PD6000 Analog Input Process Meter
Instruction Manual

- 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, or ±10 V Inputs
- Dual 6-Digit Displays, 0.60" (15 mm) & 0.46"(12 mm) Red LEDs
- Display Process Variable & Legend, Eng Units, or Set Point
- Programmable Displays & Function Keys
- 32-Point Linearization, Square Root, or Programmable Exponent
- Scale Using Internal Reference Source
- Maximum/Minimum Display
- Type 4X, NEMA 4X, IP65 Front
- Universal Power 85-265 VAC or 12/24 VDC
- Two or Four Relays and/or 4-20 mA Output
- Isolated 24 VDC @ 200 mA Transmitter Supply Standard
- Serial Communication Adapters for RS-232 & RS-485
- Expansion Modules with Four Relays & Two 4/4 Digital I/O
- Copy Meter Settings to Other Meters
- Free Multi-Point Linearization Utility

Disclaimer

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⚠	⚡
CAUTION: Read complete instructions prior to installation and operation of the meter.	**WARNING**: Risk of electric shock or personal injury.

⚡

Warning!

This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at his/her own risk. Precision Digital Corporation shall not be held liable for damages resulting from such improper use.

Limited Warranty

Precision Digital Corporation warrants this product against defects in material or workmanship for the specified period under "Specifications" from the date of shipment from the factory. Precision Digital's liability under this limited warranty shall not exceed the purchase value, repair, or replacement of the defective unit.

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INTRODUCTION

The PD6000 is a multipurpose, easy to use digital process meter ideal for level, flow rate, temperature, or pressure transmitter applications. It accepts current and voltage signals (e.g. 4-20 mA, 0-10 V). Three of the front panel buttons can be custom-programmed for specific operation.

The basic model includes an isolated 24 VDC transmitter power supply that can be used to power the input transmitter or other devices. An additional isolated 24 VDC power supply is included with the 4-20 mA output option.

A fully loaded PD6000 meter has the following: four SPDT relays, 4-20 mA output, two 24 VDC power supplies. The PD6000 capabilities may be enhanced by adding the following external expansion modules: four SPST relays –creating an eight-relay process meter–, two digital I/O modules with four inputs and four outputs each, and RS-232 or RS-485 communication adapters.

The eight relays can be used for alarm indication or process control applications, such as pump alternation control. The 4-20 mA isolated output, serial communications, and digital I/O options make the PD6000 an excellent addition to any system.

ORDERING INFORMATION

85-265 VAC Model	12-36 VDC Model	Options Installed
PD6000-6R0	PD6000-7R0	No options
PD6000-6R2	PD6000-7R2	2 relays (PD1102*)
PD6000-6R3	PD6000-7R3	4-20 mA output (PD1103*)
PD6000-6R4	PD6000-7R4	4 relays (PD1104*)
PD6000-6R5	PD6000-7R5	2 relays & 4-20 mA output (PD1105*)
PD6000-6R7	PD6000-7R7	4 relays & 4-20 mA output (PD1107*)
*Model number for replacement option board or field-installed options.		

Accessories

Model	Description
PDA1002	DIN rail mounting kit for two expansion modules
PDA1004	4 SPST (Form A) relays
PDA1044	4 digital inputs & 4 digital outputs (2 may be connected)
PDA1200	Meter copy cable
PDA1232	RS-232 serial adapter
PDA1485	RS-422/485 serial adapter
PDA7485-I	RS-232 to RS-422/485 isolated converter
PDA7485-N	RS-232 to RS-422/485 non-isolated converter
PDA8232-N	USB to RS-232 non-isolated converter
PDA8485-I	USB to RS-422/485 isolated converter
PDA8485-N	USB to RS-422/485 non-isolated converter
PDX6901	Suppressor (snubber): 0.01 µF/470 Ω, 250 VAC

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SPECIFICATIONS

Except where noted all specifications apply to operation at +25°C.

General

DISPLAY	Main display: 0.6" (15 mm) high, red LED Second display: 0.46" (12 mm) high, red LED 6 digits (-99999 to 999999), lead zero blanking.
DISPLAY INTENSITY	Eight user selectable intensity levels
DISPLAY UPDATE RATE	5/second (200 ms)
OVERRANGE	Display flashes 999999
UNDERRANGE	Display flashes -99999
PROGRAMMING METHODS	Four front panel buttons, digital inputs, PC and multi-point linearization utility, or cloning using Copy function.
NOISE FILTER	Programmable from 2 to 199 (0 will disable filter)
FILTER BYPASS	Programmable from 0.1 to 99.9% FS
RECALIBRATION	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
MAX/MIN DISPLAY	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
PASSWORD	Three programmable passwords restrict modification of programmed settings. Pass 1: Allows use of the F1–F3 function keys Pass 2: Allows use of the F1–F3 function keys and changing the set/reset points Pass 3: Restricts all programming and F1–F3 keys Note: Digital inputs are not password protected, except programming functions.
NON-VOLATILE MEMORY	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
POWER OPTIONS	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max or 12/24 VDC ± 10%, 15 W max
FUSE	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse
ISOLATED TRANSMITTER POWER SUPPLY	Terminals P+ & P-: 24 VDC ± 5% @ 200 mA max (standard), (12/24 VDC powered models rated @ 100 mA max). 5 or 10 VDC @ 50 mA max, selectable with internal jumper J4.
NORMAL MODE REJECTION	Greater than 60 dB at 50/60 Hz

ISOLATION	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
OVERVOLTAGE CATEGORY	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
ENVIRONMENTAL	Operating temperature range: -40 to 65°C Storage temperature range: -40 to 85°C Relative humidity: 0 to 90% non-condensing
CONNECTIONS	Removable screw terminal blocks accept 12 to 22 AWG wire, RJ45 for external relays, digital I/O, and serial communication adapters.
ENCLOSURE	1/8 DIN, high impact plastic, UL 94V-0, color: black
MOUNTING	1/8 DIN panel cutout required: 3.622" x 1.772" (92 mm x 45 mm) Two panel mounting bracket assemblies are provided.
TIGHTENING TORQUE	Screw terminal connectors: 5 lb-in (0.56 Nm)
OVERALL DIMENSIONS	4.68" x 2.45" x 5.64" (119 mm x 62 mm x 143 mm) (W x H x D)
WEIGHT	9.5 oz (269 g)
WARRANTY	3 years parts & labor

Process Input

INPUTS	Field selectable: 0-20, 4-20 mA, $\pm$10 V (0-5, 1-5, 0-10 V)
ACCURACY	$\pm$0.03% FS $\pm$1 count, Sq. root & prog. exponent accuracy range: 10-100% FS
MATH FUNCTIONS	Linear, square root, programmable exponent, or round horizontal tank volume calculation
MULTI-POINT LINEARIZATION	2 to 32 points
PROGRAMMA-BLE EXPONENT	1.0001 to 2.9999
LOW-FLOW CUTOFF	0-999999 (0 disables cutoff function)
TEMPERATURE DRIFT	From 0 to 65°C ambient: 50 PPM/°C From -40 to 0°C ambient: 100 PPM/°C
DECIMAL POINT	Up to five decimal places or none: *d.ddddd*, *d.dddd*, *d.ddd*, *d.dd*, *d.d*, or *dddddd*

CALIBRATION RANGE	An *Error* message will appear if the input 1 and input 2 signals are too close together.
	Input Range — Minimum Span Input 1 & Input 2
	4-20 mA — 0.15 mA
	±10 V — 0.10 V

INPUT IMPEDANCE	Voltage ranges: greater than 1 MΩ
	Current ranges: 50 - 100 Ω (depending on resettable fuse impedance)

INPUT OVERLOAD	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.

Relays

RATING	2 or 4 SPDT (Form C) internal and/or 4 SPST (Form A) external; rated 3 A @ 30 VDC and 125/250 VAC resistive load; 1/14 HP @ 125/250 VAC for inductive loads

NOISE SUPPRESSION	Noise suppression is recommended for each relay contact switching inductive loads; see page 20 for details.

DEADBAND	0-100% FS user programmable

HIGH OR LOW ALARM	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).

RELAY OPERATION	Automatic (non-latching)
	Latching (requires manual acknowledge)
	Sampling (based on time)
	Pump alternation control (2 to 8 relays)

RELAY RESET	User selectable via front panel buttons or digital inputs
	1. Automatic reset only (non-latching), when the input passes the reset point.
	2. Automatic + manual reset at any time (non-latching)
	3. Manual reset only, at any time (latching)
	4. Manual reset only after alarm condition has cleared
	Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.

TIME DELAY	0 to 999.9 seconds, on & off relay time delays
	Programmable and independent for each relay

FAIL-SAFE OPERATION	Programmable and independent for each relay.
	Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

AUTO INITIALIZATION	When power is applied to the meter, relays will reflect the state of the input to the meter.

Isolated 4-20 mA Transmitter Output

OUTPUT SOURCE	Process variable (PV), max, min, or set points 1-8
SCALING RANGE	1.000 to 23.000 mA for any display range
CALIBRATION	Factory calibrated: 4.000 to 20.000 = 4-20 mA output
ANALOG OUT PROGRAMMING	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break
ACCURACY	$\pm$ 0.1% FS $\pm$ 0.004 mA
TEMPERATURE DRIFT	50 PPM/$^\circ$C from 0 to 65°C ambient *Note: Analog output drift is separate from input drift.*
ISOLATED TRANSMITTER POWER SUPPLY	Terminals I+ & R: 24 VDC $\pm$ 5% @ 40 mA maximum; may be used to power the 4-20 mA output or other devices. Refer to Figure 5 on page 17 and Figure 13 on page 21.
EXTERNAL LOOP POWER SUPPLY	35 VDC maximum

OUTPUT LOOP RESISTANCE	Power supply	Minimum	Maximum
	24 VDC	10 Ω	700 Ω
	35 VDC (external)	100 Ω	1200 Ω

Serial Communications

METER ADDRESS	1 - 247
BAUD RATE	300 – 19,200 bps
TRANSMIT TIME DELAY	Programmable between 0 and 199 ms or transmitter always on for RS-422 communication
DATA	8 bit (1 start bit, 1 stop bit)
PARITY	None
TURN AROUND DELAY	Less than 2 ms (fixed)

Note: Refer to the PDC Serial Communication Protocol manual located at www.predig.com for details.

PDA1044 Digital Input & Output Expansion Module

CHANNELS	4 digital inputs & 4 digital outputs per module
SYSTEM	Up to 2 modules for a total of 8 inputs & 8 outputs
DIGITAL INPUT LOGIC HIGH	3 to 5 VDC
DIGITAL INPUT LOGIC LOW	0 to 1.25 VDC
DIGITAL OUTPUT LOGIC HIGH	4.75 to 5 VDC
DIGITAL OUTPUT LOGIC LOW	0 to 0.4 VDC
SOURCE CURRENT	10 mA maximum output current
SINK CURRENT	1.5 mA minimum input current
+5 V TERMINAL	To be used as pull-up for digital inputs only

COMPLIANCE INFORMATION

Safety

UL & c-UL LISTED	USA & Canada UL 508 Industrial Control Equipment
UL FILE NUMBER	E160849
FRONT PANEL	UL Type 4X, NEMA 4X, IP65; panel gasket provided
LOW VOLTAGE DIRECTIVE	EN 61010-1:2001 Safety requirements for measurement, control, and laboratory use

Electromagnetic Compatibility

EMISSIONS	EN 55022:1998/A1:2000/A2:2003 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
IMMUNITY	EN 61000-6-2:2001 EMC heavy industrial generic immunity standard
RFI - Amplitude Modulated	80 -1000 MHz 10 V/m 80% AM (1 kHz)
Electrical Fast Transients	±2kV AC mains, ±1kV other
Electrostatic Discharge	±4kV contact, ±8kV air
RFI - Conducted	10V, 0.15-80 MHz, 1kHz 80% AM
AC Surge	±2kV Common, ±1kV Differential
Surge	1KV (CM)
Power-Frequency Magnetic Field	3 A/m 70%V for 0.5 period
Voltage Dips	40%V for 5 & 50 periods
Voltage Interruptions	<5%V for 250 periods

Note:

Testing was conducted on PD6000 meters installed through the covers of grounded metal enclosures with cable shields grounded at the point of entry representing installations designed to optimize EMC performance.

Declaration of Conformity available at www.predig.com

SAFETY INFORMATION

⚠ **CAUTION**: Read complete instructions prior to installation and operation of the meter.	⚡ **WARNING**: Risk of electric shock or personal injury.

⚡ *WARNING!*
Hazardous voltages exist within enclosure. Installation and service should be performed only by trained service personnel.

INSTALLATION

There is no need to remove the meter from its case to complete the installation, wiring, and setup of the meter for most applications. Instructions are provided for 12 VDC meter power and for 5 or 10 V transmitter power applications, see page 15.
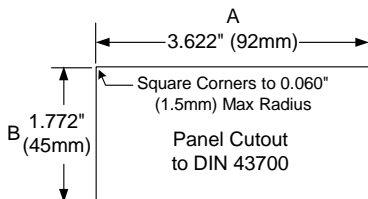
Unpacking

Remove the meter from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier.

If any part is missing or the meter malfunctions, please contact your supplier or the factory for assistance.

Panel Mounting Instructions

- Prepare a standard 1/8 DIN panel cutout – 3.622" x 1.772" (92 mm x 45 mm). Refer to *Mounting Dimensions*, page 68 for more details.
- Clearance: allow at least 5.5" (140 mm) behind the panel for wiring.
- Panel thickness: 0.04" - 0.25" (1.0 mm - 6.4 mm). Recommended minimum panel thickness to maintain Type 4X rating: 0.06" (1.5 mm) steel panel, 0.16" (4.1 mm) plastic panel.
- Remove the two mounting brackets provided with the meter (back-off the two screws so that there is ¼" (6.4 mm) or less through the bracket. Slide the bracket toward the front of the case and remove).
- Insert meter into the panel cutout.
- Install mounting brackets and tighten the screws against the panel. To achieve a proper seal, tighten the mounting bracket screws evenly until meter is snug to the panel along its short side. DO NOT OVER TIGHTEN, as the rear of the panel may be damaged.

