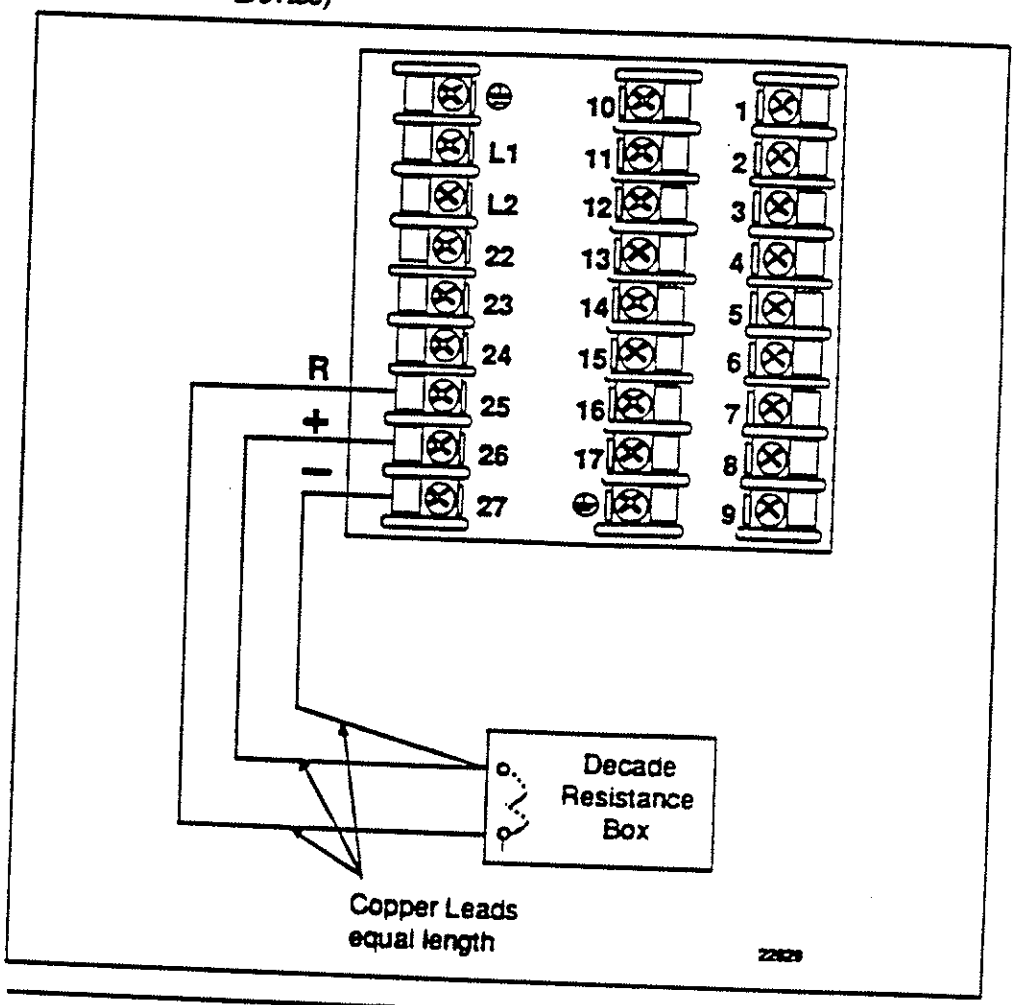
① **Warning:** The accuracy of the controller is directly affected by the accuracy of this resistor. At a minimum, use a 0.1%, 25ppm resistor.

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RTD Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1. See Figure 7-4.

Figure 7-4 Wiring Connections for RTD (Resistance Thermometer Device)

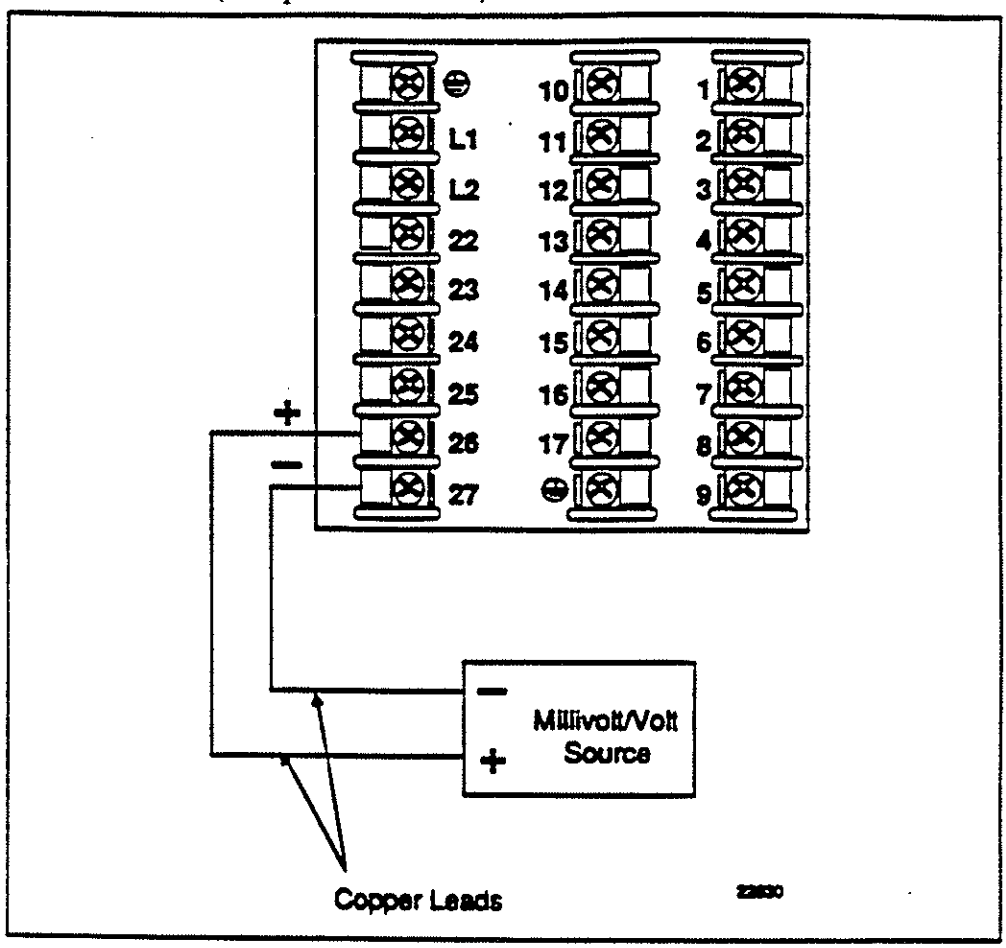


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Radiamatic, Millivolts, or Volts (except 0 to 10 Volts) Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1. See Figure 7-5.

Figure 7-5 Wiring Connections for Radiamatic, Millivolts, or Volts (except 0 to 10 Volts)

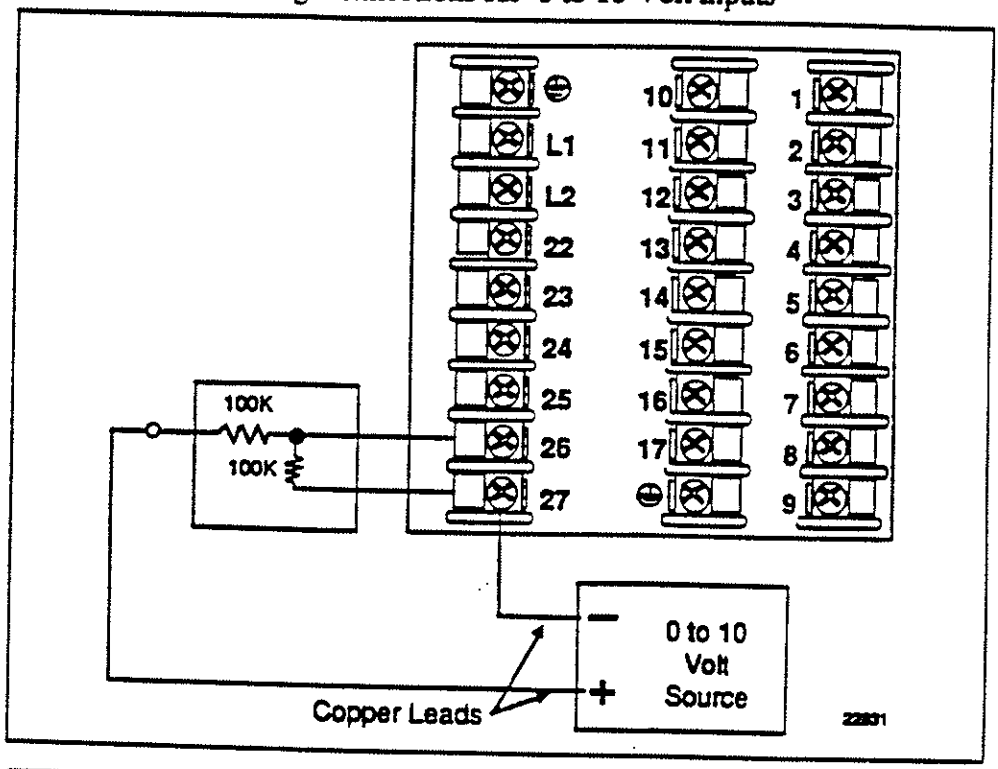


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0 to 10 Volt Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1. See Figure 7-6.

Figure 7-6 Wiring Connections for 0 to 10 Volt inputs

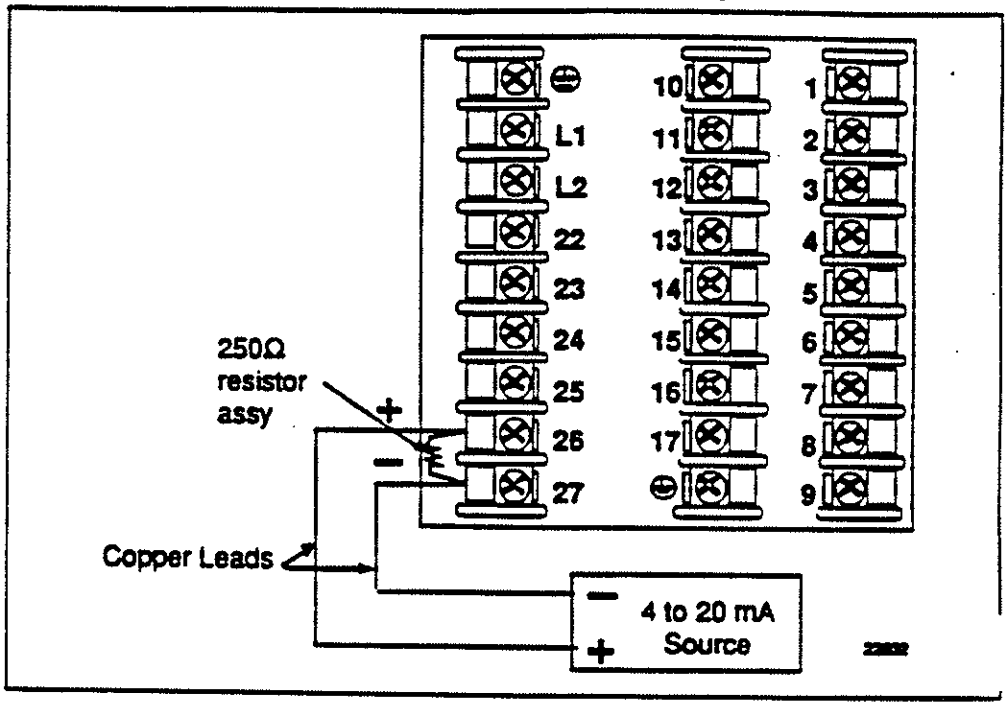


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4 to 20 mA Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1. See Figure 7-7.

Figure 7-7 Wiring Connections for 4 to 20 mA inputs



7.5 Input #1 Calibration Procedure

Introduction

Apply power and allow the controller to warm up for 15 minutes before you calibrate.
Please read "*Set Up Wiring*" before beginning the procedure.
Make sure you have "LOCKOUT" set to "NONE." See *Section 3 – Configuration*.

CAUTION For linear inputs, avoid step changes in inputs. Vary smoothly from initial value to final 100% value.

Procedure

The Calibration procedure for Input #1 is listed in table 7-5.

Table 7-5 Input #1 Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL Ib Lower Display: INPUT 1
		FUNCTION	You will see: Upper Display: dISAbL Lower Display: CAL INI
		▲	The calibration sequence is enabled and you will see: Upper Display: bEGIN Lower Display: CAL INI At the completion of the sequence, the selection automatically reverts to disable.
2	Calibrate 0%	FUNCTION	You will see: Upper Display: APPLY Lower Display: IN1 ZERO Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor. See Table 7-1 for Voltage or Resistance equivalents. Wait 30 seconds, then go to the next step.

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Table 7-5 Input #1 Calibration Procedure, continued

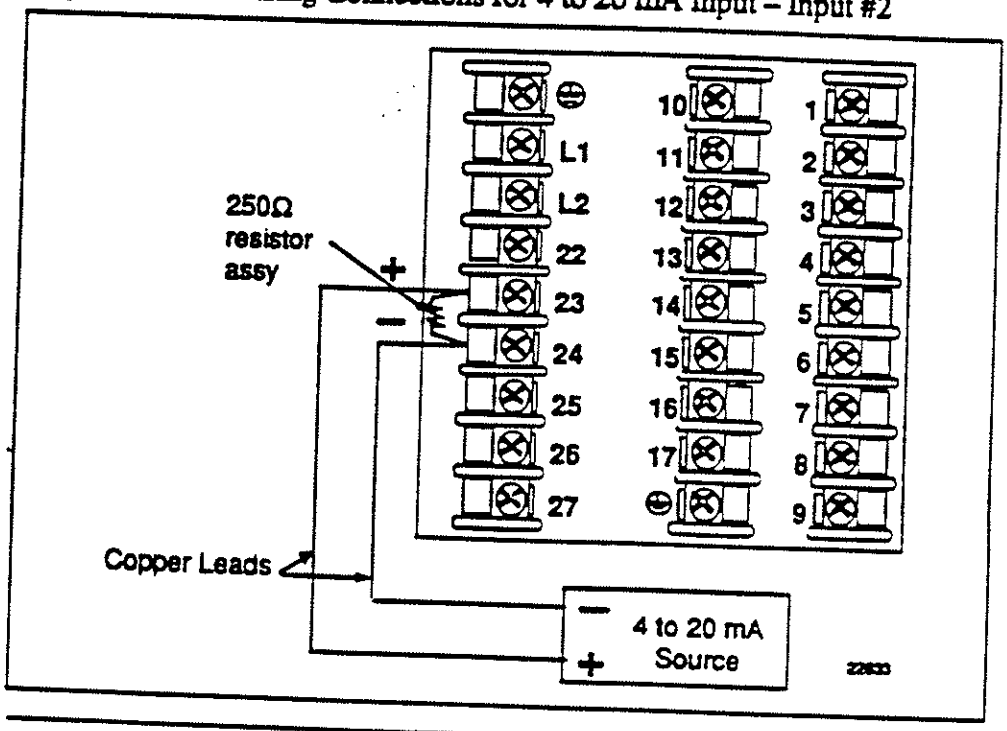
Step	Description	Press	Action
3	Calibrate 100 %	FUNCTION	You will see: Upper Display: APPLY Lower Display: IN1 SPAN Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor. See Table 7-1 for Voltage or Resistance equivalents. Wait 30 seconds, and If... / Then... you are calibrating a Thermocouple input → Go to step 4 you are calibrating other than a Thermocouple input → Go to step 5
4	Check the Cold Junction Temperature **WARNING** The accuracy of the controller is directly affected by the accuracy of this value. Change this value only if the zero and span calibration procedures did not bring the controller within the specified accuracy requirements.	FUNCTION	The calculations for zero and span are now stored and you will see: Upper Display: ← The cold junction temperature at the rear terminals Lower Display: C-J TEMP The value in the upper display is in the tenths of a degree. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the ▲ or ▼ key. **ATTENTION** When calibrating T/C inputs using a precision resistor, calibrate the cold junction as 77°F (25°C).
5	Exit the Calibration Mode	FUNCTION	The controller will store the calibration constants and exit calibration mode.

7.6 Input #2 Set Up Wiring

4 to 20 mA Input

Use the copper leads and connect the calibrator to the rear terminals of Input #2. See Figure 7-8.

Figure 7-8 Wiring Connections for 4 to 20 mA input – Input #2

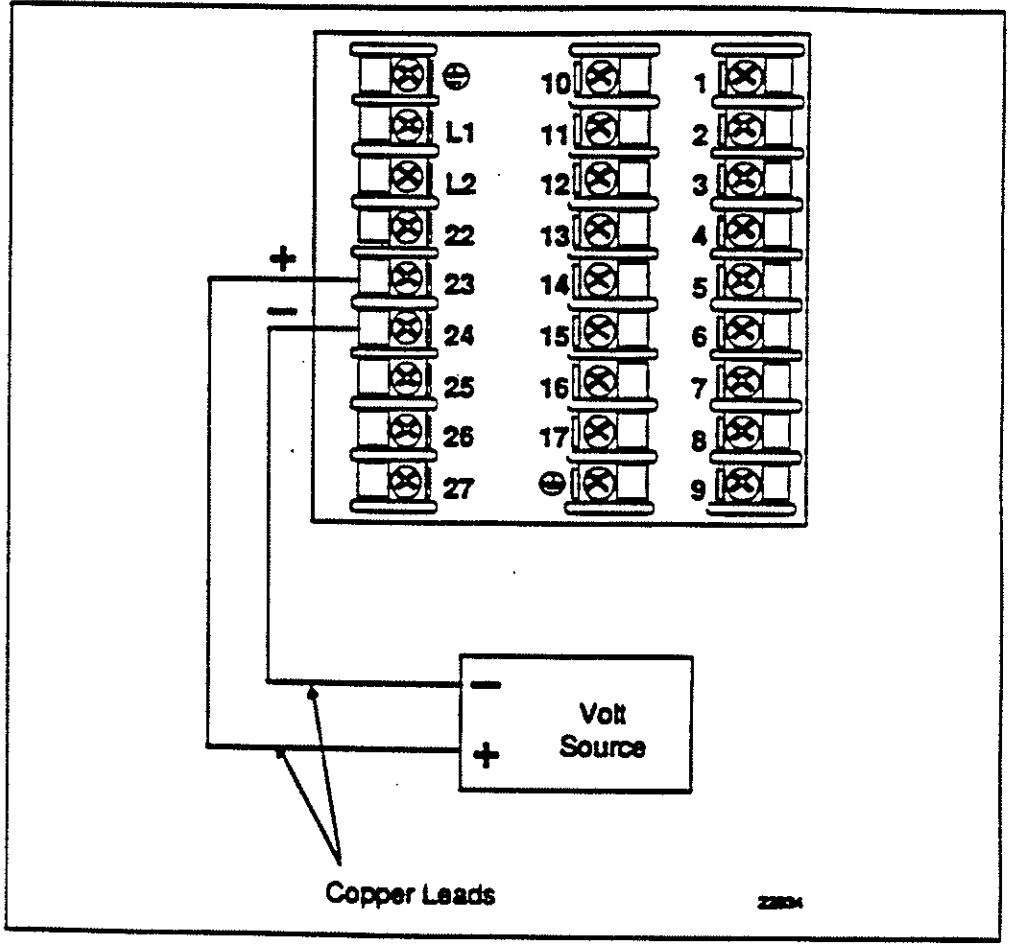


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1 to 5 Volt Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #2. See Figure 7-9.

Figure 7-9 Wiring Connections for 1 to 5 Volt input – Input 2



7.7 Input #2 Calibration Procedure

Introduction

Apply power and allow the controller to warm up for 15 minutes before you calibrate.
Please read "*Set Up Wiring*" before beginning the procedure.
Make sure you have "LOCKOUT" set to "NONE." See *Section 3 – Configuration.*

Procedure

The Calibration procedure for Input #2 is listed in table 7-6.

Table 7-6 Input #2 Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL In Lower Display: INPUT 2
		FUNCTION	You will see: Upper Display: dISAbL Lower Display: CAL In2
		▲	You will see: Upper Display: bEGIn Lower Display: CAL In2
2	Calibrate 0%	FUNCTION	You will see Upper Display: APPLY Lower Display: In2 ZERO Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor. See Table 7-1 for Voltage or Resistance equivalents. Wait 30 seconds, then go to the next step.

Continued on next page

Table 7-6 Input #2 Calibration Procedure, continued

Step	Description	Press	Action
3	Calibrate 100 %	FUNCTION	You will see Upper Display APPLY Lower Display IN2 SPAN Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor. See Table 7-1 for Voltage or Resistance equivalents. Wait 30 seconds, then go to the next step.
4	Exit the Calibration Mode	FUNCTION	The controller will store the calibration constants.
		LOWER DISPLAY or SET UP	To store the calibration constants and exit the calibration mode.

Section 8 – Output Calibration

8.1 Overview

Introduction

This section describes the field calibration procedures for the following types of outputs:

- Current Output
- Position Proportional and 3 Position Step Output
- Auxiliary Output

What's in this section

This section contains the following topics:

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8.2 Current Proportional Output Calibration

Introduction

Calibrate the controller so that the output provides the proper amount of current over the desired range.
The controller can provide an output current range of from 0 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other values between 0 and 21 mA.

Equipment needed

You will need a standard shop type milliammeter, with whatever accuracy i required, capable of measuring 0 to 20 milliamps.

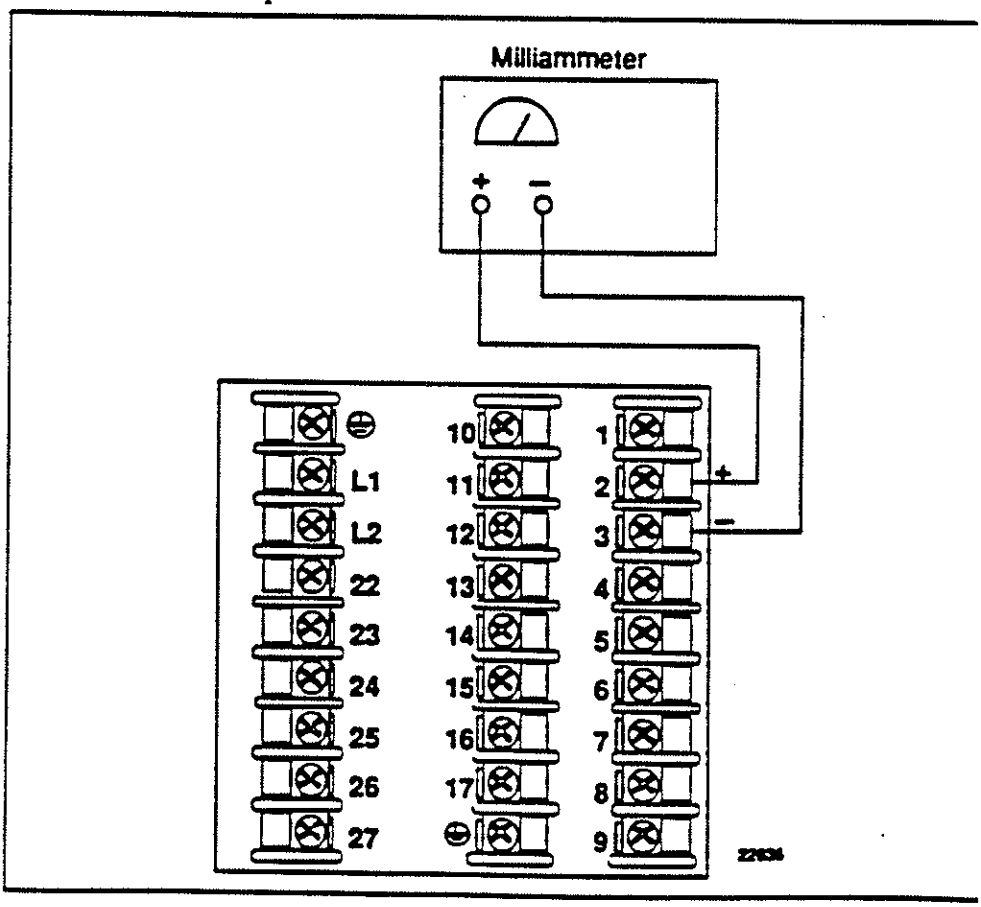
Calibrator connections

Refer to Figure 8-1 and wire the controller according to the procedure giver in table 8-1.

Table 8-1 Set Up Wiring Procedure Current Proportional Output

Step	Action
1	Apply power and allow the controller to warm up 15 minutes before you calibrate.
2	Tag and disconnect the field wiring, at the rear of the controller, from terminals 2(+) and 3(–). See Figure 8-1.
3	Connect a Milliammeter across these terminals.

Figure 8-1 Wiring Connections for Calibrating Current Proportional Output



Continued on next pag

8.2 Current Proportional Output, Continued

Procedure

The procedure for calibrating the Current Proportional Output is listed in table 8-2. Make sure "LOCKOUT" in the Tuning Set Up group is set to "NONE." See *Section 3 – Configuration.*

Table 8-2 Current Proportional Output Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL Ib Lower Display: CURRENT
2	Calibrate 0%	FUNCTION	You will see: Upper Display: ◄ a value between 1 and 2048 Lower Display: ZERO URL
		▲ or ▼	until the desired 0% output is read on the milliammeter. Use the values shown below depending on the action of your controller. 0 mA For 0 to 20 mA Direct Action* 20 mA For 0 to 20 mA Reverse Action 4 mA For 4 to 20 mA Direct Action 20 mA For 4 to 20 mA Reverse Action
3	Calibrate 100%	FUNCTION	This stores the 0%value and, You will see: Upper Display: ◄ a value between 1 and 2048 Lower Display: SPAN URL
		▲ or ▼	until the desired 100% output is read on the milliammeter. Use the values shown below depending on the action of your controller. 20 mA For 0 to 20 mA Direct Action 0 mA For 0 to 20 mA Reverse Action* 20 mA For 4 to 20 mA Direct Action 4 mA For 4 to 20 mA Reverse Action
4	Exit the Calibration Mode	FUNCTION	The controller will store the span value.
		LOWER DISPLAY or SET UP	To exit the calibration mode. * When attempting to achieve 0 mA, always adjust the output to about 0.5 mA, and slowly decrease until the output just goes to zero. Further decrementing will not change the output current (since the circuit cannot produce negative current) but will affect the accuracy of the output by creating a dead zone where no current flows.

8.3 Position Proportional and Three Position Step Output Calibration

Position Proportional control

When the UDC 3000 controller has a Position Proportional control output, calibrate the controller so that the increase and decrease relays operate properly with respect to the position of the external feedback slidewire.

3 Position Step control

Three Position Step Control Output models with Motor Position Indication
This model must have its output calibrated per the entire procedure to ensure the displayed output (slidewire position) agrees with the final control element position.
Three Position Step Control Output models without Motor Position Indication
This model only requires that the "Motor Time" be entered as shown in the calibration procedure. FULL CALIBRATION IS NOT REQUIRED.

Equipment needed

None

Connections

Apply power and allow the controller to warm up 15 minutes before you calibrate.
Leave all field wiring connected to the rear terminals.

Auto mode vs Manual mode

There are two ways in which to calibrate Position Proportional or 3 Positic Step control:
AUTO mode or MANUAL mode.

Rules for Auto mode vs Manual mode

The Auto-mode selection must be done at least once before the manual mode will operate properly. Failure to use the Auto-mode procedure will prevent the controller from going into automatic control mode.

Displayed values

During the Auto-mode calibration procedure, the values being displayed are used only to indicate if the motor is still traveling.
To view the actual calibration value, use the manual mode after the Auto-mode is completed. These values can be changed for purposes of tweaking the calibration.

Continued on next page

8.3 Position Proportional and Three Position Step Output Calibration, Continued

Procedure

The procedure for calibrating the Position Proportional output and 3 Position Step control output is listed in table 8-3.

Make sure "LOCKOUT" in Tuning Set Up group is set to "NONE." See *Section 3 – Configuration.*

For *"Three Position Step Control Output models without Motor Position Indication"*, do steps 1 and 2 only.

For *"Position Proportional Output"* and *"Three Position Step Control Output models with Motor Position Indication"* follow the entire calibration procedure.

Table 8-3 Position Proportional and 3 Position Step Output Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL Ib Lower Display: POS PROP
2	Set Motor Traverse Time Note: This is the time it takes the motor to travel from 0 to 100%.	FUNCTION	Until you see: Upper Display: ◄ a value Lower Display: MTR TIME
		▲ or ▼	until the proper motor stroke time is reached (see the motor specs or measure the time) Range of setting = 5 to 1800 Seconds

Continued on next page

Table 8-3 Position Proportional and 3 Position Step Output Calibration Procedure, continued

Step	Description	Press	Action
3	Select Automatic or Manual Calibration	FUNCTION	until you see: Upper Display: dISAbLE Lower Display: POS PROP You can calibrate the controller output manually or let the controller calibrate the output automatically. If the slidewire has never been calibrated, you must use "DO AUTO" first. In the "Automatic Calibration Mode" (DO AUTO), the controller relays automatically move the motor in the proper direction. If desired, however, the motor may be manually positioned to 0% and 100% positions. Disconnect the relay wires. "DO MAN". In the "Manual Calibration Mode" (DO MAN) the motor does not move. Instead, the existing 0% and 100% values may be changed with the ▲ or ▼ keys.
		▲ or ▼	to select automatic or manual calibration. Upper Display: ← DO AUTO or DO MAN Lower Display: POS PROP If you select DO AUTO, go to step 4 If you select DO MAN, go to step 6 Note: When calibration is terminated, this selection reverts to DISABL.
4	DO AUTO Set 0% value	FUNCTION	The decrement relay is turned on to move the motor to 0% position. Upper Display: ← counts of feedback slidewire (0 to 3000) Lower Display: ZERO URL When the motor stops, the display should stop counting, then, go on to the next step.
5	Set 100% value	FUNCTION	The increment relay is turned on to move the motor to 100% position. Upper Display: ← counts of feedback slidewire (0 to 3000) Lower Display: SPAN URL When the motor stops, the display should stop counting, then, go on to step 8.

Continued on next page

Table 8-3 Position Proportional and 3 Position Step Output Calibration Procedure, continued

Step	Description	Press	Action
6	DO MAN Set 0% value	FUNCTION	You will see: Upper Display ← The existing zero calibration value in counts. Lower Display: ZERO URL
		▲ or ▼	until the desired zero value is reached in the upper display. Upper Display ← The desired zero value Lower Display: ZERO URL
7	Set 100% value	FUNCTION	The controller will store the 0% value and you will see: Upper Display ← The existing span calibration value in counts Lower Display: SPAN URL
		▲ or ▼	until the desired span value is reached in the upper display. Upper Display ← The desired span value Lower Display: SPAN URL For manual calibration, the motor does not move from its position prior to the start of Position Proportional calibration.
8	Exit the Calibration Mode	FUNCTION	The controller will store the 100% value.
		LOWER DISPLAY or SET UP	To exit the calibration mode.

8.4 Auxiliary Output Calibration

Introduction

Calibrate the controller so that the Auxiliary output provides the proper amount of current over the desired range.
The controller can provide an auxiliary output current range of from 0 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other values between 0 and 21 mA.

Equipment needed

You will need a standard shop type milliammeter with whatever accuracy is required, capable of measuring 0 to 20 milliamps.

