

# PD6000 Analog Input Process Meter

## Instruction Manual M387



- 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, or  $\pm 10$  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

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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. JOWA USA, Inc. shall not be held liable for damages resulting from such improper use.

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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 $\mu$ F/470 $\Omega$ , 250 VAC

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## SPECIFICATIONS

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

### General

<b>DISPLAY</b>	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.
<b>DISPLAY INTENSITY</b>	Eight user selectable intensity levels
<b>DISPLAY UPDATE RATE</b>	5/second (200 ms)
<b>OVERRANGE</b>	Display flashes <b>999999</b>
<b>UNDERRANGE</b>	Display flashes <b>-99999</b>
<b>PROGRAMMING METHODS</b>	Four front panel buttons, digital inputs, PC and multi-point linearization utility, or cloning using Copy function.
<b>NOISE FILTER</b>	Programmable from 2 to 199 (0 will disable filter)
<b>FILTER BYPASS</b>	Programmable from 0.1 to 99.9% FS
<b>RECALIBRATION</b>	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
<b>MAX/MIN DISPLAY</b>	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
<b>PASSWORD</b>	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.
<b>NON-VOLATILE MEMORY</b>	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
<b>POWER OPTIONS</b>	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max or 12/24 VDC $\pm 10\%$ , 15 W max
<b>FUSE</b>	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse
<b>ISOLATED TRANSMITTER POWER SUPPLY</b>	Terminals P+ & P-: 24 VDC $\pm 5\%$ @ 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.
<b>NORMAL MODE REJECTION</b>	Greater than 60 dB at 50/60 Hz

**Model PD6000 Analog Input Process Meter** **Instruction Manual**

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

**Process Input**

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



<b>CALIBRATION RANGE</b>	An <i>Error</i> message will appear if the input 1 and input 2 signals are too close together. Input Range      Minimum Span 4-20 mA      0.15 mA $\pm 10$ V      0.10 V
<b>INPUT IMPEDANCE</b>	Voltage ranges: greater than 1 M $\Omega$ Current ranges: 50 - 100 $\Omega$ (depending on resettable fuse impedance)
<b>INPUT OVERLOAD</b>	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.
<b>Relays</b>	
<b>RATING</b>	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
<b>NOISE SUPPRESSION</b>	Noise suppression is recommended for each relay contact switching inductive loads; see page 20 for details.
<b>DEADBAND</b>	0-100% FS user programmable
<b>HIGH OR LOW ALARM</b>	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
<b>RELAY OPERATION</b>	Automatic (non-latching) Latching (requires manual acknowledge) Sampling (based on time) Pump alternation control (2 to 8 relays)
<b>RELAY RESET</b>	User selectable via front panel buttons or digital inputs <ol style="list-style-type: none"> <li>Automatic reset only (non-latching), when the input passes the reset point.</li> <li>Automatic + manual reset at any time (non-latching)</li> <li>Manual reset only, at any time (latching)</li> <li>Manual reset only after alarm condition has cleared</li> </ol> <i>Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.</i>
<b>TIME DELAY</b>	0 to 999.9 seconds, on & off relay time delays Programmable and independent for each relay
<b>FAIL-SAFE OPERATION</b>	Programmable and independent for each relay. <i>Note: Relay coil is energized in non-alarm condition.          In case of power failure, relay will go to alarm state.</i>
<b>AUTO INITIALIZATION</b>	When power is applied to the meter, relays will reflect the state of the input to the meter.

**Isolated 4-20 mA Transmitter Output**

<b>OUTPUT SOURCE</b>	Process variable (PV), max, min, or set points 1-8		
<b>SCALING RANGE</b>	1.000 to 23.000 mA for any display range		
<b>CALIBRATION</b>	Factory calibrated: 4.000 to 20.000 = 4-20 mA output		
<b>ANALOG OUT PROGRAMMING</b>	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break		
<b>ACCURACY</b>	$\pm 0.1\% \text{ FS} \pm 0.004 \text{ mA}$		
<b>TEMPERATURE DRIFT</b>	50 PPM/°C from 0 to 65°C ambient <i>Note: Analog output drift is separate from input drift.</i>		
<b>ISOLATED TRANSMITTER POWER SUPPLY</b>	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.		
<b>EXTERNAL LOOP POWER SUPPLY</b>	35 VDC maximum		
<b>OUTPUT LOOP RESISTANCE</b>	Power supply	Minimum	Maximum
	24 VDC	10 $\Omega$	700 $\Omega$
	35 VDC (external)	100 $\Omega$	1200 $\Omega$

**Serial Communications**

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

*Note: Refer to the PDC Serial Communication Protocol manual located at [www.predig.com](http://www.predig.com) for details.*

**PDA1044 Digital Input & Output Expansion Module**

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

## COMPLIANCE INFORMATION

### Safety

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

### Electromagnetic Compatibility

<b>EMISSIONS</b>	EN 55022:1998/A1:2000/A2:2003 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
<b>IMMUNITY</b>	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](http://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.

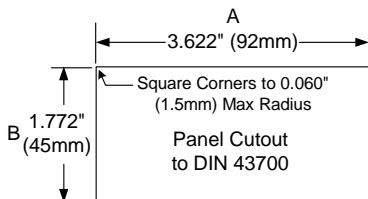
### Unpacking

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.