A
←——3.622" (92mm)——→

Square Corners to 0.060"
(1.5mm) Max Radius

B 1.772"
(45mm)

Panel Cutout
to DIN 43700

Refer to page 68 for mounting dimensions

Tolerances:
A: +0.032 (+0.8mm)
   -0.000 (-0.0mm)
B: +0.024 (+0.6mm)
   -0.000 (-0.0mm)

Figure 1. 1/8 DIN Panel Cutout Dimensions
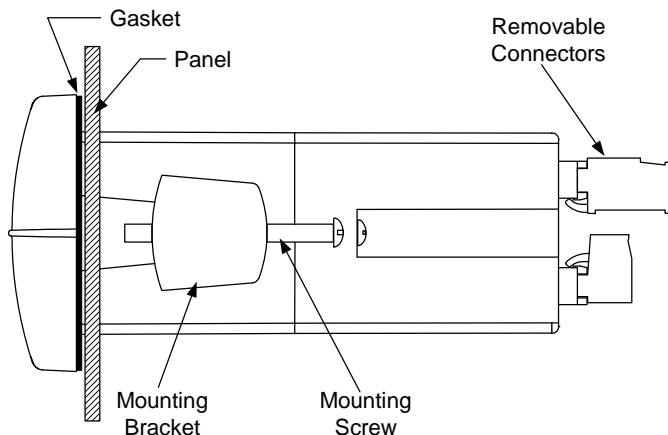
Figure 2. Panel Mounting Details

Configuration for 12 or 24 VDC Power Option

⚡ Do not exceed voltage rating of the selected configuration.

Meters equipped with the 12/24 VDC power option are shipped from the factory ready to operate from 24 VDC.

To configure the meter for 12 VDC power:

1. Remove all the connectors.
2. Unscrew the back cover.
3. Slide the back cover about 1 inch.
4. Configure the J9 jumper, located behind the power connector, for 12 V as shown below.

Figure 3. Jumper Configuration for 12/24 VDC Power

Transmitter Supply Voltage Selection (P+, P-)

All meters, including models equipped with the 12/24 VDC power option, are shipped from the factory configured to provide 24 VDC power for the transmitter or sensor.

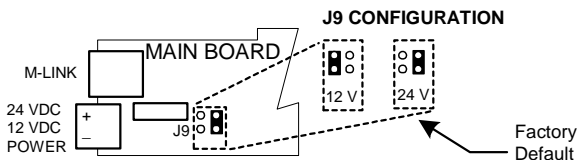If the transmitter requires 5 or 10 VDC excitation, the internal jumper J4 must be configured accordingly.

To access the voltage selection jumper:

1. Remove all the wiring connectors.
2. Unscrew the back cover.
3. Slide out the back cover by about 1 inch.
4. Configure the J4 jumper, located behind the input signal connector, for the desired excitation voltage as shown.
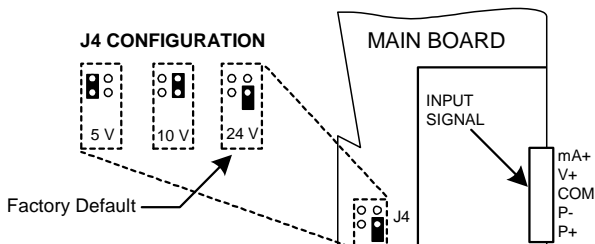
Figure 4. Transmitter Supply Voltage Selection

Connections

All connections are made to removable screw terminal connectors located at the rear of the meter.

> ⚠ Use copper wire with 60°C or 60/75°C insulation for all line voltage connections. Observe all safety regulations. Electrical wiring should be performed in accordance with all applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.

Connectors Labeling

The connectors' label, affixed to the meter, shows the location of all connectors available with requested configuration.

Figure 5. Connector Labeling for Fully Loaded PD6000

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 5. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.
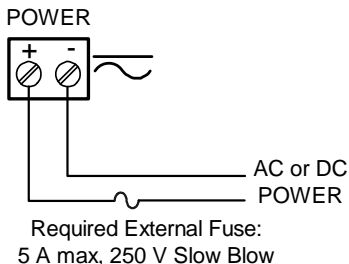
Figure 6. Power Connections

Signal Connections

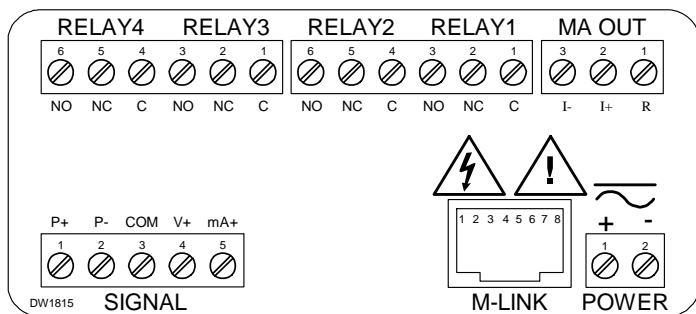Signal connections are made to a five-terminal connector labeled SIGNAL on Figure 5. The COM (common) terminal is the return for the 4-20 mA and the ±10 V input signals.

Current and Voltage Connections

The following figures show examples of current and voltage connections.

There are no switches or jumpers to set up for current and voltage inputs. Setup and programming is performed through the front panel buttons.
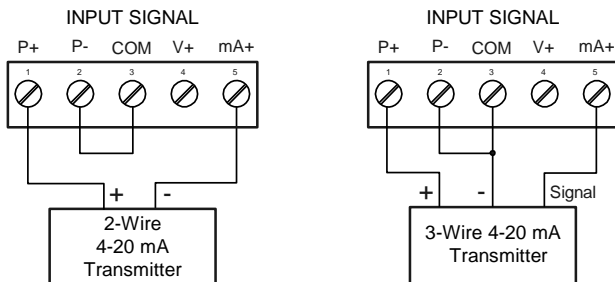
Figure 7. Transmitters Powered by Internal Supply
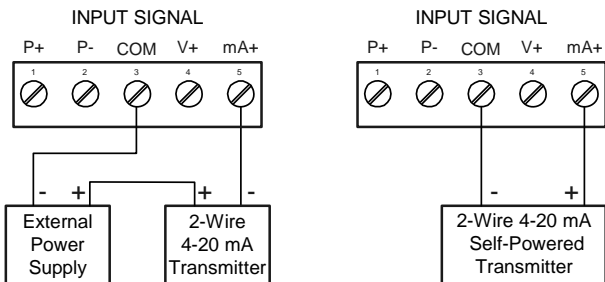
Figure 8. Transmitter Powered by Ext. Supply or Self-Powered

The current input is protected against current overload by a resettable fuse. The display may or may not show a fault condition depending on the nature of the overload.

The fuse limits the current to a safe level when it detects a fault condition, and automatically resets itself when the fault condition is removed.
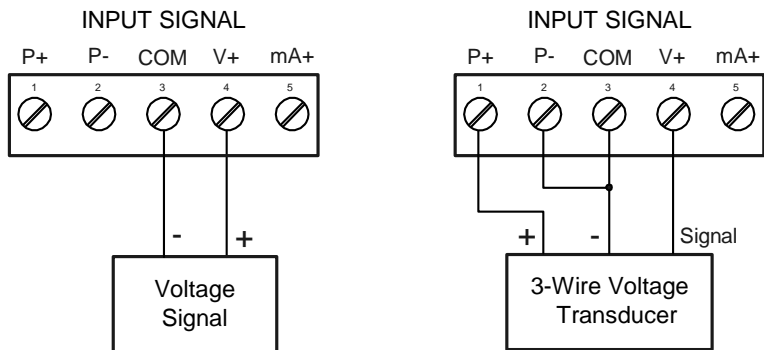
Figure 9. Voltage Input Connections

The meter is capable of accepting any voltage from -10 VDC to +10 VDC.

Serial Communications

Serial communications connection is made to an RJ45 connector labeled M-LINK on Figure 5. Use PDA1232 for RS-232 interfacing or the PDA1485 for RS-422/485 interfacing. The same port is used for interfacing with all expansion modules (e.g. external relays, digital I/O).

Use the PDA1200 meter copy cable for meter-to-meter interfacing for cloning purposes (*i.e.* copying settings from one meter to other meters).

Relay Connections

Relay connections are made to two six-terminal connectors labeled RELAY1 – RELAY4 on Figure 5. Each relay's C terminal is common only to the normally open (NO) and normally closed (NC) contacts of the corresponding relay. The relays' C terminals should not be confused with the COM (common) terminal of the INPUT SIGNAL connector.
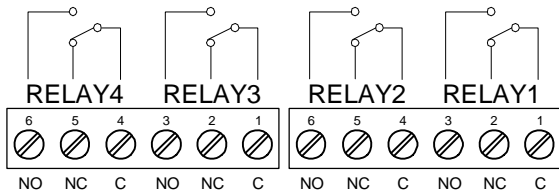
Figure 10. Relay Connections

Switching Inductive Loads

The use of suppressors (snubbers) is strongly recommended when switching inductive loads to prevent disrupting the microprocessor's operation. The suppressors also prolong the life of the relay contacts. Suppression can be obtained with resistor-capacitor (RC) networks assembled by the user or purchased as complete assemblies. Refer to the following circuits for RC network assembly and installation:
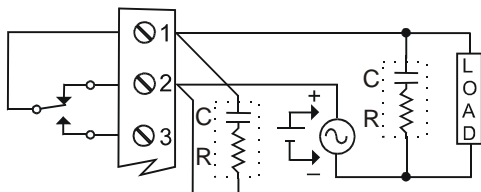
Figure 11. AC and DC Loads Protection

Choose R and C as follows:

R: 0.5 to 1 Ω for each volt across the contacts

C: 0.5 to 1 µF for each amp through closed contacts

Notes:

1. Use capacitors rated for 250 VAC.
2. RC networks may affect load release time of solenoid loads. Check to confirm proper operation.
3. Install the RC network at the meter's relay screw terminals. An RC network may also be installed across the load. Experiment for best results.
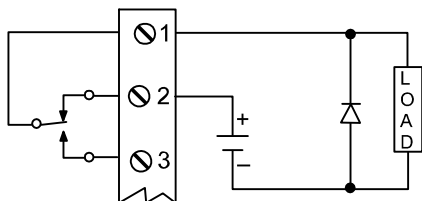
Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

Figure 12. Low Voltage DC Loads Protection

RC Networks Available from Precision Digital

RC networks are available from Precision Digital and should be applied to each relay contact switching an inductive load. Part number: PDX6901.

4-20 mA Output Connections

Connections for the 4-20 mA transmitter output are made to the connector terminals labeled MA OUT. The 4-20 mA output may be powered internally or from an external power supply.
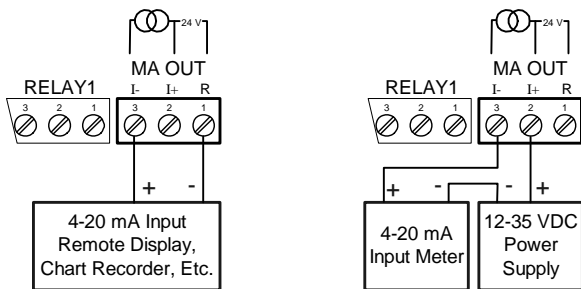
Figure 13. 4-20 mA Output Connections

Analog Output Transmitter Power Supply

The internal 24 VDC power supply powering the analog output may be used to power other devices, if the analog output is not used. The I+ terminal is the +24 V and the R terminal is the return. This power supply is capable of sourcing up to 40 mA.

External Relays & Digital I/O Connections

The relay and the digital I/O expansion modules PDA1004 & PDA1044 are connected to the meter using a CAT5 cable provided with each module. The two RJ45 connectors on the expansion modules are identical and interchangeable; they are used to connect additional modules to the system.

Note 1: The jumper located between the RJ45 connectors of the PDA1044 must be removed on the second digital I/O module in order for the system to recognize it as module #2.

Note 2: More detailed instructions are provided with each optional expansion module.
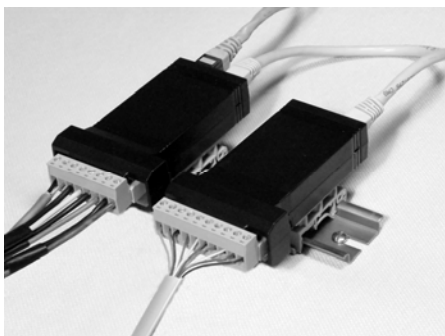
Figure 14. Expansion Modules & DIN Rail Mounting Kit
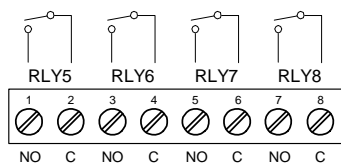
Figure 15. External Relays Module Connections
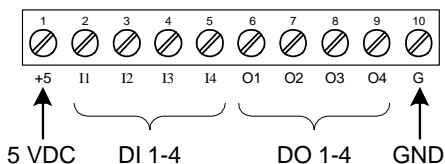
Figure 16. Digital I/O Module Connections

SETUP AND PROGRAMMING

The meter is factory calibrated prior to shipment to read in milliamps and volts depending on the input selection. The calibration equipment is certified to NIST standards.

Overview

There are no jumpers involved in the setup process of the meter.

Setup and programming is done through the front panel buttons.

After power and input signal connections have been completed and verified, apply power to the meter.

Front Panel Buttons and Status LED Indicators

Button Symbol	Description
Menu	**Menu**
F1	**Right arrow/F1**
F2	**Up arrow/F2**
F3	**Enter/F3**

LED	Status
1-4	Alarm 1 – 4 indicator
5-8	Alarm 5 – 8 indicator
Note: *Alarms 5-8 are enabled when relay expansion module is installed.*	

- Press the Menu button to enter or exit the Programming Mode at any time.
- Press the Right arrow button to move to the next digit during digit or decimal point programming.
- Press the Up arrow button to scroll through the menus, decimal point, or to increment the value of a digit.
- Press the Enter button to access a menu or to accept a setting.
- Press and hold the Menu button for three seconds to access the advanced features of the meter.

Display Functions & Messages

The meter displays various functions and messages during setup, pro-gramming, and operation. The following table shows the main menu functions and messages in the order they appear in the menu.