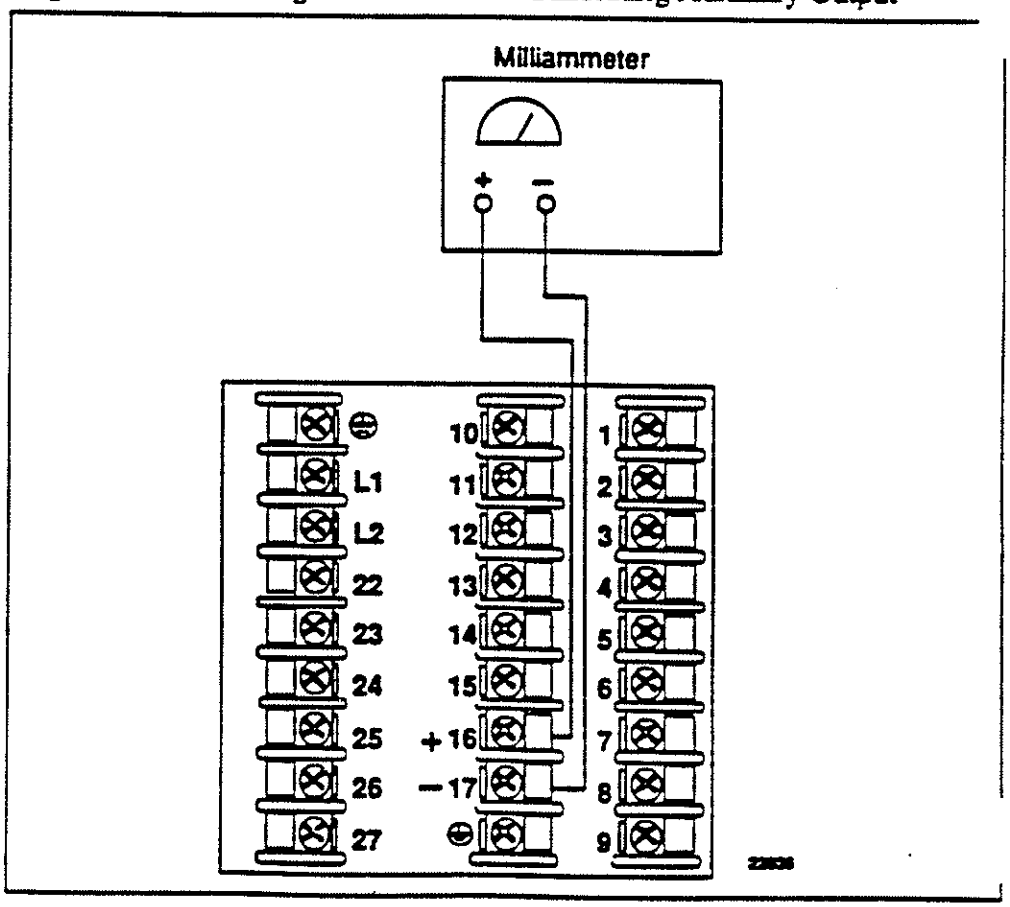
Calibrator connections

Refer to Figure 8-2 and wire the controller according to the procedure given in table 8-4

Table 8-4 Set Up Wiring Procedure for Auxiliary Output

Step	Action
1	Apply power and allow the controller to warm up 15 minutes before you calibrate.
2	Tag and disconnect the field wiring, at the rear of the controller, from terminals 16(+) and 17(–). See figure 8-2.
3	Connect a Milliammeter across these terminals.

Figure 8-2 Wiring Connections for Calibrating Auxiliary Output



Continued on next page

Procedure

The procedure for calibrating the Auxiliary Output is listed in table 8-5. Make sure "LOCKOUT" in the Tuning Set Up group is set to "NONE." See *Section 3 – Configuration.*

Table 8-5 Auxiliary Output Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CAL Ib Lower Display: AUX OUT
2	Calibrate 0%	FUNCTION	You will see: Upper Display: ▭ ← a value Lower Display: ZERO URL
		▲ or ▼	until the desired 0% output is read on the milliammeter. Use the values shown below depending on the action of your controller. 0 mA For 0 to 20 mA Direct Action * 20 mA For 0 to 20 mA Reverse Action 4 mA For 4 to 20 mA Direct Action 20 mA For 4 to 20 mA Reverse Action
3	Calibrate 100%	FUNCTION	This stores the 0%value and, you will see: Upper Display: ▭ ← a value Lower Display: SPAN URL
		▲ or ▼	until the desired 100% output is read on the milliammeter. Use the values shown below depending on the action of your controller. 20 mA For 0 to 20 mA Direct Action 0 mA For 0 to 20 mA Reverse Action* 20 mA For 4 to 20 mA Direct Action 4 mA For 4 to 20 mA Reverse Action
4	Exit the Calibration Mode	FUNCTION	The controller will store the span value.
		LOWER DISPLAY or SET UP	To exit the calibration mode. * When attempting to achieve 0 mA, always adjust the output to about 0.5 mA, and slowly decrease until the output just goes to zero. Further decrementing will not change the output current (since the circuit cannot produce negative current) but will affect the accuracy of the output by creating a dead zone where no current flows.

Section 9 – Troubleshooting / Service

9.1 Overview

Introduction

Instrument performance can be adversely affected by installation and application problems as well as hardware problems. We recommend that you investigate the problems in the following order;

- Installation related problems
- Application related problems
- Hardware and software related problems

and use the information presented in this section to solve them.
If a replacement of any part is required, follow the procedures listed under "Parts Replacement Procedures".

What's in this section?

The following topics are covered in this section.

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Installation related problems	Read the Installation section in this manual to make sure the UDC3000 has been properly installed. The installation section provides information on protection against electrical noise, connecting external equipment to the controller, and shielding and routing external wiring. **ATTENTION** System noise induced into the controller will result in diagnostic error messages recurring. If the diagnostic error messages can be cleared, it indicates a "soft" failure and is probably noise related. If system noise is suspected, completely isolate the controller from all field wiring. Use calibration sources to simulate PV and check all controller functions; i.e. Gain, Rate, Reset, Output, Alarms, etc.
Application related problems	Review the application of the controller; then, if necessary, direct your questions to the local sales office.
Hardware and software related problems	Use the troubleshooting error message prompts and controller failure symptoms to identify typical failures which may occur in the controller. Follow the troubleshooting procedures to correct them.

9.2 Troubleshooting Aids

Overall error messages

An error message can occur

- at power-up
- during continuous background tests while in normal operation
- when the Status Tests are requested

Table 9-1 lists all the error message prompts that you could see, the reason for the failure, and under what test group the prompt could appear. Refer to Tables 9-3 (Power-up), 9-5 (Status), and 9-6 (Background) for the particular test group indicated.

Table 9-1 Error Message Prompts

Error Message (lower display)	Reason for Failure	Test Group	Refer to Table
CAL TEST	Calibration test failure	Power-up or Status	9-3 9-5
CONF ERR	Low limit greater than high limit for PV, SP, Reset, or Output	Background	9-6
CONFTEST	Configuration test failure	Power-up or Status	9-3 9-5
E E FAIL	Unable to write to non-volatile memory	Background	9-6
FACT CRC	Factory Calibration Cyclic Redundancy test	Status	9-5
FAILSAFE	Controller in Failsafe	Power-up, Background, or Status	9-3 9-5 9-6
INP1FAIL	Two consecutive failures of Input 1 integration	Background	9-6
INP2FAIL	Two consecutive failures of Input 2 integration	Background	9-6
INP1 RNG	Input 1 Out of Range	Background	9-6
INP2 RNG	Input 2 Out of Range	Background	9-6
PV LIMIT	PV Out of Range	Background	9-6
RAM TEST	RAM test failed	Power-up or Status	9-3 9-5
RV LIMIT	Remote Variable Out of Range	Background	9-6
SW FAIL	Position Proportional slidewire input failure	Background	9-6
CAL MTR	Position Proportional or 3 Position Step control with motor position indication, Auto Cal never performed.	Power-up	9-3

Continued on next page

Controller failure symptoms

Other failures may occur that deal with the Power, Output, or Alarms. Refer to the controller failure symptom in Table 9-7 to determine what is wrong and the troubleshooting procedures to use to correct the problem.

Check installation

If a set of symptoms still persists, refer to *Section 2 - Installation* and ensure proper installation and proper use of the controller in the system.

Customer support

If you cannot solve the problem using the troubleshooting procedures listed in this section; or get the model number and serial number from the label on the chassis molding, and software version (see Table 9-2) then:

call Customer Support Phone Number
1-800-423-9883 USA
1-800-461-0013 Canada.

If it is determined that a hardware problem exists and the controller is still within the two year warranty, a replacement controller will be shipped with instructions for returning the defective unit.

Determining the software version

Table 9-2 lists the procedure for identifying the software version number.

Table 9-2 Procedure for Identifying the Software Version

Step	Operation	Press	Action
1	Select STATUS Set Up Group	SET UP	Until you see: Upper Display: REAd Lower Display: STATUS
2	Read the software version	FUNCTION	Until you see: Upper Display: [ ] ← Software version Number Lower Display: UERSION Please give this number to the Customer Support person. It will indicate which version of UDC3000 you have and help them determine a solution to your problem.

9.3 Power-up Tests

What happens at power-up

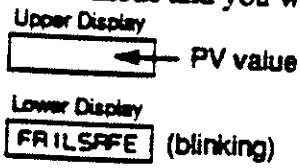
When the controller is powered-up, three tests are run by the UDC3000 software to ensure memory integrity.
As the tests are run, the displays will appear as shown in Table 9-3.

Table 9-3 Power-up Tests

Lower Display	Upper Display
RAM TEST	PASSED or FAILED
CONFTEST	PASSED or FAILED
CAL TEST	PASSED or FAILED

Test failures

If any of these three tests fail, "FAILED" will appear momentarily in the upper display, then a display test is run, after which the controller will go into manual mode and you will see:



Refer to "*Status Tests*" to determine which tests have failed and how to correct them.

Position proportional or 3 position step test failures

For controller configured for Position Proportional or 3 Position step control with motor position indication and Auto-cal has never been done, a prompt "CAL MTR" will appear suggesting that the controller be calibrated.

9.4 Status Tests

Introduction

When required, the results of these tests can be checked to determine the reason the controller has gone to "Failsafe".

How to check the status tests

The procedure in Table 9-4 tells you how to display the results of the status tests. Table 9-5 lists the tests, the reason for the failure, and how to correct the problem.

Table 9-4 Procedure for Displaying the Status Tests Results

Step	Operation	Press	Action
1	Select STATUS Set Up Group	SET UP	Until you see: Upper Display: REAd Lower Display: STATUS
2	Read the status tests results	FUNCTION	Until you see: Upper Display: NO or YES — YES indicates a failure Lower Display: FAILSAFE Successive presses of the [FUNCTION] key will display the results of the status tests in the following order: RAM TEST CONF TEST CAL TEST FACT CRC Identify the problem and correct the failure as shown in Table 9-5.

Continued on next page

Status Tests

Table 9-5 lists the Status tests, the reason for their failure, and how to correct the failure.

Table 9-5 Status Tests

Test (Lower Display)	Definition	Upper Display	Reason for Failure	How to Correct the Failure
FAILSAFE	Failsafe Fault	NO	No Failure	
		YES	Burnout configured for none and input fails. –RAM TEST failed –CONFTEST failed –CALTEST failed	1. Step through the rest of the STATUS check to identify the particular failure. Also see Table 9-6, Background tests
RAM TEST	RAM test run at power-up	PASS	No Failure	RAM test passed.
		FAIL	RAM Failure	1. Power cycle to see if the error clears.
CONF TEST	Configuration Checksum	PASS	No Failure	Configuration checksum passed.
		FAIL	Configuration data is in error.	1. Step through STATUS tests – the controller will recalculate the checksum. 2. Check all configuration prompts for accuracy. See *Section 3 - Configuration*
CAL TEST	Working Calibration	PASS	No Failure	Working calibration checksum passed.
		FAIL	The working calibration constants in the controller are in error.	1. If the controller has not been field calibrated, see *Section 3 - Configuration* and change the input to a different type. Enter it, loop through the status tests, then return the input type to the original one. 2. If the controller has been field calibrated, recalibrate the controller.
FACT CRC	Factory calibration test	PASS	No Failure	Factory calibration cyclic redundancy test passed
		FAIL	Factory set input constants have been changed due to the change in input type.	1. Cycle through Status to clear the error. 2. Check the calibration. Make sure 0 and 100% are correct values. 3. Recalibrate if step 1 is unsatisfactory. Refer to *Section 7 - Input Calibration.*

9.5 Background Tests

Introduction

The UDC3000 performs on-going background tests to verify data and memory integrity. If there is a malfunction, an error message will be displayed (blinking) in the lower display.

Background Tests

In the case of more than one simultaneous malfunction, only the one with the highest priority will appear in the lower display. Table 9-6 lists these background tests, the reason for their failure, and how to correct the problem.

Table 9-6 Background Tests

Lower Display	Reason for Failure	How to Correct the Problem
EE FAIL	Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see EE FAIL.	1. Check the accuracy of the parameter and re-enter. 2. Try to change something in configuration. 3. Run through STATUS tests to re-write to EEPROM.
FAILSAFE	This error message shows whenever the controller goes into a failsafe mode of operation. This will happen if: • RAM test failed • Configuration test failed • Calibration test failed • Burnout configured for none and the input failed.	1. Run through STATUS check to determine the reason for the failure. 2. Press the SET UP key until STATUS appears in the lower display. 3. Press the FUNCTION key to see what tests pass or fail, then run through the STATUS codes a second time to see if the error cleared. Correct according to the recommendations given in table 9-5.
INP1FAIL	Two consecutive failures of input 1 integration. i.e., cannot make analog to digital conversion. This will happen if: • Upscale or Downscale burnout is selected • Input not configured correctly	1. Make sure the actuation is configured correctly. See *Section 3 - Configuration.* 2. Make sure the input is correct. 3. Check for gross over-ranging. 4. Replace the cold junction assembly.
INP2FAIL	Two consecutive failures of input 2 integration. i.e., cannot make analog to digital conversion.	1. Make sure the actuation is configured correctly. See Section 3 - Configuration. 2. Make sure the input is correct. 3. Check for gross over-ranging.
SW FAIL	Position Proportional input slidewire failure	1. Check motor slidewire connections. 2. Recalibrate the slidewire motor position. see the calibration section.
CONF ERR	• PV low limit is > PV high limit • SP low limit is > SP high limit • Output low limit > Output high limit	1. Check the configuration for each item and reconfigure if necessary.

Table continued on next page

Table 9-6 Background Tests, continued

Lower Display	Reason for Failure	How to Correct the Problem
INP1 RNG	Input 1 out of range. The process input is outside the range limits. If you have a linear input and the range goes outside the range limits, the controller will switch to the configured Failsafe output value.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. Restore the factory calibration: a. Disconnect the wiring from and place a jumper across terminals 26 and 27. The controller should read room temperature if it is configured for a thermocouple input. b. If it does not read room temperature, see *Section 3-Configuration* and change the IN1TYP prompt in the INPUT 1 group to another type of thermocouple. c. After the change, press FUNCTION key, then the LOWER DISPLAY key. The controller should read the correct room temperature. If it does not, the unit has an input failure. d. Repeat step b. This time switch the IN1TYP back to the originally selected thermocouple. e. Repeat step c. The controller is restored with factory calibration. f. Remove the jumper and reconnect the thermocouple. 4. Field calibrate. See *Section 7 - Input Calibration.*
INP2 RNG	Input 2 out of range. The remote input is outside the range limits.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. Field calibrate. See *Section 7 - Input Calibration.*
PV LIMIT	PV out of range. PV = INP1 + INP1 BIAS	1. Make sure the input signal is correct. 2. Make sure the Bias setting is correct 3. Recheck the calibration. Use Bias of 0.0
RV LIMIT	The result of the formula shown below is beyond the range of the remote variable. RV = INP2 X RATIO + BIAS	1. Make sure the input signal is correct. 2. Make sure the Ratio and Bias settings are correct. 3. Recheck the calibration. Use a Ratio of 1.0 and a Bias of 0.0.

9.6 Controller Failure Symptoms

Introduction

In addition to the error message prompts, there are failure symptoms that can be identified by noting how the controller displays and indicators are reacting.

Symptoms

Compare your symptoms with those shown in Table 9-7 and refer to the troubleshooting procedure indicated to correct the problem.

Table 9-7 Controller Failure Symptoms

Upper Display	Lower Display	Indicators	Controller Output	Probable Cause	Trouble-shooting Procedure
Blank	Blank	Off	None	Power Failure	1
OK	Displayed Output disagrees with Controller Output	OK	Controller Output disagrees with Displayed Output	Current Proportional Output	2
OK		OK		Position Proportional Output	3
OK		OK		Time Proportional Output	4
OK		OK		Current/Time Proportional Output	5
OK	OK	OK	External Alarm function does not operate properly	Malfunction in alarm output	6
Display does not function when a key is pressed				Keyboard Malfunction	7
Controller fails to go into "Slave" operation during communications				Communications Failure	8

Other symptoms

If a set of symptoms or prompts other than the one you started with appears while troubleshooting, re-evaluate the symptoms. This may lead to a different troubleshooting procedure.
If the symptom still persists, refer to the installation section in this manual to ensure proper installation and proper use of the controller in your system.

9.7 Troubleshooting Procedures

Introduction

The troubleshooting procedures are listed in numerical order as they appear in Table 9-7. Each procedure lists what to do if you have that particular failure and how to do it or where to find the data needed to accomplish the task.

Equipment needed

You will need the following equipment in order to troubleshoot the symptoms listed in the tables that follow:

- DC Milliammeter – mAdc
- Calibration sources – T/c, mV, Volt, etc.
- Voltmeter

Procedure #1

Table 9-8 explains how to troubleshoot power failure symptoms.

Table 9-8 Troubleshooting Power Failure Symptoms

Step	What to do	How to do it
1	Check the AC line voltage.	Use a Voltmeter to measure the AC voltage across terminals L1 and L2 on the rear terminal panel of the controller. Check the earth ground connection.
2	Make sure the chassis plugs into the rear of the case properly.	Withdraw the chassis and visually inspect the controller board and the inside of the case.
3	Check the system for Brown-outs, heavy load switching, etc.; and conformance to installation instructions.	Refer to *Section 2 - Installation.*

Continued on next page

Procedure #2

Table 9-9 explains how to troubleshoot Current Proportional Output failure symptoms.

Table 9-9 Troubleshooting Current Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Current output.	Make Set Up group prompt "ALGORTHM". Function prompt "OUT ALG" = selection "CURRNT" Refer to *Section 3 - Configuration.*
2	Check the field wiring.	Output impedance must be less than or equal to 1000 Ohms.
3	Make sure all the configurable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure, if necessary.	Refer to *Section 3 - Configuration* to check all this data and how to reconfigure.
4	Check the output.	Put the controller into Manual mode and change the output from 0 to 100% (4-20 mA). Use a DC milliammeter at the rear terminals to verify the output.
5	Recalibrate the Current Proportional Output.	Refer to *Section 8 - Output Calibration* for details.

Continued on next page

Procedure #3

Table 9-10 explains how to troubleshoot Position Proportional Output failure symptoms.

Table 9-10 Troubleshooting Position Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Position Proportional output.	Make Set Up group prompt "ALGORTHM". Function prompt "OUT ALG" = selection "POSITN" Refer to *Section 3 - Configuration.*
2	Check the field wiring.	Refer to *Section 2 - Installation* for Position Proportional Wiring information.
3	Check the output.	Put the controller into Manual mode and change the output from 0 to 100%.
4	Check whether the motor drives in both directions. If it does go to step 6.	See the Position Proportional calibration procedure in the Calibration Section for motor slidewire calibration.
5	Check whether the motor drives in either direction. If the motor drives in one direction, check the slidewire. If the motor does not drive in either direction, check the motor.	Refer to the Motor instructions.
6	Check the output voltage to the slidewire.	Should equal from 1.3 to 1.0 volts. See wiring in the installation section for terminal designations. The feedback slidewire output voltage must vary with the valve position.
7	Make sure the output relays are actuating properly.	Put the controller into Manual mode. Vary the output above and below the present value.Observe "OUT" indicator on the operator interface. If they are not working properly, check the field wiring, then go to step 5. If they are, go to step 8.
8	Recalibrate the controller.	Refer to Section 8 - *Output Calibration.*

Continued on next page

Procedure #4

Table 9-11 explains how to troubleshoot Time Proportional Output failun

Table 9-11 Troubleshooting Time Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Time Proportional output.	Make Set Up group prompt "ALGORTHM". Function prompt "OUT ALG" = selection "TIME" or "TIME D" Refer to *Section 3 - Configuration.*
2	Check the field wiring.	Make sure the NO or NC contact wiring is correct at the rear terminals. Refer to *Section 2 - Installation* for details.
3	Make sure all the configurable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure, if necessary.	Refer to *Section 3- Configuration* to check all this data and how to reconfigure.
4	Check the output.	Put the controller into Manual mode. Vary the output above and below the present value. Observe "OUT" indicator on the operator interface.

Continued on next page

Procedure #5

Table 9-12 explains how to troubleshoot Current/Time or Time/Current Proportional Output failure.

Table 9-12 Troubleshooting Time/Current or Current/Time Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Time/Current or Current/Time Proportional output.	Make Set Up group prompt "ALGORTHM". Function prompt "OUT ALG" = selection "TI CUR" or "CUR TI" Refer to *Section 3 - Configuration.*
2	Check the field wiring.	Make sure the NO or NC contact wiring is correct at the rear terminals. Refer to *Section 2 - Installation* for details.
3	Make sure all the configurable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure, if necessary.	Refer to *Section 3 - Configuration* to check all this data and how to reconfigure.
4	Check the relay output.	Put the controller into Manual mode. Vary the output above and below the present value. Observe "OUT" indicator on the operator interface.
5	Check the Current Proportional Output.	Put the controller into Manual mode and change the output from 0 to 100% (4-20 mA). Use a DC milliammeter at the rear terminals to verify the output.
6	Recalibrate the controller.	Refer to *Section 8 - Output Calibration* for details

Continued on next page

Procedure #6

Table 9-13 explains how to troubleshoot Alarm Relay Output failure.

Table 9-13 Troubleshooting Alarm Relay Output Failure

Step	What to do	How to do it
1	Check the alarm configuration data. If it is correct, check the field wiring.	Reconfigure if necessary. Refer to *Section 3 - Configuration* for details.
2	Check that the applicable alarm relay actuates properly depending on what you have set at prompt "ALARM TYPE". If it does, check the field wiring.	If the alarm type is set for PV, place the controller in manual mode. Vary the input to raise and lower the PV around the setpoint. Listen for a click from the relay as the PV moves in either direction and note that the proper ALM1 or ALM2 is lit. If the alarm is set for output, put the controller into manual mode. Raise or lower the output above or below the value you have set as the alarm setpoint.
3	Check the field wiring.	Make sure the NO or NC contact wiring is correct on the alarm output terminals. Refer to *Section 2 - Installation* for details.

Continued on next page

Procedure #7

Table 9-14 explains how to troubleshoot a Keyboard failure.

Table 9-14 Troubleshooting a Keyboard Failure

Step	What to do	How to do it
1	Make sure the keyboard is connected properly to the MCU/output and power/input boards.	Withdraw the chassis from the case and visually inspect the connection.
2	Controller Keyboard or specific keys may be "LOCKED OUT" via the security code.	Use your 4 digit security code number to change the lockout level. Refer to *Section 3 – Configuration.* ATTENTION Using "1000" as a security code number will override the 4-digit code previously entered.
3	Run the keyboard test.	Press the [SET UP] key and hold in, then press the [FUNCTION] key at the same time. The controller will run a display test. Then you will see: Upper Display KEYS Lower Display TRY ALL Press each key. If it works, the key name will appear in the lower display.
4	Replace the display/keyboard if any keys are shorted out.	Refer to *"Parts Replacement Procedures"* in this section.

Continued on next page

Procedure #8

Table 9-15 explains how to troubleshoot a Communications failure.

Table 9-15 Troubleshooting a Communications Failure

Step	What to do	How to do it
1	Check the field wiring and termination resistor.	Refer to the RS422/485 Manual or the Gateway Manual depending on the protocol used.
2	Make sure the Communications Printed Wiring Board is installed properly in the controller.	Withdraw the chassis from the case and inspect the board. See the exploded view (Figure 10-1) for location of the board. Return the chassis to the case.
3	Determine if the Communications board is faulty by running a LOCAL LOOPBACK TEST. If the test fails, replace the board.	Run the Local Loopback Test. Press [SET UP] until you see: Upper Display SET UP Lower Display COM Press [FUNCTION] until you see: Upper Display dISAbL Lower Display LOOPbACK Press ▲ or ▼, you will see: Upper Display ENAbLE Lower Display LOOPbACK The test will run until the operator disables it here.

9.8 Parts Replacement Procedures

Introduction

These procedures tell you how to access and replace the following printed wiring boards in your controller.

- Display/Keyboard
- MCU/Output
- Power/Input
- 2nd Input
- Digital Input
- Auxiliary Output
- DMCS Communications
- RS422/485 Communications

Equipment needed

To accomplish the procedures that follow, you will need the following equipment:

- Phillips Head Screwdriver
- Flat Bladed Screwdriver
- Small Pliers

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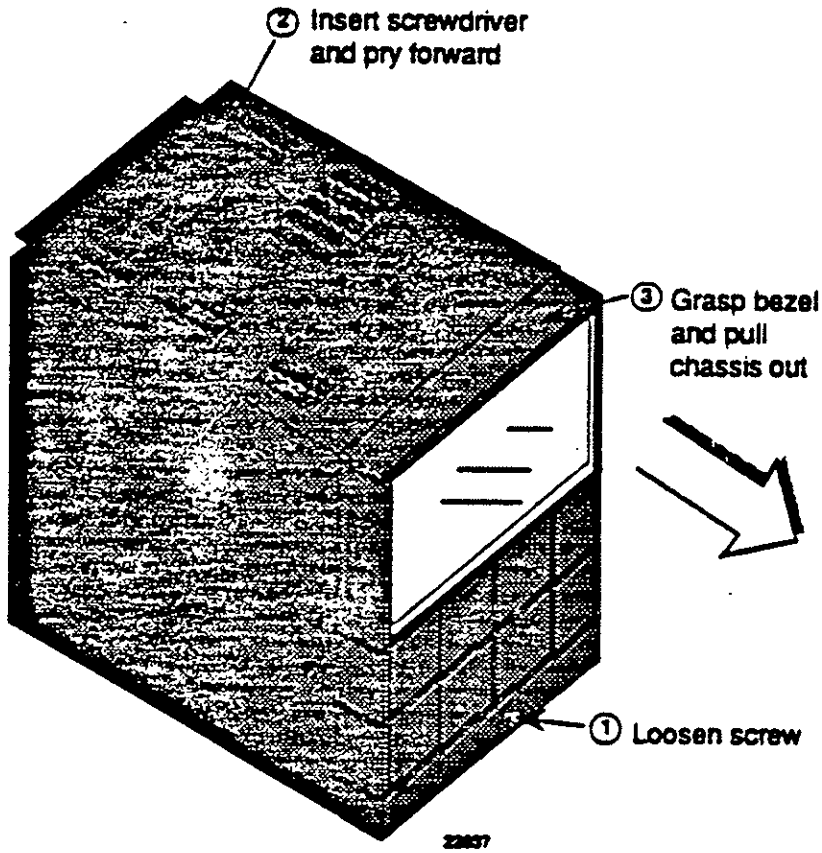
How to remove the chassis

Refer to Figure 9-1 for steps and follow the procedure listed in Table 9-16.

Table 9-16 How to remove the chassis

Step	Action
1	Loosen the screw on the front face.
2	Insert a flat-bladed screwdriver into the hole on the top of the case as shown in Figure 9-1 and pry chassis forward slightly until the chassis connectors separate from the back of the case.
3	Grasp the bezel and pull the chassis out of the case.

Figure 9-1 Chassis Removal



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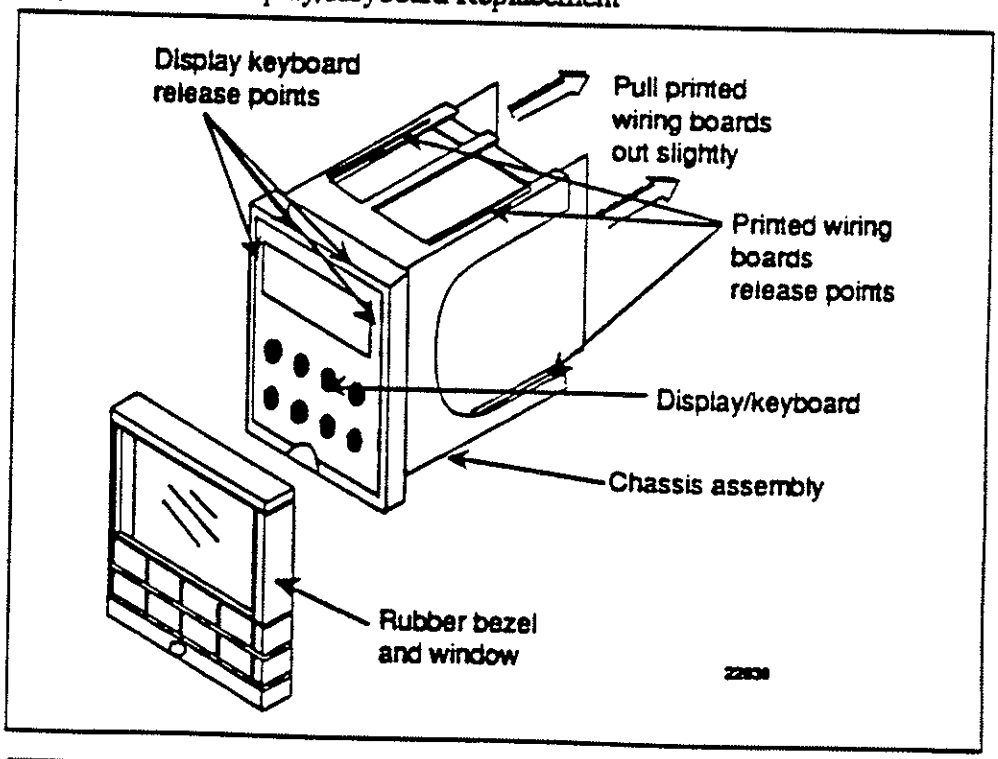
How to replace the display/keyboard assembly

Refer to Figure 9-2 and follow the procedure listed in Table 9-17.

Table 9-17 Display/Keyboard Assembly Replacement Procedure

Step	Action
1	Remove the chassis from the case as shown in Figure 9-1.
2	Peel the rubber bezel and display window off the chassis assembly.
3	Separate the chassis frame at the four release points shown in Figure 9-2 and wiggle each printed wiring board out of its socket on the display/keyboard assembly. Pull out slightly.
4	Insert a small flat-bladed screwdriver into each of the display/keyboard release points (Figure 9-2) and pry out the board.
5	Install the new board, bottom end in first, and push in the top until it clicks into place.
6	Reinstall the printed wiring boards into the rear of the display board making sure that the boards click into their release points.
7	Replace the bezel and window assembly.
8	Reinstall chassis into case. Press in hard, then tighten the screw.

Figure 9-2 Display/Keyboard Replacement



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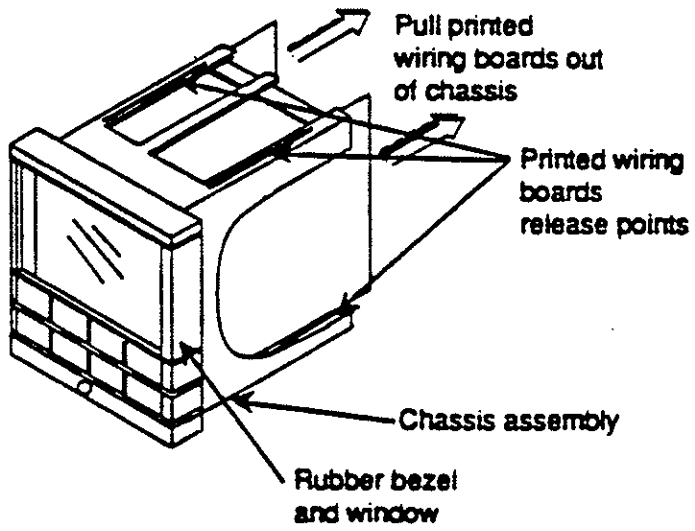
How to remove the printed wiring boards from the chassis

To remove the printed wiring boards from the chassis, refer to Figure 9-3 and follow the procedure in Table 9-18.