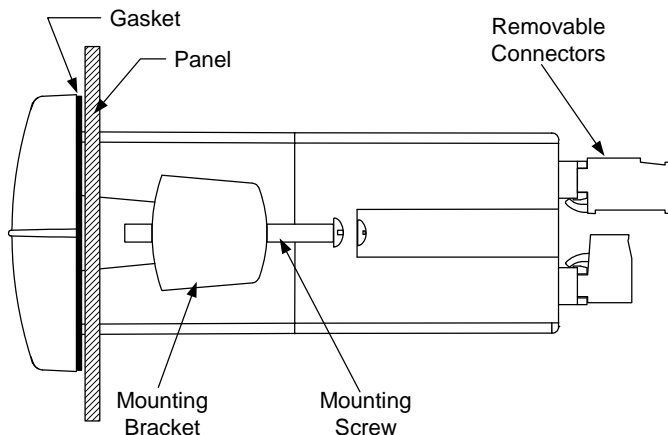
Refer to  
page 68 for  
mounting  
dimensions

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

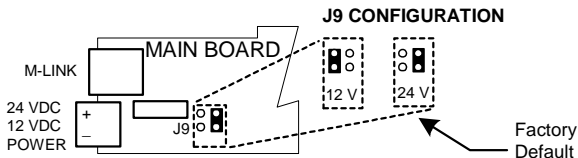


Do not exceed voltage rating of the selected configuration.

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**

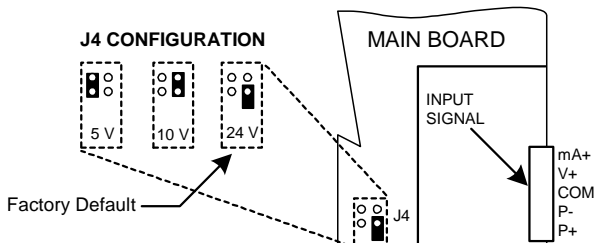
## Transmitter Supply Voltage Selection (P+, P-)

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.

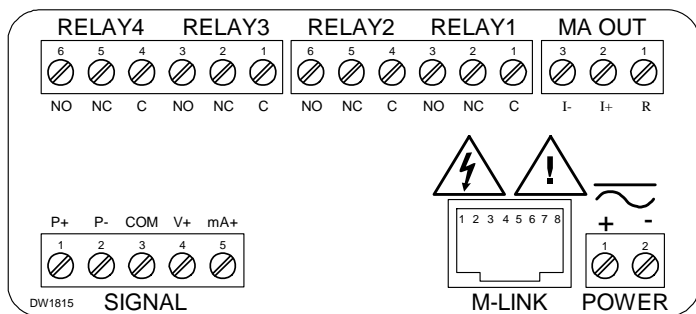


Use copper wire with 60°C or 60/75°C insulation for all line voltage connections. Observe all safety regulations. Electrical wiring should be performed in accordance with all applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.



## Connectors Labeling

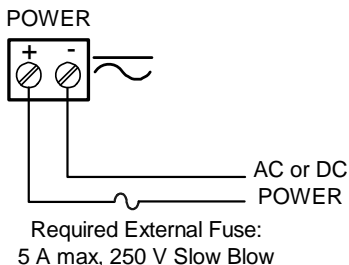
The connectors' label, affixed to the meter, shows the location of all connectors available with requested configuration.



**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.



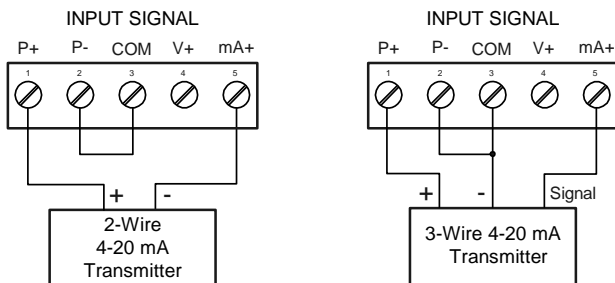
**Figure 6. Power Connections**

## Signal Connections

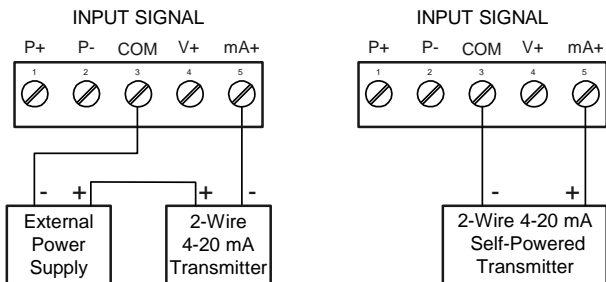
Signal connections are made to a five-terminal connector labeled SIGNAL on Figure 5. The COM (common) terminal is the return for the 4-20 mA and the  $\pm 10$  V input signals.

### 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.



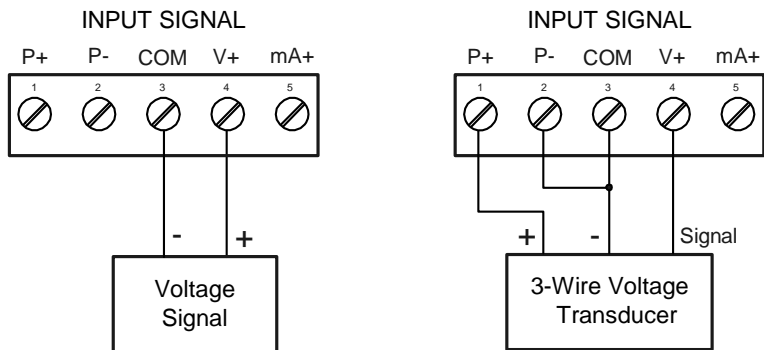
**Figure 7. Transmitters Powered by Internal Supply**