Display	Parameter	Action/Setting Description
rESEt	*Reset*	Press Enter to access the *Reset* menu
rSt Hi	*Reset high*	Press Enter to reset max display
rSt Lo	*Reset low*	Press Enter to reset min display
rSt HL	*Reset high & low*	Press Enter to reset max & min displays
Contrl	*Control*	Enter *Control* menu
Auto	*Automatic*	Press Enter to set meter for automatic operation
m An	*Manual*	Press Enter to manually control relays or analog output operation
SEtuP	*Setup*	Enter *Setup* menu
inPut	*Input*	Enter *Input* selection menu
m A	*4-20 mA*	Set meter for 4-20 mA input
Uolt	*0-10 VDC*	Set meter for ±10 VDC input
dEc Pt	*Decimal point*	Set decimal point
dSPLAY	*Display*	Enter the *Display* menu
b iG	*Big display*	Press Enter to assign the Main display parameter (default: PV)
L ittLE	*Little display*	Press Enter to assign the small display parameter (default: engineering units)
d- intY	*Display intensity*	Set display intensity level from 1 to 8
rELAY	*Relay*	Enter the *Relay* menu
rLY 1	*Relay 1*	Relay 1 setup
Act 1	*Action 1*	Set relay 1 action
Auto	*Automatic*	Set relay for automatic reset
A-m An	*Auto-manual*	Set relay for automatic & manual reset any time

Display	Parameter	Action/Setting Description
LAtCH	Latching	Set relay for latching operation
Lt-CLr	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared
ALtErn	Alternate	Set relay for pump alternation control
SAm PL	Sampling	Set relay for sampling operation
OFF	Off	Disable relay and front panel status LED
SEt 1	Set 1	Program set point 1
rSt 1	Reset 1	Program reset point 1
rLY 2	Relay 2	Relays 2-8 setup *Note: Relays 5-8 are shown, only if expansion relay module is installed.*
FA iLSF	Fail-safe	Enter *Fail-safe* menu
FLS 1	Fail-safe 1	Set relay 1 fail-safe operation
on	On	Enable fail-safe operation
FLS 2	Fail-safe 2	Set relays 2-8 fail-safe operation
dELAY	Delay	Enter relay *Time Delay* menu
dLY 1	Delay 1	Enter relay 1 time delay setup
On 1	On 1	Set relay 1 On time delay
OFF 1	Off 1	Set relay 1 Off time delay
dLY 2	Delay 2	Enter relays 2-8 time delay setup
brEAK	Loop break	Set relay condition if loop break detected
iGnorE	Ignore	Ignore loop break condition (Relay remains in the last condition before detecting a break)
On	On	Relay goes to alarm condition when loop break is detected
OFF	Off	Relay goes to non-alarm condition when loop break is detected
Aout	Analog output	Enter the *Analog output* scaling menu
d iS 1	Display 1	Program display 1 value
Out 1	Output 1	Program output 1 value (e.g. 4.000 mA)

Display	Parameter	Action/Setting Description
d iS 2	*Display 2*	Program display 2 value
Out 2	*Output 2*	Program output 2 value (e.g. 20.000 mA)
ProG	*Program*	Enter the *Program* menu
ScALE	*Scale*	Enter the *Scale* menu
CAL	*Calibrate*	Enter the *Calibration* menu
InP 1	*Input 1*	Calibrate input 1 signal or program input 1 value
d iS 1	*Display 1*	Program display 1 value
InP 2	*Input 2*	Calibrate input 2 signal or program input 2 value (up to 32 points)
d iS 2	*Display 2*	Program display 2 value (up to 32 points)
Error	*Error*	Error, calibration not successful, check signal or programmed value
PASS	*Password*	Enter the *Password* menu
PASS 1	*Password 1*	Set or enter Password 1
PASS 2	*Password 2*	Set or enter Password 2
PASS 3	*Password 3*	Set or enter Password 3
unLoc	*Unlocked*	Program password to lock meter
Locd	*Locked*	Enter password to unlock meter
999999 -99999	*Flashing display*	Overrange condition Underrange condition

Main Menu

The main menu consists of the most commonly used functions: *Reset, Control, Setup*, *Program*, and *Password*.

- Press Menu button to enter Programming Mode then press the Up arrow button to scroll main menu.
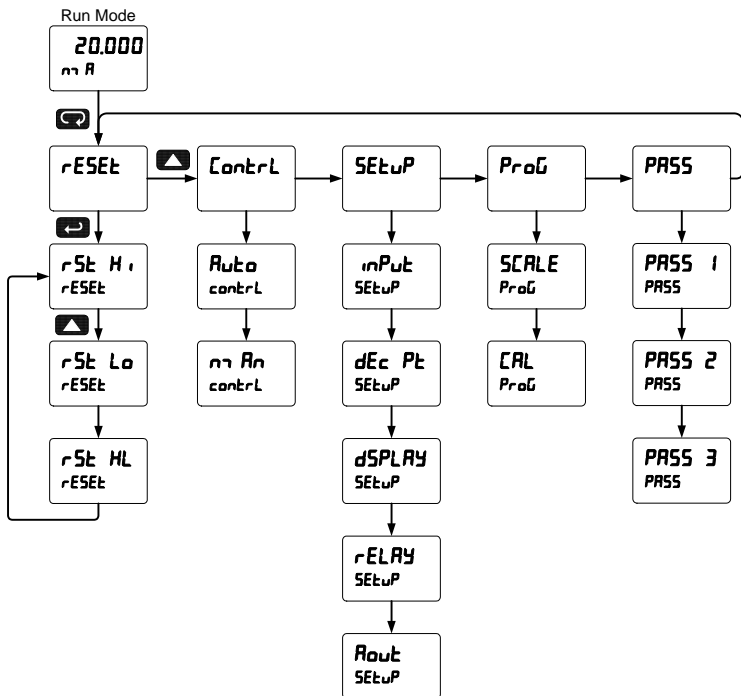
- Press Menu, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing Enter are not saved.
- Changes to the settings are saved to memory only after pressing Enter.
- The display moves to the next menu every time a setting is accepted by pressing Enter.

Setting Numeric Values

The numeric values are set using the Right and Up arrow buttons. Press Right arrow to select next digit and Up arrow to increment digit value.

The digit being changed is displayed brighter than the rest.

Press the Enter button, at any time, to accept a setting or Menu button to exit without saving changes.

| Select Next Digit | Increment Digit Value | Accept Setting |
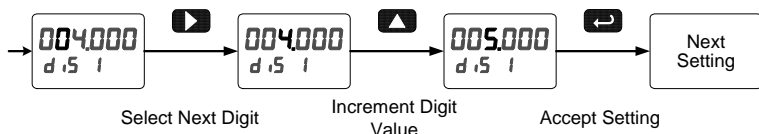
Note: The decimal point is set in the Setup-decimal point menu.

Reset Menu (rESEt)

The *Reset* menu is used to reset the maximum or minimum reading (peak or valley) reached by the process; both may be reset at the same time by selecting "reset high & low" (r5t HL).

Control Menu (Contrl)

The *Control* menu is used to control the 4-20 mA analog output and the relays manually, ignoring the input. Each relay and analog output can be programmed independently for manual control. Selecting automatic control sets all relays and analog output for automatic operation.
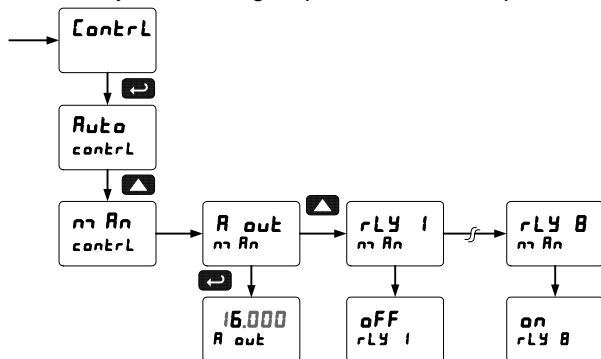
Setting Up the Meter (**SEtuP**)

The *Setup* menu is used to select:

1. Input signal the meter will accept
2. Decimal point position
3. Display parameter and intensity
4. Relay operation
5. 4-20 mA analog output scaling

Press the Enter button to access any menu or press Up arrow button to scroll through choices. Press the Menu button to exit at any time.

SEtuP		
InPut SEtuP	**mA** InPut	**UoLt** InPut
dEc Pt SEtuP	**ddd.ddd** dEc Pt	**dddd.dd** dEc Pt / **ddddd.d** dEc Pt
dSPLAY SEtuP	**bIG** dSPLAY	**LIttLE** dSPLAY / **d-IntY** dSPLAY
rELAY SEtuP	**rLY 1-8** rELAY	**FAILSF** rELAY / **dELAY** rELAY
Aout SEtuP	**dIS 1** Aout	**004.000** dIS 1 / **Out 1** Aout

Press **Enter** to Accept

30
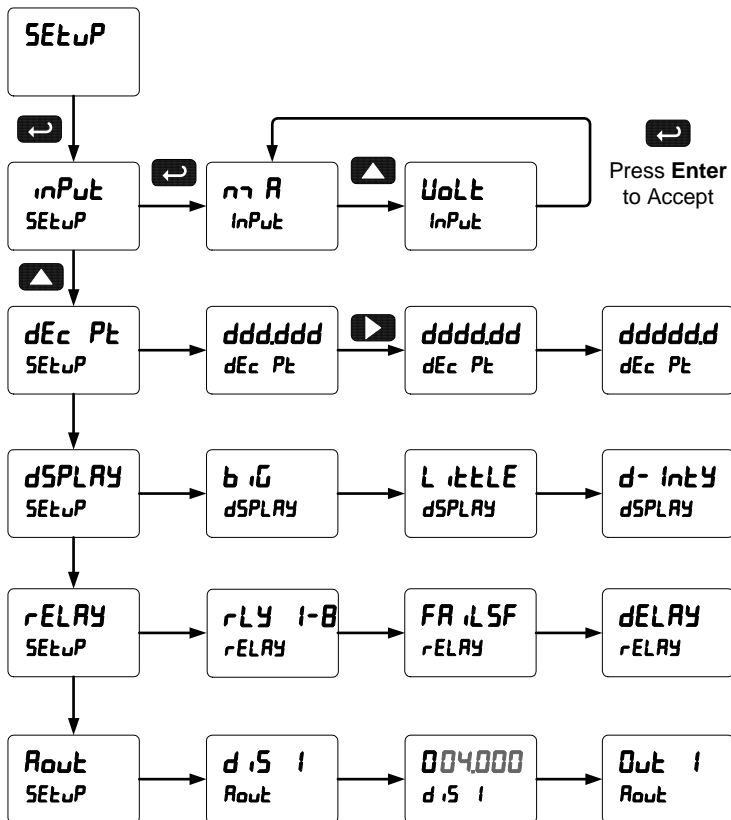
Setting the Input Signal (ꞮₙPᵤₜ)

Enter the *Input* menu to set up the meter to display current (ꞃꞃ A) or voltage (Uₒₗₜ) inputs.

The current input is capable of accepting any signal from 0 to 20 mA. Select current input to accept 0-20 mA or 4-20 mA signals.

The voltage input is capable of accepting any signal from -10 to +10 VDC. Select voltage input to accept 0-5, 1-5, 0-10, or ±10 VDC signals.

Setting the Decimal Point (dEc Pₜ)

The decimal point may be set with up to five decimal places or with no decimal point at all.

Pressing the Right arrow moves the decimal point one place to the right until no decimal point is displayed, then it moves to the leftmost position.

Setting the Display Parameter & Intensity (dₛPLAY)

The main display (b ꞮǕ) can be programmed to display:

1. Process value
2. Relay set points
3. Max & min values

The small display (L ꞮₜₜLE) can be programmed to display:

1. Process value
2. Relay set points
3. Max & min values
4. Engineering units or custom legends
5. Off (no display)

Display Intensity: The meter has eight display intensity levels to give the best performance under various lighting conditions. Select intensity 8 for outdoor applications.

Character Set for Engineering Units Display (*d un it*)

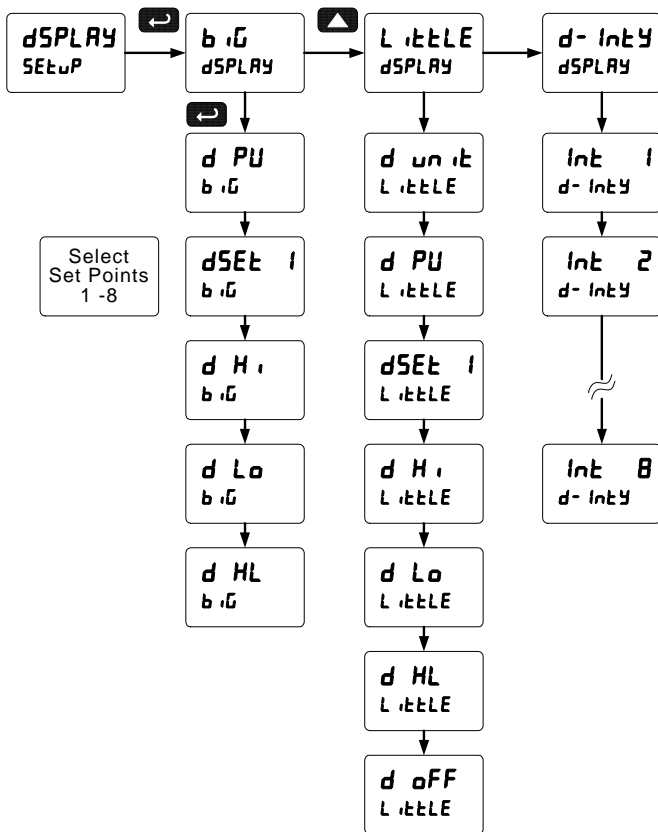The small display can be programmed to show engineering units or custom legends using the following 7-segment character set:

0 123456 789AbCcdEFG9Hh I ιJHL
nOoP9r StuUHY2-ر=[ ]=¬↵°

To create the letter "m" use the characters "*n*" followed by "*ר*" to get "*רn*".
To create the letter "w" use the characters "*u*" followed by "*↵*" to get "*u↵*".
See the flow chart on the next page to access the display units menu.

Display Setup Menu

- Press the Up arrow to change selection
- Press Enter to accept setting
- Press Menu to exit programming

dSPLAY SEtuP	→	b iG dSPLAY	→	L ittLE dSPLAY	→	d- intY dSPLAY

```
        dSPLAY  ⏎→  b iG    ▲→  L ittLE  →  d- intY
        SEtuP       dSPLAY      dSPLAY       dSPLAY
                      │ ⏎          │            │
                      ▼            ▼            ▼
                    d PU        d un it      int  1
                    b iG        L ittLE      d- intY
                      │            │            │
    ┌─────────┐       ▼            ▼            ▼
    │ Select  │     dSEt 1       d PU        int  2
    │Set Points│     b iG        L ittLE      d- intY
    │  1 -8   │       │            │            │
    └─────────┘       ▼            ▼            ≈
                    d H i       dSEt 1          │
                    b iG        L ittLE         ▼
                      │            │          int  8
                      ▼            ▼          d- intY
                    d Lo        d H i
                    b iG        L ittLE
                      │            │
                      ▼            ▼
                    d HL        d Lo
                    b iG        L ittLE
                                   │
                                   ▼
                                 d HL
                                 L ittLE
                                   │
                                   ▼
                                 d oFF
                                 L ittLE
```

After setting up the input and display, press the Menu button to exit programming and skip the rest of the setup menu. Press the Menu button again and the Up arrow to reach the *Program* menu and complete the scaling or calibration of the meter.
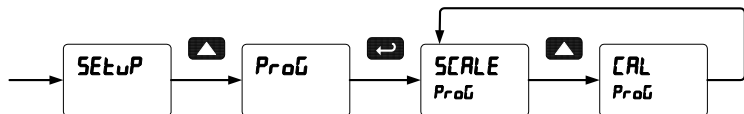
Programming the Meter (ProG)

It is **very important** to read the following information, before proceeding to program the meter:

- The meter is factory calibrated prior to shipment to read in milliamps and volts depending on the input selection. The calibration equipment is certified to NIST standards.