Table 9-18 Printed Wiring Board Removal from Chassis

Step	Action
1	Remove the chassis from the case as shown in Figure 9-1.
2	Separate the chassis frame at the release points shown in Figure 9-3 and wiggle each printed wiring board out of its socket on the display/keyboard assembly. Pull both boards out of the chassis assembly.

Figure 9-3 Removing the Printed Wiring Boards



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Printed wiring board identification

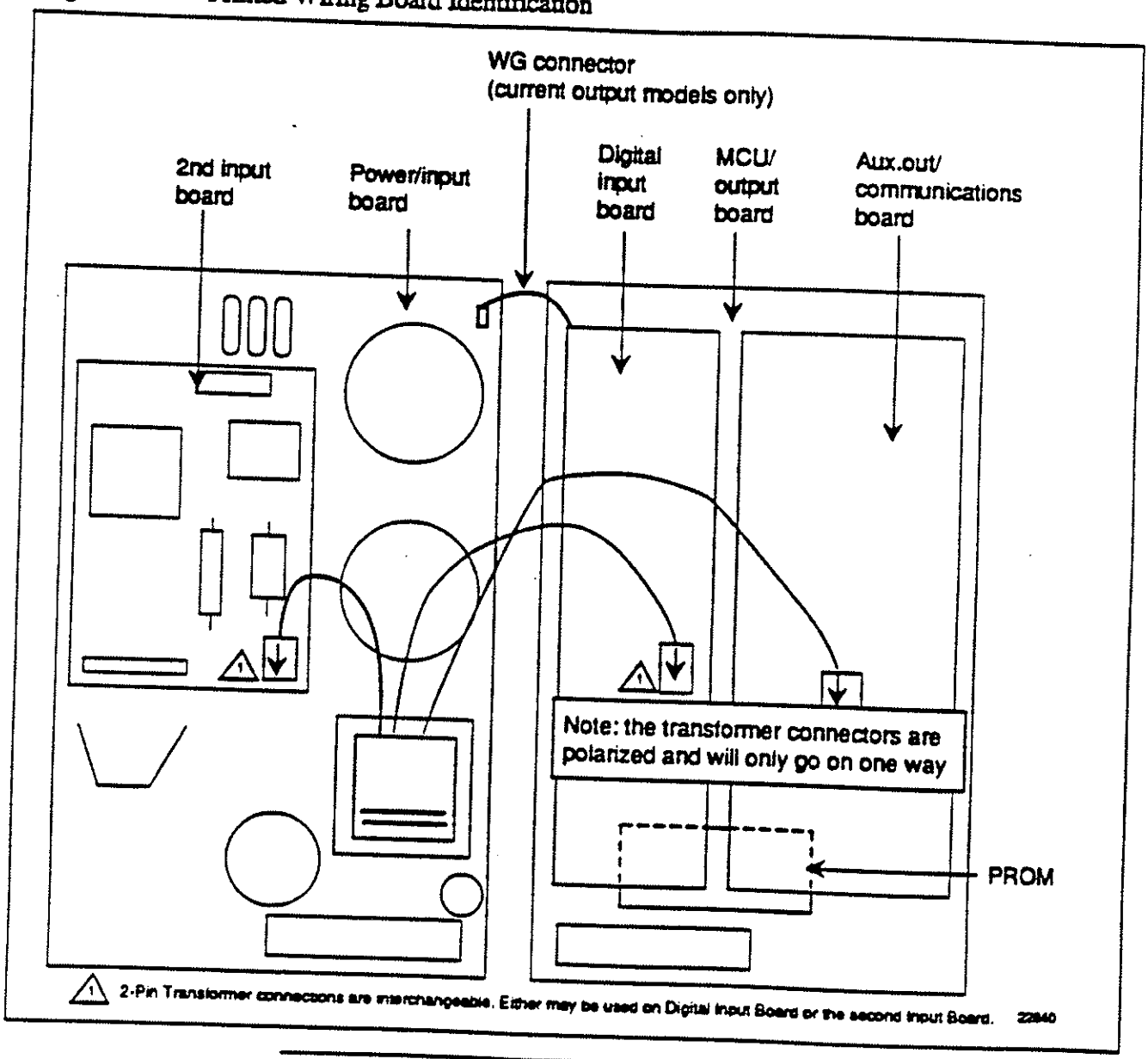
Figure 9-4 identifies each of the printed wiring boards that can be replaced. Refer to this drawing when following the replacement procedures for each of the boards, since you have to remove all of them from the chassis to replace the one you want.

In order to lay boards flat, remove the transformer lead from the Aux.Out/Communications board and the Digital Input board.

Refer to the specific procedure table to remove the desired board.

- 2nd Input Board — Table 9-19
- Power Input Board — Table 9-20
- Digital Input Board — Table 9-21
- Aux.Out/Communications Board — Table 9-22
- MCU/Output Board — Table 9-23

Figure 9-4 Printed Wiring Board Identification



Continued on next page

2nd Input board

Follow the procedure listed in Table 9-19 to replace the Second Input board—P/N 30756715-501.

Table 9-19 Second Input Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. See Figure 9-1.
2	Remove the printed wiring boards from the chassis. See Figure 9-3.
3	Lay the boards flat and identify the 2nd Input board. See Figure 9-4.
4	Remove the transformer plug from connector J14.
5	The 2nd Input board is attached to the Power Input board by three mounting posts. Locate these posts under the power input board.
6	Use a small pliers and squeeze the ends of each post together and push it up through the board. Remove 2nd Input board.
7	Orient the new 2nd Input board onto the Power Input board and push the mounting posts down through the Power Input board until they click into place.
8	Replace the transformer plug onto connector J14.
9	Slide the printed wiring boards back into the chassis. Make sure the connections to the display/keyboard assembly are made and that the release points on the chassis snap into place on the printed wiring boards.
10	Reinstall the chassis into the case. Push in hard, then tighten screw.

Continued on next page

Power Input board

Follow the procedure listed in Table 9-20 to replace the Power Input board—P/N 30756669-501.

Table 9-20 Power Input Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. See Figure 9-1.
2	Remove the printed wiring boards from the chassis. See Figure 9-3.
3	Lay the boards flat and identify the Power Input board. See Figure 9-4.
4	Remove the 2nd Input board, if present. See procedure in Table 9-19.
5	Remove the transformer connections to the Digital Input board and Aux.Out/Communications board, if present.
6	Remove the connector from plug WG if present (current output models only). Slide a small screwdriver under the connector and lift the release.
7	Replace the Power Input board.
8	Reinstall WG connector and transformer connections to Digital Input board and Aux.Out/Communications board, if present.
9	Reinstall the 2nd Input board. See procedure in Table 9-19.
10	Slide the printed wiring boards back into the chassis. Make sure the connections to the display/keyboard assembly are made and that the release points on the chassis snap into place on the printed wiring boards.
11	Reinstall the chassis into the case. Push in hard, then tighten screw.

Continued on next page

Digital input board

Follow the procedure listed in Table 9-21 to replace the Digital Input board—P/N 30756696-501.

Table 9-21 Digital Input Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. See Figure 9-1.
2	Remove the printed wiring boards from the chassis. See Figure 9-3.
3	Lay the boards flat and identify the Digital Input board. See Figure 9-4.
4	Remove the transformer plug from connector J9.
5	The Digital Input board is attached to the MCU/output board by three mounting posts. Locate these posts under the MCU/output board.
6	Use small pliers and squeeze the ends of each post together and push it up through the board. Remove the Digital Input board.
7	Orient the new Digital Input board onto the MCU/Output board and push the mounting posts down through the MCU/Output board until they click into place.
8	Replace the transformer plug onto connector J9.
9	Slide the printed wiring boards back into the chassis. Make sure the connections to the display/keyboard assembly are made and that the release points on the chassis snap into place on the printed wiring boards.
10	Reinstall the chassis into the case. Push in hard, then tighten the screw.

Continued on next page

Aux.Out/ communications board

Follow the procedure listed in Table 9-22 to replace the following boards:

- Auxiliary Output Board—P/N 30756687-501
- DMCS Communications Board—P/N 30756690-501
- RS422/485 Communications Board—P/N 30756693-501

Table 9-22 Aux.Out/Communications Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. See Figure 9-1.
2	Remove the printed wiring boards from the chassis. See Figure 9-3.
3	Lay the boards flat and identify the Auxiliary Output or the Communications board. See Figure 9-4.
4	Remove the transformer plug from connector J8.
5	The Aux.Out/Communications board is attached to the MCU/Output board by three mounting posts. Locate these posts under the MCU/Output board.
6	Use small pliers and squeeze the ends of each post together and push it up through the board. Remove the Aux.Out/Communications board.
7	If you are replacing a Communications Board, a new PROM is supplied with the board. Locate the PROM (shown in Figure 9-4) and gently pry out the old PROM. Orient the new PROM supplied and gently press into place.
8	Orient the new Aux.Out/Communications board onto the MCU/Output board and push the mounting posts down through the MCU/Output board until they click into place.
9	Replace the transformer plug onto connector J8.
10	Slide the printed wiring boards back into the chassis. Make sure the connections to the keyboard assembly are made and that the release points on the chassis snap into place on the printed wiring boards.
11	Reinstall the chassis into the case. Push in hard, then tighten the screw.

Continued on next page

MCU/output board

Follow the procedure listed in Table 9-23 to replace the following MCU/output boards:

- Current Output—P/N 30756718-502
- Relay Output—P/N 30756718-503

Table 9-23 MCU/Output Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. See Figure 9-1.
2	Remove the printed wiring boards from the chassis. See Figure 9-3.
3	Lay the boards flat and identify the MCU/Output board. See Figure 9-4.
4	Each option board is held onto the MCU/Output board with three posts.. Locate these posts under the MCU/Output board.
5	Use small pliers and squeeze the ends of each post together and push it up through the board. Remove the option boards present.
6	Remove the transformer connections to the Digital Input board and the Aux.Out/Communications board, if present.
7	Remove the Digital Input Board, if present. See Table 9-21.
8	Remove the Aux.Out/Communications board, if present. See Table 9-22.
9	Remove the connector from plug WG. Slide a small screwdriver under the connector and lift the release.
10	Replace the MCU/Output board.
11	Reinstall the Digital Input board, if present, onto the new MCU/Output board.
12	Reinstall the Aux.Out/Communications board, if present, onto the new MCU/Output board.
13	Reinstall the WG connector and the transformer connectors to the Digital Input board and Aux.Out/Communications board, if present.
14	Slide the printed wiring boards back into the chassis. Make sure the connections to the display/keyboard assembly are made and that the release points on the chassis snap into place on the printed wiring boards.
15	Reinstall the chassis into the case. Push in hard, then tighten the screw.

9.9 Maintenance

Cleaning

If you find it necessary to clean the elastomer bezel, use an alcohol solution or mild soapy water.

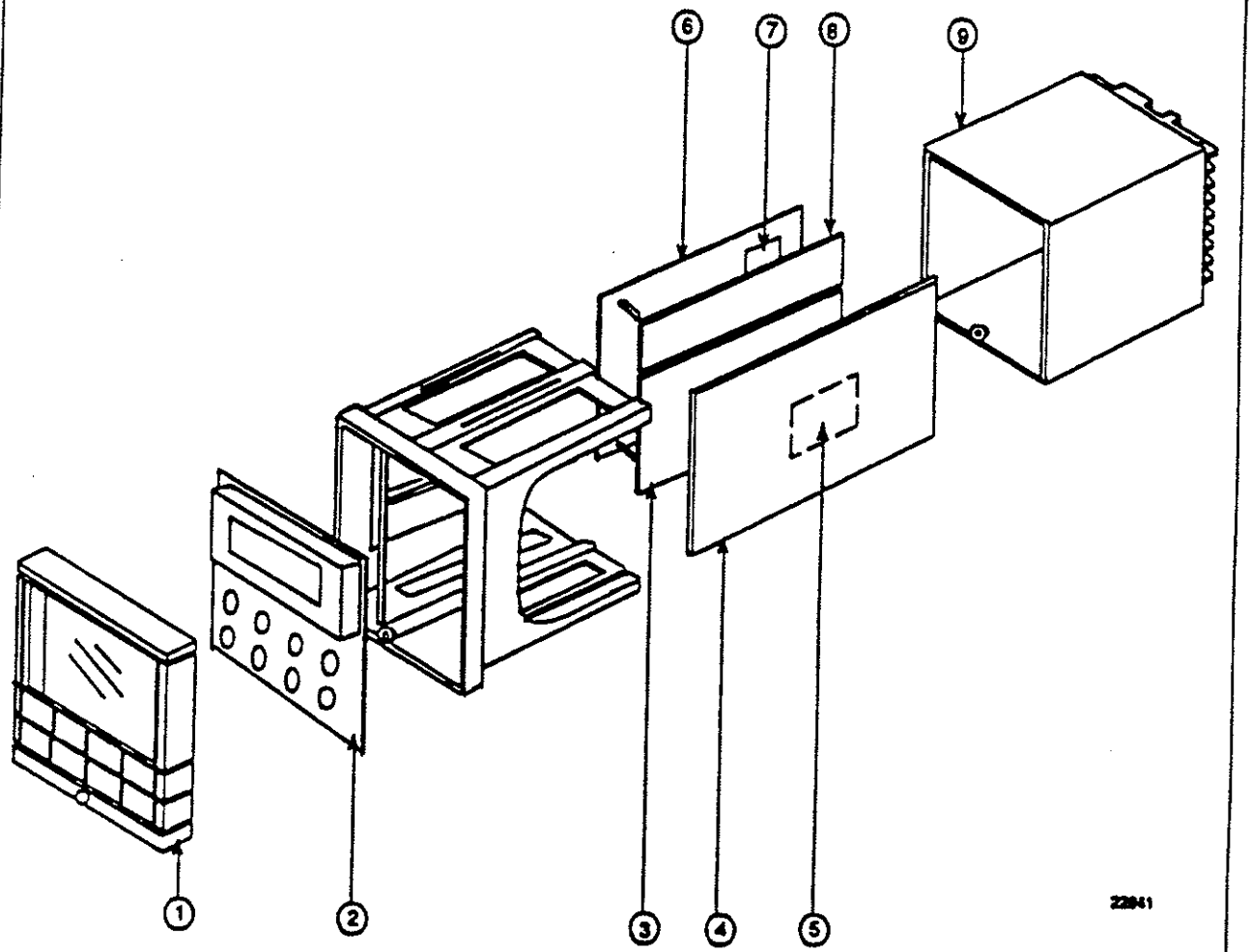
Section 10 – Parts List

10.1 Exploded View

Introduction

Figure 10-1 is an exploded view of the UDC3000 Controller. Each part is labeled with a key number. The part numbers are listed by key number in Table 10-1. There is a list of parts not shown in Table 10-2.

Figure 10-1 UDC3000 Exploded View



Continued on next page

Parts Identification

Table 10-1 lists the part numbers for the key numbers shown in the exploded view.

Table 10-1 Parts Identification

Key Number	Part Number	Description	Quantity
1	30756667-501	Bezel Assembly	1
2	30756672-501	Display/Keyboard Printed Wiring Assembly	1
3	30756687-501 30756690-501 30756693-501	Auxiliary Output Printed Wiring Board DMCS Communications Printed Wiring Board (includes new PROM) RS422/485 Communications Printed Wiring Board (includes new PROM)	1
4	30756669-501	Power/Input Printed Wiring Board	1
5	30756715-501	2nd Input Printed Wiring Board	1
6	30756718-502 30756718-503	Current Output MCU/Output Printed Wiring Board Relay Output MCU/Output printed Wiring Board	1
7	30755306-501 30756725-501 30756679-501	Relay, Electromechanical Relay, Solid State 1 Amp Open Collector Output Printed Wiring Jumper	1 per kit
8	30756696-501	Digital Input Printed Wiring Board	1
9	30756721-501	Case Assembly	1

Continued on next pa

Parts not shown

Table 10-2 lists the part numbers of the parts not show in the exploded view.

Table 10-2 Parts Not Shown

Part Number	Description	Quantity
30731996-506	4-20 mA Resistor Assembly, 250 Ohms	1
30754465-501	0-10 Volt Input Resistor Assembly, 100K Pair	1
30752441-501 30752441-502	Varistor, 120V Varistor, 240V	1
30755050-001	Mounting Kit	1
30756746-001	Snubber Assembly	1
30756764-002	Rear Cover Kit	1
30755223-002 30755223-003	DIN Adapter Kit, Blue DIN Adapter Kit, Gray	1
30756774-501	Adaptive Tune Prom Upgrade	1
30756775-501	Adaptive Tune/Setpoint Programming Prom Upgrade	1
30757088-001	Cold Junction Resistor Kit	1
30756018-003	External Relay, Solid State 10 Amp	1
30756682-501	Adapter (New chassis to old case)	1
30756683-001	Gasket (Panel to case)	

Section 11 – Appendix A – Manual Tuning

11.1 Overview

Introduction

When you tune a controller, there are some things to consider:

- Process Characteristics - Gain, Time Constants, etc.
- Desired response - Minimal overshoot

Basically, controller tuning consists of determining the appropriate values for the Gain (PB), Rate (Derivative), and Reset (Integral) time tuning parameters (control constants) that will give the control you want. Depending on the characteristics of the deviation of the process variable from the setpoint, the tuning parameters interact to alter the controller's output and produce changes in the value of the process variable.

Since each parameter responds to a specific characteristic of the deviation, you may not need a combination of all three. It depends on the process characteristics and the desired control response.

Tuning technique

You can estimate a starting point and the tuning parameters required to give the desired controller response and with some experience become proficient with this method.

An alternate approach is to rely on a tuning technique. In practice, tuning techniques usually do not give exactly the type of response desired; thus, some final adjustments to the tuning parameters must be made.

However, you should at least obtain a reasonable starting point from which the desired response characteristics can be obtained.

Controller tuning procedures

There are three procedures for tuning the controller:

- Time, Position, or Current Proportional simplex control.
- Duplex Time or Current Proportional control,
- Two sets of tuning constants for single output operation.

The suggested procedures describe how to establish and store values of Gain(PB), Rate, and Reset time constants for your process. You must know the type of control and algorithm your controller has.

Tuning aids

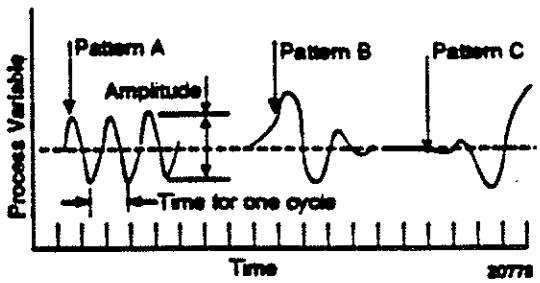
A graphic recorder (such as Honeywell model DPR, DR4500, or VP131) connected to the process variable will make it easier to determine when the oscillations are constant and also the time for one oscillation. If a recorder is not available, you can use a stop watch to time the oscillation of the process variable displayed on the controller.

11.2 Time, Position, or Current Proportional Simplex Control

Procedure

The procedure listed in table 11-1 gives you the steps for manually tuning a controller with Time, Position, or Current proportional simplex control.

Table 11-1 Manual Tuning Procedure for Simplex Control

Step	Action
1	In Manual Mode, adjust the output to bring the PV (Process Variable) near the desired value.
2	Set the Rate time to 0 minutes and set the Reset time to the maximum value (50.00 minutes) or set repeats/min to the minimum value to minimize reset action If applicable, set the CYCLE TIME to 4 seconds and DEADBAND to 0.5.
3	Increase GAIN (decrease PB) significantly. Try a factor of 10.
4	Adjust the local setpoint to equal PV and switch to Automatic control mode.
5	Increase the setpoint by 5 or 10% and observe the process variable response.
6	If the PV oscillates, continue to step 7. If it does not oscillate, return to the original setpoint and increase GAIN (decrease PB) again by a factor of 2, and repeat step 5.
7	Compare the oscillations with the figure below:  • If the oscillation matches pattern A, go to step 8. • If the oscillation matches pattern B, increase GAIN (decrease PB) by a factor of 2 and repeat steps 4 to 6. • If the oscillation matches pattern C, decrease GAIN (increase PB) by a factor of 0.8 and repeat steps 4 to 6 The amplitude of the cycle is immaterial, but all of the elements of the loop must be within the operating range (i.e., the valve must no go full open or closed).
8	Record the current value of GAIN (or PB) and measure and record the value of time for one completed oscillation of PV.

Continued on next

Procedure, continued

Table 11-1 Manual Tuning Procedure for Simplex Control, continued

Step	Action
9	Select the proper set of formulas from Table 11-2. Use the values of Gain (or PB) and time (in minutes) in the formulas to arrive at the controller's tuning parameters settings.
10	Enter the values of GAIN (or PB), RATE, and RESET in minutes (or repeats per minute) into the UDC3000 controller and verify that the PV response is adequate. Make additional trimming adjustments, if necessary, to fine tune the controller per the guidelines shown below: TO REDUCE OVERSHOOT Less Gain (more PB) perhaps a longer Rate time. TO INCREASE OVERSHOOT OR INCREASE SPEED OR RESPONSE More Gain (less PB), perhaps shorter Rate time.

Manual tuning formulas

Table 11-2 lists the formulas used in the procedure listed in table 11-1.

Table 11-2 Manual Tuning Formulas

	Units	
	GAIN and RESET TIME in Minutes / Repeat	% PROPORTIONAL BAND and RESET ACTION in Repeats / Minutes
Proportional (P) only Use PD+MR Algorithm (i.e. No Reset)	GAIN = Measured Gain x 0.5 RESET TIME = 50.00 (minimum reset) RATE = 0	%PB = Measured PB x 2 RESET ACTION = 0.02 (repeats/minute) RATE = 0
Proportional + Reset (PI) (No Rate)	GAIN = Measured Gain x 0.5 RESET TIME = $\frac{\text{Measured Time}}{(\text{M/R}) \quad 1.2}$ RATE = 0	%PB = Measured PB x 2.2 RESET ACTION = $\frac{12}{(\text{R/M}) \quad \text{Measured Time}}$ RATE = 0
Proportional + Reset + Rate (PID)	GAIN = Measured Gain x 0.6 RESET TIME = $\frac{\text{Measured Time}}{2}$ RATE = $\frac{\text{Measured Time}}{8}$	%PB = Measured PB x 1.7 RESET ACTION = $\frac{2}{\text{Measured Time}}$ RATE = $\frac{\text{Measured Time}}{8}$

11.3 Time Proportional Duplex or Current Proportional Duplex Control

Introduction

For HEAT/COOL applications.
Tune the controller with the output above 50% for Heat and below 50% for Cool.

HEAT/COOL prompts

The "TUNING" function prompts for HEAT/COOL are:

HEAT	COOL
PB or GAIN	GAIN2
RSETMIN or RSETRPM	RSET2MIN or RSETRPM2
RATEMIN	RATE2MIN
CYCSEC	CYC2SEC

11.4 Two Sets of Tuning Parameters for Single Output Operation

Introduction

You can use two sets of tuning constants for single output types and tune each set separately.

TWO SETS prompts

The "TUNING" function prompts for two sets are:

PID SET 1	PID SET 2
PB or GAIN	GAIN2
RSETMIN or RSETRPM	RSET2MIN or RSETRPM2
RATEMIN	RATE2MIN
CYCSEC	CYC2SEC

Section 12 - Appendix B

How to Apply Digital Instrumentation in Severe Electrical Noise Environments

12.1 Overview

Guideline overview

Products that incorporate digital technology provide recognized performance advantages over conventional analog instrumentation used for process control. These advantages can result in better product uniformity and greater overall efficiency when used correctly.

There are, however, certain guidelines regarding installation and wiring which must be carefully followed in order to achieve this performance. In addition to the traditional precaution of the separation of signal and power wiring in separate conduits, other measures must be taken to minimize the effects of electromagnetic interference (EMI) and radio frequency interference (RFI) on the operation of the equipment. Otherwise, if high level, short duration, noise spikes are permitted to enter the digital equipment, the noise can be transferred into the system's logic networks and can be misinterpreted as signal data, resulting in erroneous system operation and other unpredictable responses.

What's in this section

This section contains the following information:

Topic		See Page
12.1	Overview	189
12.2	Potential Noise Sources	190
12.3	Prevention Methods	191
12.4	Recommended Wiring Practices	192
12.5	Power Source Considerations	194
12.6	Noise Suppression at the Source	195

12.2 Potential Noise Sources

Overview

Noise can enter electronic equipment via three methods of coupling, namely:

- Capacitive (or electrostatic)
- Inductive (or magnetic)
- Impedance.

Capacitive and inductive coupling

Capacitive and inductive coupling have the same essential effect — they couple current or voltage, without any actual connection of the two circuits. Impedance coupling requires a connection between the two circuits. Typical noise-generating sources that could affect electronic equipment through capacitive and inductive coupling include:

- Relay coils
- Solenoids
- AC power wires — particularly at or above 100 Vac
- Current carrying cables
- Thyristor field exciters
- Radio frequency transmissions.

Impedance coupled noise

Impedance-coupled noise may enter by way of the lines used to power the digital equipment or by way of improper grounding. Most power lines, at typical industrial locations, are far from noise-free. The noise on them can be generated in many ways, but are nearly always associated with switching circuits of some nature.

These include:

- Large relays
- Contactors
- Motor starters
- Business and industrial machines
- Power tools
- HID (high intensity discharge) lights
- Silicon controlled rectifiers (SCRs) that are phase-angled fired.

12.3 Prevention Methods

Introduction

There are three ways to prevent electrical noise from interfering with the operation of the electronic digital equipment.

- Built-in noise rejection
- Separation of signal and power lines
- Noise suppression at source

Built-in noise rejection

The first method is to design the digital equipment with a high degree of noise rejection built-in. This includes housing the equipment in a case that will provide shielding, liberal use of noise rejection filters and opto-isolators, and the use of noise suppressors on potential noise sources within the equipment itself. This, of course, is the responsibility of the manufacturer who usually performs extensive laboratory and field testing of newly designed digital equipment to insure the adequacy of its immunity to noise. As a minimum requirement, the equipment should be able to pass the tests outlined in the IEEE Standard 472-1974 *(Surge Withstand Capacity Tests)*.

Signal and power line separation

The second method is to prevent noise from getting on the signal and power lines that are connected to the equipment. This is achieved by proper separation and shielding of those lines. In some cases, separate power lines or special power line regulation or filtering may be required for satisfactory electronic digital equipment operation. It is the responsibility of the installer to follow good wiring practices.

Suppression at the source

The third prevention method is to suppress the noise at its source. This is the most effective but also the most difficult because it is not easy to identify all of the potential noise sources in a typical industrial installation. Therefore, "suppression" is usually a last resort for those extreme situations where the other methods are insufficient by themselves. See *Noise Suppression at Source* which follows.

12.4 Recommended Wiring Practices

General rules

- All wiring must conform to local codes and practices.
- Wires carrying similar types of signals (Table 12-1) may be bundled together, but bundles with different types of signals must be kept separated to prevent inductive or capacitive coupling.

Wire bundling

Table 12-1 shows what wiring should be bundled together to prevent inductive or capacitive coupling.

Table 12-1 External Wiring

Wire Function		Bundle No.	Are Shielded Twisted Wires Recommended?
No.	Type		
1 2 3	HIGH VOLTAGE Line Power Earth Ground Line Voltage Digital I/O	1	NO
4 5	ANALOG I/O Process Variable RTD Thermocouple dc Millivolts Low level (<100V) 4-20 mA dc 1-5 Vdc	2	YES
6 7	DIGITAL I/O Low Voltage (<100V) Computer Interface	3	YES

Continued on next pa

Additional rules

Please observe these additional rules for wire bundling:

- For distances over five (5) feet, and when shielding is recommended, use a separate metal tray or conduit for each bundle. Where conduits or trays are not practical, use twisted wires with a metal overbraid and provide physical separation of at least one foot.
- Tray covers must be in continuous contact with the side rails of the trays.
- When unlike signal levels must cross, either in trays or conduits, they should cross at a 90-degree angle and at a maximum spacing. Where it is not possible to provide spacing, a grounded steel barrier or grid should be placed between the unlike levels at the crossover points.
- Trays containing low level wiring should have solid bottoms and sides. Tray covers must be used for complete shielding. Tray cover contact with side rails must be positive and continuous to avoid high reluctance air gaps, which impair shielding. Trays for low level cables should be metal and solidly grounded.
- Wires containing low level signals should not be routed near any of the following:
  - Contactors
  - Motors
  - Generators
  - Radio transmitters
  - Wires carrying high current that is being switched on and off.
- Use a 12-gage (or heavier) insulated stranded wire for the ground connection. Attach it firmly to a proven good earth ground such as a metal stake driven into the ground.
- All shields should be grounded at one end only — preferably the instrument end.

12.5 Power Source Considerations

Operate within limits

The AC power for the digital electronic equipment must be within the voltage and frequency limits specified for that equipment. Attempts to operate outside the specified limits will result in no performance. For those installations where the supply voltage will not stay within the specified limits, a ferroresonant transformer, for voltage resolution, should be used.

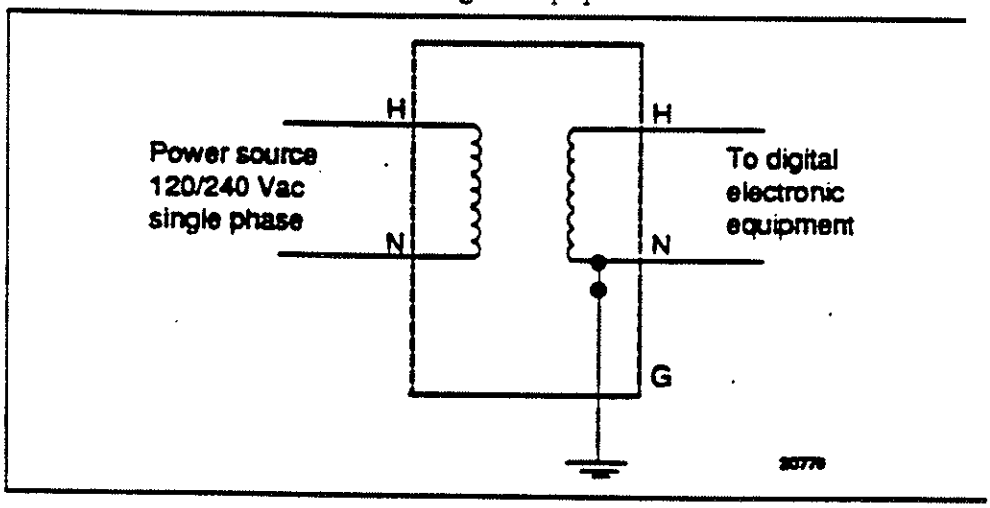
Independent AC source

For protection against noise, the AC source for the digital electronic equipment should be independent of all other loads especially when switching loads are involved. For example, it should not provide power for air-conditioning, convenience outlets, lighting, motors, or similar noise-generating devices. To obtain electrical isolation (see Figure 12-1) a separate transformer is required to supply power to the digital equipment. For additional noise and transient rejection, shielded primary and secondary windings may be required. And, if necessary, power line filters may be added to attenuate noise signals that have a higher frequency than the power line frequency.