**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.

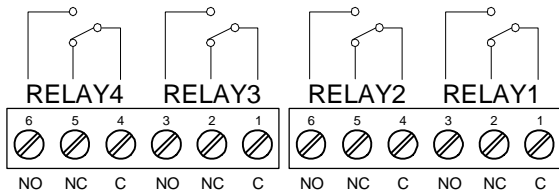
### Serial Communications

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**



### 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.

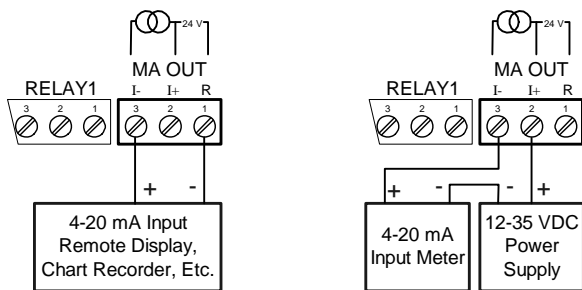


Figure 13. 4-20 mA Output Connections

### Analog Output Transmitter Power Supply

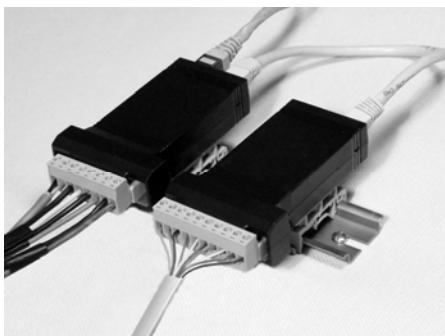
The internal 24 VDC power supply powering the analog output may be used to power other devices, if the analog output is not used. The I+ terminal is the +24 V and the R terminal is the return. This power supply is capable of sourcing up to 40 mA.

## External Relays & Digital I/O Connections

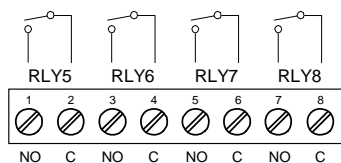
The relay and the digital I/O expansion modules PDA1004 & PDA1044 are connected to the meter using a CAT5 cable provided with each module. The two RJ45 connectors on the expansion modules are identical and interchangeable; they are used to connect additional modules to the system.

*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.*

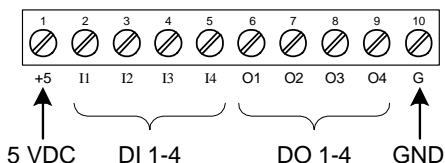
*Note 2: More detailed instructions are provided with each optional expansion module.*



**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	LED	Status
	Menu	1-4	Alarm 1 – 4 indicator
	Right arrow/F1	5-8	Alarm 5 – 8 indicator
	Up arrow/F2	<i>Note:</i> Alarms 5-8 are enabled when relay expansion module is installed.	
	Enter/F3		

- 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, programming, 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	<i>Reset</i>	Press Enter to access the <i>Reset</i> menu
rSt H i	<i>Reset high</i>	Press Enter to reset max display
rSt Lo	<i>Reset low</i>	Press Enter to reset min display
rSt HL	<i>Reset high &amp; low</i>	Press Enter to reset max & min displays
Control	<i>Control</i>	Enter <i>Control</i> menu
Auto	<i>Automatic</i>	Press Enter to set meter for automatic operation
on An	<i>Manual</i>	Press Enter to manually control relays or analog output operation
SEtUP	<i>Setup</i>	Enter <i>Setup</i> menu
inPUt	<i>Input</i>	Enter <i>Input</i> selection menu
on R	<i>4-20 mA</i>	Set meter for 4-20 mA input
VolT	<i>0-10 VDC</i>	Set meter for $\pm 10$ VDC input
dEc Pt	<i>Decimal point</i>	Set decimal point
dSPLY	<i>Display</i>	Enter the <i>Display</i> menu
b i	<i>Big display</i>	Press Enter to assign the Main display parameter (default: PV)
L tLE	<i>Little display</i>	Press Enter to assign the small display parameter (default: engineering units)
d- IntY	<i>Display intensity</i>	Set display intensity level from 1 to 8
rELAY	<i>Relay</i>	Enter the <i>Relay</i> menu
rLY 1	<i>Relay 1</i>	Relay 1 setup
Act 1	<i>Action 1</i>	Set relay 1 action
Auto	<i>Automatic</i>	Set relay for automatic reset
R-on An	<i>Auto-manual</i>	Set relay for automatic & manual reset any time

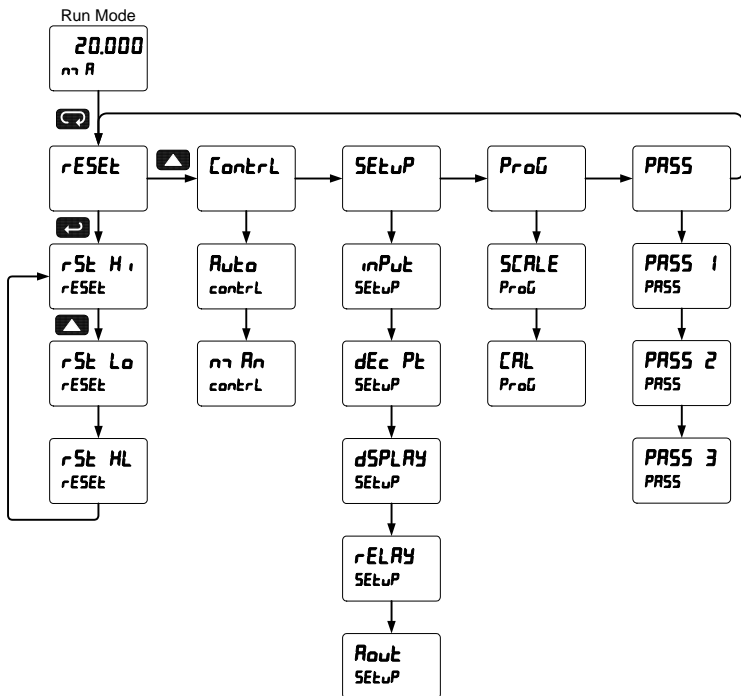
Display	Parameter	Action/Setting Description
LRLCH	Latching	Set relay for latching operation
Lt-Clr	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared
RLTern	Alternate	Set relay for pump alternation control
SRn PL	Sampling	Set relay for sampling 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 <i>Note: Relays 5-8 are shown, only if expansion relay module is installed.</i>
FRILSF	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
Rout	Analog output	Enter the Analog output scaling menu
dIS 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 15 2	Display 2	Program display 2 value
Out 2	Output 2	Program output 2 value (e.g. 20.000 mA)
Prog	Program	Enter the <i>Program</i> menu
SCALE	Scale	Enter the <i>Scale</i> menu
CAL	Calibrate	Enter the <i>Calibration</i> menu
inP 1	Input 1	Calibrate input 1 signal or program input 1 value
d 15 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 15 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 <i>Password</i> 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 -999999	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.