- Use the *Scale* menu to scale the process inputs (e.g. 4-20 mA). A calibrated signal source is not needed to scale the meter.

The *Program* menu contains the *Scale* and the *Calibrate* menus.

The process inputs may be calibrated or scaled to any display value within the range of the meter.

Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu; see *Advanced Features Menu*, page 52.

Multi-Point Calibration & Scaling

The meter is set up at the factory for 2-point linear calibration. The number of points for multi-point calibration/scaling is set up in the *Advanced Features* menu. Up to 32 linearization points may be selected. See page 58 for details.

### Multi-Point Linearization Utility

The meter can be programmed for multi-point scaling using the PC-based Multi-Point Linearization Utility available for free download at www.predig.com.

In order to program the meter using a computer, the meter must be connected using an RS-232 or RS-485 serial adapter, see ORDERING INFORMATION on page 3 for details.

Scaling the Meter (SCALE)

The process inputs (4-20 mA and ±10 VDC) can be scaled to display the process variable in engineering units.

A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.
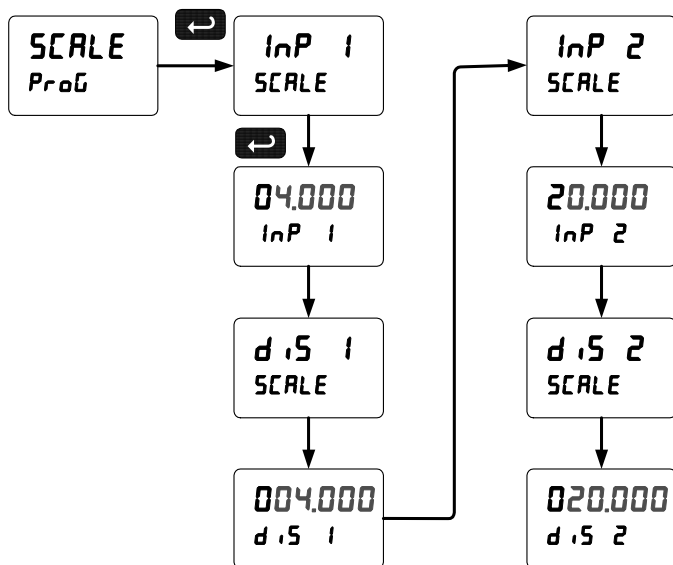
For instructions on how to program numeric values see *Setting Numeric Values*, page 29.

Error Message (Error)

An error message indicates that the calibration or scaling process was not successful.

After the error message is displayed, the meter reverts to input 2 during calibration or scaling and to input 1 during internal calibration, allowing the appropriate input signal to be applied or programmed.

The error message might be caused by any of the following conditions:

1. Input signal is not connected to the proper terminals or it is connected backwards.
2. Wrong signal selection in *Setup* menu.
3. Minimum input span requirements not maintained.
4. Input 1 signal inadvertently applied to calibrate input 2.

Minimum Input Span

The minimum input span is the minimum difference between input 1 and input 2 signals required to complete the calibration or scaling of the meter.

Input range	Input 1 & input 2 span
4-20 mA	0.15 mA
$\pm$10 VDC	0.10 VDC

Calibrating the Meter with External Source (*CAL*)

> To scale the meter without a signal
> source refer to Scaling the Meter
> (*SCALE*), page 35.

The meter can be calibrated to display the process variable in engineering units by applying the appropriate input signal and following the calibration procedure.

The use of a calibrated signal source is strongly recommended to calibrate the meter.
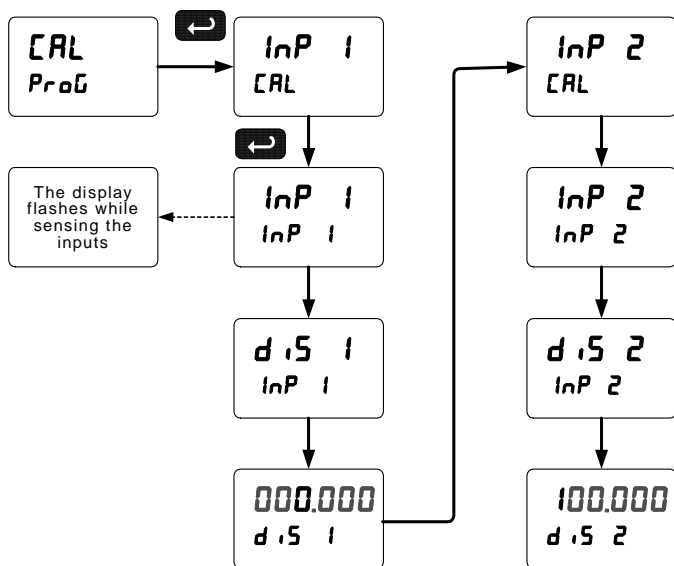
> *Warm up the meter for at least 15 minutes*
> *before performing calibration to ensure*
> *specified accuracy.*

Setting the Relay Operation (rELAY)

This menu is used to set up the operation of the relays.

CAUTION! During setup, the relays do not follow the input and they will remain in the state found prior to entering the Relay menu.

1. Relay action
   a. Automatic reset only (non-latching)
   b. Automatic + manual reset at any time (non-latching)
   c. Latching (manual reset only)
   d. Latching with Clear (manual reset only after alarm condition has cleared)
   e. Pump alternation control (automatic reset only)
   f. Sampling (the relay is activated for a user-specified time)
   g. Off (relay and status LED disabled)
2. Set point
3. Reset point
4. Fail-safe operation

   > Refer to page 25 for a description of *Display Functions and Messages*

   a. On (enabled)
   b. Off (disabled)
5. Time delay
   a. On delay (0-999.9 seconds)
   b. Off delay (0-999.9 seconds)
6. Relay action for loss (break) of 4-20 mA input (ignore, on, off)

Note: The setup of relays 2-8 follows the same pattern shown here for relay 1.
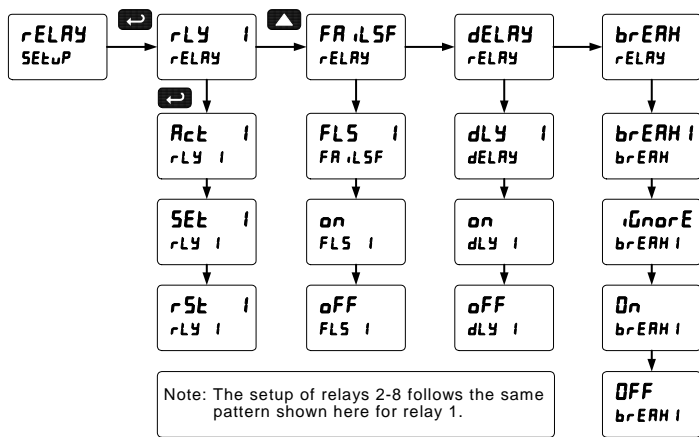
Setting the Relay Action

Operation of the relays is programmed in the *Action* menu. The relays may be set up for any of the following modes of operation:

1. Automatic reset (non-latching)
2. Automatic + manual reset at any time (non-latching)
3. Latching (manual reset only, at any time)
4. Latching with Clear (manual reset only after alarm condition has cleared)
5. Pump alternation control (automatic reset only)
6. Sampling (the relay is activated for a user-specified time)
7. Off (relay and status LED disabled)

The following graphic shows relay 1 action setup; relay 2-8 are set up in a similar fashion.
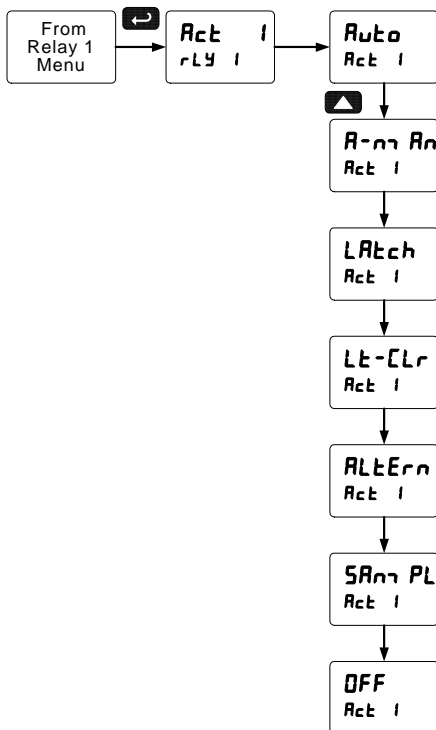
Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

The deadband is determined by the difference between set and reset points. Minimum deadband is one display count. If the set and reset points are programmed with the same value, the relay will reset one count below the set point.
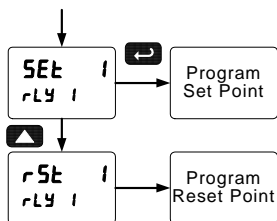
Setting Fail-Safe Operation

In fail-safe mode of operation, the relay coil is energized when the process variable is within safe limits and the relay coil is de-energized when the alarm condition exists. The fail-safe operation is set independently for each relay. Select **on** to enable or select **oFF** to disable fail-safe operation.

Programming Time Delay

The *On* and *Off* time delays may be programmed for each relay between 0 and 999.9 seconds. The relays will transfer only after the condition has been maintained for the corresponding time delay.

The *On* time delay is associated with the set point.

The *Off* time delay is associated with the reset point.

### Relay Action for Loss of 4-20 mA Input (Loop Break)

The loop break feature is associated with the 4-20 mA input. Each relay may be programmed to go to one of the following conditions when the meter detects the loss of the input signal (i.e. < 0.005 mA):

1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
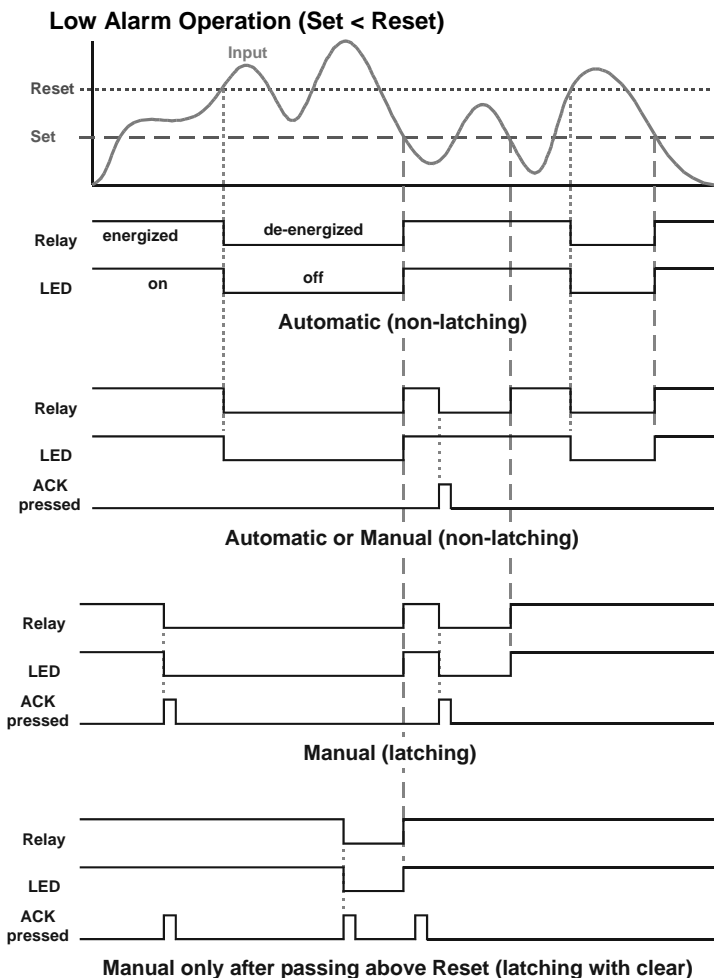3. Ignore (Remain in the last condition before detecting a break)

Note: This is not a true loop break condition; if the signal drops below 0.005 mA, it is interpreted as a "loop break" condition.