Transformer for digital equipment

Figure 12-1 is an illustration of a separate transformer required to supply power to digital equipment.

Figure 12-1 Transformer for Digital Equipment



12.6 Noise Suppression at the Source

Introduction

Generally speaking, when good wiring practices are used with well-designed digital electronic equipment, no further noise protection is necessary. However, in some severe electrical environments, the magnitude of the electrical noise is so great that it must be suppressed at the source. In most control cabinets, the main sources of noise are motor starters, contactors, relays, and switching gear. For this reason, many manufacturers of these devices supply "surge suppressors" which mount directly on the noise source, (for example, on the coil of a control relay or motor starter).

For those devices that do not have accessory "surge suppressors," resistance-capacitance (RC) circuits and/or voltage limiters such as metal varistors may be added when and where needed. This can be broken down into two categories, namely inductive loads (for example, a relay switch in series with a relay coil) and contacts.

Inductive coils

Metal Oxide Varistors (MOVs) are recommended for transient suppression in inductive coils. An MOV is connected in parallel with the coil and is as close as physically possible to the coil (see Figure 12-2). MOV devices (listed in Table 12-2) are recommended for general purpose applications.

Table 12-2 lists part numbers for recommended MOV devices.

Table 12-2 MOV Devices

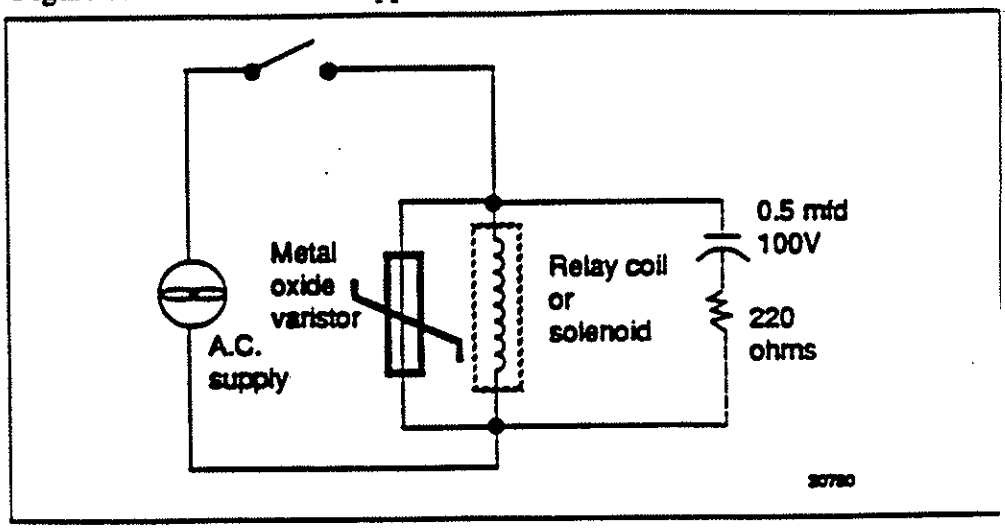
Part Number	30732481-001 *	30732481-002
Maximum AC	130V	275V
Energy Pulse Rating	10 Joules	15 Joules
Supplier (General Electric)	V130LA10A	V275LA15A

Continued on next page

Inductive coils, continued

Figure 12-2 is an illustration of transient suppression in inductive coils.

Figure 12-2 Transient Suppression in Inductive Coils



Additional protection may be provided by adding an RC circuit in parallel with the MOV. This consists of a 220-ohm resistor in series with a 0.5 microfarad, 1000V capacitor. The power rating of the resistor will depend on the voltage rating of the coil (see Table 12-3).

Table 12-3 Coil Voltage vs Resistor Voltage Rating

Coil Voltage	Resistor Voltage Rating
115V	1/4 Watt
230V	1 Watt
460V	3 Watt
550V	5 Watt

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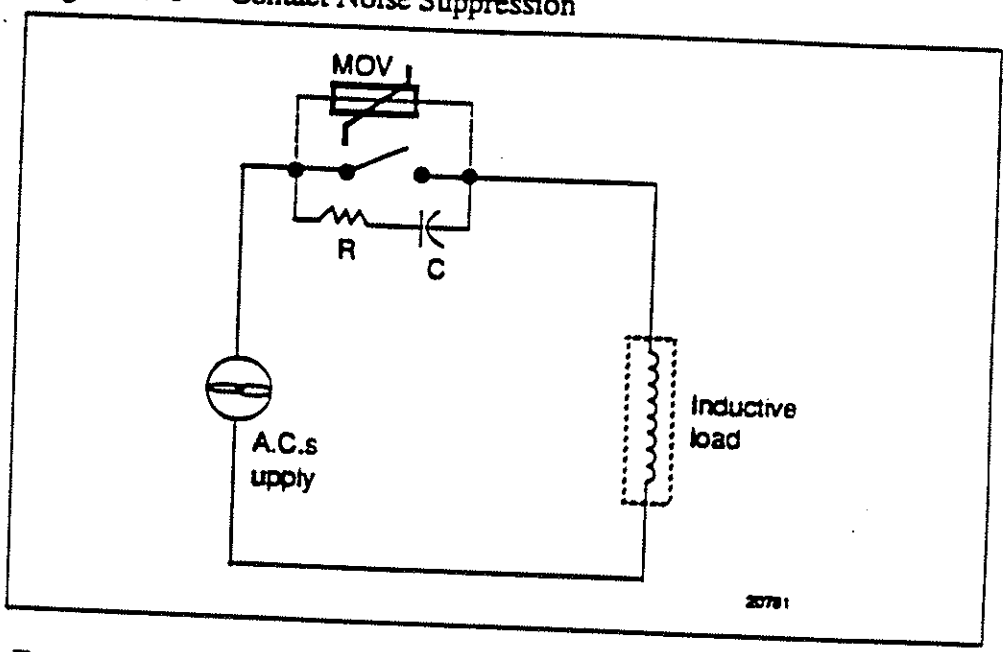
Contacts

When a contact interrupts an inductive load, a certain amount of energy is stored in the load. An MOV or RC circuit in parallel with the load provides a place where this energy may be dissipated. However, if there is no MOV or RC circuit, the energy may create a visible electrical arc across the open contacts. This, in turn, results in electrical noise as well as damage to the contacts.

One way to eliminate this arc is to connect a resistor and capacitor across the contacts (see Figure 12-3). A combination of 47 ohms and 0.1 microfarads (1000 Vdc) is recommended for circuits up to 3 amps and 300 Vac. For voltages above 2000 Vac, an MOV across the contact may be added for extra protection.

Figure 12-3 is an illustration of a resistor and capacitor connected across a contact to eliminate electrical noise.

Figure 12-3 Contact Noise Suppression



For large load currents, a rule of thumb is to size the capacitor so that the number of microfarads equals the number of amperes in the load current, and the resistor has the same resistance value as the load. The objective is to eliminate the visible arc.

Either discreet resistors and capacitors or packaged RC networks may be used. An RC network (47 ohms and 0.1 microfarad) is available from Honeywell as part number 30371852-001. Similar RC networks are available from Electrocube Inc. (part number RG1782-3) and from Industrial Condensor Corporation.

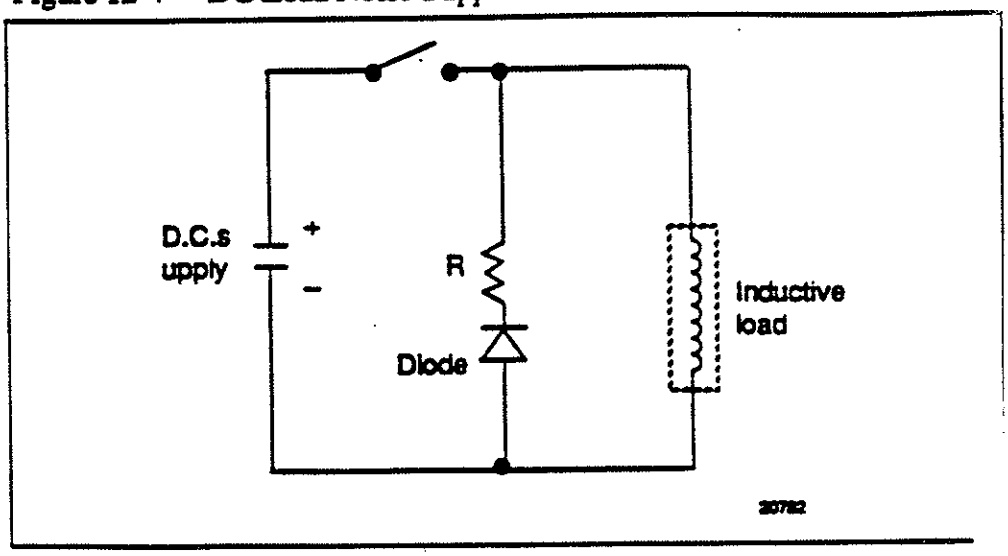
Continued on next page

ntacts, continued

In DC circuits, th ower dissipation under steady state condition can be eliminated by pla a diode (in series with a resistor) in parallel with the load (see Figure 1 -4). The value of R should be less than or equal to the DC resistance of the inductive load.

Figure 12-4 is an illustration of DC load noise suppression.

Figure 12-4 DC Load Noise Suppression



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A DIVISION OF KOCH ENGINEERING

SPECIFICATION

CONTROL VALVES

SPEC.NO. 16

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL | TAG.NO. : FCV-102/ZSO-102/ZSO-102/SV-103

INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.:1

GENERAL	1	Tag. No.		FCV 102			
	2	Service		LANDFILL GAS			
	3	Line No./Vessel No.					
	4	Line Size/Sched. No.					
BODY	5	Type of Body		BUTTERFLY			
	6	Body Size	Port Size	10"			
	7	Guiding	No. Of Ports		1		
	8	End Conn. & Rating		WAFER 150#			
	9	Body Material		C.S.			
	10	Packing Material		PTFE			
	11	Lubricator	Isolating Valve				
	12	Bonnet Type					
	13	Trim Form					
	14	Trim Material	Seat/Plug	316 S.S.			
			Shaft Mtl.				
	15	Required Seat Tightness		BUBBLE TIGHT			
	16	Max. Allow.,Sound Level dBA					
ACTUATOR	17	Model No. & Size		BETTIS CB525SR100	ACCESSORIES: OPEN	AND CLOSED LIMIT	SWITCHES:3R-021AFC
	18	Type of Actuator		PNEUMATIC	PILOT	SOL. VALVE: ASCO #	EF8320G184
	19	Close at	Open at	0 PSIG	100 PSIG		
	20	Flow Action to					
	21	Fail Position		CLOSED			
	22	Handwheel & Location					
POSITIONER	23	MFR. & Model No.					
	24	Filt Reg.	Gages	Bypass			
	25	Input Signal					
	26	Output Signal					
	27	Air Supply Pressure					
TRANSDUCER	28	MFR. & Model No.					
	29	Input Signal					
	30	Output Signal					
OPTIONS	31	Tubing and Fitting Mat'l		S.S.			
	32	OPEN/CLOSE SPEED CONTL VALVE		YES			
SERVICE	33	FLOW UNITS SCFM		LIQUID	STEAM	GAS LANDFILL GAS (METHANE)	
	34	Fluid		LANDFILL GAS			
	35	Quant. Max	C	3150			
	36	Quant. Oper.	C				
	37	Valve C	Valve FL				
	38	Norm. Inlet Press.	Δ P	1" W.C.			
	39	Max. Inlet Press.		12" W.C.			
	40	Max. Shut Off Δ P					
	41	Temp. Max. F	Operating F	350	100		
	42	Oper. sp. gr.	Mol. Wt.				
	43	Oper. Visc.	% Flash				
	44	% Superheat	% Solids				
	45	Vapor Press.	Crit. Press.				
	46	Predicted Sound Level dBA					
SHIPMENT	47	Manufacturer		XOMOX			
☐ SKID MOUNT	48	Model No.		#801-2-6-7-ST1			
■ SHIP LOOSE	49	JZ Part No.		402310			

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SPECIFICATION

MISCELLANEOUS INSTRUMENTS

AUTO-DIALER

SPEC.NO. 17

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

RACO MODEL # VSS-4C AUTOMATIC DIALER

4 DRY CONTACT INPUTS

CHANNEL 1: FLAME FAILURE (OPEN TO ALARM)

CHANNEL 2: UNIT OVERTEMPERATURE (OPEN TO ALARM)

CHANNEL 3: TANK LEAK (OPEN TO ALARM)

CHANNEL 4: TANK HIGH LEVEL (OPEN TO ALRAM)

1 DAUGHTER CARD ASSY

POWER: 120 V/60 Hz (20 HOUR BATTERY BACK-UP)

JZ PART NO. 404880

U.L. LABER REQUIRED

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IGNITION TRANSFORMER

IGN.PANEL (PNL 103)

SPEC.NO. 18

S.O.NO. BF -A0012224

PAGE 1 OF 1

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FACILITY: PHELHAM BAY LANDFILL	TAG.NO. : PNL-103

INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

TRANSFORMER	Manufacturer	WEBSTER
	Model No.	612-6A7
	Quantity	ONE (1)
	Primary Power Req.	120VAC
	Secondary Power Req.	6000V
	Tag Number	IT-1
	John Zink Part No.	002558
ENCLOSURE	Manufacturer	HOFFMAN
	Enclosure Model No.	A1412NF
	Quantity	ONE (1)
	Enclosure Type	NEMA 4
	Dimensions	O.D.■ I.D.□
	John Zink Part No.	015278
SUB-PANEL	Manufacturer	HOFFMAN
	Sub-Panel Model No.	A14P12
	John Zink Part No.	003527

Notes: ALL ITEMS TO BE U.L. LISTED

MOUNT: PANEL □ SKID □ FIELD ■ OTHER □ MOUNT ON STACK

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SPECIFICATION

PROGRAMMABLE LOGIC CONTROLLER

SPEC.NO. 19

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

MANUFACTURER : ALLEN BRADLEY

PROGRAMMABLE LOGIC CONTROLLER SYSTEM CONSISTING OF THE FOLLOWING COMPONENTS

ITEM	QTY	PART No.	DESCRIPTION	JZ Part No
1	1	1747-L40A	SLC-500 FIXED PLC, 24 INPUTS (120V,60HZ),16 OUTPUTS RELAY(120V/60HZ)	402023
			(120V/60 HZ POWER)	
2	1	1747-M1	EEPROM	036491

Notes:

MOUNT: PANEL ■ SKID □ FIELD □ OTHER □

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CONTROL PANEL BILL OF MATERIALS

CONTROL POWER TRANSFORMER

SPEC.NO. 20
S.O.NO. BF -A0012Z24

LOCATION: NEW YORK CITY, NEW YORK
CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL
INQ.:
JZ.PO.NO:
CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	TX-1	HEVI-DUTY # HS5F3AS CONTROL TRANSFORMER	404388
			(240/480V PRIMARY / 120/240V SECONDARY / 3 KVA)	
			(RACK MOUNTED)	

NOTES: PANEL MTG.
U.L. LABEL REQUIRED

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SPECIFICATION

CONTROL PANEL BILL OF MATERIALS

MAIN DISCONNECT AND FUSES

SPEC.NO. 21

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	DS-1	GENERAL ELECTRIC TH3362SS 3P SAFETY SWITCH △	*-021A
			600 VAC/ 60 AMP/3 POLE	
			(MOUNTED ON RACK)	
2	3	F1, F2, F3	GOULD # TRS40R 40 AMP FUSE △	*-021B

NOTES:

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SPECIFICATION

CONTROL PANEL BILL OF MATERIALS

PANEL 102

SPEC.NO. 22

S.O.NO. BF -A0012224

PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	PNL 102	HOFFMAN #A36H2408SS NEMA 4X ENCLOSURE WITH # A-39P24 PANEL	*-022
2	1	PDB-1	MARATHON #1433553 3 POLE POWER DISTRIBUTION BLOCK, 1 PRI., 6 SEC./ POLE	034502
3	1	PDB-3	MARATHON #1423570 3 POLE POWER DISTRIBUTION BLOCK, 1 PRI., 3 SEC./ POLE	900034
4				
5				
6				
7	1	CB-6	WESTINGHOUSE #EHD2015 MOLDED CASE CIRCUIT BREAKER, THERMAL MAGNETIC, FIXED TRIP, 480V, 2-POLE, 15 AMP	404385
8	1	CB-7	WESTINGHOUSE #EHD1030 MOLDED CASE CIRCUIT BREAKER, THERMAL MAGNETIC, FIXED TRIP, 480V, 1-POLE, 30 AMP	404563
9				
10	1	M-3	CUTLER-HAMMER #AN16ANOAC M.S.,120V COIL, 1-N/O AUX. CONTACT, H-2005B HEATERS 3 PHASE, 3/4 HP, NEMA SIZE "00" 480V, 60 HZ.	
11				
12	25'		#6 AWG WIRE, WHITE, THHN	401151
13	50'		#6 AWG WIRE, BLACK, THHN	042962
14	20'		#8 AWG WIRE, BLACK, THHN	042963
15	25'		#12 AWG WIRE, WHITE, THHN	405575
16	50'		#12 AWG WIRE, BLACK, THHN	405576
17	35'		#2 AWG WIRE, BLACK, THHN	042960
18	30'		#2/0 AWG WIRE, BLACK, THHN	043151
19	25'		#4 AWG WIRE, BLACK, THHN	042961
20				
21				
22	1	FB-2	GOULD #60328R 30A ,600V 3 POLE FUSE BLOCK	404881
23	3	F-10,F-11,F-12	GOULD #TRS3R 600V, 3 AMP ,RK5 CLASS FUSE	404005
24	50'		#10 AWG WIRE, BLACK, THHN	042968

NOTES: U.L. LABEL REQUIRED

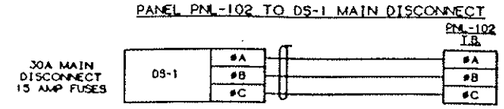
PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 2 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 3 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 4 DATE:	APP:	Shipment Promise Date: / /

JZ401.02 ADOPTED FROM ISA-20-1975

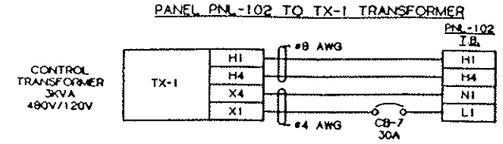
CL 07-26-1995 10:51:30

XIV. CUSTOMER DRAWINGS

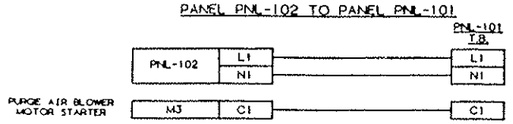
PANEL PNL-102 TO DS-1 MAIN DISCONNECT



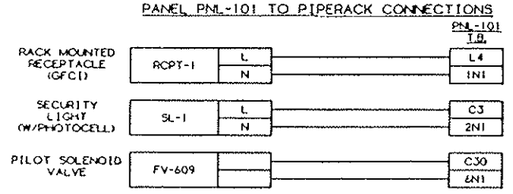
PANEL PNL-102 TO TX-1 TRANSFORMER



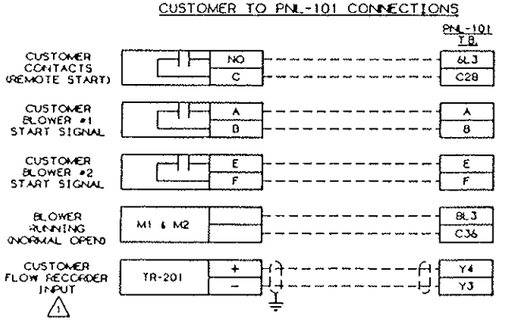
PANEL PNL-102 TO PANEL PNL-101



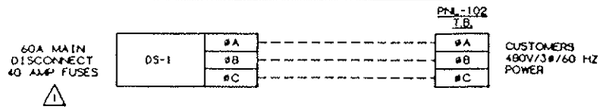
PANEL PNL-101 TO PIPERACK CONNECTIONS



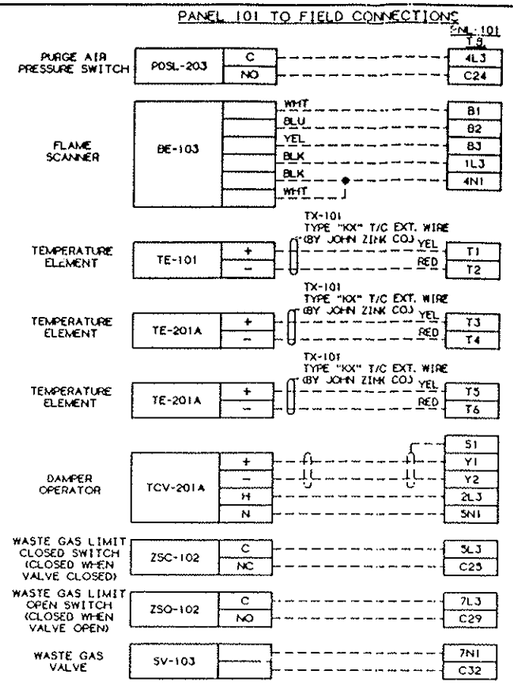
CUSTOMER TO PNL-101 CONNECTIONS



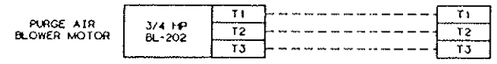
CUSTOMER TO PNL-102 CONNECTIONS



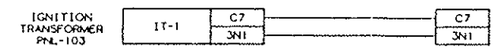
PANEL 101 TO FIELD CONNECTIONS



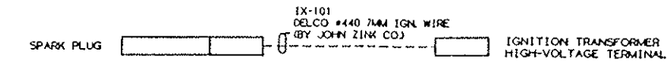
PANEL PNL-102 TO FIELD CONNECTIONS



PANEL PNL-102 TO PANEL PNL-103



PANEL 103 TO IGNITOR CONNECTION



NOTES:

ALL JOHN ZINK SHOP WIRING TO BE AS FOLLOWS:

1. #14 AWG STRANDED OR 2/C SHIELDED CABLE, UNLESS OTHERWISE NOTED.
2. RACK OR SKID WIRES TO BE ASSIGNED NUMBERS THAT CORRESPOND WITH CONTROL PANEL TERMINAL NUMBERS FROM WHICH THEY ORIGINATE, UNLESS OTHERWISE NOTED.

NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE
1	REV'D. WHERE MARKED, PER CUSTOMER APPROVAL COMMENTS	Beth	TCP		7-20-95

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FOR: BRECO MECHANICAL
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: (BF) AO-12224
P.O. NO.: 1304

DR: Beth DATE: 4-12-95
CK: GWG DATE: 4-25-95
APP: T.C. DATE: 4-26-95

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A KOCH INDUSTRIES COMPANY
PARTS AND SERVICE, CALL (918) 234-2751 FAX (918) 234-2700

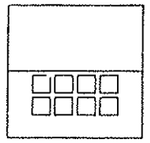
INTERCONNECT DIAGRAM

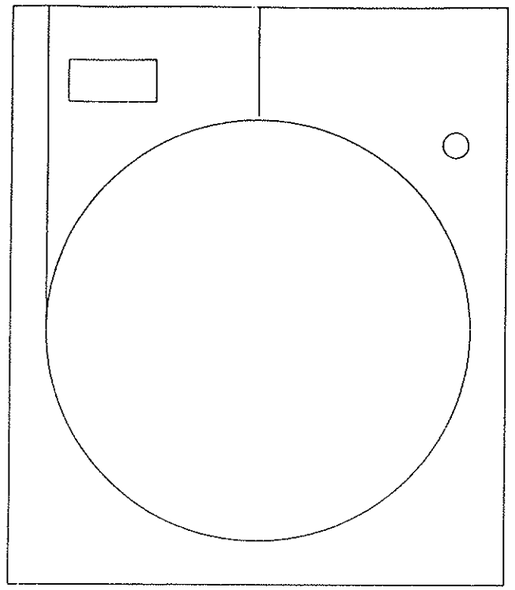
CERTIFIED
DATE:

DRAWING NUMBER: B-F-A12224-405 REV: 1
SCALE: NONE

BASE NUMBER: AO-11166 APPROVAL

DCD/C-A12224-405



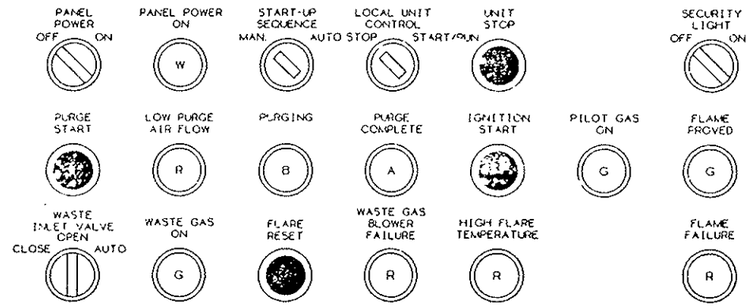


PNL-101 NAMEPLATE SCHEDULE			
COLOR	SIZE	PANEL No.	NAMEPLATE INFORMATION
WHT/BLK	1 1/2" X 3"	PNL-101 (FIELD TERMINAL STRIP)	USE ONLY COPPER WIRE TORQUE CONNECTIONS TO 20 POUND INCHES
WHT/BLK	1" X 3"	PNL-101	PNL-101 FLARE CONTROL PANEL
RED/WHT	1 1/2" X 3"	PNL-101 (OUTSIDE FRONT)	PNL-101 120V AC / 10 AMP / 1 PH 60 HZ.

PNL-102 NAMEPLATE SCHEDULE			
COLOR	SIZE	PANEL No.	NAMEPLATE INFORMATION
WHT/BLK	1" X 3"	PNL-102 (TERMINAL BLOCKS)	USE ONLY 75° C COPPER WIRE
RED/WHT	6" X 8"	PNL-102 (INSIDE PANEL)	WARNING: TO MAINTAIN OVERCURRENT, SHORT CIRCUIT AND GROUND FAULT PROTECTION, THE MANUFACTURERS INSTRUCTIONS FOR SELECTING CURRENT ELEMENTS MUST BE FOLLOWED.
RED/WHT	6" X 8"	PNL-102 (INSIDE PANEL)	WARNING: TRIPPING OF THE INSTANTANEOUS-TRIP CIRCUIT BREAKER IS AN INDICATION THAT A FAULT CURRENT HAS BEEN INTERRUPTED. CURRENT-CARRYING COMPONENTS OF THE MAGNETIC MOTOR CONTROLLER SHOULD BE EXAMINED AND REPLACED IF DAMAGED TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK. IF BURNOUT OF THE CURRENT ELEMENT OF AN OVERLOAD OCCURS, THE COMPLETE OVERLOAD RELAY MUST BE REPLACED.

(PNL-102 FLA 7.5 AMPS)

MAIN DISCONNECT			
COLOR	SIZE	PANEL No.	NAMEPLATE INFORMATION
WHT/BLK	3" X 4"	30A DISCONNECT SWITCH (OUTSIDE FRONT)	30A DISCONNECT SWITCH REPLACEMENT FUSE: (3) 600V AC/ 15 AMP/ DUAL ELEMENT, TIME DELAY



DETAIL 'A'

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NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE

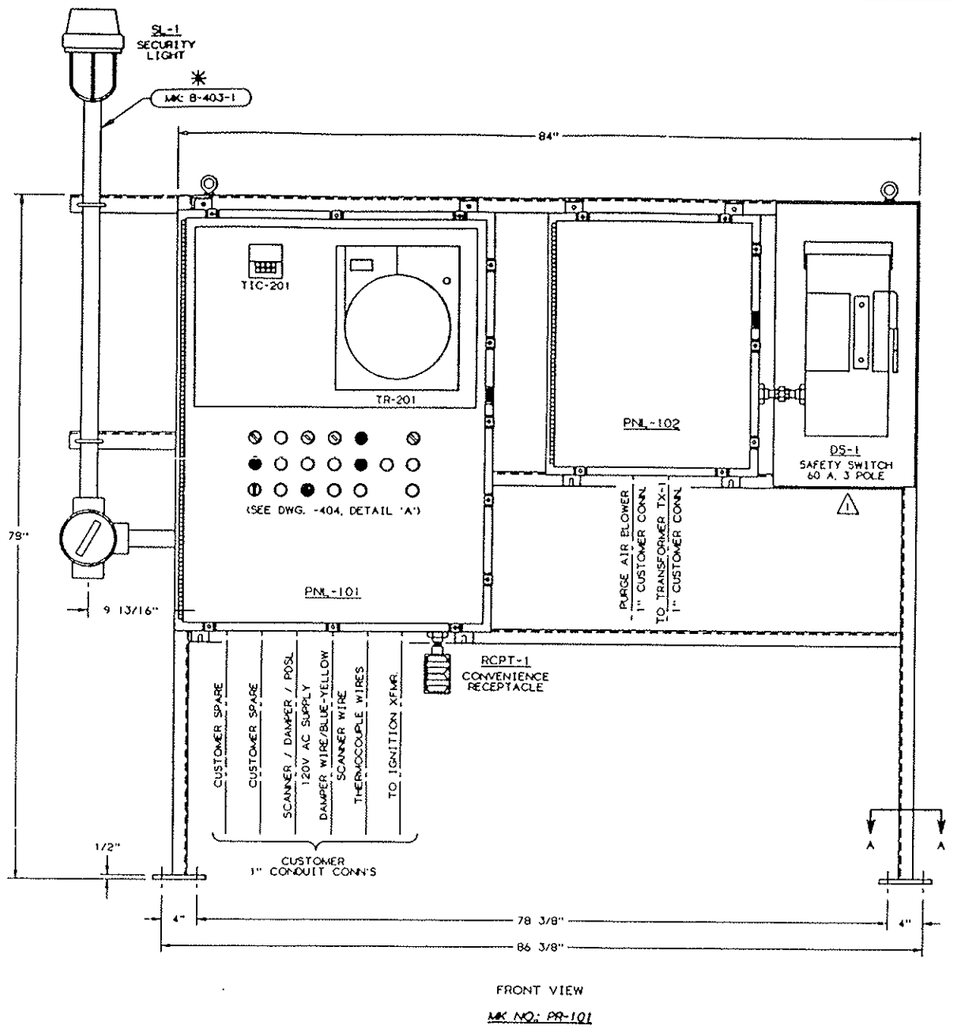
FOR: BRECO MECHANICAL
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: (BF) AQ-12224
P.O. NO.: 1304
DR: BWH DATE: 12-12-95
CK: GWG DATE: 12-95
APP: JC DATE: 4-24-95
CERTIFIED DATE:

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PANEL DETAILS
FOR PANEL PNL-101

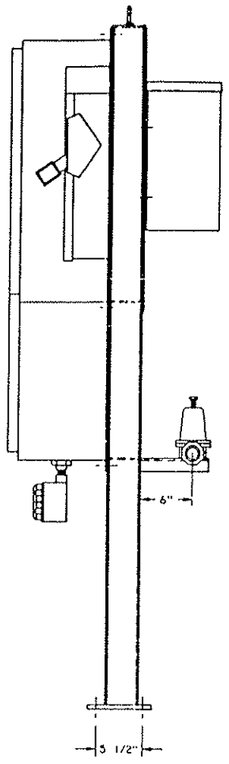
DRAWING NUMBER: B-F-A12224-404
REV: 0
SCALE: NONE