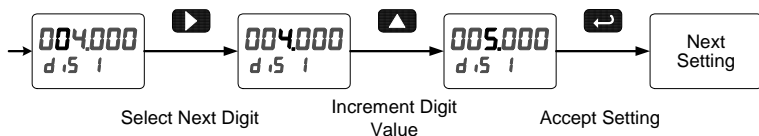
- Press Menu, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing Enter are not saved.
- Changes to the settings are saved to memory only after pressing Enter.
- The display moves to the next menu every time a setting is accepted by pressing Enter.

### 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.



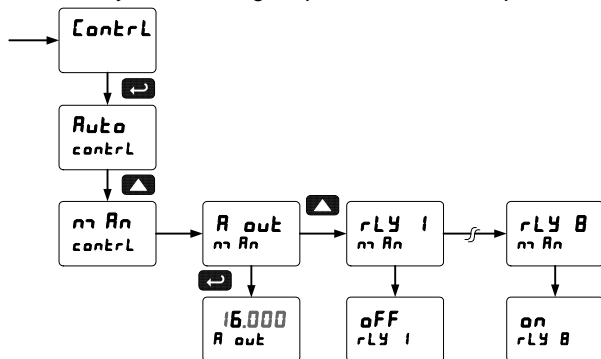
*Note: The decimal point is set in the Setup-decimal point menu.*

### 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.

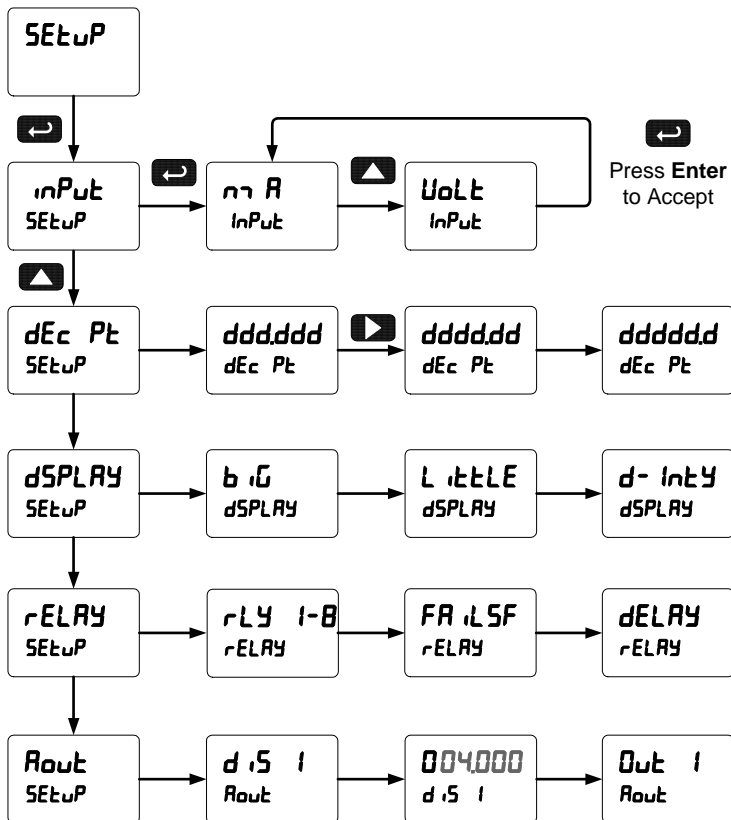


## Setting Up the Meter (SEtUP)

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.



### Setting the Input Signal ( *INPUL* )

Enter the *Input* menu to set up the meter to display current ( *mA* ) or voltage ( *VDC* ) 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  $\pm 10$  VDC signals.

### Setting the Decimal Point ( *DEC PL* )

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 ( *DISPLAY* )

The main display ( *MAIN* ) can be programmed to display:

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

The small display ( *LEFT* ) 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 u t e)**