Relay and Alarm Operation

The following graphs illustrate the operation of the relays, status LEDs, and ACK button.
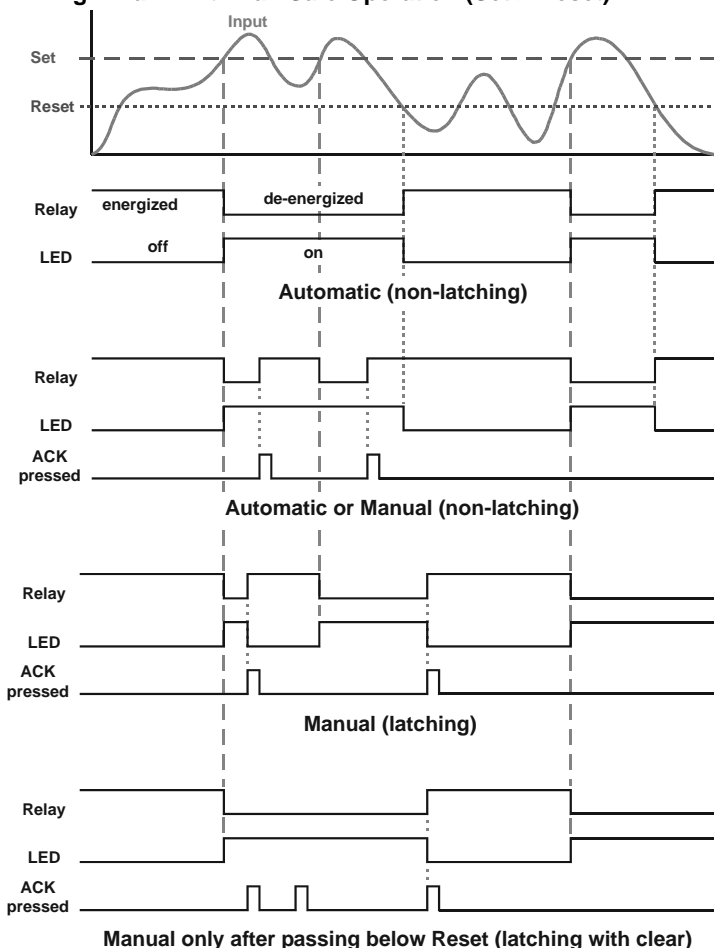
High Alarm Operation (Set > Reset)
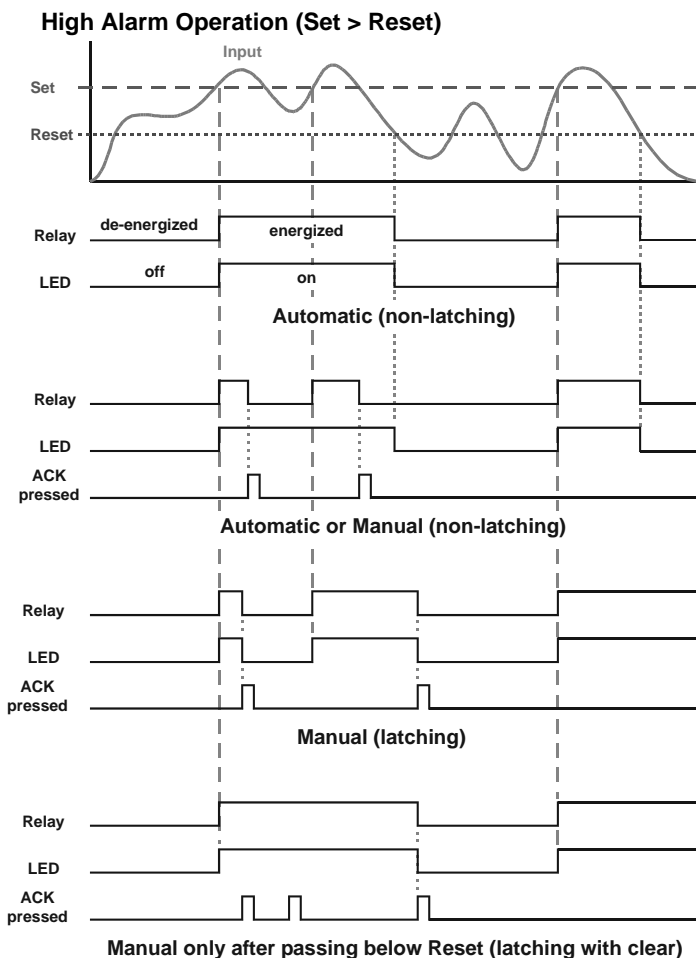
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

Low Alarm Operation (Set < Reset)

Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

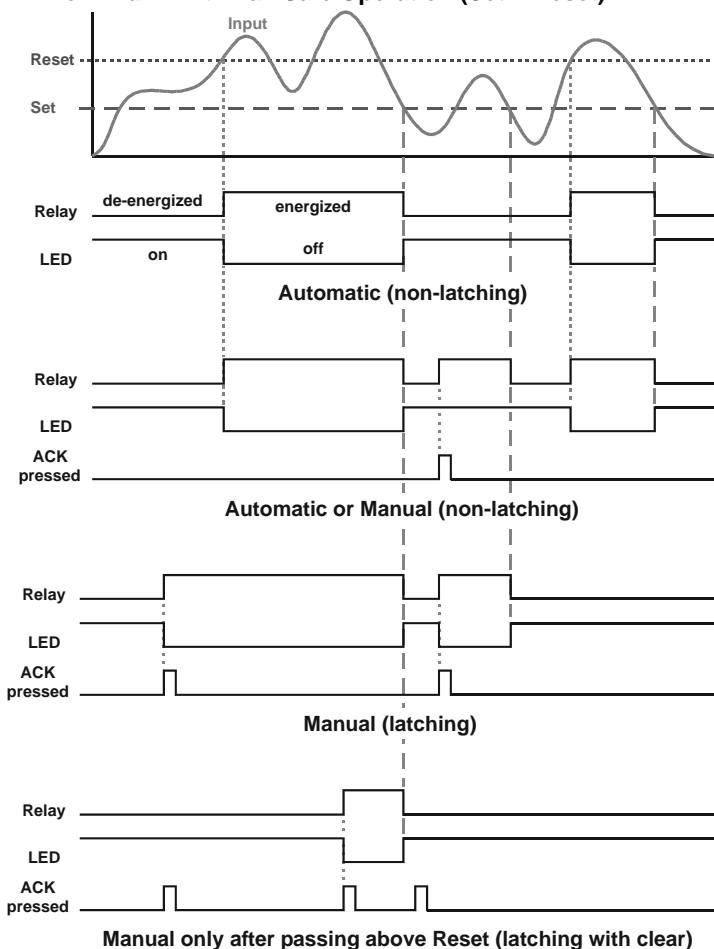**Manual only after passing above Reset (latching with clear)**

For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point, and then go below it.

High Alarm with Fail-Safe Operation (Set > Reset)

Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing below Reset (latching with clear)

Note: Relay coil is energized in non-alarm condition.
In case of power failure, relay will go to alarm state.

Low Alarm with Fail-Safe Operation (Set < Reset)

Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

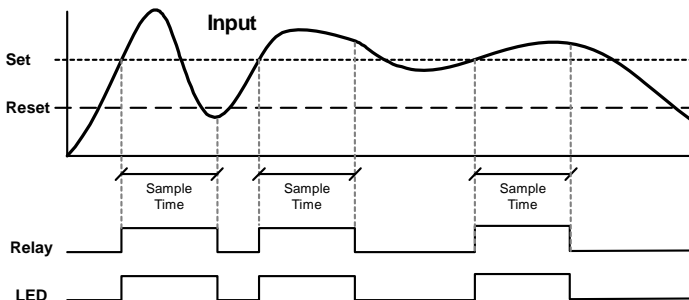**Manual only after passing above Reset (latching with clear)**

Note: Relay coil is energized in non-alarm condition.
In case of power failure, relay will go to alarm state.

**Pump Alternation Control Operation**
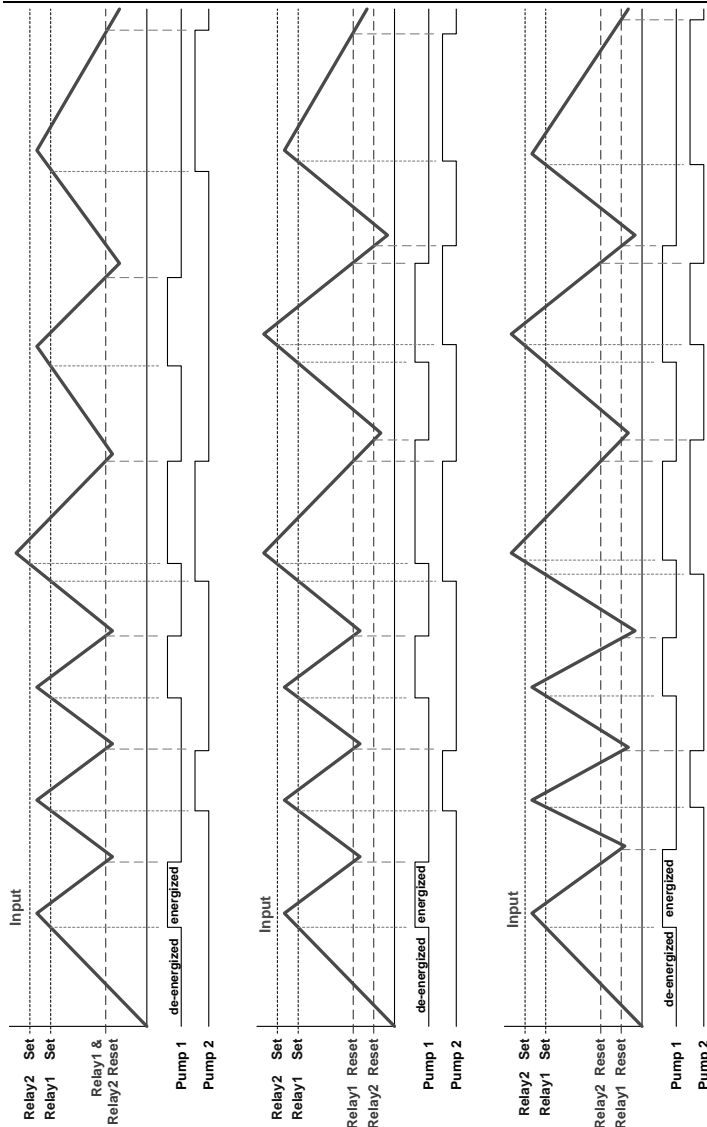
LEDs indicate the relay status

Relay Sampling Operation

When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

Signal Loss or Loop Break Relay Operation
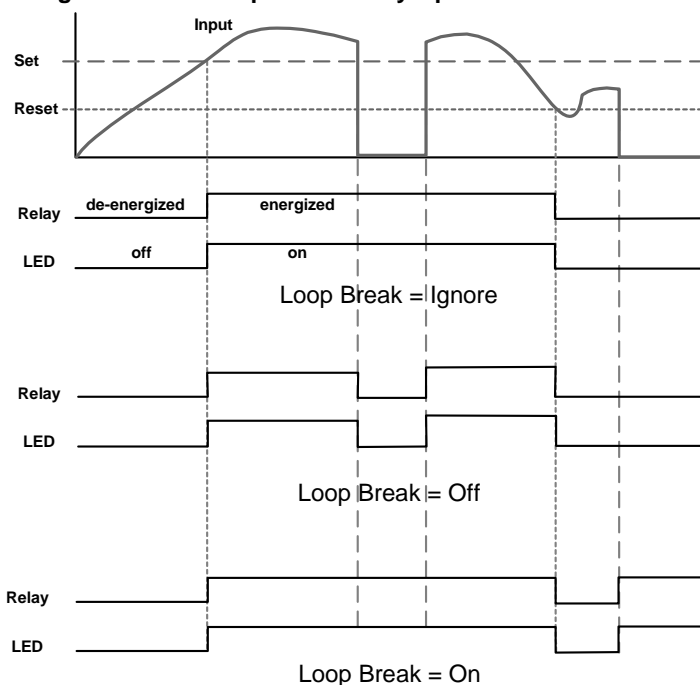
When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
3. Ignore (Remain in the last condition before detecting a break)

Time Delay Operation

The following graphs show the operation of the time delay function.

On Time Delay
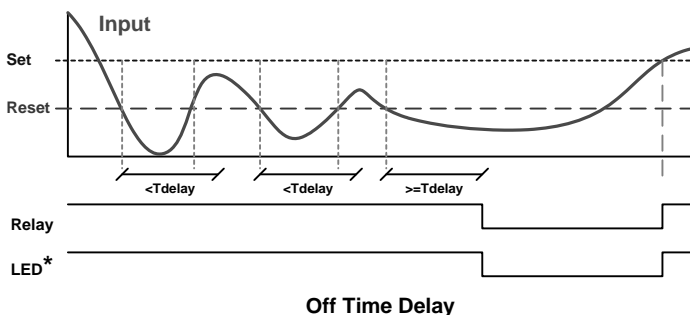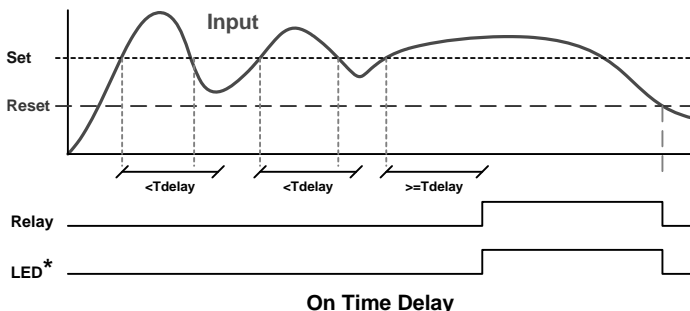
Off Time Delay

When the signal crosses the set point, the *On* time delay timer starts and the relay trips when the time delay has elapsed. If the signal drops below the set point (high alarm) before the time delay has elapsed, the *On* time delay timer resets and the relay does not change state. The same principle applies to the *Off* time delay.

* Note: The LED is not affected by the time delay when *"Automatic or Manual"* reset mode is selected. Rather the LED follows the set and reset points.

Scaling the 4-20 mA Analog Output (*Rout*)

The 4-20 mA analog output can be scaled to provide a 4-20 mA signal for any display range selected.

No equipment is needed to scale the analog output; simply program the display values to the corresponding mA output signal.

The *Analog Output* menu is used to program the 4-20 mA output based on display values.
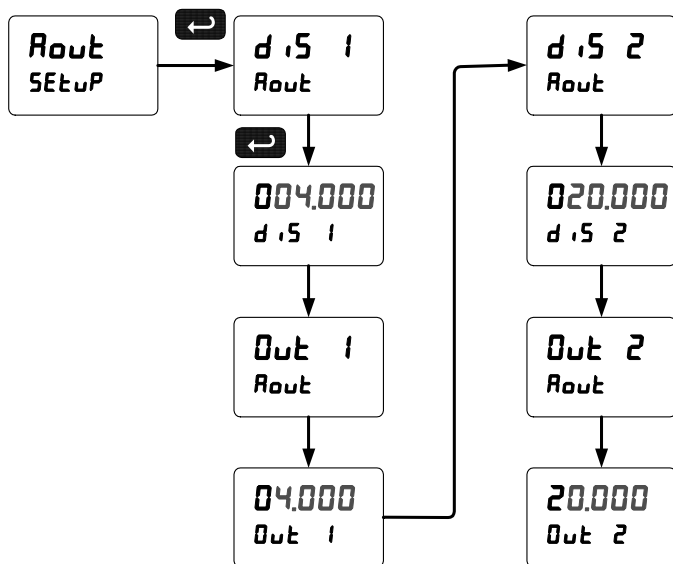
For instructions on how to program numeric values see *Setting Numeric Values*, page 29.

Setting Up the Password (*PASS*)

The *Password* menu is used for programming three levels of security to prevent unauthorized changes to the programmed parameter settings.

Pass 1: Allows use of the F1–F3 function keys
Pass 2: Allows use of the F1–F3 function keys and changing the set/reset points
Pass 3: Restricts all programming and F1–F3 keys

Note: Digital inputs are not password protected

Protecting or Locking the Meter

Enter the *Password* menu and program a six-digit password.