BASE NUMBER: AQ-11146
APPROVAL
JOB-A12224-404

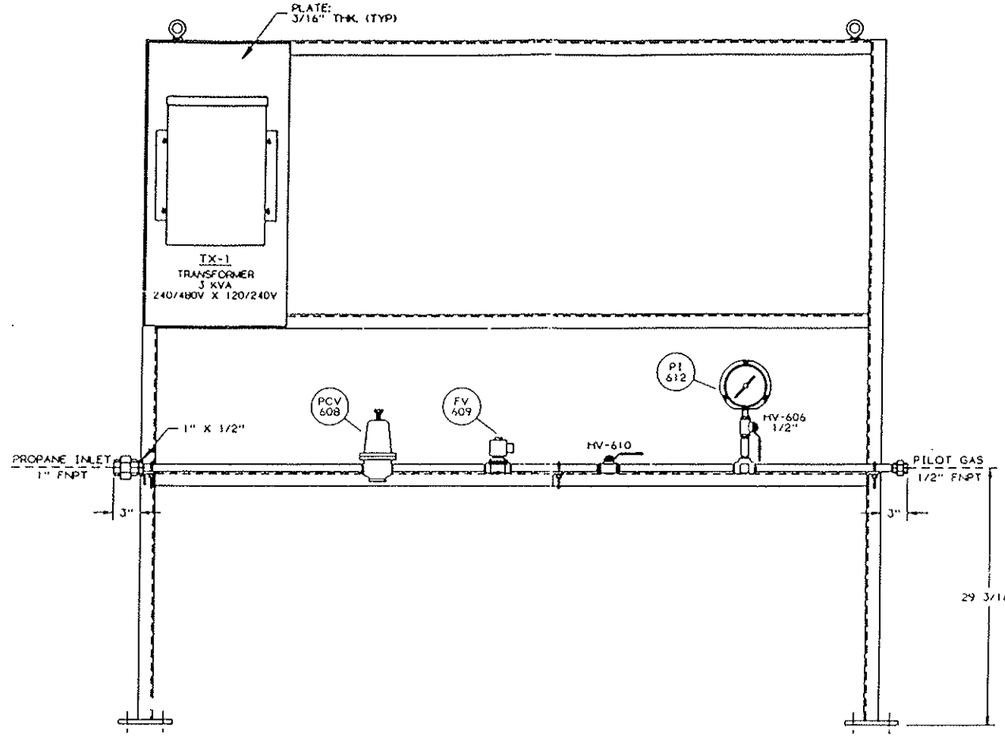


FRONT VIEW

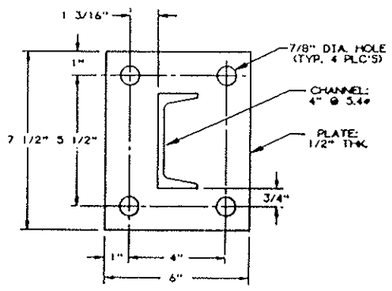
MK NO: PR-101



SIDE VIEW



BACK VIEW



DETAIL 'A-A'
(2 REQ'D)

GENERAL NOTES

1. PIPING & RACK TO BE CLEANED & PAINTED PER SSPC-SP2 AND J.Z. SPEC #3; PRIMED 3-4 MILS WITH SHERWIN WILLIAMS EPOXY #B67H5/ B67V5; BASE COAT 2.5-3.0 MILS WITH SHERWIN WILLIAMS POLYURETHANE #B65T304/ B60V30.
2. AREA CLASSIFICATION: UNCLASSIFIED. ENCLOSURES ARE NEMA 4X.
3. EPOXY STARTER HEATER SCHEDULE TO INSIDE OF PNL-101 DOOR.
4. * - SHIPPED LOOSE

NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE
1	REV'D. WHERE MARKED, PER CUSTOMER APPROVAL COMMENTS	Beth	[illegible]		7-20-95

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FOR: BRECO MECHANICAL
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: (BF) AO-12224
P.O. NO.: 1304
DR: Beth DATE: 4-12-95
CK: SWG DATE: 4-25-95
APP: F.C. DATE: 4-26-95

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PANEL RACK ASSEMBLY
FOR ENCLOSED FLARE SYSTEM

CERTIFIED
DATE:

DRAWING NUMBER: B-F-A12224-403 REV: 1
SCALE: NONE

BASE NUMBER	APPROVAL
AO-11166	

DCD:C-A12224-403

CONT'D FROM DWG. 8-F-401

TEMPERATURE CONTROLLER

COMBUSTION AIR CONTROL DAMPER

FLAME FAILURE (OPEN TO ALARM)

UNIT OVERTEMP. (OPEN TO ALARM)

TANK LEAK (OPEN TO ALARM)

TANK HIGH LEVEL ALARM (OPEN TO ALARM)

START-UP SEQUENCE SWITCH

PURGE AIR PRESSURE SWITCH

WASTE GAS VALVE CLOSED LIMIT SWITCH

PURGE START

IGNITION START

LOCAL UNIT CONTROL

WASTE GAS 'ON' LIGHT

PILOT GAS 'ON' LIGHT

PILOT SOLENOID VALVE

WASTE GAS VALVE PILOT SOLENOID VALVE

FLARE RESET

BLOWER RUNNING

WASTE GAS BLOWER FAILURE LIGHT

PURGING LIGHT

LOW PURGE AIR FLOW LIGHT

PURGE COMPLETE LIGHT

HIGH FLARE TEMPERATURE LIGHT

FLAME FAILURE LIGHT

PLC-100

UNIT STOP (MAINTAINED)

PILOT CUTOFF JUMPER INSTALL JUMPER TO CUTOFF PILOT AFTER MAIN FLAME IS ESTABLISHED. REMOVE JUMPER FOR CONTINUOUS PILOT.

CUSTOMER REMOTE CONTACT CLOSED TO RUN UNIT, OPEN TO SHUTDOWN. (AUTOMATICALLY STARTS UNIT WHEN CLOSED IF UNIT START-UP SEQUENCE SWITCH IS IN AUTO POSITION)

WASTE INLET VALVE CLOSE OPEN AUTO

WIRING LEGEND

- I:X/X — IN X — INPUT ADDRESS, PLC INPUT, TERM. WIRED TO SLOT POSITION
- O:X/X — OUT X — OUTPUT ADDRESS, PLC OUTPUT, TERM. WIRED TO SLOT POSITION
- ENCLOSURE PNL-101 TERMINAL
- ENCLOSURE PNL-102 TERMINAL
- WIRING BY JOHN ZINK
- WIRING BY OTHERS
- WIRE EXTENSION NUMBER INSIDE SYMBOL IS LINE NUMBER OF MATING SYMBOL

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NO.	REVISION DESCRIPTION	BY	CK.	APP	DATE
1	REV'D. PER AS-BUILT CHANGES	Beth	SJG		10-17-95

FOR: BRECO MECHANICAL
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
SO. NO.: (BF) AO-12224
P.O. NO.: 1304
DR: Beth DATE: 4-11-95
CK: GWG DATE: 4-26-95
APP: T.C. DATE: 4-26-95
CERTIFIED DATE:

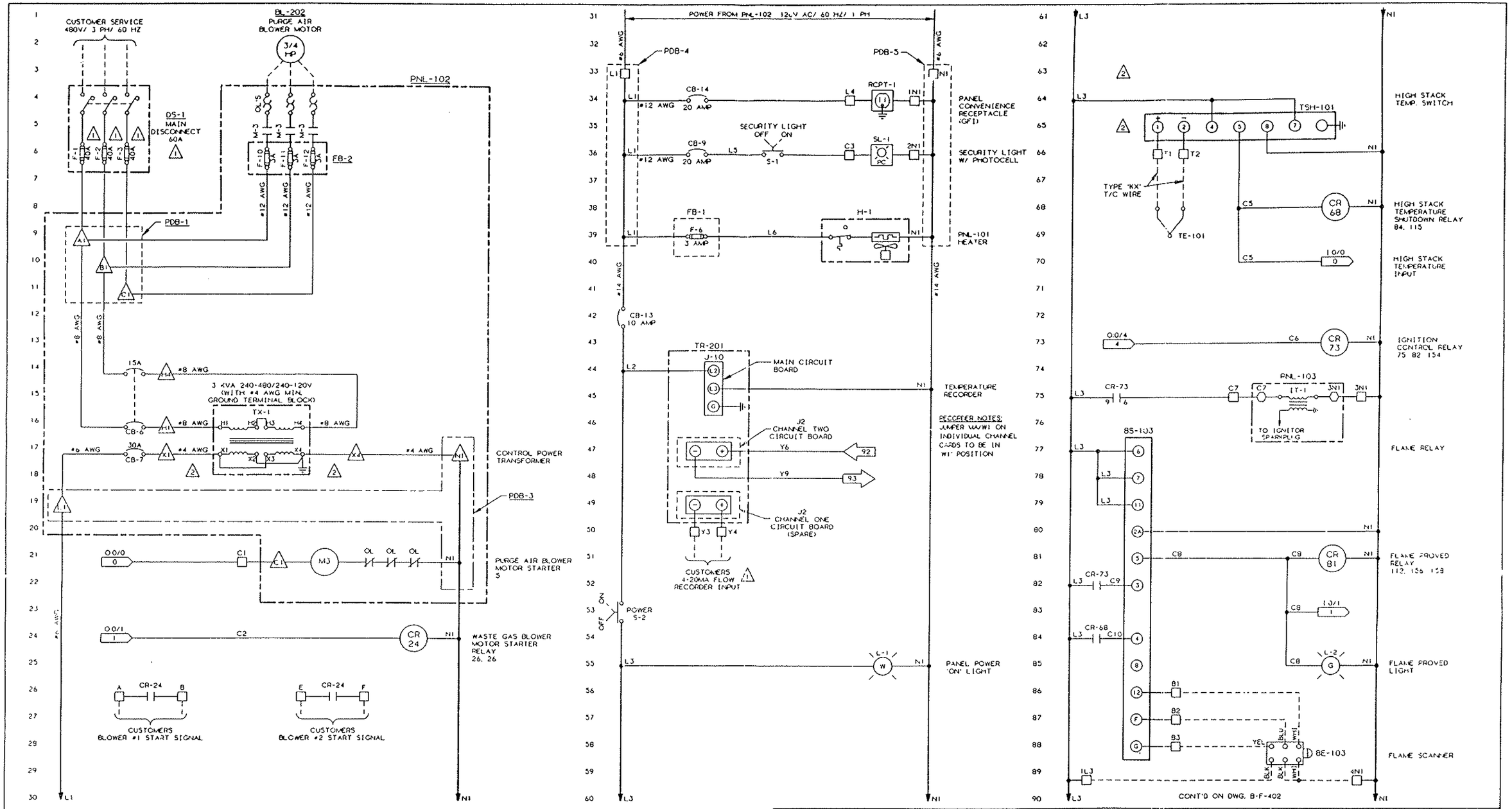
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WIRING DIAGRAM
FOR ZTOF ENCLOSED FLARE SYSTEM

DRAWING NUMBER B-F-A12224-402 REV 1
SCALE NONE

BASE NUMBER AO-08608 | APPROVAL

DCOC-A12224-402



WIRING LEGEND

- I:X/X — INPUT ADDRESS; IN Y — PLC INPUT; TERM. WIRED TO SLOT POSITION
- O:X/X — OUTPUT ADDRESS; OUT X — PLC OUTPUT; TERM. WIRED TO SLOT POSITION
- ENCLOSURE PNL-101 TERMINAL
- ENCLOSURE PNL-102 TERMINAL
- WIRING BY JOHN ZINK
- WIRING BY OTHERS
- WIRE EXTENSION NUMBER INSIDE SYMBOL IS LINE NUMBER OF MATING SYMBOL

NOTES:
- LOCATE TERMINALS FOR AMMETERS ADJACENT TO THERMOCOUPLE TERMINALS IN PNL-101.
- USE #14 AWG WIRE IN PANELS UNLESS OTHERWISE NOTED.
- TWIST WIRES TO AVOID VOLTAGE PICK-UP FROM OTHER AC WIRING.

BASE NUMBER	APPROVAL
AO-08608	

DCD C-A12224-401

NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE
2	REV'D. PER AS-BUILT CHANGES	Beth	GWG		10-17-95
1	REV'D. WHERE MARKED, PER CUSTOMER APPROVAL COMMENTS	Beth	C.L.		7-20-95

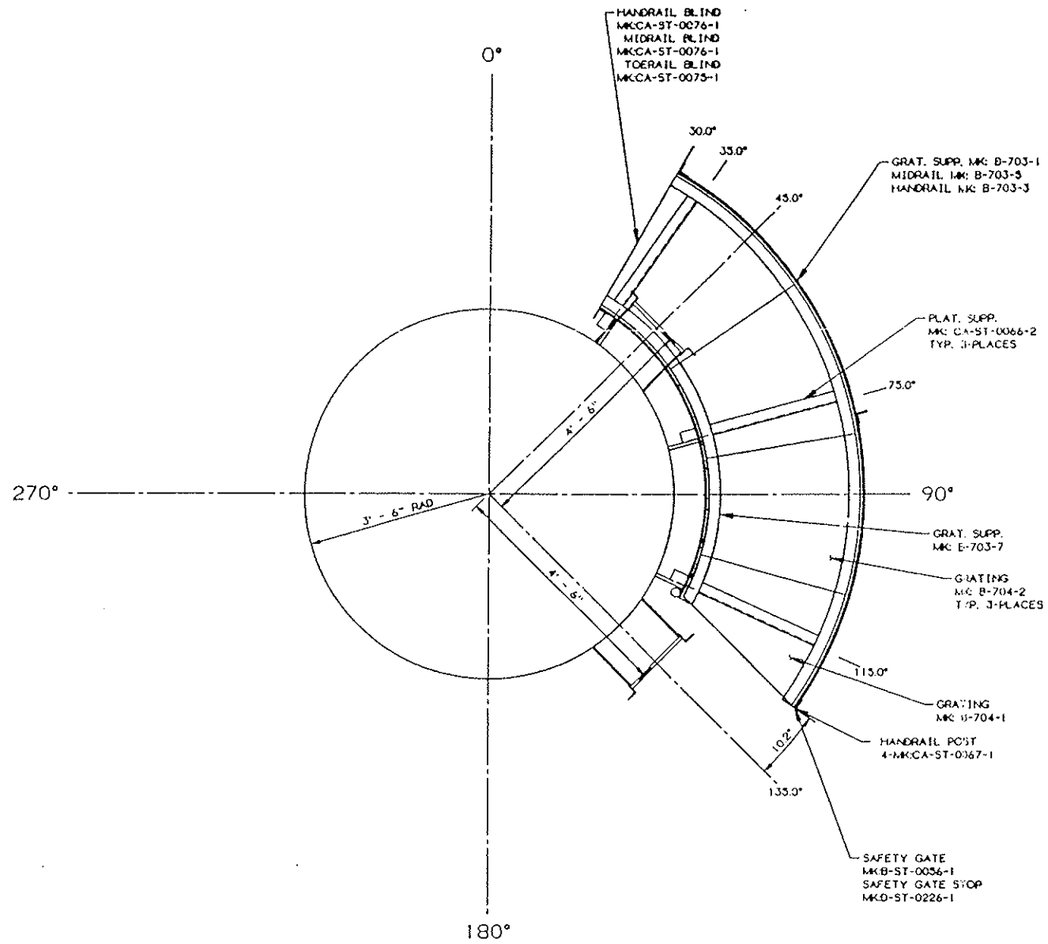
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FOR: BRECO MECHANICAL
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: (BF) AO-12224
P.O. NO.: 1304

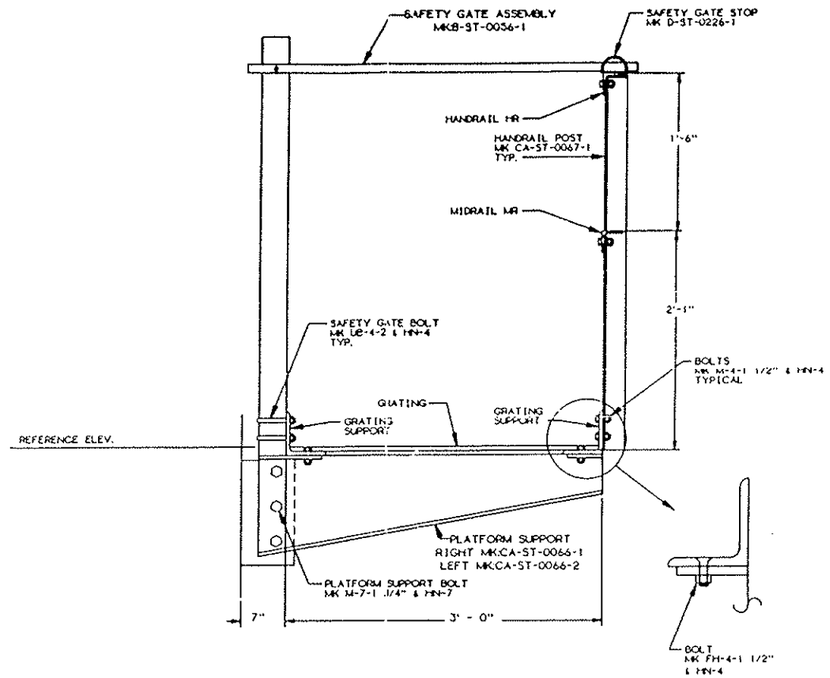
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WIRING DIAGRAM
FOR ZTOF ENCLOSED FLARE SYSTEM

DR: Beth	DATE: 4-11-95	CERTIFIED	DRAWING NUMBER: B-F-A12224-401 REV: 2
CK: GWG	DATE: 4-25-95		
APP: T.C.	DATE: 4-26-95	DATE:	SCALE: NONE



ELEVATION: 13' - 0"



PLATFORM ASSEMBLY

GENERAL NOTES

1. ALL SURFACES TO BE GALVANIZED PER A.S.T.M. SPEC. A-123 UNLESS OTHERWISE NOTED.
2. ALL PLATFORMS AND LADDERS ARE IN ACCORDANCE WITH O.S.H.A. STANDARDS.
3. BOLTS M-4-1 1/2": 1/2"DIA. X 1 1/2"LG. BOLT WITH NUT
   UB-4-2": U-BOLT WITH 4 NUTS EACH
   M-7-1 3/4": 7/8"DIA. X 1 3/4"LG. BOLT WITH NUT
   FH-4-1 1/2": 1/2"DIA. X 1 1/2"LG. FLAT HEAD BOLT WITH NUT
4. SADDLE CLIPS WITH SCREWS MK SC-2-1 1/2 SC-1
5. ALL BOLTS TO BE A.S.T.M. A-307 GALVANIZED.
6. ALL MARK NUMBERS TO BE PRECEDED BY A012224

REFERENCE DRAWINGS

B-ST-0062	PLATFORMS STANDARD
B-ST-0064	LADDER STANDARD

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NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE

BASE NUMBER | APPROVAL

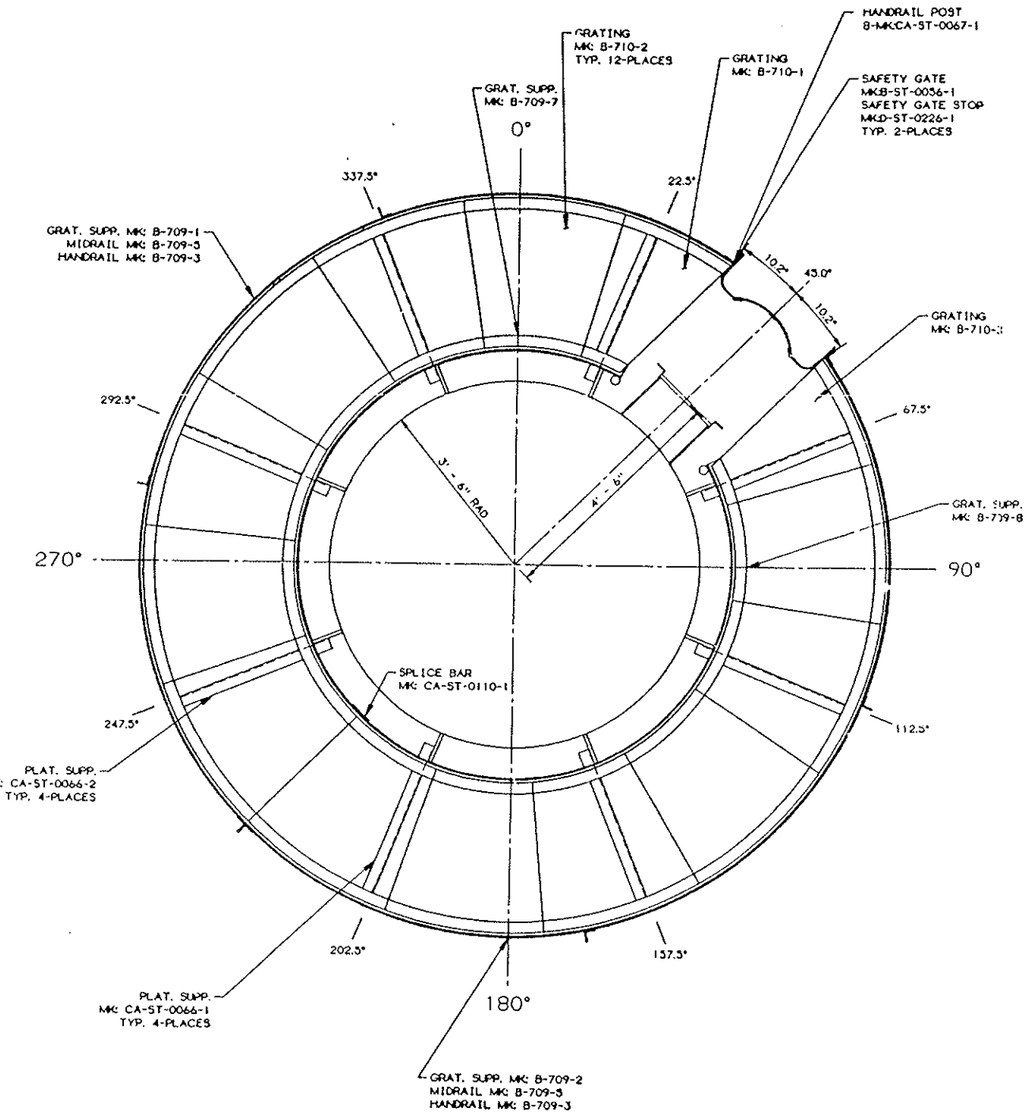
FOR: BRECO MECH. GRP
UNDR: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: A012224
P.O. NO.: 1304
DR: KLM DATE: 27-JUN-95
CK: DLG DATE: 6-29-95
APP.: JC DATE: 7-18-95

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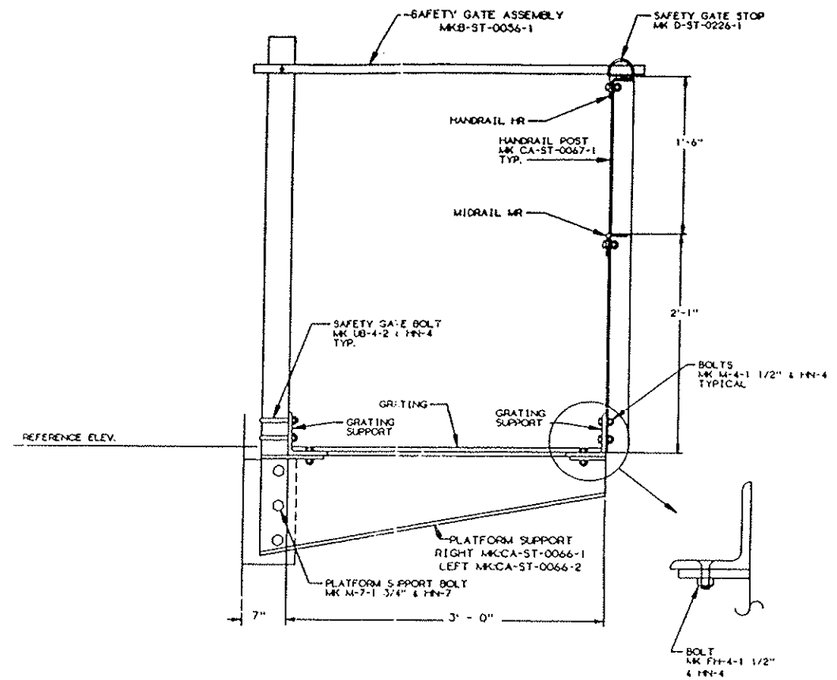
STEP OFF PLATFORM
ELEV. 13' - 0"

CERTIFIED DATE:

DRAWING NUMBER B-F-A012224-304 REV 0
SCALE NONE



ELEVATION: 32' - 0"



PLATFORM ASSEMBLY

GENERAL NOTES

1. ALL SURFACES TO BE GALVANIZED PER A.S.T.M. SPEC. A-123 UNLESS OTHERWISE NOTED.
2. ALL PLATFORMS AND LADDERS ARE IN ACCORDANCE WITH O.S.H.A. STANDARDS.
3. BOLTS M-4-1 1/2": 1/2"DIA. X 1 1/2"LG. BOLT WITH NUT
   UB-4-2": U-BOLT WITH 4 NUTS EACH
   M-7-1 3/4": 7/8"DIA. X 1 3/4"LG. BOLT WITH NUT
   FH-4-1 1/2": 1/2"DIA. X 1 1/2"LG. FLAT HEAD BOLT WITH NUT
4. SADDLE CLIPS WITH SCREWS MK SC-2-1 1/2 SC-1
5. ALL BOLTS TO BE A.S.T.M. A-307 GALVANIZED.
6. ALL MARK NUMBERS TO BE PRECEDED BY AO12224

REFERENCE DRAWINGS

B-ST-0062	PLATFORMS STANDARD
B-ST-0064	LADDER STANDARD

NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE

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FOR: BRECO MECH. GRP
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: AO12224
P.O. NO.: 1304
DR: KLM DATE: 27-JUN-95
CK: DLB DATE: 6-29-95
APP: CJO DATE: 7-18-95

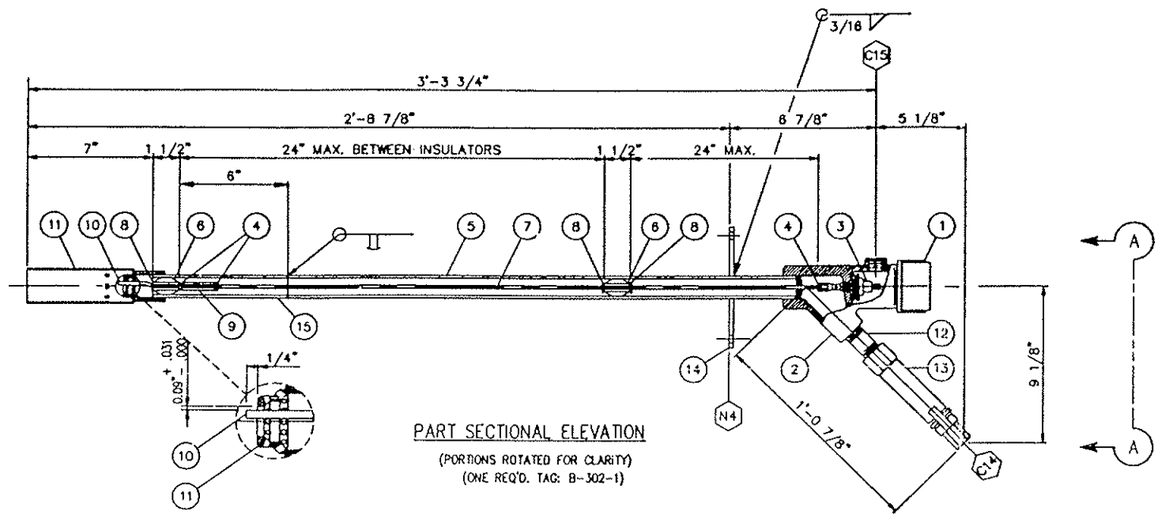
JOHN ZINK®
A KOCH INDUSTRIES COMPANY
PARTS AND SERVICE, CALL (918) 234-2751 FAX (918) 234-2700

360° PLATFORM
ELEV. 32' - 0"

CERTIFIED
DATE:

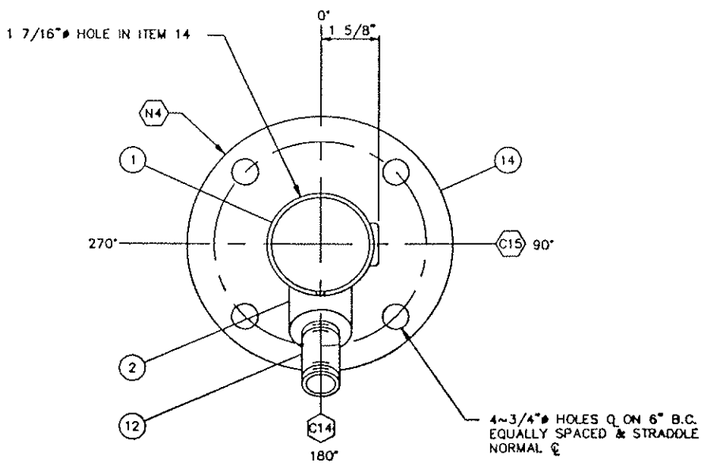
DRAWING NUMBER B-F-AO12224-303 REV 0
SCALE NONE

BASE NUMBER	APPROVAL



PART SECTIONAL ELEVATION

(PORTIONS ROTATED FOR CLARITY)
(ONE REQ'D. TAG: B-302-1)



VIEW A-A

(TRUE ORIENTATION, MIXER NOT SHOWN)

MIXER SHOULD BE ORIENTATED BELOW THE ELECTRICAL CONNECTION FOR FREE LIQUID DRAINING

PARTS LIST

ITEM	QTY	DESCRIPTION	PART NO.	MATERIAL
		KE-1ST PILOT ASSEMBLY		
1	1	PIPE CAP (2" - 150#)	003398	A-197
2	1	WEATHERHEAD (KE-1) (A-PAT-0697)	010092	DUCT.
3	1	SPARK PLUG (WCC-12-1)	003020	
4	3	JAM NUT (#10-24)	016741	A-307
5	1	PIPE 1" SCH. 40	000135	A106-B
6	2	INSULATOR (CA-PAT-1714)	003587	CERAMIC
7	1	IGNITION ROD EXTENSION (3/16" DIA.)	000199	316 S.S.
8	3	3/16" PUSH ON RETAINER (S-10288-4)	003470	STL
9	1	CONNECTOR COUPLING (CA-PAT-1720)	001250	416 S.S.
10	1	IGNITION ROD (CA-ST-0907)	001240	316 S.S.
11	1	PILOT TIP ST-1S (CA-ST-0606)	001448	S.S.
12	1	PIPE NIPPLE (1" SCH. 40 PIPE)	033808	A-53F
13	1	PILOT MIXER ASSEMBLY (CA-ST-0619-60)	043941	
14	1	PLATE FLANGE	000324	A-36
15	1	GAS NIPPLE (PIPE 1" SCH. 80 BORED TO 1" I.D.)	000130	304SS

NOTE LEGEND

ITEM	QTY	DESCRIPTION
C14	1	PILOT GAS CONN. 1/2" FEMALE N.P.T.
C15	1	PILOT CONDUIT CONN. 1/2" FEMALE N.P.T.
N4	1	PILOT MTG. FLG. 3/8" PL. 150# DRILLING

NOTES:

1. PILOT ORIFICE IS DRILLED #TO 60
2. FUEL GAS MUST BE FILTERED TO ELIMINATE FOREIGN MATTER ABOVE .01 INCH EFFECTIVE DIAMETER. (IT IS RECOMMENDED THAT THE FUEL FILTER BE LOCATED FOR ACCESS WITHOUT INTERRUPTING OPERATION.)
3. NATURAL GAS USAGE 45 SCFH @ 15 PSIG
   PROPANE GAS USAGE 22 SCFH @ 10 PSIG

NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE

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FOR: BRECO MECH. GROUP INC.
USER: PELHAM BAY LANDFILL
JOB/STD: BRONX, NY
S.O. NO. A012224
P.O. NO. 1304