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

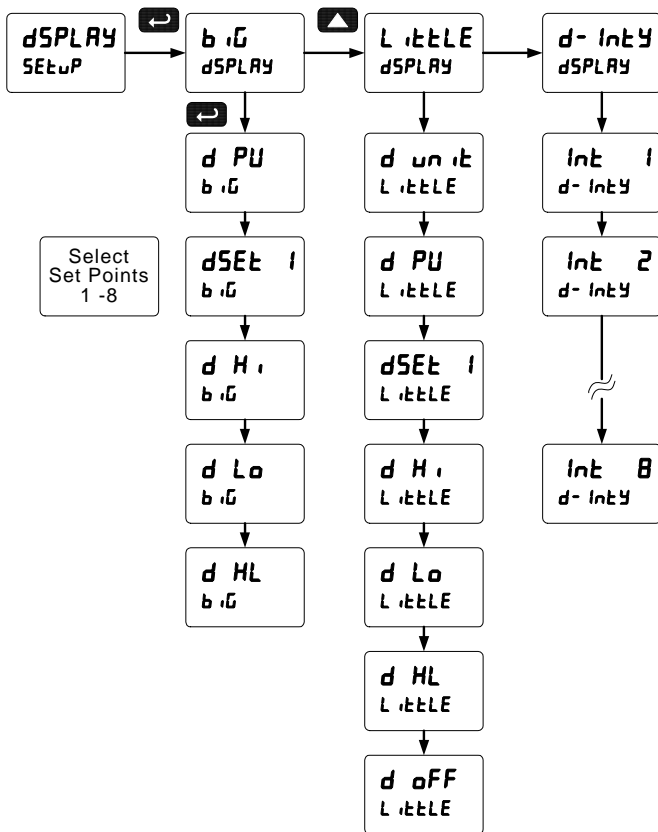
0 1 2 3 4 5 6 7 8 9 A b C c d E F G 9 H h i . j k L  
n 0 o P q r S t u V X Y Z - / = [ ] = r j o

To create the letter “m” use the characters “h” followed by “r” to get “rh”.  
To create the letter “w” use the characters “u” followed by “j” to get “uj”.  
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



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.

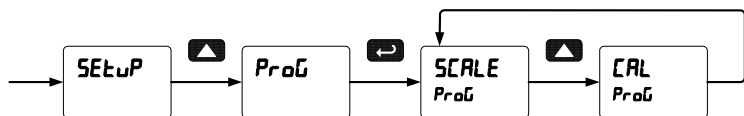
## Programming the Meter (*Prog*)

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

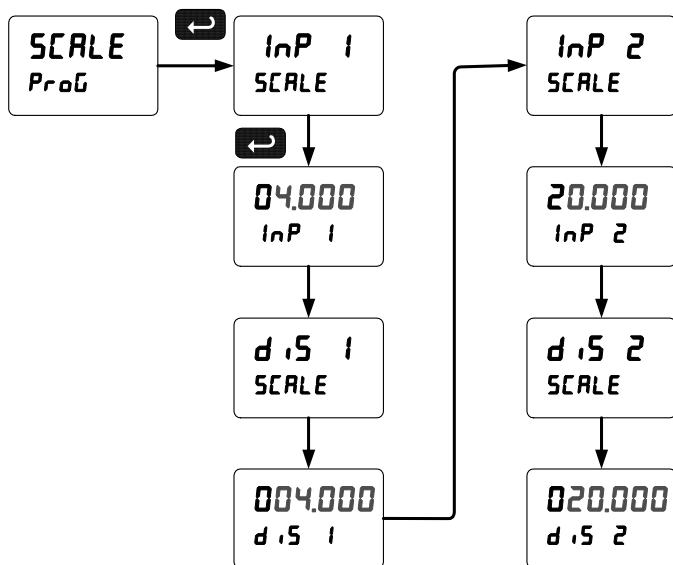
The meter can be programmed for multi-point scaling using the PC-based Multi-Point Linearization Utility available for free download at [www.predig.com](http://www.predig.com).

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  $\pm 10$  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.

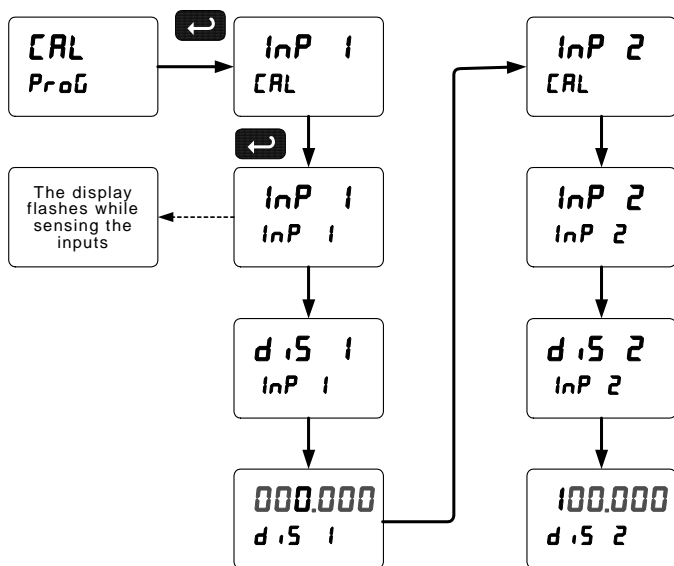
Input range	Input 1 & input 2 span
4-20 mA	0.15 mA
±10 VDC	0.10 VDC

## 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.*

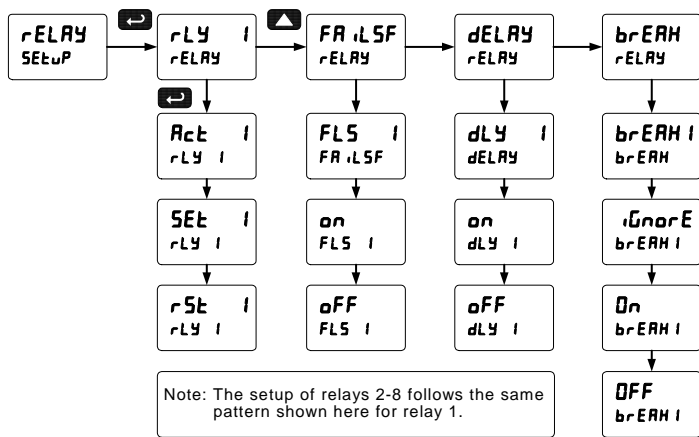
## Setting the Relay Operation (rELAY)

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
  - 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)