For instructions on how to program numeric values see *Setting Numeric Values*, page 29.
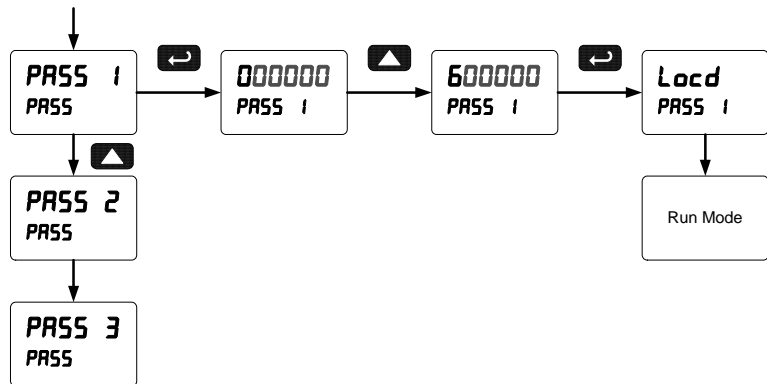
Record the password for future reference. If appropriate, it may be recorded in the space provided.

Model:	
Serial Number:	
Password 1:	__ __ __ __ __ __
Password 2:	__ __ __ __ __ __
Password 3:	__ __ __ __ __ __

Making Changes to a Password Protected Meter

If the meter is password protected, the meter will display the message
Locd (*Locked*) when the Menu button is pressed. Press the Enter button
while the message is being displayed and enter the correct password to
gain access to the menu. After exiting the programming mode, the me-
ter returns to its password protected condition.

Disabling Password Protection

To disable the password protection, access the *Password* menu and
enter the correct password twice, as shown below. The meter is now
unprotected until a new password is entered.

Run Mode
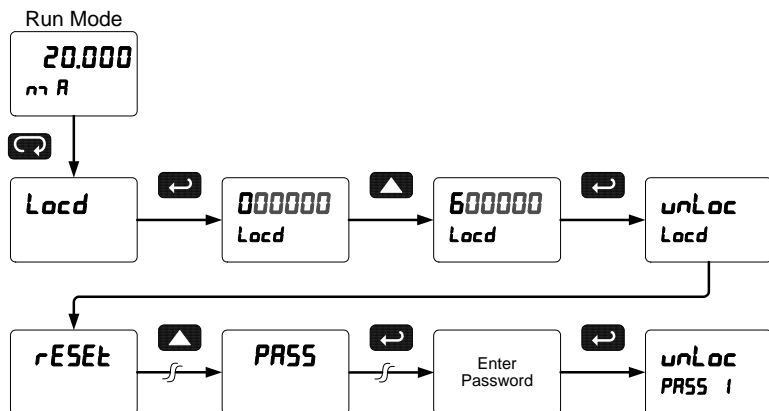
If the correct six-digit password is entered, the meter displays the mes-
sage unLoc (*unlocked*) and the protection is disabled until a new pass-
word is programmed.

If the password entered is incorrect, the meter displays the message
Locd (Locked) for about two seconds, and then it returns to Run Mode.
To try again, press Enter while the *Locked* message is displayed.

Did you forget the password?

The password may be disabled by entering a master
password. If you are authorized to make changes, enter
the master password 508655 to unlock the meter.

Advanced Features Menu

To simplify the setup process, functions not needed for most applications are located in the *Advanced Features* menu.

Press and hold the Menu button for three seconds to access the advanced features of the meter.
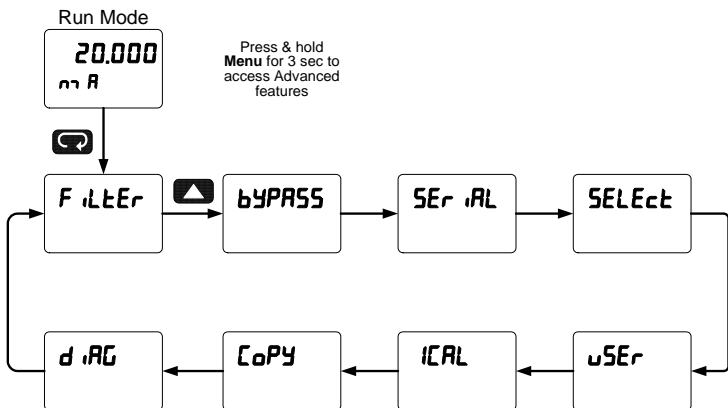
Advanced Features Menu & Display Messages

The following table shows the functions and messages of the *Advanced Features* menu in the order they appear in the menu.

Display	Parameter	Action/Setting
F iLtr	*Filter*	Set noise filter value
bYPRSS	*Bypass*	Set filter bypass value
SEr iRL	*Serial*	Set serial communication parameters
RddrES	*Address*	Set meter address
bRud	*Baud rate*	Select baud rate
tr dLY	*Transmit delay*	Set transmit delay for serial communication
SELEct	*Select*	Enter the Select menu (function, cutoff, out)
Functn	*Math Function*	Select linear, square root, programmable exponent, or round horizontal tank function
L inERr	*Linear*	Set meter for linear function and select number of linearization points
no PtS	*Number of points*	Set meter for 2 to 32-point linearization
SquRrE	*Square root*	Set meter for square root extraction
ProG E	*Programmable exponent*	Set meter for programmable exponent and enter exponent value
rht	*Round horizon-tal tank*	Set meter for round horizontal tank volume calculation
d iRn⌐ r	*Diameter*	Enter the tank's diameter in inches
LEnGth	*Length*	Enter the tank's length in inches
CutoFF	*Cutoff*	Set low-flow cutoff
RoutPr	*Analog output programming*	Program analog output parameters
SourcE	*Source*	Select source for the 4-20 mA output
0-rRnG	*Overrange*	Program mA output for display overrange
u-rRnG	*Underrange*	Program mA output for display underrange
n⌐ RH	*Maximum*	Program maximum mA output allowed
n⌐ in	*Minimum*	Program minimum mA output allowed

Display	Parameter	Action/Setting
CAL ib	*Calibrate*	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 mᴧ A	*4 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 mᴧ A	*20 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
uSEr	*User I/O*	Assign function keys and digital I/O
F 1	*F1 function key*	Assign F1 function key
F2	*F2 function key*	Assign F2 function key
F3	*F3 function key*	Assign F3 function key
LL 1 1	*Logic level input 1*	Assign logic level input 1 – 8, if expansion modules are connected
LL O 1	*Logic level output 1*	Assign logic level output 1 – 8, if expansion modules are connected
ICRL	*Internal source calibration*	Enter internal source calibration (used for scaling the meter without a signal source)
C CAL	*Current calibration*	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
C Lo	*Current low*	Calibrate low current input (e.g. 4 mA)
C H ı	*Current high*	Calibrate high current input (e.g. 20 mA)
U CAL	*Voltage calibration*	Calibrate voltage input
U Lo	*Voltage low*	Calibrate low voltage input (e.g. 0 V)
U H ı	*Voltage high*	Calibrate high voltage input (e.g. 10 V)
CoPY	*Copy*	Enter copy function
SEnd	*Send*	Send meter settings to another meter
donE	*Done*	Copy function completed
d ıAG	*Diagnostics*	Display parameter settings
InPut	*Input*	Input selection
Functn	*Function*	Function selected
SCRLE	*Scale*	Scaling parameter
CutoFF	*Cutoff*	Cutoff value

Display	Parameter	Action/Setting
dSPLAY	*Display*	Display assignments
rELAY	*Relays*	Relay settings
Rout	*Analog output*	Analog output scaling
RoutPr	*Analog output programming*	Analog output programming
SEr iAL	*Serial*	Serial communication settings
LEd t	*LED test*	Test all LEDs
inFo	*Information*	Display software and S/N information

Noise Filter (F iLtEr)

The noise filter is available for unusually noisy signals that cause an unstable process variable display. The noise filter averages the input signal over a certain period. The filter level determines the length of time over which the signal is averaged. The filter level can be set between 2 and 199. The higher the filter level, the longer the averaging time and so the longer it takes the display to settle to its final value. Setting the filter level to zero disables the filter function.

Noise Filter Bypass (bYPASS)

The noise filter bypass changes the behavior of the meter so that small variations in the signal are filtered out but large abrupt changes in the input signal are displayed immediately. The bypass value determines the minimum amount of signal change to be displayed immediately. All signal changes smaller than the bypass value are filtered or averaged by the meter. The noise filter bypass may be set between 0.1 and 99.9% of full scale.

Serial Communications (SErıRL)

The meter is equipped with serial communications capability as a standard feature using PDC Serial Communication Protocol.

To communicate with a computer or other data terminal equipment, an RS-232 or RS-422/485 adapter option is required; see *Ordering Information* on page 3 for details.

Note: More detailed instructions are provided with each optional serial communications adapter.
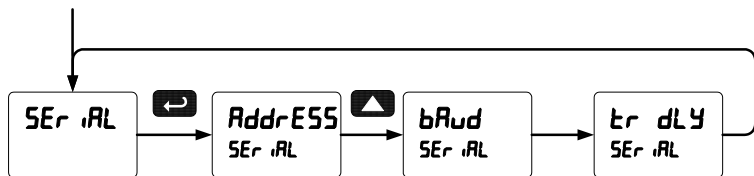

When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The address may be programmed from 1 to 247. The transmit delay may be set between 0 and 199 ms.

The PD6000 can also be connected to another PD6000 allowing the user to copy all the settings from one meter to another, using the *Copy* function.

Select Menu (SELEct)

The *Select* menu is used to select the math function applied to the input (linear, square root, programmable exponent, or round horizontal tank), low-flow cutoff, and analog output programming. The multi-point linearization is part of the linear function selection.
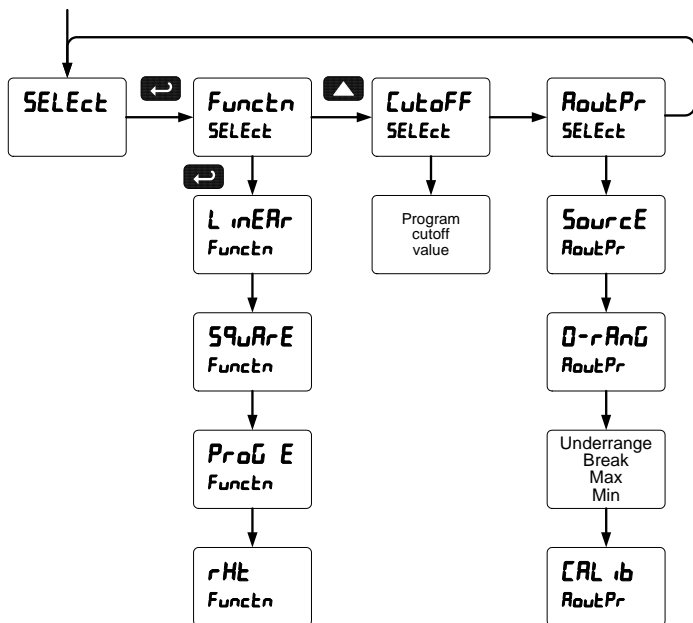
Math Function Selection (Functn)

The *Function* menu is used to select the math function applied to the input: linear, square root, programmable exponent, or round horizontal tank volume calculation. The multi-point linearization is part of the linear function selection.

Meters are set up at the factory for linear function with 2-point linearization. The linear function provides a display that is linear with respect to the input signal.

Up to 32 linearization points can be selected under the linear function. The multi-point linearization can be used to linearize the display for non-

linear signals such as those from level transmitters used to measure volume in odd-shaped tanks.

The square root function can be used to linearize the signal from a differential pressure transmitter and display flow rate in engineering units.

The programmable exponent can be used to linearize the signal from level transmitters in open-channel flow applications using weirs and flumes.

The round horizontal tank function is used to calculate the volume using the signal from a level transmitter and entering the length and diameter of the tank.

### Multi-Point Linearization (L inERr)

Meters are set up at the factory for linear function with 2-point linearization. Up to 32 linearization points can be selected under the linear function.
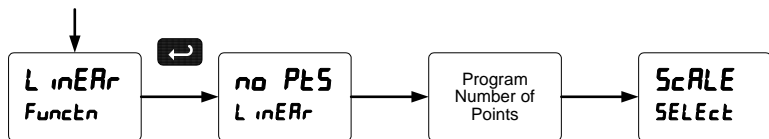
Round Horizontal Tank Linearization (rHt)

This function automatically calculates the volume in a round horizontal tank with flat ends. Enter the diameter and the length in inches and the results are given in US gallons.

The meter can be scaled to display the volume in any engineering unit.

Set the display for the desired decimal point and engineering units before entering the round horizontal tank function.
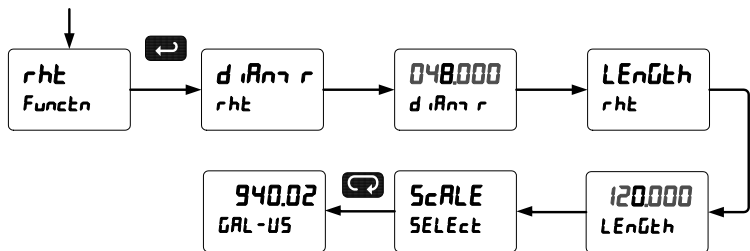
Low-Flow Cutoff (`CutoFF`)

The low-flow cutoff feature allows the meter to be programmed so that the often-unsteady output from a differential pressure transmitter, at low flow rates, always displays zero on the meter.

The cutoff value may be programmed from 0 to 999999. The meter will display zero below the cutoff value. Programming the cutoff value to zero disables the cutoff feature.

Analog Output Programming (`RoutPr`)

The *Analog Output Programming* menu is used to program the behavior of the 4-20 mA output. The following parameters and functions are programmed in this menu:

1. Source: Source for generating the 4-20 mA output (e.g. PV)
2. Overrange: Analog output value with display in overrange condition
3. Underrange: Analog output value with display in underrange condition
4. Break: Analog output value when loop break is detected
5. Max: Maximum analog output value allowed regardless of input
6. Min: Minimum analog output value allowed regardless of input
7. Calibrate: Calibrate the internal 4-20 mA source reference used to scale the 4-20 mA output

Analog Output Source

The source for generating the 4-20 mA output may be assigned to the process variable, maximum or minimum value reached by the process, or one of the set points.
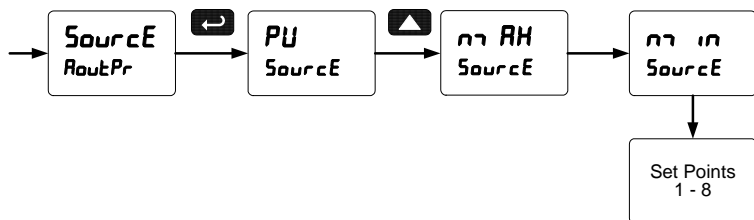

Analog Output Calibration

To perform the analog output calibration it's recommended to use a milliamp meter with a resolution of at least 0.1 µA to measure the output current. The values saved internally during this procedure are used for scaling the 4-20 mA output in the *Setup* menu.