DR. J.H. DATE: 2-27-95
CK. D.L.B. DATE: 6-12-95
APP. JC DATE: 7-18-95

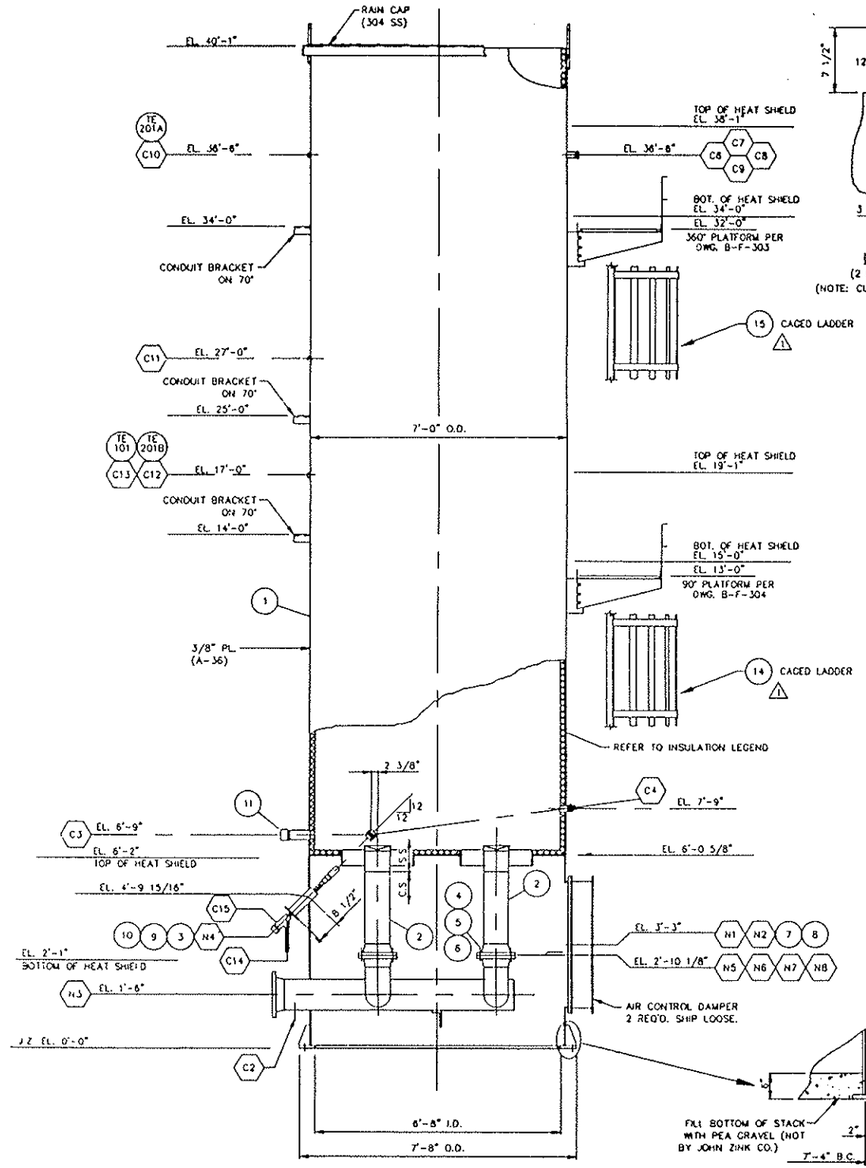
JOHN ZINK
A KOCH INDUSTRIES COMPANY
PARTS AND SERVICE, CALL (918) 234-2966 FAX (918) 234-1976

XE-1ST PILOT ASSEMBLY
(1 - REQ'D)

CERTIFIED DATE:

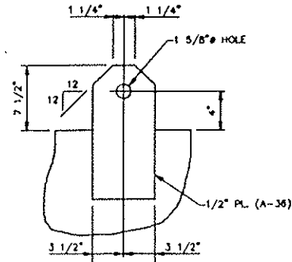
DRAWING NUMBER: B-F-A012224-302 REV. 0
SCALE: 3"=1'-0"

BASE NUMBER | APPROVAL



PART SECTIONAL ELEVATION

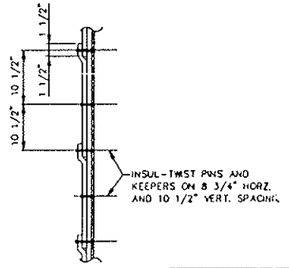
(NOT TRUE ORIENTATION)



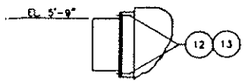
LIFTING LUG DETAIL

(2 REQ'D. LOCATED @ 90° & 270°) ⚠1

(NOTE: CUT OFF LUGS AFTER STACK ERECTION)

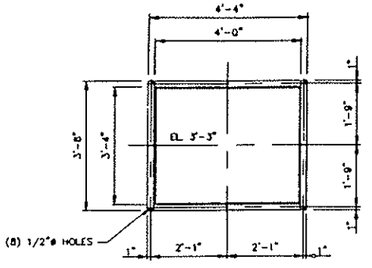


INSULATION DETAILS

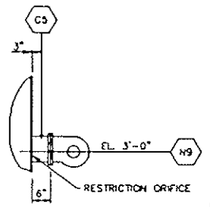


IGNITION TRANSFORMER PANEL

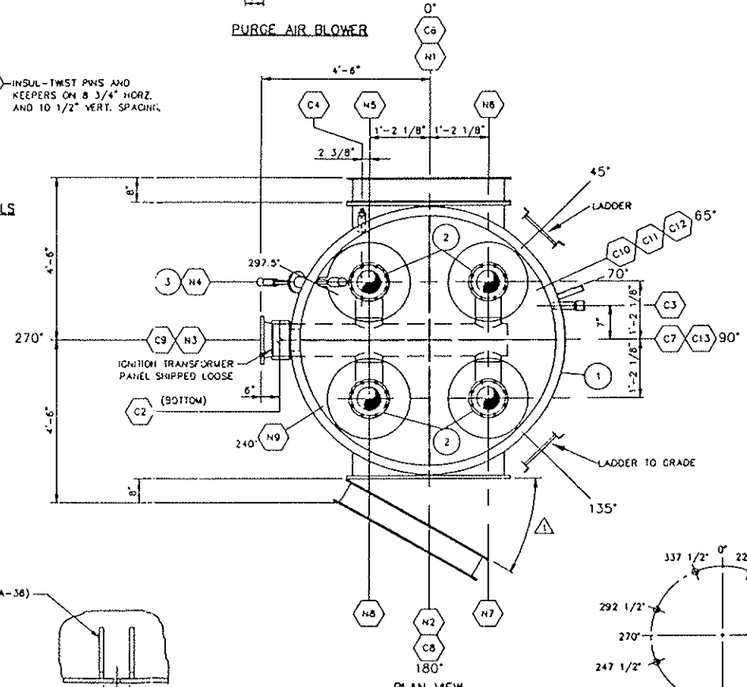
SHIPPED LOOSE FOR FIELD INSTALLATION



DETAIL ⟨N1⟩ & ⟨N2⟩



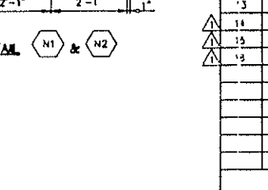
PURGE AIR BLOWER



PLAN VIEW

(TRUE ORIENTATION)

BASE RING DETAIL



FOUNDATION BOLT HOLE LAYOUT

NOTES:

1: BOLT HOLES TO STRADDLE NORM. CL'S UNLESS NOTED

2: FLARE ASS'Y IS NOT TO BE USED AS AN ANCHOR POINT FOR CUSTOMER PIPING

3: PRE-TENSION ANCHOR BOLTS BY THE "TURN OF THE NUT" METHOD / AISC

4: IGN. WIRE AND T.C. WIRE MUST BE RUN IN SEP. CONDUIT

5: TAG NO.'S TO BE PRECEDED BY JOHN ZINK SHOP ORDER NO. A012224

6: FINISH (EXT. C.S., INSIDE OF SKIRT & BTM. OF FLOOR PLATE) SANDBLAST PER SSPC-SP-6 & PRIME W/ SHERWIN-WILLIAMS ZINC CLAD I (3 M.D.F.T.) & TOP COAT WITH ⚠1 KEM HI-TEMP ALUMINUM 1004518 (1-2 M.D.F.T.)

7: LADDERS & PLATFORMS TO BE GALV. PER ASTM A123

PARTS LIST (1 REQ'D)

ITEM	QTY.	DESCRIPTION	MARK NO.	MATL
-	1	FLARE STACK ASSEMBLY	B-701-1	
2	4	8" FLARE TIP ASSEMBLY	D-ST-1243-1	
3	1	PILOT ASSEMBLY	B-302-1	
4	4	GASKET, 8"-150 LB. R.F. x 1/16" THK.	CB-150-R	C4401
5	32	STUD BOLT, 3/4"ø x 4 1/2" LG.	SB-8-4 1/2	A-193-B7
6	64	HEAVY HEX NUT, 3/4"ø	SN-6	A-194-2H
7	8	HEX HEAD BOLT, 3/8"ø x 1 1/4" LG.	HB-3-1 1/4	A-307
8	8	HEX NUT, 3/8"ø	HN-3	A-307
9	4	STUD BOLT, 5/8"ø x 2 1/2" LG.	SB-5-2 1/2	A-193-B7
10	8	HEAVY HEX NUT, 5/8"ø	SN-5	A-194-2H
11	1	SIGHT PORT	CA-ST-0600	PYREX/MI
12	4	HEX HEAD BOLT, 1/4" ø x 1" LG.	HB-2-1	A-307
13	4	HEX NUT, 1/4"	HN-2	A-307
14	1	LOWER CAGED LADDER	B-705-1	A-36
15	1	UPPER CAGED LADDER	B-705-2	A-36
16	1 CAL	ZINC CLAD I		PAINT

NOZZLE LEGEND

MK.	QTY.	DESCRIPTION
N1,2	2	DAMPER CONN. - SEE DETAIL
N3	1	WASTE GAS CONN. - 10"-150 LB. F.F.W.N.
N4	1	PILOT MTG. CONN. - 3/8" PL FLG. W/ 3" ~ 150# DRILLING
N5-8	4	FLARE TIP CONN. - 8"-150 LB. R.F.
N9	1	BLOWER - 8" CONN. - 10" O.D. X 3/8" PL. W/4 - 3/8" ø STUDS ON 9 1/8" B.C.
J2	1	DRAIN - 1" F.N.P.T. W/ PLUG
J3	1	SIGHT PORT - 2" M.N.P.T.
J4	1	SCANNER CONN. - 1" M.N.P.T.
J5	1	PDSL CONN. - 1/2" F.N.P.T.
J6-9	4	SAMPLE PORT - 4" F.N.P.T. W/ PLUG
J10-13	4	THERMOCOUPLE CONN. - 1" F.N.P.T. (C11 W/PLUG)
J14	1	PILOT GAS CONN. - 1/2" F.N.P.T.
J15	1	PILOT CONDUIT CONN. - 1/2" F.N.P.T.

DESIGN DATA

WIND LOAD (ASCE 7-93, EXP. C)	100 M.P.H.
SEISMIC (UBC-91)	ZONE 4
SHEAR @ BASE	6.0 K
MOMENT @ BASE	134.0 K-FT
DEAD LOAD	18.0 K
SHELL DESIGN TEMPERATURE	500° F
CORROSION ALLOWANCE	0.0

LIFTING NOTES

A: MAIN CRANE AT TOP REQUIRES SPREADER BAR (BY OTHERS)
B: CHOKE STACK AT APPROX. 6'-0" EL. WITH TAILING CRANE
C: LIFTING LUGS DESIGN FOR 13.5 TON CROSBY ANCHOR SHACKLE AND VERTICAL SLINGS.

INSULATION LEGEND

1" THK., 8 LB. DENSITY, 2700° F (OR EQUAL) BACKED WITH 3" THK., 8 LB. DENSITY, 2400° F (OR EQUAL) ON INCONEL PINS & KEEPERS
⚠1 (INSULATION A.P. GREEN OR EQUAL)

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NO.	REVISION DESCRIPTION	BY	CK.	APP.	DATE
2	ADDED KEM HI-TEMP 1004518 TOP COAT	DLB	DLB	T.C.	9-11-95
1	ADDED HINGEABLE MANUAL DAMPER	DLB	DLB	T.C.	6-12-95

FOR: BRECO MECH. GRP. INC.
USER: PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO. A012224
P.O. NO. 1304

DR. JH DATE: 12/27/95
CH. DLB DATE: 3-22-95
AP. T.C. DATE: 3-24-95
CERTIFIED DATE:

JOHN ZINK
A KOCH INDUSTRIES COMPANY
PARTS AND SERVICE, CALL (918) 234-2966 FAX (918) 234-1978

ENCLOSED GROUND FLARE ASSEMBLY
7'-0"ø X 40'-0"

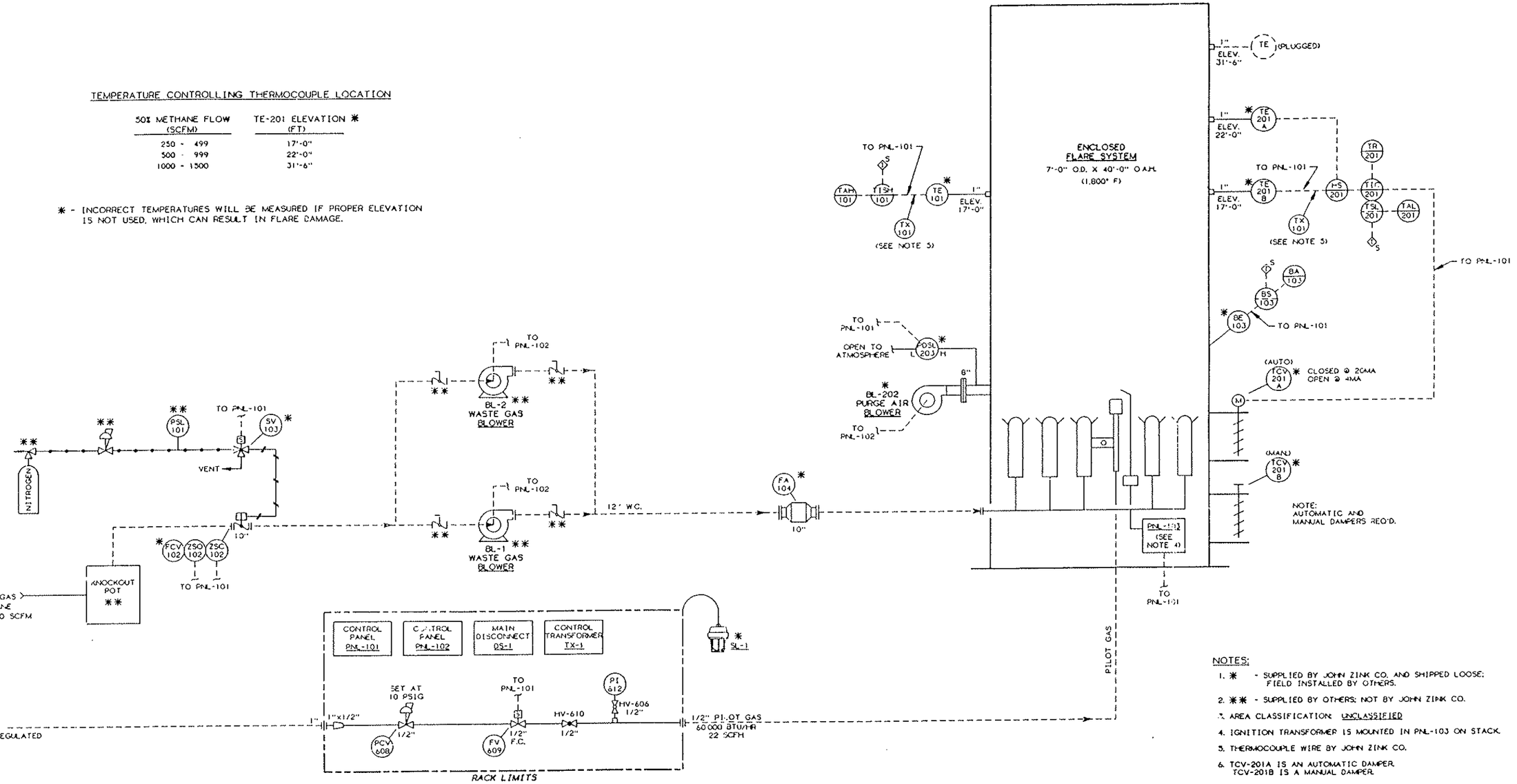
DRAWING NUMBER B-F-A012224-301 REV. 2
SCALE NONE

BASE NUMBER | APPROVAL

TEMPERATURE CONTROLLING THERMOCOUPLE LOCATION

50% METHANE FLOW (SCFM)	TE-201 ELEVATION * (FT)
250 - 499	17'-0"
500 - 999	22'-0"
1000 - 1500	31'-6"

* - INCORRECT TEMPERATURES WILL BE MEASURED IF PROPER ELEVATION IS NOT USED, WHICH CAN RESULT IN FLARE DAMAGE.



NOTES:

1. * - SUPPLIED BY JOHN ZINK CO. AND SHIPPED LOOSE; FIELD INSTALLED BY OTHERS.
2. ** - SUPPLIED BY OTHERS; NOT BY JOHN ZINK CO.
3. AREA CLASSIFICATION: UNCLASSIFIED
4. IGNITION TRANSFORMER IS MOUNTED IN PNL-103 ON STACK.
5. THERMOCOUPLE WIRE BY JOHN ZINK CO.
6. TCV-201A IS AN AUTOMATIC DAMPER. TCV-201B IS A MANUAL DAMPER.

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NO.	REVISION DESCRIPTION	BY	CK.	APP	DATE

FOR: BRECO MECHANICAL
USER: BRECO MECHANICAL
PELHAM BAY LANDFILL
JOBSITE: BRONX, NY
S.O. NO.: (BF) AO-12224
P.O. NO.: 1304
DR: Both DATE: 4-11-95
CK: GWG DATE: 4-25-95
APP: MB DATE: 4-26-95
CERTIFIED DATE:

JOHN ZINK® A KOCH INDUSTRIES COMPANY
PARTS AND SERVICE, CALL (918) 234-2751 FAX (918) 234-2700

PIPING & INSTRUMENT DIAGRAM
FOR ENCLOSED FLARE SYSTEM

DRAWING NUMBER: B-F-A12224-150 REV: 0
SCALE: NONE

ENGINEER NUMBER: B-ST-3735
APPROVAL
DC-A12224-150

Allen-Bradley Co.
1747 Series Software
APS Release 5.01
Documentation Utility
Program Listing

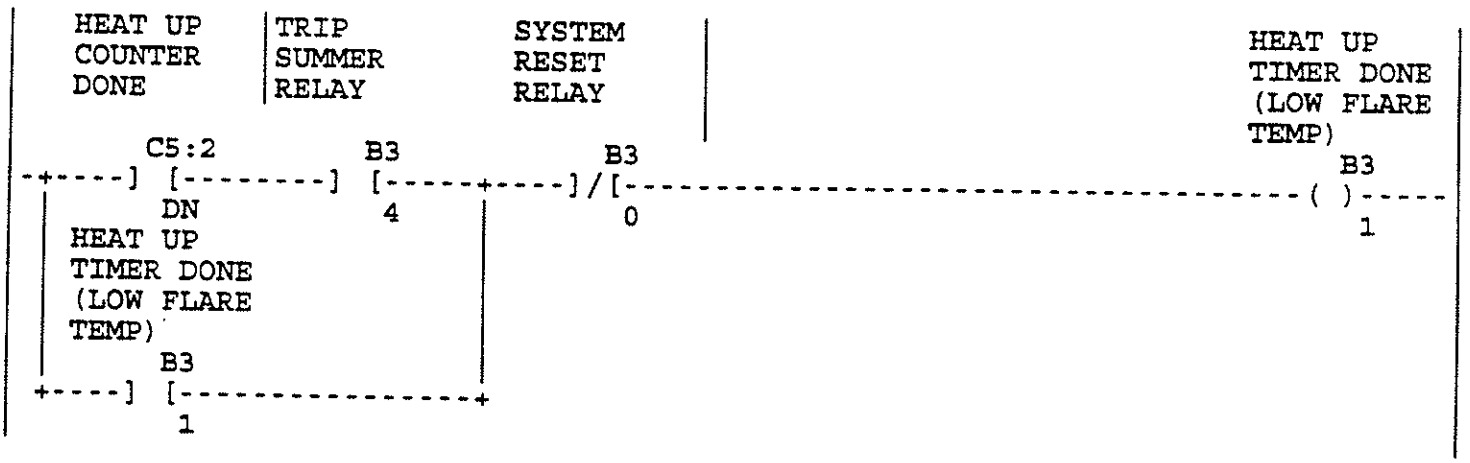
BRECO A12224 ZTOF

Processor File: AO12224.ACH
October 02, 1995 - 16:24

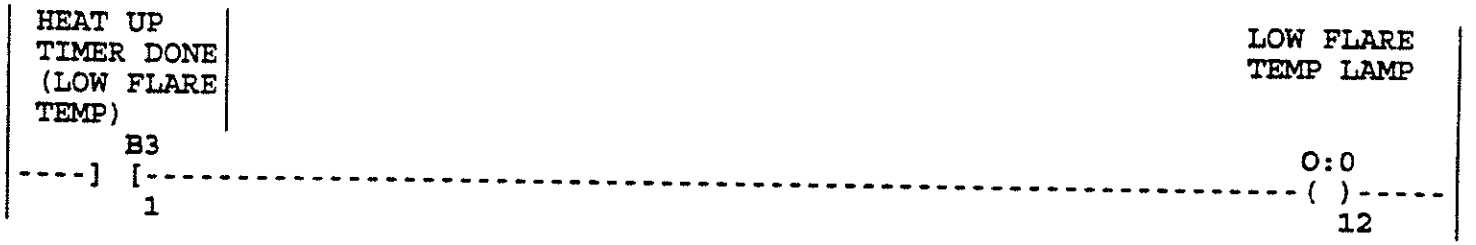
Rung 2:0
OPERATE SYSTEM RESET RELAY



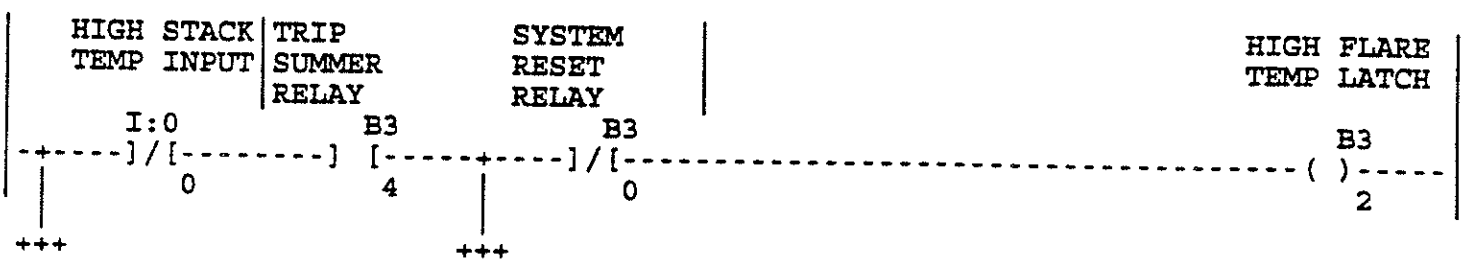
Rung 2:1
OPERATE HEAT UP TIMER DONE RELAY (LOW FLARE TEMP)