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

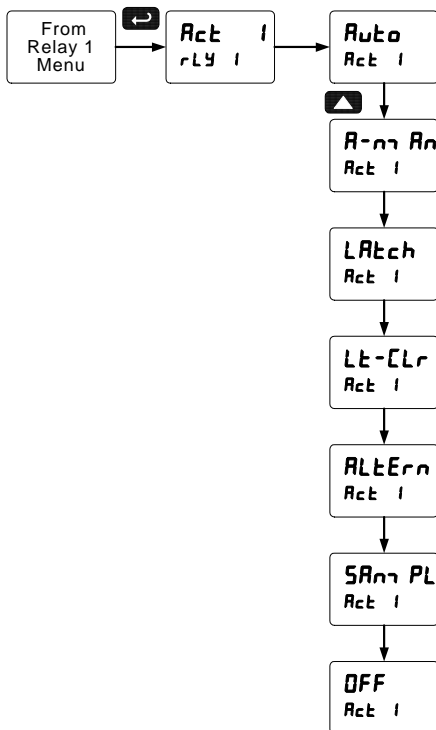


### Setting the Relay Action

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.

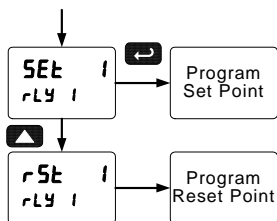


### Programming Set and Reset Points

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):

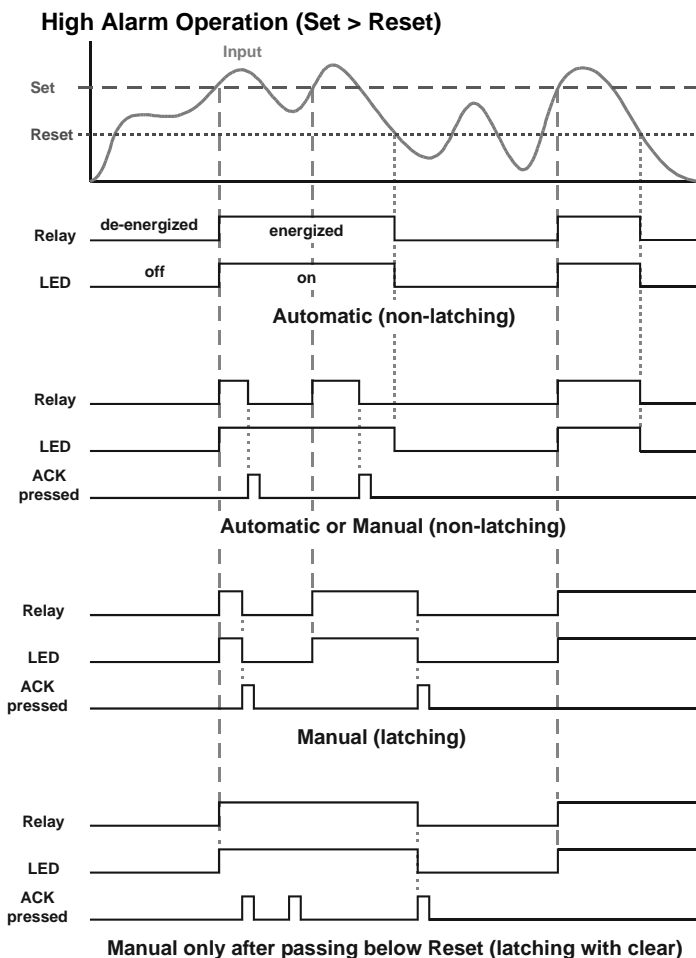
1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
3. Ignore (Remain in the last condition before detecting a break)

*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.*

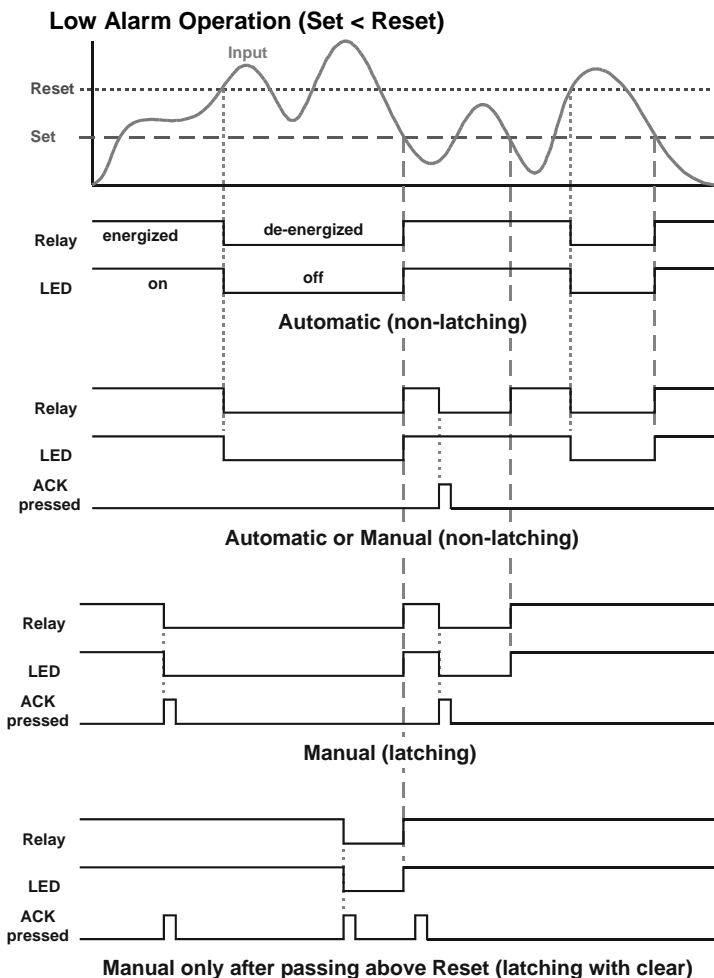


## Relay and Alarm Operation

The following graphs illustrate the operation of the relays, status LEDs, and ACK button.