Programmable Function Keys User Menu (𝗎𝖲𝖤𝗋)

The *User* menu allows the user to assign the front panel function keys F1, F2, F3 and up to eight digital inputs to access most of the menus or to activate functions immediately (e.g. Reset max & min). Up to eight digital outputs can be assigned to a number of actions and functions executed by the meter (e.g. Alarms, relay acknowledgement, etc.).
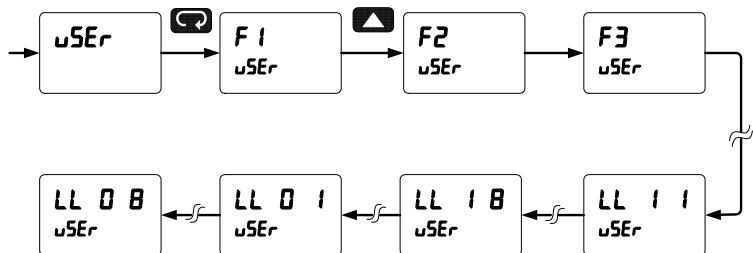
Function Keys & Digital I/O Available Settings

Display	Description	Display	Description
AcH	Acknowledge relays	b iG Lo	Min on big display
rESEt	Reset menu	b iG HL	Max/min big display
rSt H i	Reset max	L ittLE	Little display menu
rSt Lo	Reset min	L it H i	Max on little display
rSt HL	Reset max & min	L it Lo	Min on little display
rELAY	Relay menu	L it HL	Max/min little display
SEt 1	Set point 1 - 8	d iSAbL	Disable function key
rLY d	Disable all relays	n7 Enu	Menu button
rLY E	Enable all relays	r iGht	Right arrow button
O HoLd	Relays output hold	uP	Up arrow button
dSPLAY	Display menu	EntEr	Enter button
b iG	Big display menu	ALn7 1	Alarm 1 – 8
b iG H i	Max on big display		

Internal Source Calibration (*ICAL*)

> - The meter is factory calibrated prior to shipment to read in milliamps and volts depending on the input selection. The calibration equipment is certified to NIST standards.

The internal source allows the user to scale the meter without applying a signal.

The use of calibrated signal sources is necessary to perform the internal source calibration of the meter.

Check calibration of the meter at least every 12 months. Each input must be recalibrated separately.

> Notes:
> - If meter is in operation and it is intended to accept only one input type (e.g. 4-20 mA), recalibration of other input is not necessary.
> - Allow the meter to warm up for at least 15 minutes before performing the internal source calibration procedure.

The *Internal calibration* menu is part of the *Advanced Features* menu.

1. Press and hold the Menu button for three seconds to access the advanced features of the meter.
2. Press the Up arrow button to scroll to the *Internal calibration* menu (*ICAL*) and press Enter.
3. The meter displays either current calibration (*C CAL*) or voltage calibration (*U CAL*), according to the input setup. Press Enter to start the calibration process.

Example of *Internal Calibration* for current input:

4. The meter displays *low* input current message (Ɛ Lo). Apply the low input signal and press Enter. The display flashes for a moment while the meter is accepting the low input signal.

5. After the display stops flashing, a number is displayed with the leftmost digit brighter than the rest. The bright digit is the active digit that can be changed by pressing the Up arrow button. Press the Right arrow button to move to the next digit.

6. Set the display value to correspond to the input signal being calibrated, typically 4.000 mA.

7. The display moves to the *high* input calibration (Ɛ Hı). Apply the high input signal and press Enter.

8. Set the display for the high input calibration, in the same way as it was set for the low input calibration, typically 20.000 mA.

> For instructions on how to program numeric values see *Setting Numeric Values,* page 29.
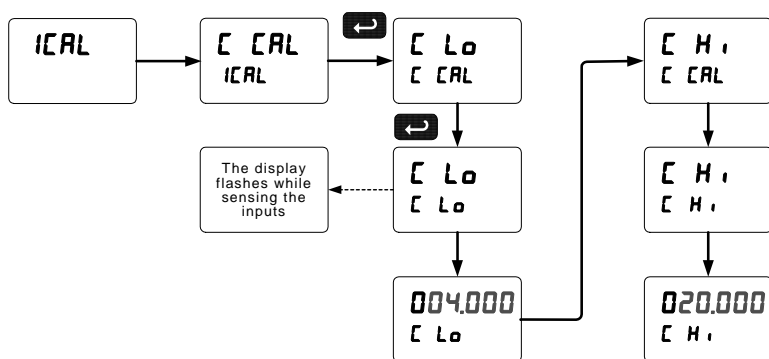
The graphic above shows the calibration of the current input. The voltage input is calibrated in a similar way.

Tips:

- Low and high input signals can be any valid values within the range of the meter.
- Observe minimum input span requirements between input 1 and input 2.
- Low input should be less than high input signal.

Error Message (Error)

An error message indicates that the calibration or scaling process was not successful.

After the error message is displayed, the meter reverts to input 2 during calibration or scaling and to input 1 during internal calibration, allowing the appropriate input signal to be applied or programmed.

The error message might be caused by any of the following conditions:

1. Input signal is not connected to the proper terminals, or it is connected backwards.
2. Wrong signal selection in *Setup* menu.
3. Minimum input span requirements not maintained.

Minimum Input Span

The minimum input span is the minimum difference between input 1 and input 2 signals required to complete the calibration or scaling of the meter.

Input range	Input 1 & input 2 span
4-20 mA	0.15 mA
$\pm$10 VDC	0.10 VDC

Meter Copy Function (ᴄₒᴘꙨ)

The *Copy* function is used to copy (or clone) all the settings from one meter to other meters requiring exactly the same setup and programming (*i.e.* type of input, scaling, decimal point, filter, bypass, etc.).

⚠️ **Warning!**

Only the PDA1200 meter copy cable must be used for meter-to-meter interfacing. The PDA1200 is a special eight-conductor flat cable with two wires swapped.

Using standard CAT5 or other cable will cause damage to both meters.
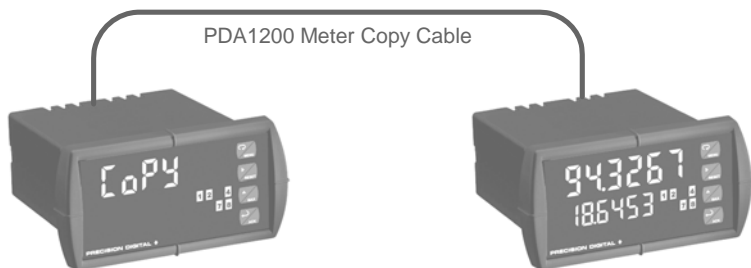

PDA1200 Meter Copy Cable

Figure 17. Meter Copy Connection

Copy Function Requirements

To successfully copy settings from one meter to another, both meters must have:
1. *Same software version*
2. *Same baud rate setting*

See *Determining Software Version*, page 69 for instructions.

Meter Copy or Cloning Instructions

> ⚠ **Caution!** *Do not connect the two meters to the same signal source while cloning. Internal calibration may be affected.*

1. Connect two meters using a PDA1200 meter copy cable.

⚡ **Warning!**
Using standard CAT5 or other cable will cause damage to both meters.

2. Do not connect the two meters to the same signal source.
3. Power up both meters. Leave Clone meter in Run Mode.
4. Enter the *Advanced Features* menu of the Master meter; see *Advanced Features Menu* on page 52.
5. Scroll to the *Copy* function using the Up arrow button then press Enter.
6. The meter displays the message 5End. Press Enter, the display flashes while sending data. The message donE is displayed when copying is completed.
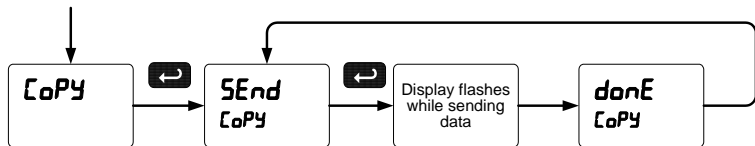
7. The Clone meter displays the message CPY rC while being programmed then the message donE when copying is completed. The meter initializes and returns to Run Mode using the same settings as the Master.
8. If meter to be cloned does not respond to the data being sent, refer to **Copy Function Requirements** above.

OPERATION

The meter is capable of accepting current and voltage signals and displaying these signals in engineering units from -99999 to 999999 (*e.g.* a 4-20 mA signal could be displayed as -50.000 to 50.000).

Front Panel Buttons Operation

Button Symbol	Description
MENU	Press to enter or exit Programming Mode, view settings, or exit max/min readings
F1	Press to reset max/min readings or other parameter/function assigned through the *User* menu
F2	Press to display max/min readings or other parameter/function assigned through the *User* menu
F3	Press to acknowledge relays or other parameters/function assigned through the *User* menu

Maximum/Minimum Readings

The max & min readings (peak & valley) reached by the process can be displayed either continuously or momentary:

1. Display briefly by assigning to the F1-F3 function keys or to the digital inputs in the *User* menu.
2. Display continuously by assigning either display to max/min through the *Display* menu.

Any of the F1-F3 function keys (buttons) and the digital inputs can be programmed to reset the max & min readings. The meters are set at the factory to display the max reading by pressing the Up arrow/F2 button and to use the Right arrow/F1 button to access the *Reset* menu.

To display max reading using function key with factory defaults:

1. Press Up arrow/F2 button to display maximum reading since the last reset/power-up.
2. To reset max/min press Right arrow/F1 button to access the Reset menu. The max & min displays are reset to actual values.
3. Press Menu to exit max/min display reading.

To display max/min readings continuously:

Assign either display to Max (d H ı), Min (d Lo), or toggle between Max and Min (d HL).
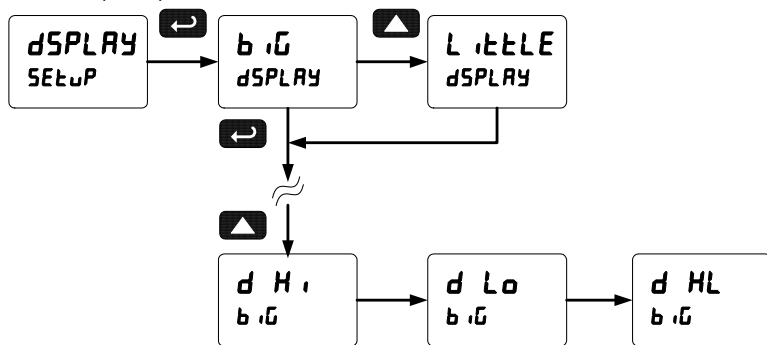
MOUNTING DIMENSIONS

Figure 18. Meter Dimensions - Side View

Figure 19. Meter Dimensions - Top View

TROUBLESHOOTING

The rugged design and the user-friendly interface of the meter should make it unusual for the installer or operator to refer to this section of the manual. However, due to the many features and functions of the meter, it's possible that the setup of the meter does not agree with what an operator expects to see.
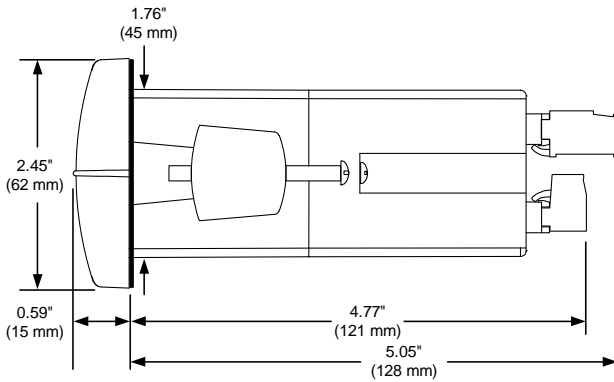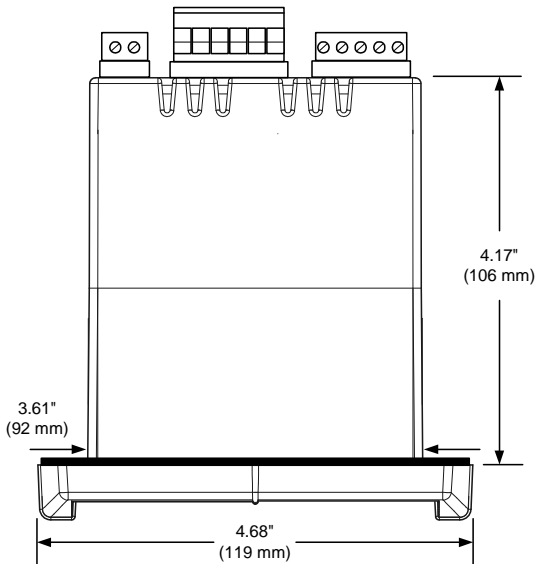
If the meter is not working as expected, refer to the *Diagnostics* menu and recommendations below.

Diagnostics **Menu (d ıRG)**

The *Diagnostics* menu is located in the *Advanced Features* menu, to access *Diagnostics* menu see *Advanced Features Menu*, page 52.

It provides an easy way to view the programmed parameter settings for troubleshooting purposes. Press the Enter button to view the settings and the Menu button to exit at any time.

For a description of the diagnostic messages, *see Advanced Features Menu &* Display Messages, page 53.

Determining Software Version

To determine the software version of a meter:

1. Go to the *Diagnostics* menu (d ıRG) and press Enter button.
2. Press Up arrow button and scroll to Information menu (ınFo).
3. Press Enter to access the software number (SFt), version (UEr), and serial number (Sn) information. Write down the information as it is displayed. Continue pressing Enter until all the information is displayed.
4. The meter returns to Run Mode after displaying all the settings.

Reset Meter to Factory Defaults

When the parameters have been changed in a way that is difficult to determine what's happening, it might be better to start the setup process from the factory defaults.

Instructions to load factory defaults:

1. Enter the *Advanced Features* menu. See *Advanced Features Menu*, page 52.
2. Press Up arrow to go to *Diagnostics* menu
3. Press and hold Right arrow for five seconds, press Enter when display flashes rESEt.
    Note: If Enter is not pressed within three seconds, the display returns to the *Diagnostics* menu.
4. The meter goes through an initialization sequence (similar as on power-up), and loads the factory default settings.