Rung 2:2
ILLUMINATE LOW FLARE TEMPERATURE LAMP

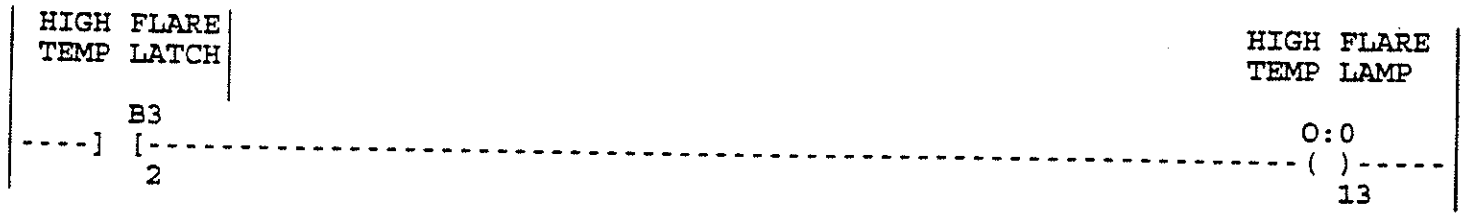


Rung 2:3
OPERATE HIGH FLARE TEMPERATURE LATCH

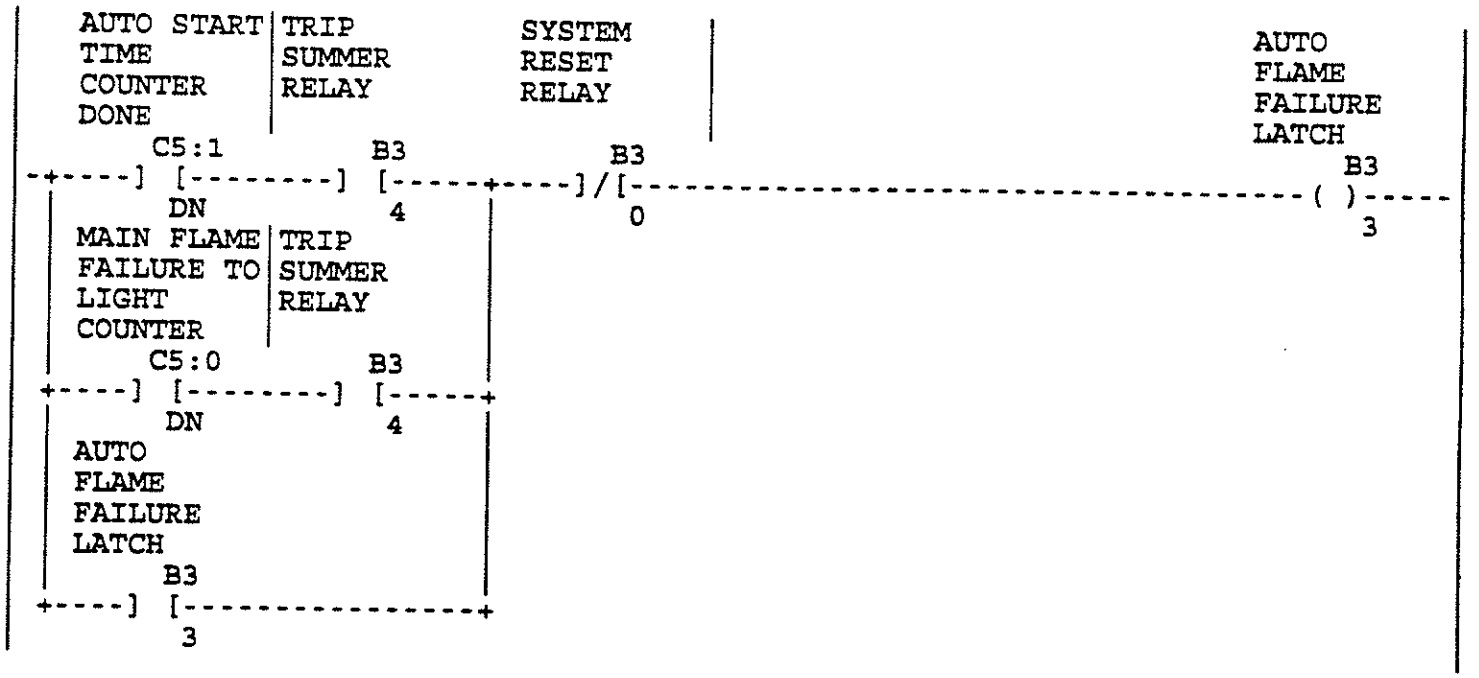




Rung 2:4
ILLUMINATE HIGH FLARE TEMPERATURE LAMP



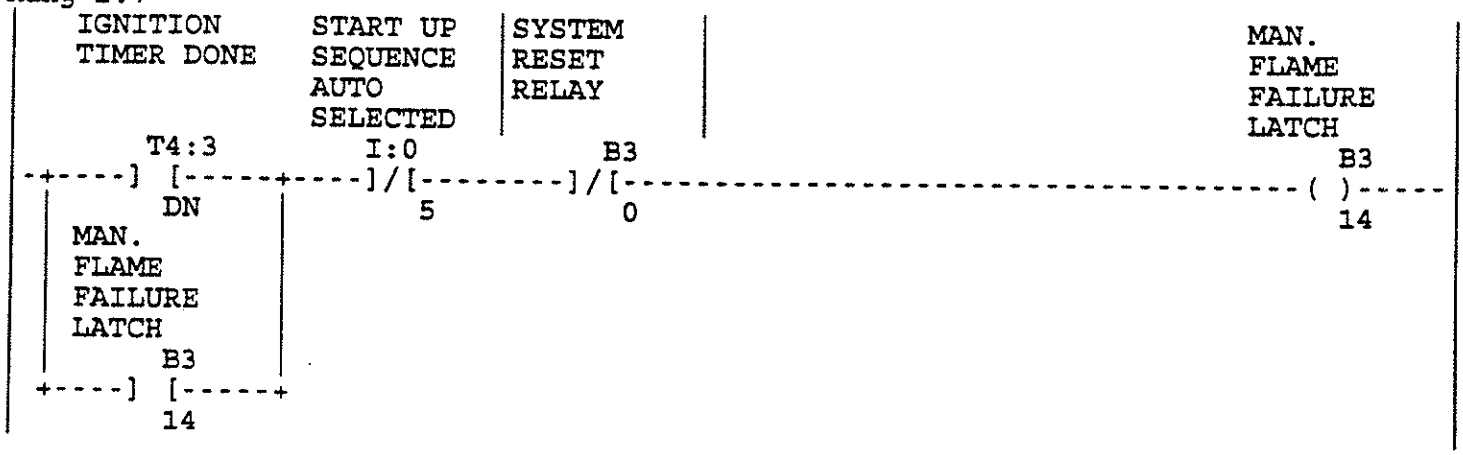
Rung 2:5
OPERATE FLAME FAILURE LATCH



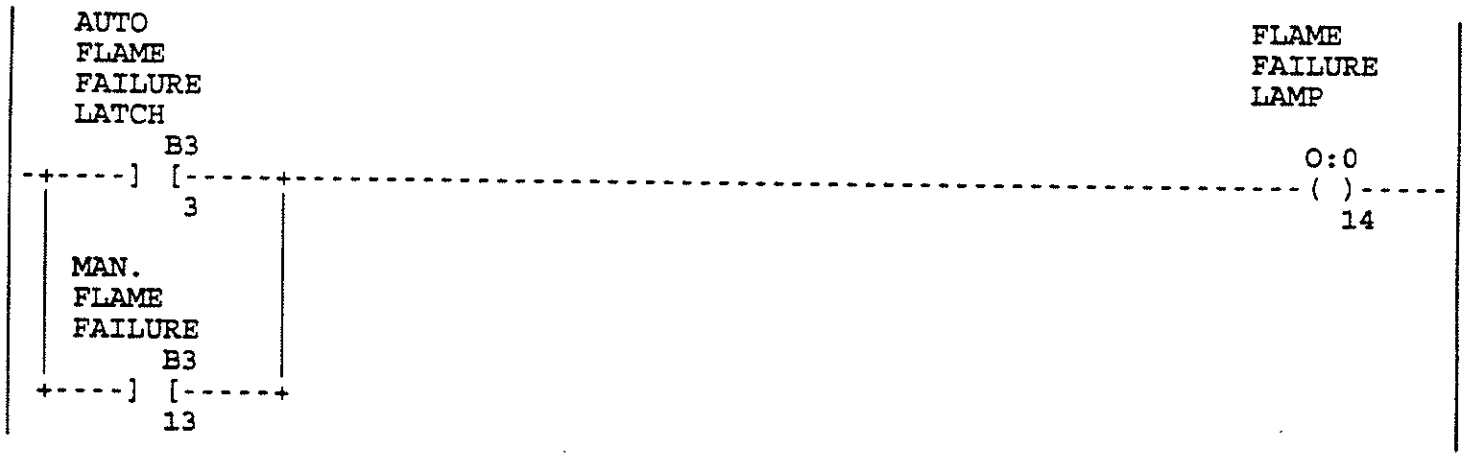
Rung 2:6



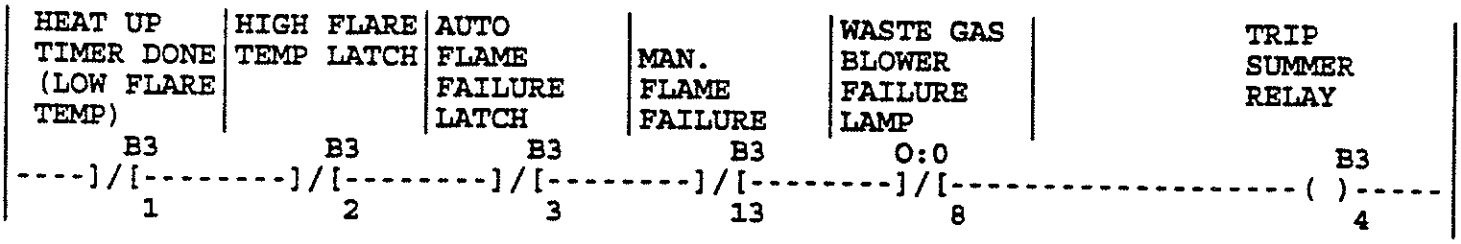
Rung 2:7



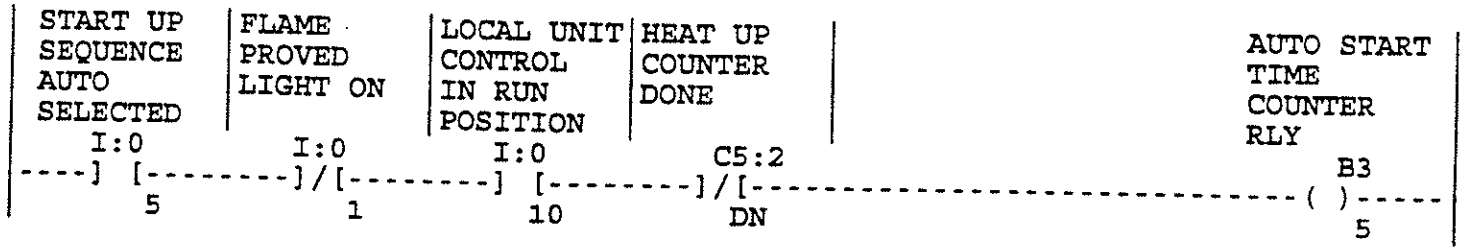
Rung 2:8
ILLUMINATE FLAME FAILURE LAMP



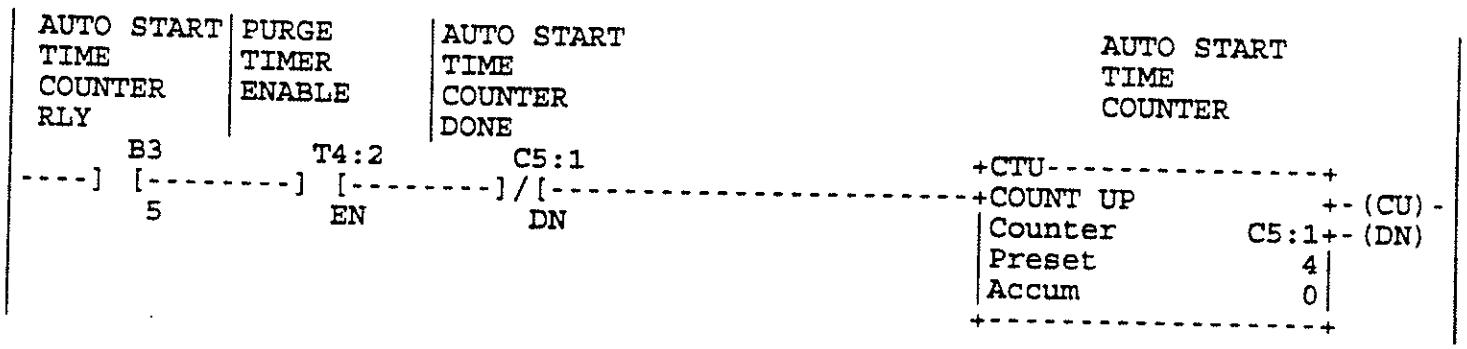
Rung 2:9
OPERATE TRIP SUMMER RELAY



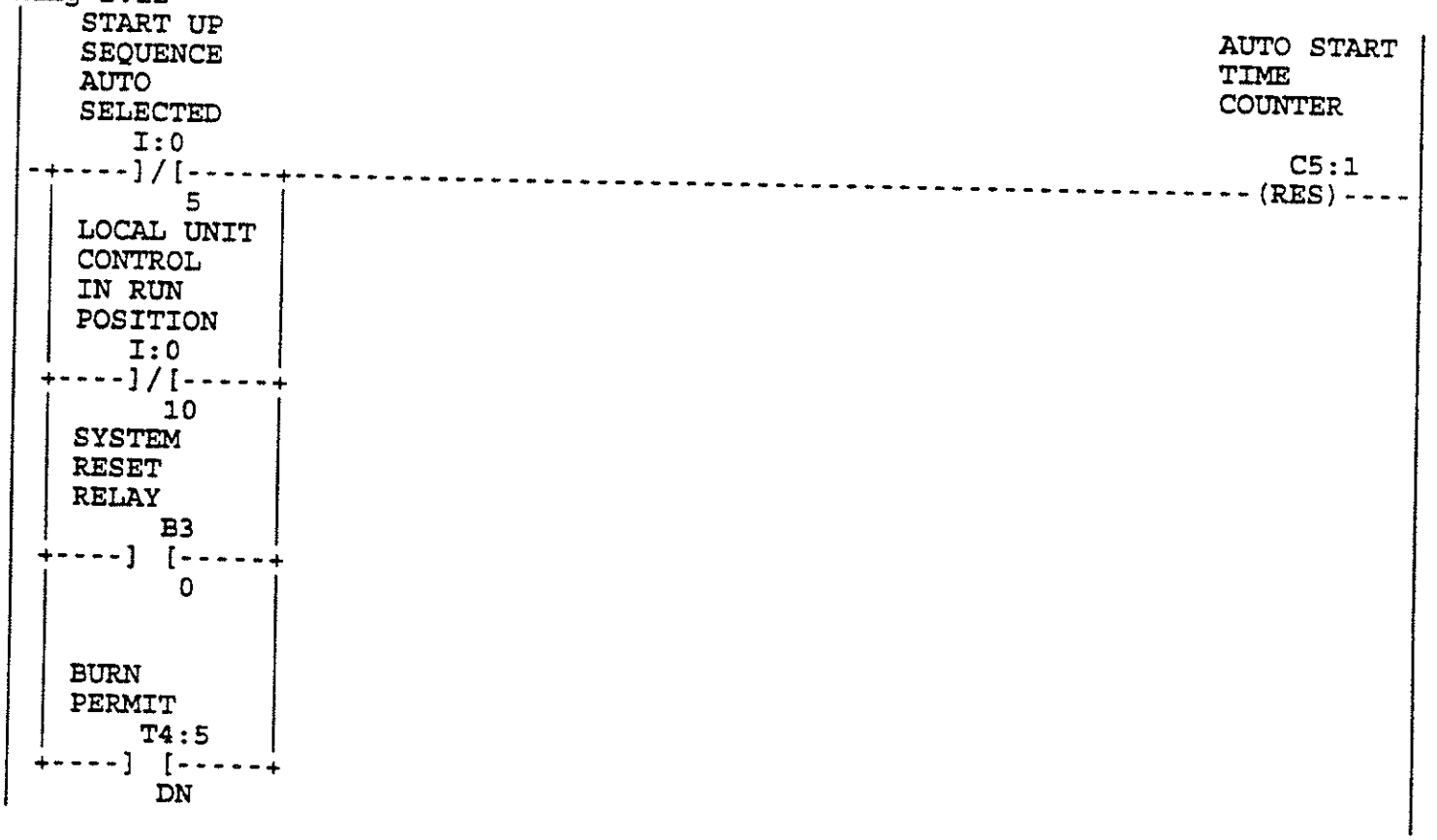
Rung 2:10
OPERATE AUTO START TIME COUNTER RELAY



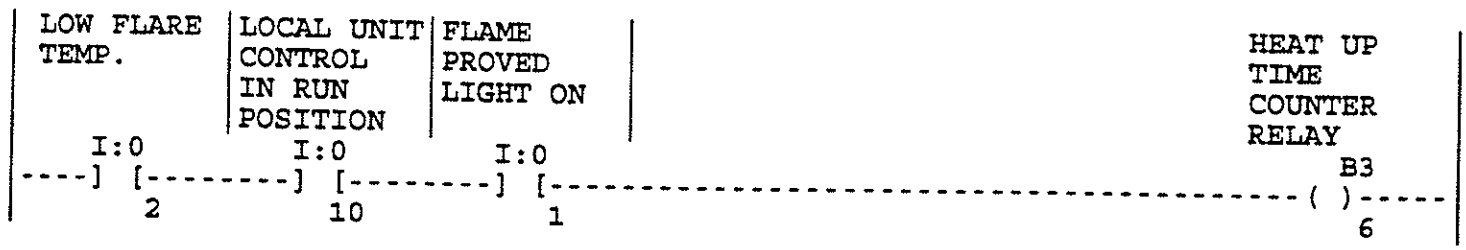
Rung 2:11
OPERATE AUTO START TIME COUNTER



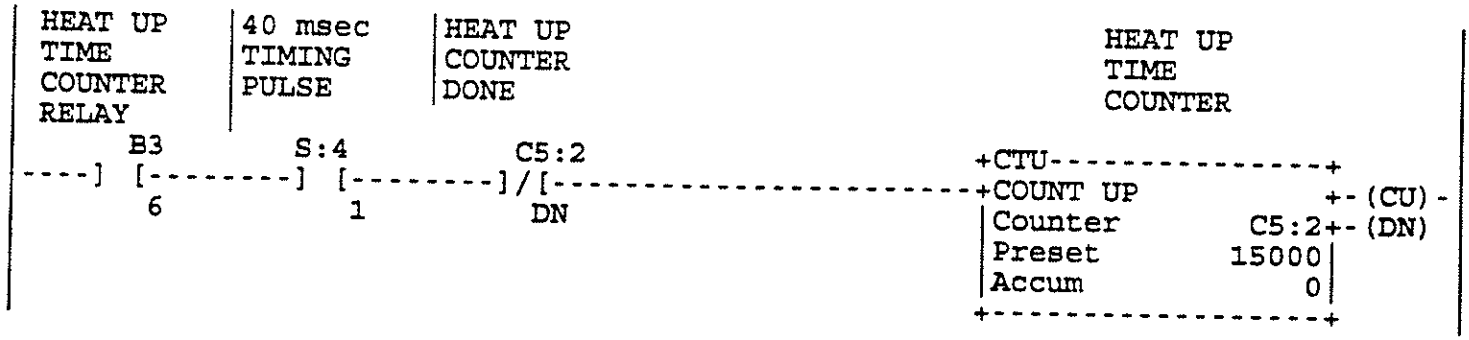
Rung 2:12



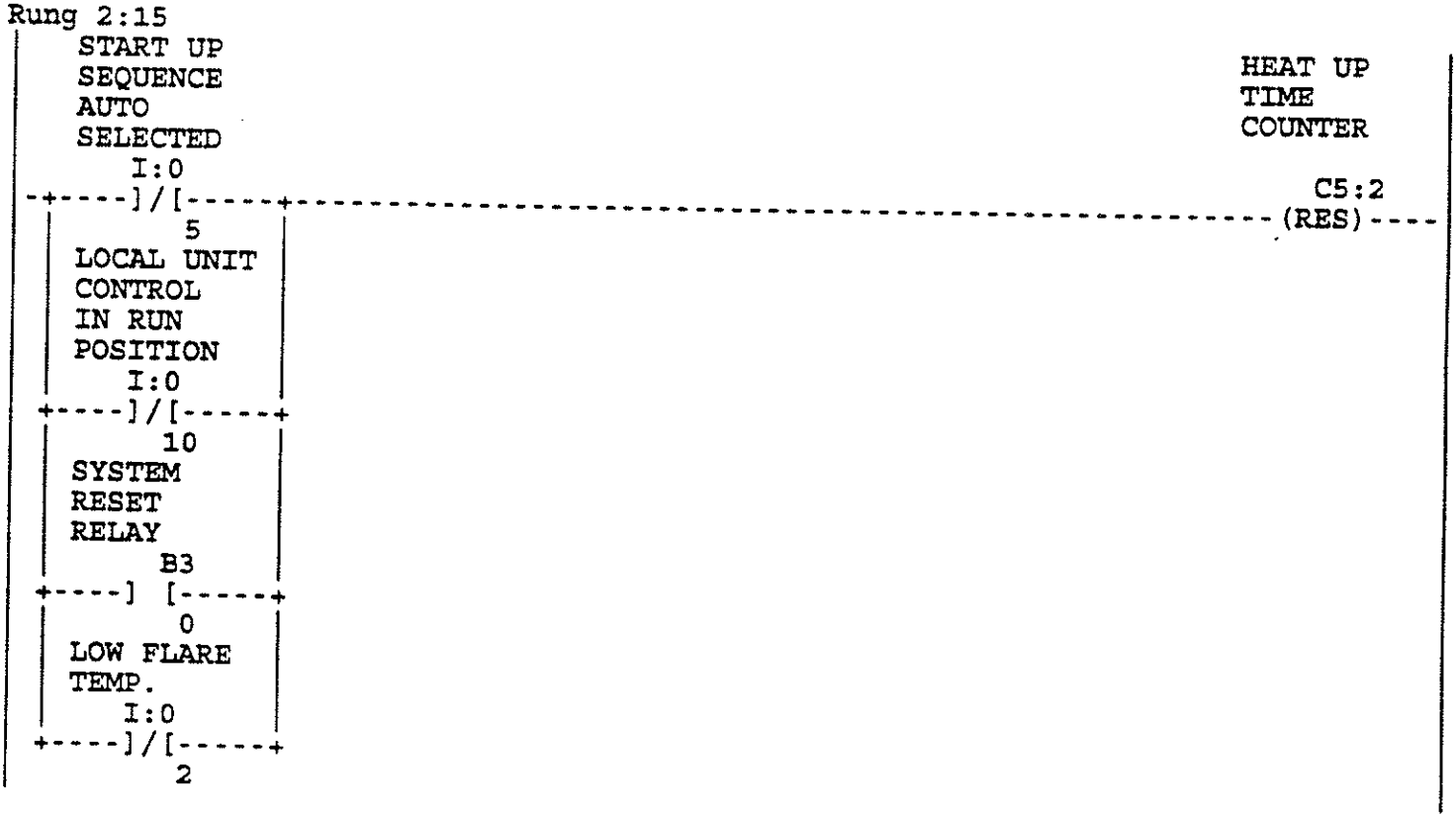
Rung 2:13
OPERATE HEAT UP TIME COUNTER RELAY



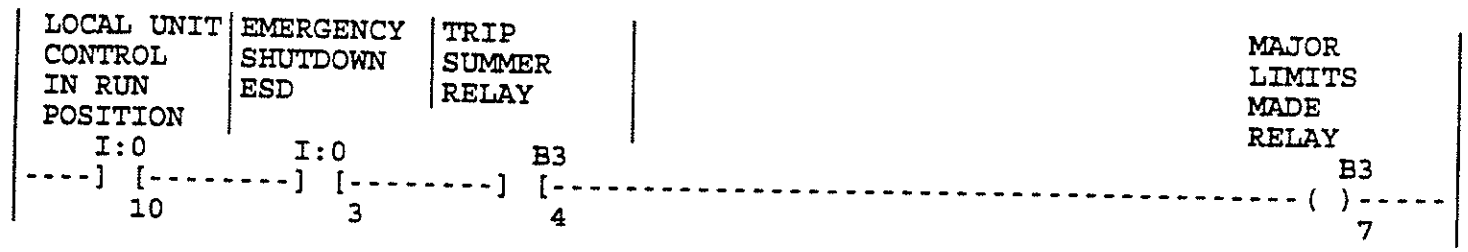
Rung 2:14
OPERATE HEAT UP TIME COUNTER



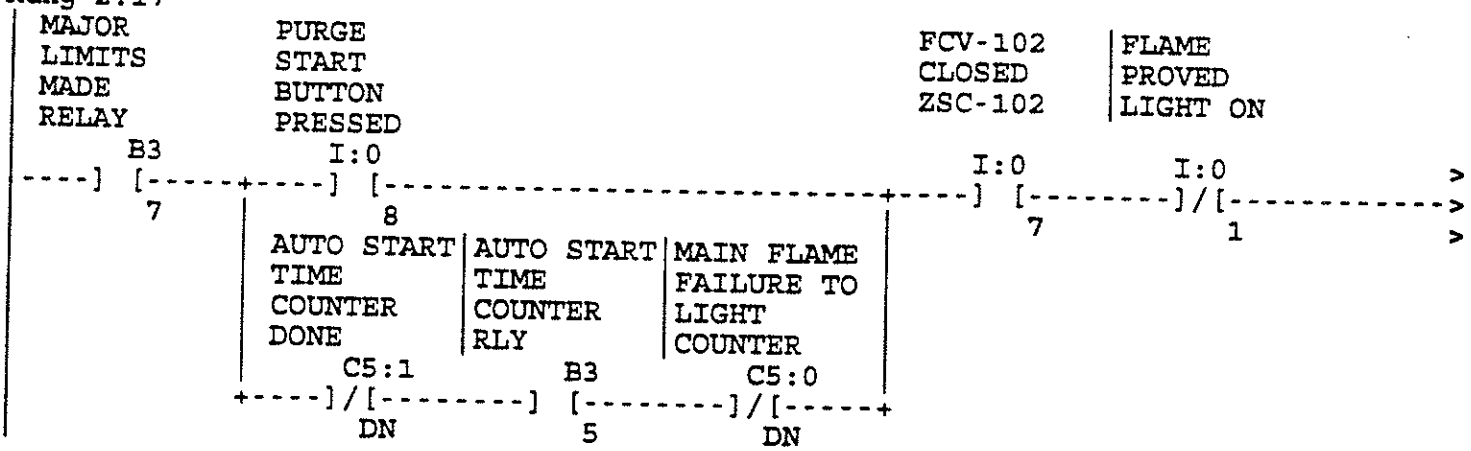
Rung 2:15

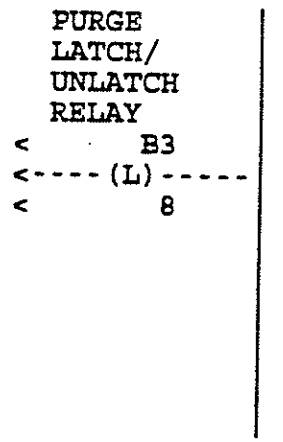


Rung 2:16
OPERATE MAJOR LIMITS MADE RELAY

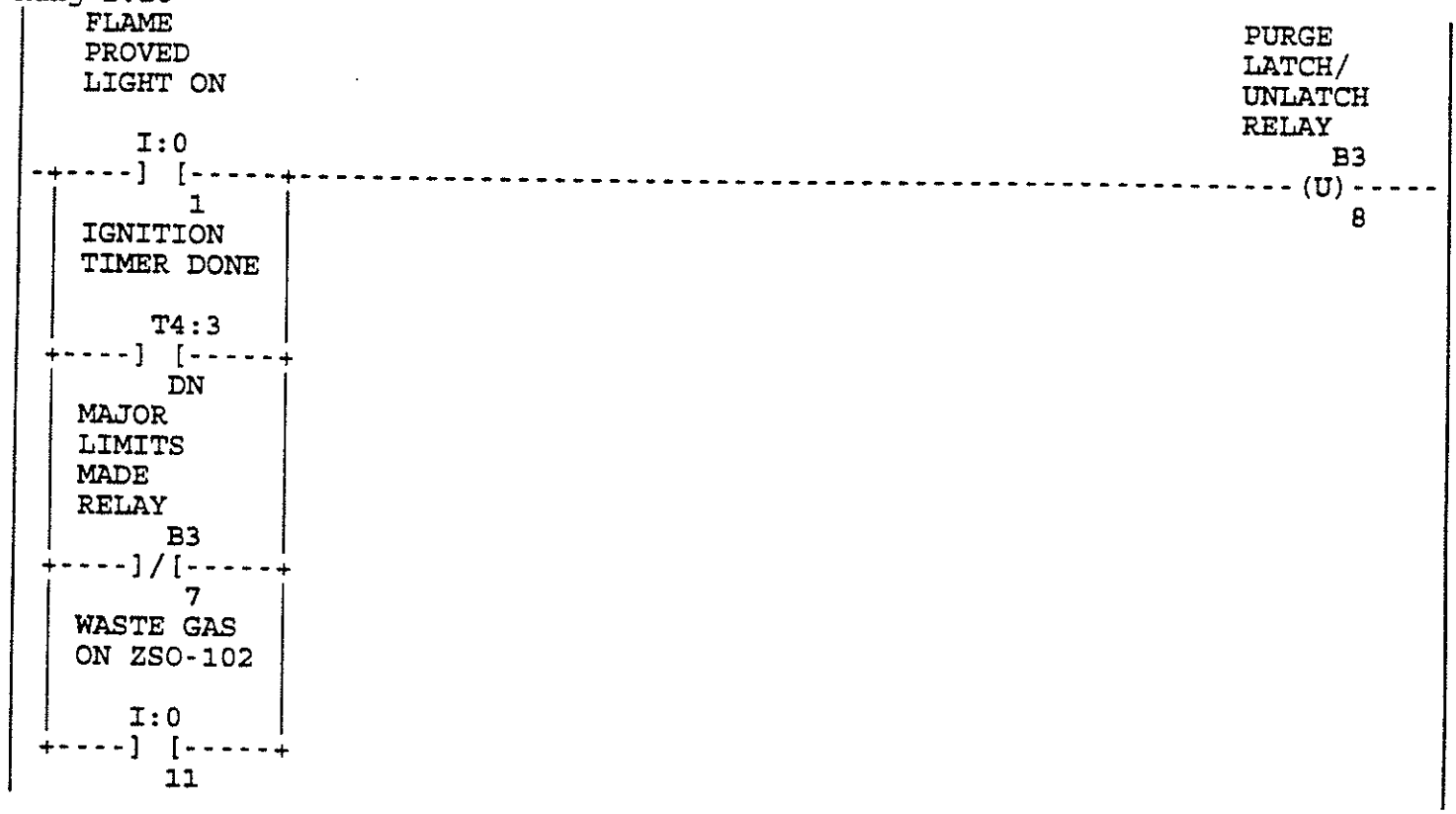


Rung 2:17

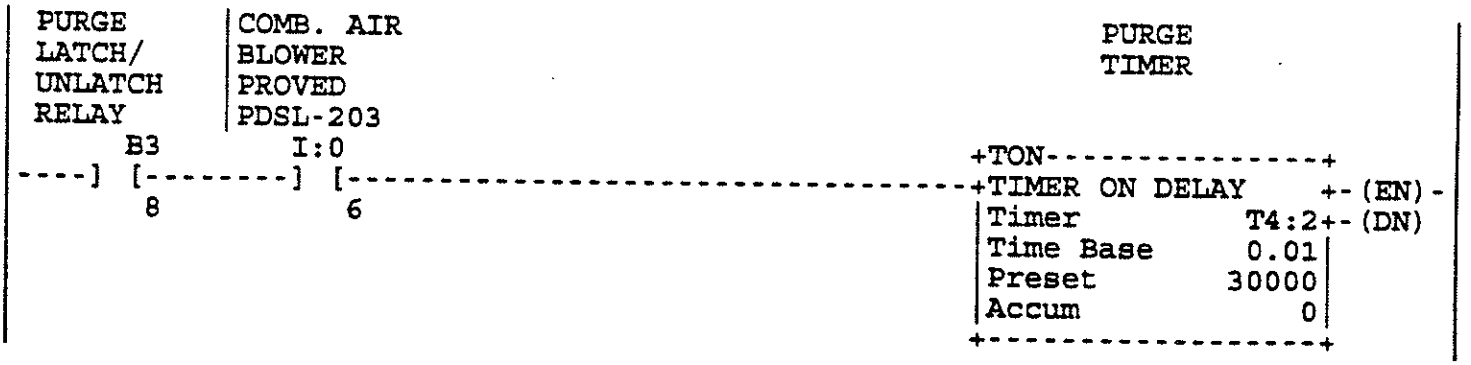




Rung 2:18



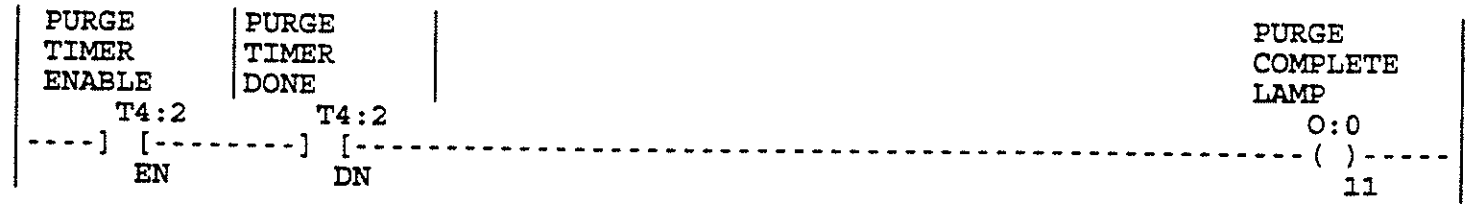
Rung 2:19
OPERATE PURGE TIMER



Rung 2:20
ILLUMINATE PURGING LAMP



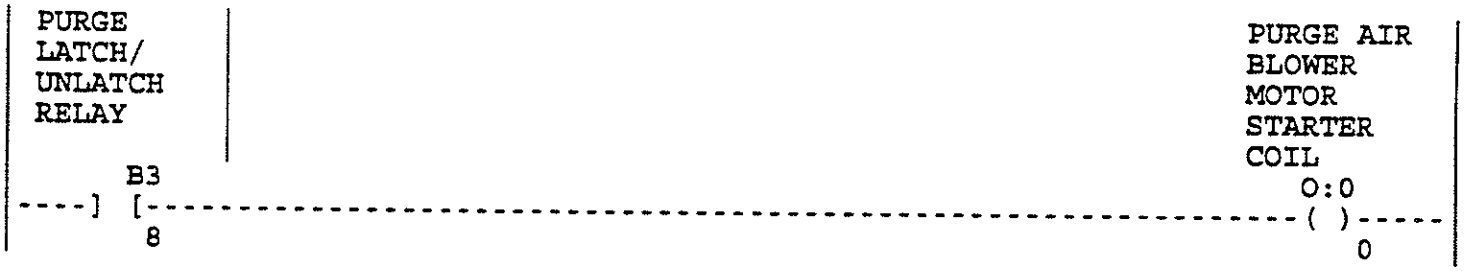
Rung 2:21
ILLUMINATE PURGE COMPLETE LAMP



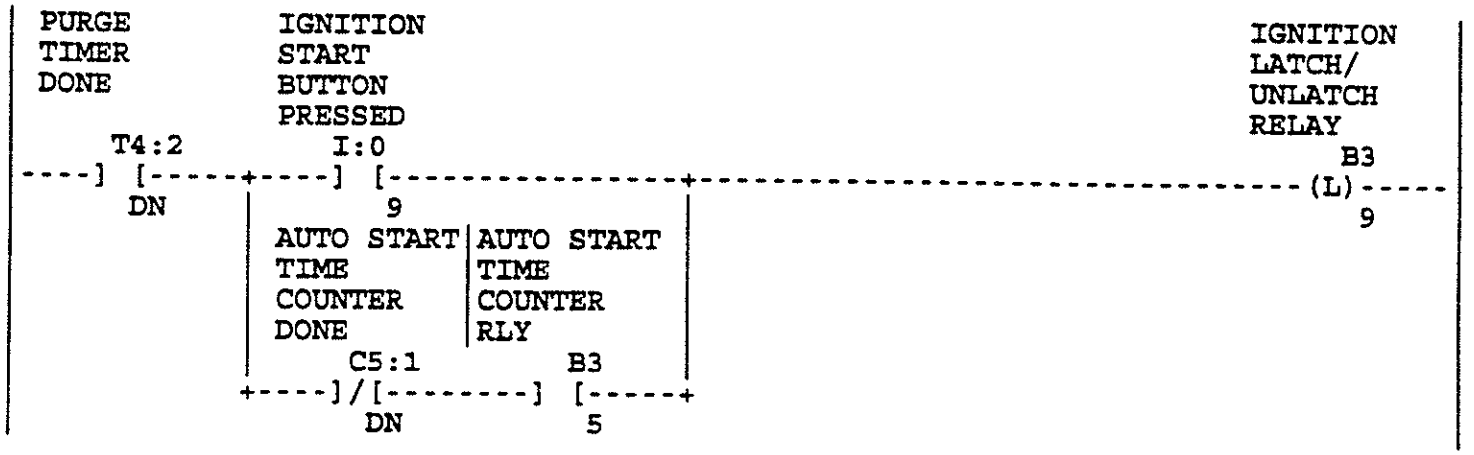
Rung 2:22
ILLUMINATE LOW PURGE AIR FLOW LAMP



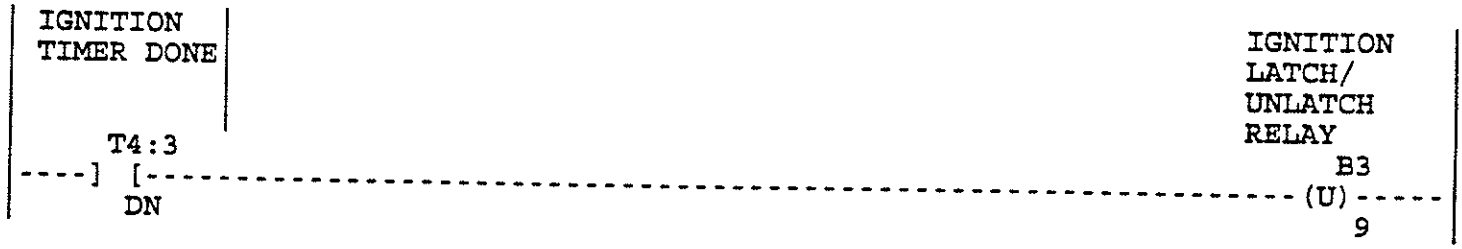
Rung 2:23
OPERATE PURGE AIR BLOWER MOTOR STARTER COIL