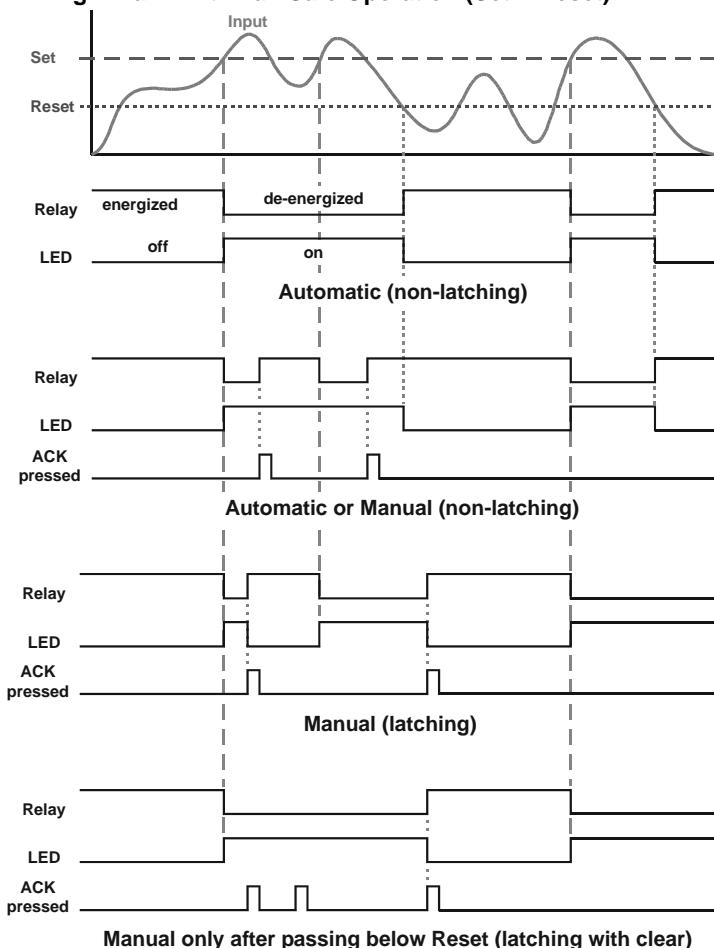


For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.



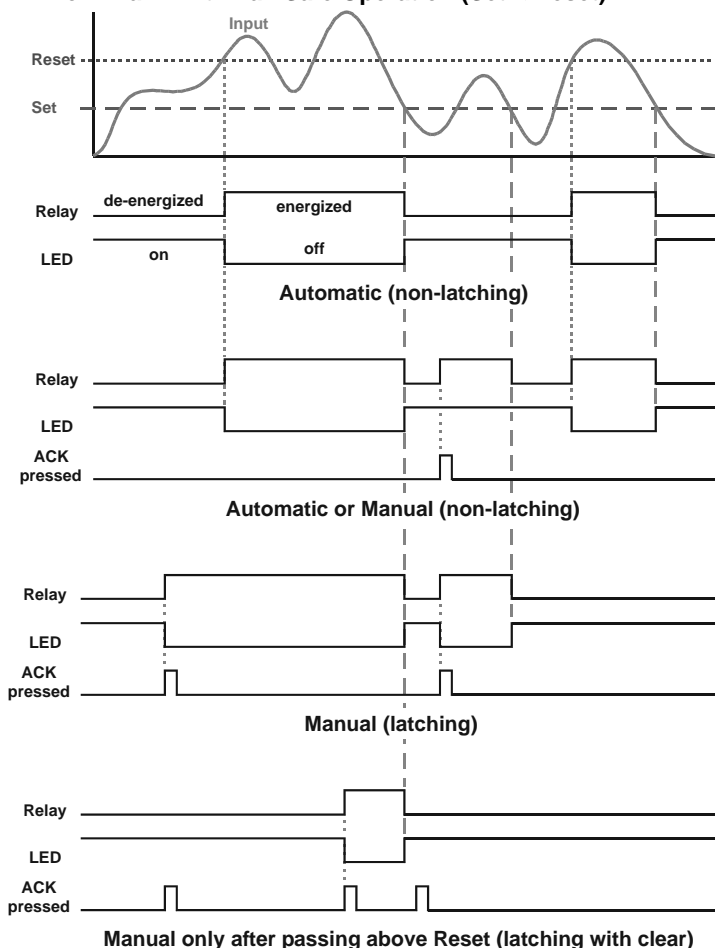
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point, and then go below it.