Run Mode

Press & hold Menu for 3 sec to access Advanced features

Press & hold right arrow for 3 sec to reset meter
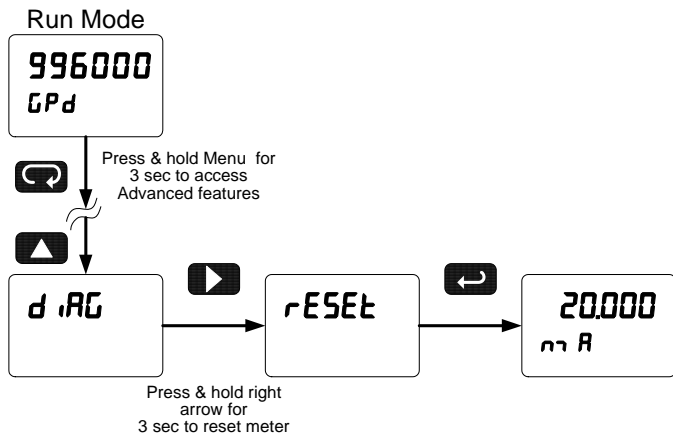
Factory Defaults & User Settings

The following table shows the factory setting for most of the programmable parameters on the meter. Next to the factory setting, the user may record the new setting for the particular application.

Model: _____   S/N: _____   Date: _____

Parameter	Display	Default Setting	User Setting
Input type	*inPut*	4-20 mA	
Filter	*FiLtEr*	10	
Bypass	*bYPASS*	0.2	
Function	*Functn*	Linear	
Number of points	*no PtS*	2	
Programming	*ProG*	Scale	
Input 1	*inP 1*	4.000 mA	
Display 1	*diS 1*	4.000	
Input 2	*inP 2*	20.000 mA	
Display 2	*diS 2*	20.000	
Decimal point	*dd.ddd*	3 places	
Cutoff value	*CutoFF*	0.000 (disabled)	
Display assignment	*dSPLAY*		
Big display (Main)	*biG*	PV: Process variable	
Little display (Small)	*LittLE*	Eng units: mA	
Display intensity	*d-intY*	6	
Relay 1 action	*Act 1*	Automatic	
Relay 1 set point	*SEt 1*	7.000	
Relay 1 reset point	*rSt 1*	6.000	
Relay 2 action	*Act 2*	Automatic	
Relay 2 set point	*SEt 2*	10.000	
Relay 2 reset point	*rSt 2*	9.000	
Relay 3 action	*Act 3*	Automatic	
Relay 3 set point	*SEt 3*	13.000	

Parameter	Display	Default Setting	User Setting
Relay 3 reset point	r5t 3	12.000	
Relay 4 action	Act 4	Automatic	
Relay 4 set point	5Et 4	20.000	
Relay 4 reset point	r5t 4	19.000	
Fail-safe relay 1	FL5 1	Off	
Fail-safe relay 2	FL5 2	Off	
Fail-safe relay 3	FL5 3	Off	
Fail-safe relay 4	FL5 4	Off	
On delay relay 1	On 1	0.0 sec	
Off delay relay 1	OFF 1	0.0 sec	
On delay relay 2	On 2	0.0 sec	
Off delay relay 2	OFF 2	0.0 sec	
On delay relay 3	On 3	0.0 sec	
Off delay relay 3	OFF 3	0.0 sec	
On delay relay 4	On 4	0.0 sec	
Off delay relay 4	OFF 4	0.0 sec	
Loop break relay 1	iGnorE	Ignore	
Loop break relay 2	iGnorE	Ignore	
Loop break relay 3	iGnorE	Ignore	
Loop break relay 4	iGnorE	Ignore	
Display 1 analog out	di5 1	4.000	
Output 1 value	Out 1	4.000 mA	
Display 2 analog out	di5 2	20.000	
Output 2 value	Out 2	20.000 mA	
Source analog output	SourcE	Process Variable	
Overrange output	O-rAnG	21.000 mA	
Underrange output	u-rAnG	3.000 mA	
Loop break output	brEAH	1.000 mA	
Maximum output	mi AH	23.000 mA	

Parameter	Display	Default Setting	User Setting
Minimum output	n⁷ ın	0.000 mA	
Serial address	AddrES	001	
Baud rate	bAud	2400	
Transmit delay	tr dLY	10 ms	
F1 function key	F1	Reset max & min	
F2 function key	F2	Big display: Max (Hi)	
F3 function key	F3	Acknowledge relays	
Logic level input 1	LL I 1	Menu	
Logic level input 2	LL I 2	Right arrow	
Logic level input 3	LL I 3	Up arrow	
Logic level input 4	LL I 4	Enter	
Logic level output 1	LL O 1	Disabled	
Logic level output 2	LL O 2	Disabled	
Logic level output 3	LL O 3	Disabled	
Logic level output 4	LL O 4	Disabled	
Password 1	PASS 1	000000 (unlocked)	
Password 2	PASS 2	000000 (unlocked)	
Password 3	PASS 3	000000 (unlocked)	

Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, $Lo c d$ is displayed	Meter is password-protected, enter correct six-digit password to unlock
Meter displays error message during calibration ($Error$)	Check: 1. Signal connections 2. Input selected in *Setup* menu 3. Minimum input span requirements
Meter displays • 999999 • -99999	Check: 1. Input selected in *Setup* menu 2. Corresponding signal at Signal connector
Display is unstable	Check: 1. Input signal stability and value 2. Display scaling vs. input signal 3. Filter and bypass values (increase)
Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: 1. Math function selected: Linear, square root, etc. 2. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check: 1. Display assignment, it might be displaying max, min, or set point.
Display alternates between 1. H_i and a number 2. Lo and a number	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: 1. Fail-safe in *Setup* menu 2. Wiring of relay contacts
Relay and status LED do not respond to signal	Check: 1. Relay action in *Setup* menu 2. Set and reset points
Meter not communicating with application programs	Check: 1. Serial adapter and cable 2. Serial settings 3. Meter address and baud rate
If the display locks up or the meter does not respond at all	Cycle the power to reboot the microprocessor.
Other symptoms not described above	Call Technical Support for assistance.

Alphabetical List of Display Functions & Messages

Display	Parameter	Action/Setting Description
20 n⁊ A	*20 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
4 n⁊ A	*4 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
999999 *-99999*	*Flashing display*	Overrange condition Underrange condition
AcH	Acknowledge	Acknowledge relays
Act 1	*Action 1*	Set relay 1 action
AddrES	*Address*	Set meter address
ALn⁊ 1	Alarm 1	Assign digital output to Alarm 1-8
ALtErn	*Alternate*	Set relay for pump alternation control
A-n⁊ An	*Auto-manual*	Set relay for automatic & manual reset
Aout	*Analog output*	Enter the *Analog output* scaling menu
AoutPr	*Analog output programming*	Enter analog output programming
Auto	*Automatic*	Press Enter to set automatic operation
bAud	*Baud rate*	Select baud rate
b ᵢᵤ	*Big display*	Press Enter to assign the main display parameter (default: PV)
b ᵢᵤ H ᵢ	Max on big display	Assign digital input to display max on the main display
b ᵢᵤ HL	Max/min big display	Assign digital input to toggle max/min on the main display
b ᵢᵤ Lo	Min on big display	Assign digital input to display min on the main display
brEAH	*Loop break*	Set relay condition if loop break detected
bYPASS	*Bypass*	Set filter bypass value
C CAL	*Current calibration*	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
C H ᵢ	*Current high*	Calibrate high current input (e.g. 20 mA)
C Lo	*Current low*	Calibrate low current input (e.g. 4 mA)

Display	Parameter	Action/Setting Description
CAL	*Calibrate*	Enter the *Calibration* menu
CAL ib	*Calibrate*	Calibrate 4-20 mA output (internal reference source used for scaling the output)
Contrl	*Control*	Enter *Control* menu to turn relays on/off, set analog output manually, or return meter to automatic operation
CoPY	*Copy*	Enter copy function
CutoFF	*Cutoff*	Set low-flow cutoff
dEc Pt	*Decimal point*	Set decimal point
dELAY	*Delay*	Enter relay *Time Delay* menu
d iAG	*Diagnostics*	Display parameter settings
d iAn⌐ r	*Diameter*	Enter the tank's diameter in inches
d- intY	*Display intensity*	Set display intensity level from 1 to 8
d iS 1	*Display 1*	Program display 1 value
d iS 2	*Display 2*	Program display 2 value (up to 32 points)
d iSAbL	Disable	Disable function key
dLY 1	*Delay 1*	Enter relay 1 time delay setup (1-8)
donE	*Done*	Copy function completed
dSPLAY	*Display*	Enter the *Display* menu
EntEr	Enter button	Assign digital input to Enter button
Error	*Error*	Error, calibration not successful, check signal or programmed value
F 1	*F1 function key*	Assign F1 function key
F2	*F2 function key*	Assign F2 function key
F3	*F3 function key*	Assign F3 function key
FA iLSF	*Fail-safe*	Enter *Fail-safe* menu
F iLtr	*Filter*	Set noise filter value
FLS 1	*Fail-safe 1*	Set relay 1 fail-safe operation (1-8)

Display	Parameter	Action/Setting Description
ForcE	*Force*	Force analog output value for loop break
Functn	*Math Function*	Select linear, square root, programmable exponent, or round horizontal tank function
iCAL	*Internal source calibration*	Enter internal source calibration (used for scaling the meter without a signal source)
iⅭnorE	*Ignore*	Ignore loop break condition
InFo	*Information*	Display software and S/N information
InP 1	*Input 1*	Calibrate input 1 signal or program input 1 value
InP 2	*Input 2*	Calibrate input 2 signal or program input 2 value (up to 32 points)
inPut	*Input*	Enter *Input* selection menu
LAtCH	*Latching*	Set relay for latching operation
LEd t	*LED test*	Test all LEDs
LEnⅭth	*Length*	Enter the tank's length in inches
L inEAr	*Linear*	Set meter for linear function and select number of linearization points
L it Hi	Max on little display	Assign digital input to display max on the small display
L it HL	Max/min little display	Assign digital input to toggle max/min on the small display
L it Lo	Min on little display	Assign digital input to display min on the small display
L ittLE	*Little display*	Press Enter to assign the small display parameter (default: engineering units)
LL 1 1	*Logic level input 1*	Assign logic level input 1 – 8, if expansion modules are connected
LL 0 1	*Logic level output 1*	Assign logic level output 1 – 8, if expansion modules are connected
Locd	*Locked*	Enter password to unlock meter
Lt-CLr	*Latching-cleared*	Set relay for latching operation with manual reset only after alarm condition has cleared
n⁊ A	*4-20 mA*	Set meter for 4-20 mA input

Display	Parameter	Action/Setting Description
ⁿ⁊ ℛⁿ	*Manual*	Press Enter to manually control relays or analog output operation
ⁿ⁊ ℛℋ	*Maximum*	Program maximum mA output allowed
ⁿ⁊ Eⁿᵤ	Menu button	Assign digital input to Menu button
ⁿ⁊ ᵢⁿ	*Minimum*	Program minimum mA output allowed
ⁿₒ Pℒ5	*Number of points*	Set meter for 2 to 32-point linearization
0 Hₒℒd	Relays output hold	Assign digital input to hold all relays state
0FF	*Off*	Disable relay and front panel status LED, turn relays off, program off time delay
0FF ı	*Off 1*	Set relay 1 Off time delay (1-8)
0ⁿ	*On*	Enable fail-safe operation, turn relays on, program on time delay
0ⁿ ı	*On 1*	Set relay 1 On time delay (1-8)
0-rℛⁿ6	*Overrange*	Program mA output for display overrange
0ᵤℒ ı	*Output 1*	Program output 1 value (e.g. 4.000 mA)
0ᵤℒ 2	*Output 2*	Program output 2 value (e.g. 20.000 mA)
Pℛ55	*Password*	Enter the *Password* menu
PℛSS ı	*Password 1*	Set or enter Password 1 (Allows use of the F1–F3 function keys)
PℛSS 2	*Password 2*	Set or enter Password 2 (Allows use of the F1–F3 function keys and changing the set/reset points)
PℛSS ₃	*Password 3*	Set or enter Password 3 (Restricts all programming & F1–F3 keys)
Prₒ6	*Program*	Enter the *Program* menu
Prₒ6 E	*Programma-ble exponent*	Set meter for programmable exponent and enter exponent value
rELℛ9	*Relay*	Enter the *Relay* menu
rE5Eℒ	*Reset*	Press Enter to access the *Reset* menu
rhℒ	*Round hori-zontal tank*	Set meter for round horizontal tank volume calculation

Display	Parameter	Action/Setting Description
r ¡ᏩhᏋ	Right arrow	Assign digital input to Right arrow button
rᒪᎽ ¡	*Relay 1*	Relay 1 setup (1-8)
rᒪᎽ d	Disable relay	Assign digital input to disable all relays
rᒪᎽ Ε	Enable relay	Assign digital input to enable all relays
rᏕᏋ ¡	*Reset 1*	Program reset point 1 (1-8)
rᏕᏋ Ꮋ ¡	*Reset high*	Press Enter to reset max display
rᏕᏋ Ꮋᒪ	*Reset high & low*	Press Enter to reset max & min displays
rᏕᏋ ᒪo	*Reset low*	Press Enter to reset min display
ᏕᎪnⁿ Pᒪ	*Sampling*	Set relay for sampling operation
ᏕᏮᎪᒪᏋ	*Scale*	Enter the *Scale* menu
ᏕᏋᒪᏋᏮᏋ	*Select*	Enter Select menu (function, cutoff, output programming)
ᏕᏋnd	*Send*	Send meter settings to another meter
ᏕᏋr ¡Ꭺᒪ	*Serial*	Set serial communication parameters
ᏕᏋᏋ ¡	*Set 1*	Program set point 1 (1-8)
ᏕᏋᏝuᏢ	*Setup*	Enter *Setup* menu
ᏕourcᏋ	*Source*	Select source for the 4-20 mA output
ᏕᏝuᎪrᏋ	*Square root*	Set meter for square root extraction
Ꮭr dᒪᎽ	*Transmit delay*	Set transmit delay for serial communication
unᒪoc	*Unlocked*	Program password to lock meter
uᏢ	Up arrow	Assign digital input to Up arrow button
u-rᎪnᏮ	*Underrange*	Program mA output for display underrange
uᏕᏋr	*User I/O*	Assign function keys and digital I/O
�u ᏮᎪᒪ	*Voltage calibration*	Calibrate voltage input
�u Ꮋ ¡	*Voltage high*	Calibrate high voltage input (e.g. 10 V)
�u ᒪo	*Voltage low*	Calibrate low voltage input (e.g. 0 V)
ᏌoᒪᏝ	*0-10 VDC*	Set meter for ±10 VDC input

How to Contact Precision Digital

- For Technical Support please

  Call: (800) 610-5239 or (508) 655-7300

  Fax: (508) 655-8990

  Email: support@predig.com

- For Sales Support or to place an order please contact your local distributor or

  Call: (800) 343-1001 or (508) 655-7300

  Fax: (508) 655-8990

  Email: sales@predig.com

- For the latest version of this manual please visit

  www.predig.com