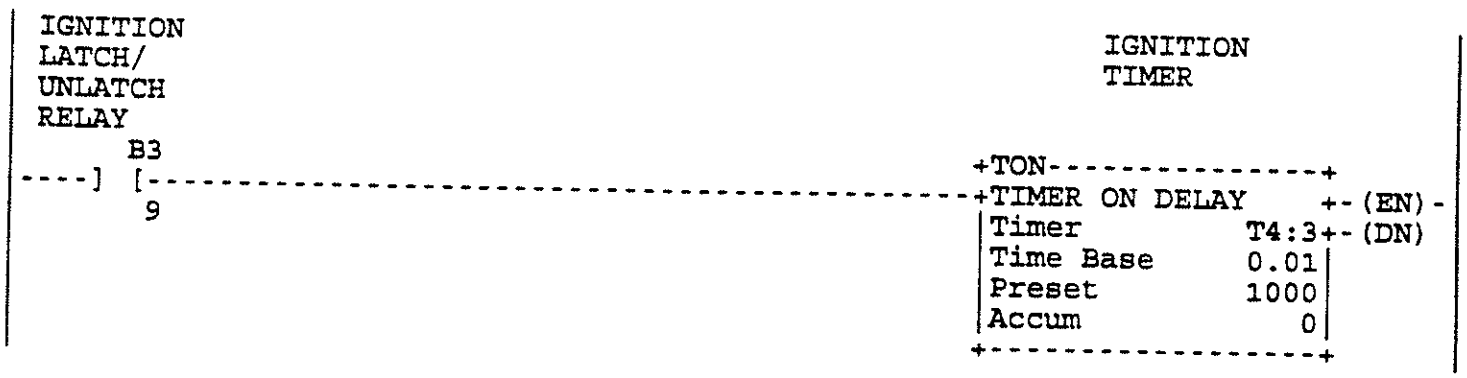
Rung 2:24
OPERATE IGNITION LATCH RELAY



Rung 2:25
OPERATE IGNITION UNLATCH RELAY



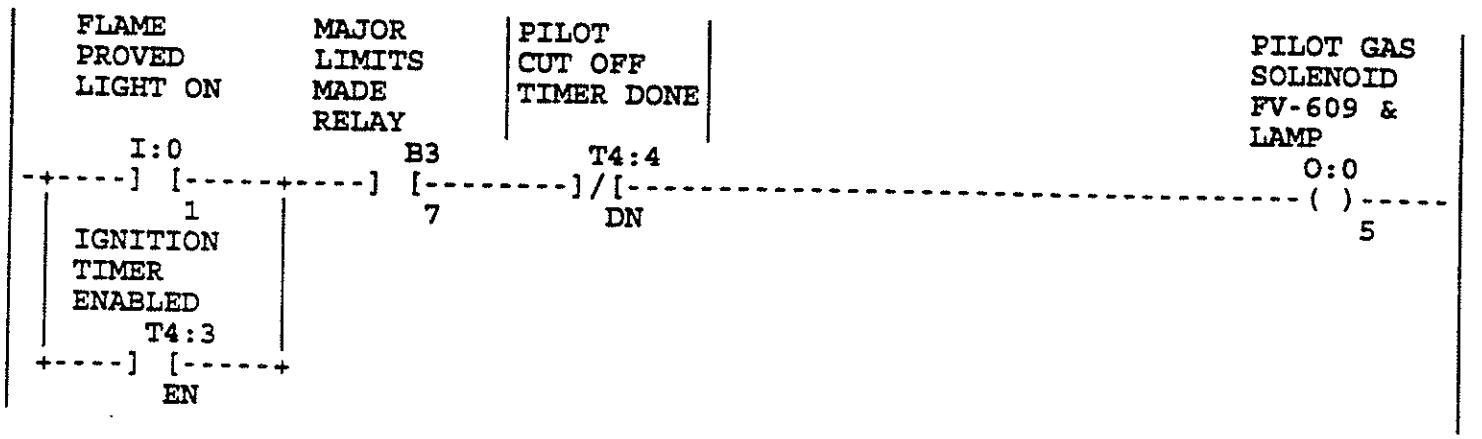
Rung 2:26
OPERATE IGNITION TIMER



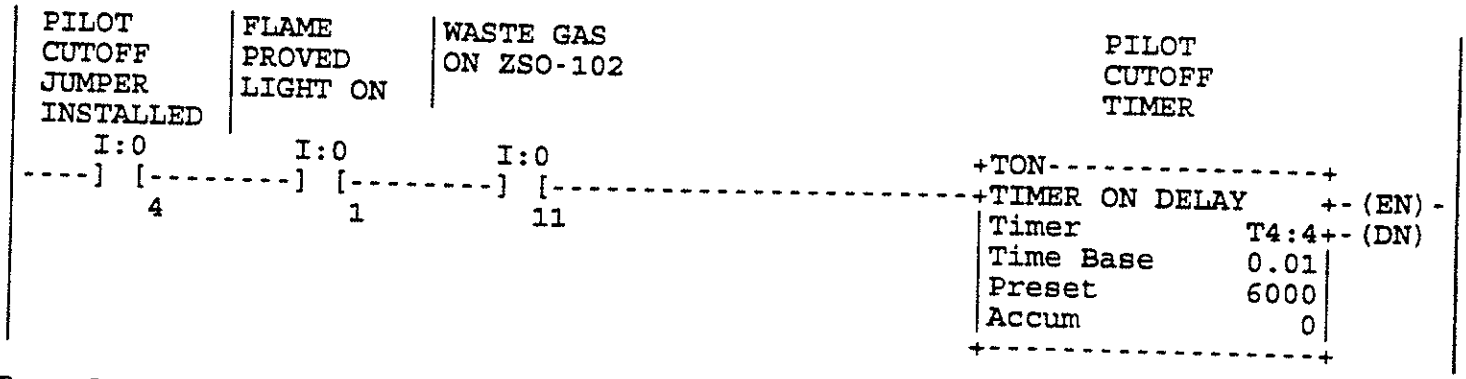
Rung 2:27
OPERATE IGNITION CONTROL RELAY CR-113



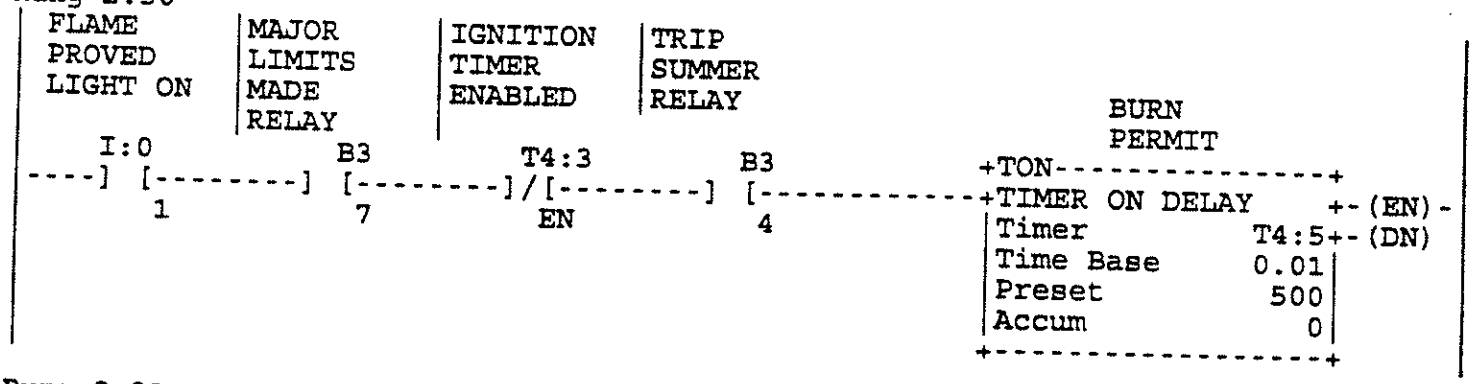
Rung 2:28
OPERATE PILOT GAS SOLENOID AND ILLUMINATE LAMP



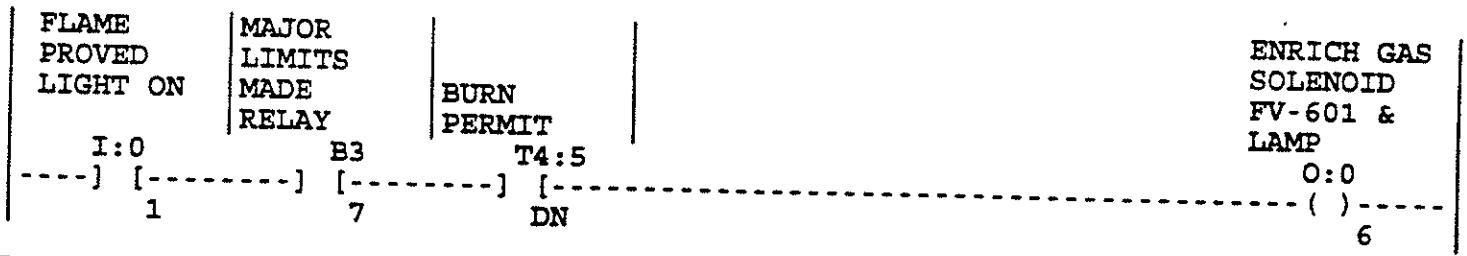
Rung 2:29
OPERATE PILOT CUTOFF TIMER



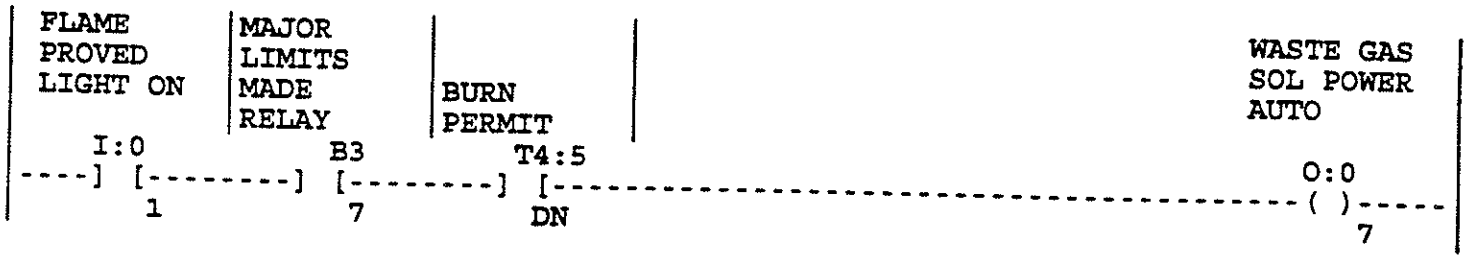
Rung 2:30



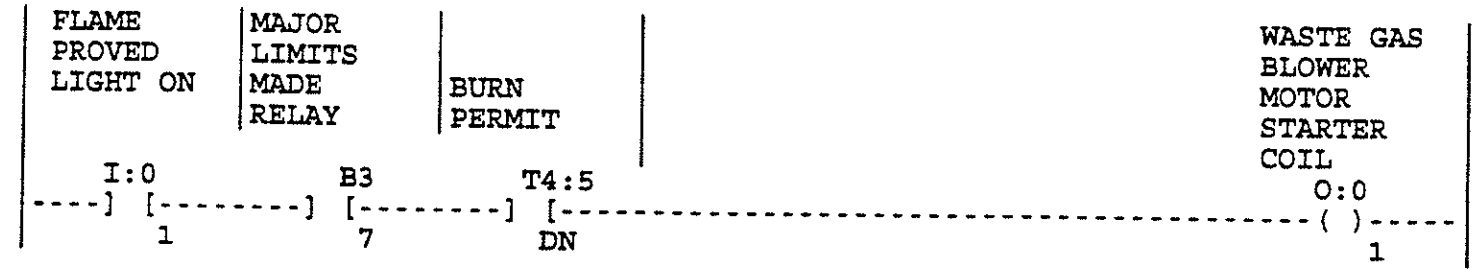
Rung 2:31
OPERATE ENRICH GAS SOLENOID FV-601 AND ILLUMINATE LAMP



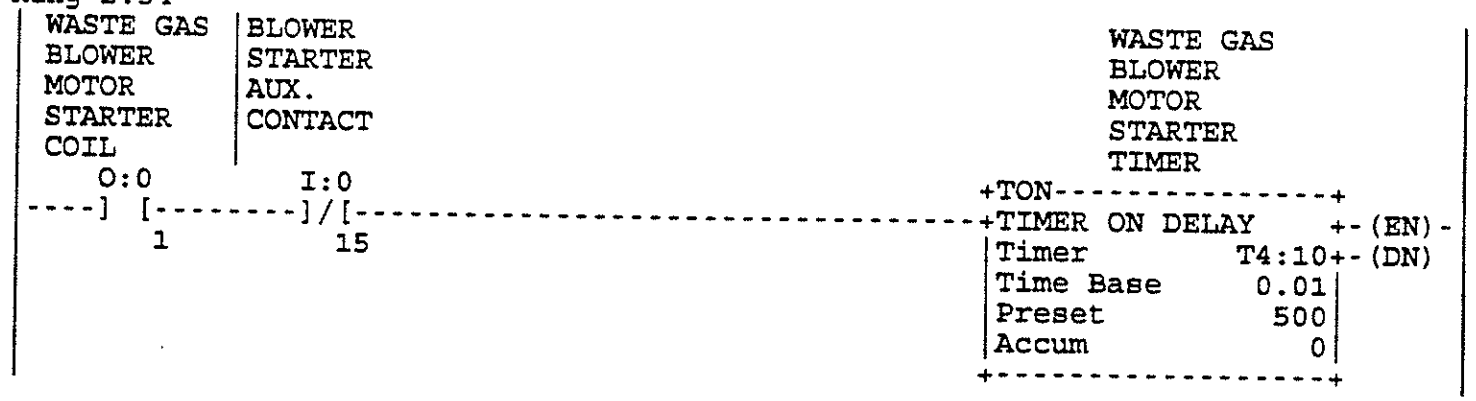
Rung 2:32
OPERATE WASTE SOLENOID (AUTO)



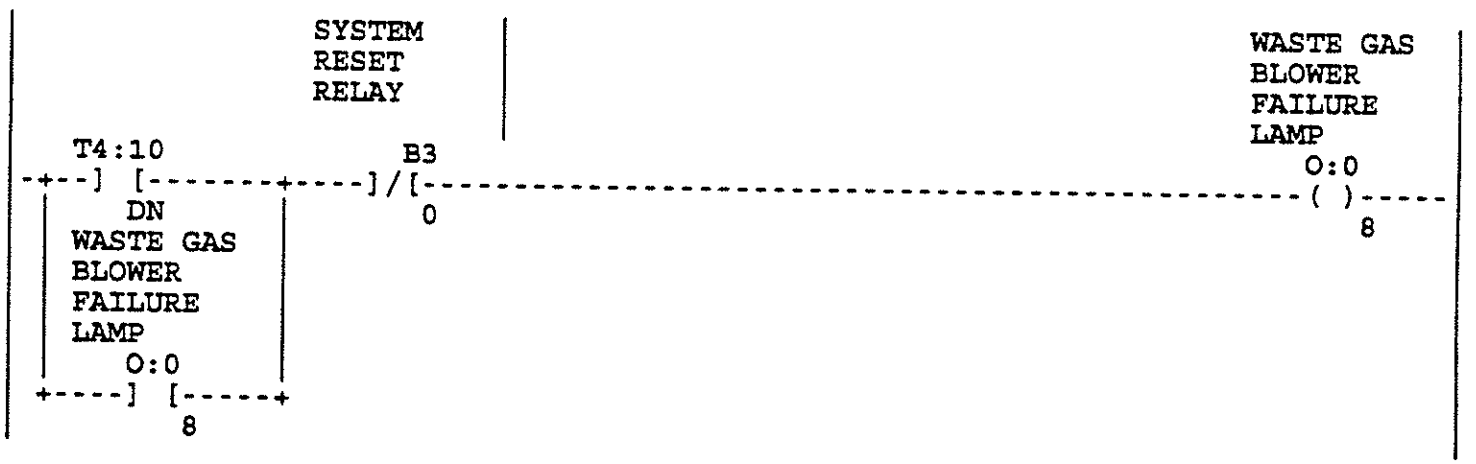
Rung 2:33
OPERATE WASTE GAS BLOWER MOTOR STARTER



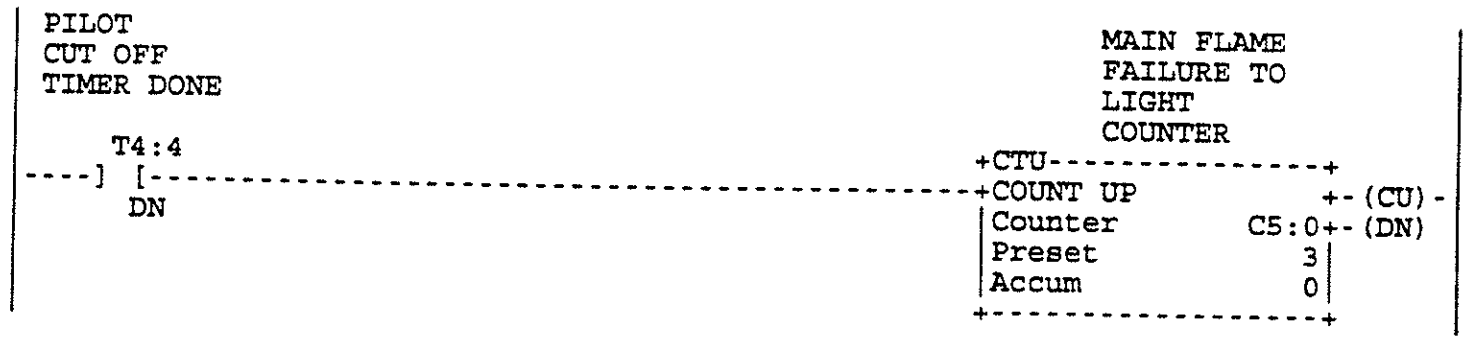
Rung 2:34



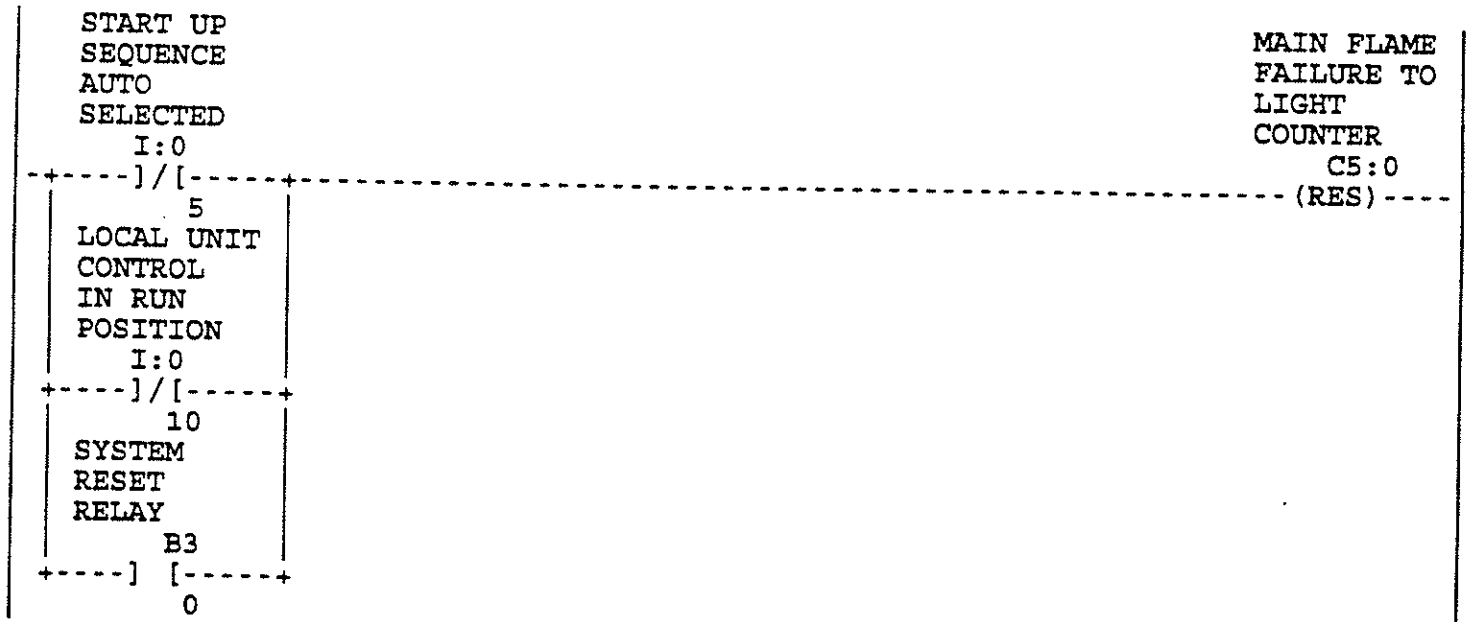
Rung 2:35
ILLUMINATE WASTE GAS BLOWER OFF LAMP



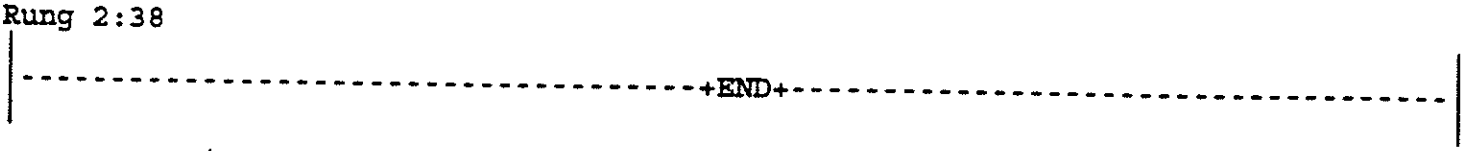
Rung 2:36
OPERATE MAIN FLAME FAILURE TO LIGHT COUNTER



Rung 2:37
OPERATE MAIN FLAME FAILURE TO LIGHT COUNTER RESET



Rung 2:38



REPORT OPTIONS SUMMARY

Insure Valid X-Ref Info:	YES
Graphics Mode:	NO
Page Width:	80
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Starting File:	2
Ending File:	2
Power Rail:	YES
Address Comments:	YES
Address Display:	NO
Rung Comments:	YES
Ladder Cross Reference:	NONE

Allen-Bradley Co.
1747 Series Software
APS Release 5.01
Documentation Utility
Cross Reference

BRECO A12224 ZTOF

Processor File: AO12224.ACH
October 02, 1995 - 16:24

Processor File: AO12224.ACH

Address	Symbol / Instruction	Comment / File Number:Rung Number
B3/0		SYSTEM RESET RELAY
	-] [-	2:12 2:15 2:37
	-]/[-	2:1 2:3 2:5 2:7 2:35
	-( )-	2:0
B3/1		HEAT UP TIMER DONE(LOW FLARETEMP)
	-] [-	2:1 2:2
	-]/[-	2:9
	-( )-	2:1
B3/2		HIGH FLARETEMP LATCH
	-] [-	2:3 2:4
	-]/[-	2:9
	-( )-	2:3
B3/3		AUTO FLAME FAILURE LATCH
	-] [-	2:5 2:8
	-]/[-	2:9
	-( )-	2:5
B3/4		TRIP SUMMER RELAY
	-] [-	2:1 2:3 2:5 2:5 2:16 2:30
	-( )-	2:9
B3/5		AUTO STARTTIME COUNTER RLY
	-] [-	2:11 2:17 2:24
	-( )-	2:10
B3/6		HEAT UP TIME COUNTER RELAY
	-] [-	2:14
	-( )-	2:13
B3/7		MAJOR LIMITS MADE RELAY
	-] [-	2:17 2:28 2:30 2:31 2:32 2:33
	-]/[-	2:18
	-( )-	2:16
B3/8		PURGE LATCH/ UNLATCH RELAY
	-] [-	2:19 2:22 2:23
	-(L)-	2:17
	-(U)-	2:18
B3/9		IGNITION LATCH/ UNLATCH RELAY
	-] [-	2:26
	-(L)-	2:24
	-(U)-	2:25

Address	Symbol / Instruction	Comment / File Number:Rung Number
B3/13		MAN. FLAME FAILURE
	-] [- 2:8	
	-]/[- 2:9	
	-( )- 2:6	
B3/14		MAN. FLAME FAILURE LATCH
	-] [- 2:6 2:7	
	-( )- 2:7	
C5:0		MAIN FLAMEFAILURE TOLIGHT COUNTER
	-CTU- 2:36	
	-RES- 2:37	
C5:0/DN		MAIN FLAMEFAILURE TOLIGHT COUNTER
	-] [- 2:5	
	-]/[- 2:17	
C5:1		AUTO STARTTIME COUNTER
	-CTU- 2:11	
	-RES- 2:12	
C5:1/DN		AUTO STARTTIME COUNTER DONE
	-] [- 2:5	
	-]/[- 2:11 2:17 2:24	
C5:2		HEAT UP TIME COUNTER
	-CTU- 2:14	
	-RES- 2:15	
C5:2/DN		HEAT UP COUNTER DONE
	-] [- 2:1	
	-]/[- 2:10 2:14	
I:0/0		HIGH STACKTEMP INPUT
	-]/[- 2:3	
I:0/1		FLAME PROVED LIGHT ON
	-] [- 2:13 2:18 2:28 2:29 2:30 2:31 2:32 2:33	
	-]/[- 2:6 2:10 2:17	
I:0/2		LOW FLARE TEMP.
	-] [- 2:13	
	-]/[- 2:15	
I:0/3		EMERGENCY SHUTDOWN ESD
	-] [- 2:16	
I:0/4		PILOT CUTOFF JUMPER INSTALLED
	-] [- 2:29	

Address	Symbol / Instruction	Comment / File Number:Rung Number
I:0/5		START UP SEQUENCE AUTO SELECTED
	-] [- 2:10	
	-]/[- 2:7 2:12 2:15 2:37	
I:0/6		COMB. AIR BLOWER PROVED PDSL-203
	-] [- 2:19	
	-]/[- 2:22	
I:0/7		FCV-102 CLOSED ZSC-102
	-] [- 2:17	
I:0/8		PURGE START BUTTON PRESSED
	-] [- 2:17	
I:0/9		IGNITION START BUTTON PRESSED
	-] [- 2:24	
I:0/10		LOCAL UNITCONTROL IN RUN POSITION
	-] [- 2:10 2:13 2:16	
	-]/[- 2:0 2:12 2:15 2:37	
I:0/11		WASTE GAS ON ZSO-102
	-] [- 2:18 2:29	
I:0/14		RESET PUSHBUTTON
	-] [- 2:0	
I:0/15		BLOWER STARTER AUX. CONTACT
	-]/[- 2:34	
O:0/0		PURGE AIR BLOWER MOTOR STARTER COIL
	-( )- 2:23	
O:0/1		WASTE GAS BLOWER MOTOR STARTER COIL
	-] [- 2:34	
	-( )- 2:33	
O:0/4		IGNITION CONTROL RELAY CR-113
	-( )- 2:27	
O:0/5		PILOT GAS SOLENOID FV-609 & LAMP
	-( )- 2:28	
O:0/6		ENRICH GASSOLENOID FV-601 & LAMP
	-( )- 2:31	
O:0/7		WASTE GAS SOL POWER AUTO
	-( )- 2:32	

Address	Symbol / Instruction	Comment / File Number:Rung Number
O:0/8		WASTE GAS BLOWER FAILURE LAMP
	-] [- 2:35	
	-]/[- 2:9	
	-( )- 2:35	
O:0/9		PURGING LAMP
	-( )- 2:20	
O:0/10		LOW PURGE AIR FLOW LAMP
	-( )- 2:22	
O:0/11		PURGE COMPLETE LAMP
	-( )- 2:21	
O:0/12		LOW FLARE TEMP LAMP
	-( )- 2:2	
O:0/13		HIGH FLARETEMP LAMP
	-( )- 2:4	
O:0/14		FLAME FAILURE LAMP
	-( )- 2:8	
S:4/1		40 msec TIMING PULSE
	-] [- 2:14	
T4:2		PURGE TIMER
	-TON- 2:19	
T4:2/DN		PURGE TIMER DONE
	-] [- 2:21 2:24	
	-]/[- 2:20	
T4:2/EN		PURGE TIMER ENABLE
	-] [- 2:11 2:20 2:21	
T4:3		IGNITION TIMER
	-TON- 2:26	
T4:3/DN		IGNITION TIMER DONE
	-] [- 2:7 2:18 2:25	
T4:3/EN		IGNITION TIMER ENABLED
	-] [- 2:27 2:28	
	-]/[- 2:30	
T4:4		PILOT CUTOFF TIMER
	-TON- 2:29	

Address	Symbol / Instruction	Comment / File Number:Rung Number
T4:4/DN		PILOT CUT OFF TIMER DONE
	-] [- 2:36	
	-]/[- 2:28	
T4:5		BURN PERMIT
	-TON- 2:30	
T4:5/DN		BURN PERMIT
	-] [- 2:12 2:31 2:32 2:33	
T4:10		WASTE GAS BLOWER MOTOR STARTER TIMER
	-TON- 2:34	
T4:10/DN		
	-] [- 2:35	

REPORT OPTIONS SUMMARY

Insure Valid X-Ref Info:	YES
Graphics Mode:	NO
Page Width:	80
Page Length:	60
Starting Value:	B
Ending Value:	T
Sort Order:	ADDRESS
Address Comments:	YES
Instruction Mnemonics:	YES

XV. RECOMMENDED SPARE PARTS

Component	Tag #	P/N	Recommended Quantity
1. Flame Scanner	BE-103A	026441	1
2. Flame Scanner Amplifier	BS-103A	001506	1
3. Thermocouple Assembly	TE-101, TE-201A & B	022963	3
4. Spark Plug	for B-302-1	003020	1
5. Ignitor Rod Insulator	for B-302-1	003587	3
6. Sight Glass	CA-ST-0600	008170	1
7. Pilot Assembly	B-302-1		1
8. Panel Lights	for PNL-101	001598	6
9. Pressure Gauge	PI-612	030373	1
10. Regulator	PCV-608	016414	1
11. Solenoid Valve	FV-609	012004	1
12. Damper Actuator	for TCV-201A&B	001625	1
13. Pressure Switch	PDSL-203	024372	1

APPENDIX A.

TEMPERATURE CONTROLLER AND RECORDER INFORMATION

The Honeywell Controllers and Recorders are configured and tested at our manufacturing facility. Most likely, the operator will never need to change the settings. However, if a change is necessary, consult the following process and configuration sheets.

Note:
Read all of the Honeywell Controller and Recorder information before changing any of the configurations. Improper programming of the controller may result in damage to the equipment. This Appendix does not replace the Honeywell Operating Instructions.

As you look at the controller or recorder, you will see eight buttons. Each function as follows:

Function:	Used in conjunction with Set Up key to select the individual function of a selected Configuration Set Up group.
Lower Display:	Selects an operating parameter to be shown in the lower display. The preferred item to be shown is the temperature set point.
Manual/Auto:	Alternately selects between the Auto and Manual output. In the Manual mode, the operator may change the percentage of the signal to open or close the dampers.
Setpoint Select:	Alternately selects between the Local Setpoint 1 and the Remote Setpoint.
Set Up:	Places the controller in the Configuration Set Up group select mode. This sequentially displays the Set Up groups and allows the Function key to display the individual functions in each Set Up group.
Up Arrow:	Increases the setpoint, output, or configuration values in the display.
Down Arrow:	Decreases the setpoint, output, or configuration values in the display.
Run/Hold:	Alternately allows the operator to hold the Setpoint Ramp or Setpoint Program or restores the original value in the Run mode.

Example:

The operator wants to change the high limit on the temperature set point from 1600 °F to 1800 °F. The operator would:

1. Press the Set Up key five times until the lower display shows "Control".
2. Press the Function key until the lower display shows "SP Hilim".
3. Press the Up Arrow key until the upper display shows 1800.
4. Press the Lower Display button to exit the configuration. The new upper limit of the set point is 1800.

The configuration sheet should be used as a guide for programming. If changes are necessary, please contact John Zink Company for assistance.

Changing the Set Point

To change the set point while the unit is in operation, simply press the up or down arrow until the desired number is reached. The unit will automatically respond.