## High Alarm with Fail-Safe Operation (Set &gt; Reset)



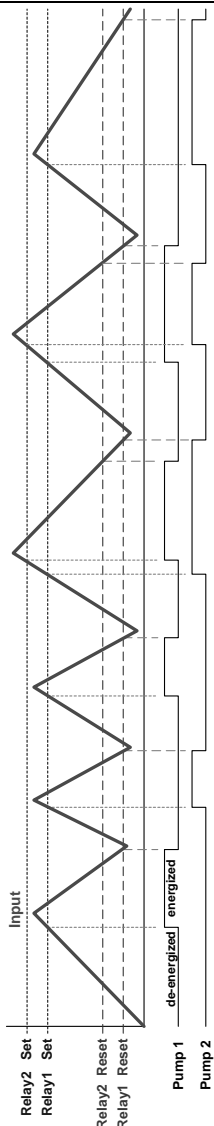
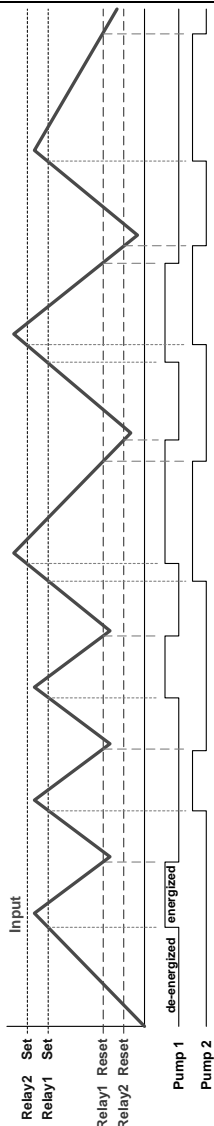
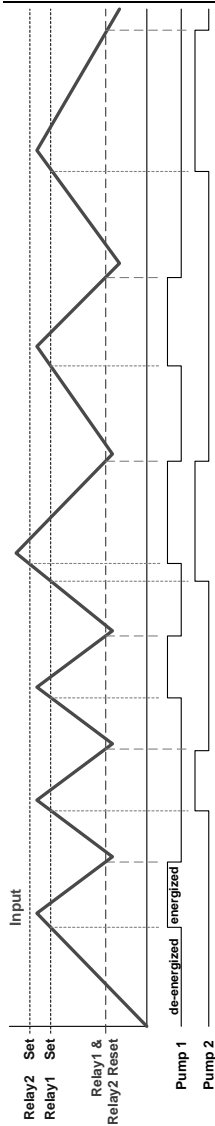
*Note: Relay coil is energized in non-alarm condition.  
In case of power failure, relay will go to alarm state.*

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



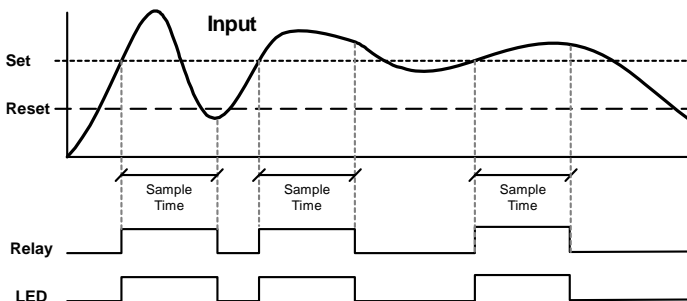
*Note: Relay coil is energized in non-alarm condition.  
In case of power failure, relay will go to alarm state.*

Pump Alternation Control Operation



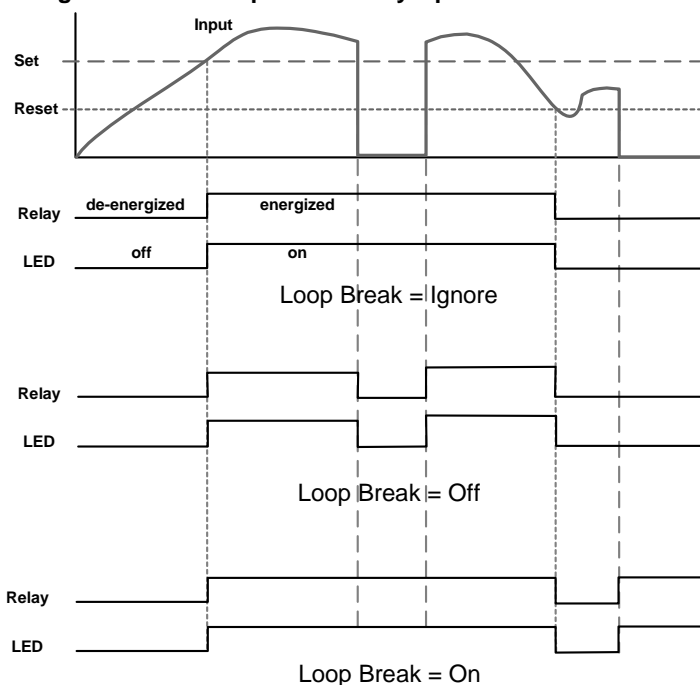
*LEDs indicate the relay status*

### 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

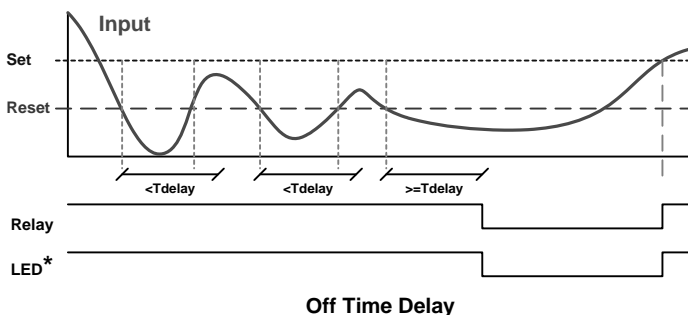
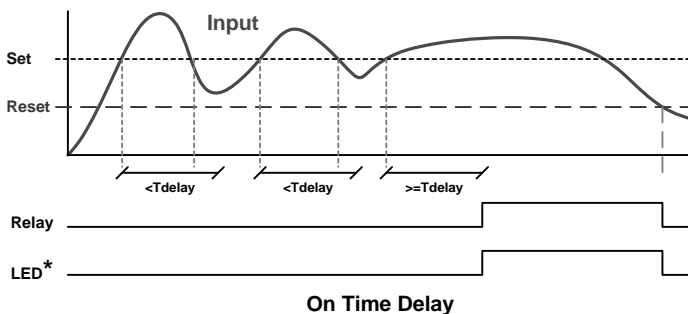


When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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.



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.

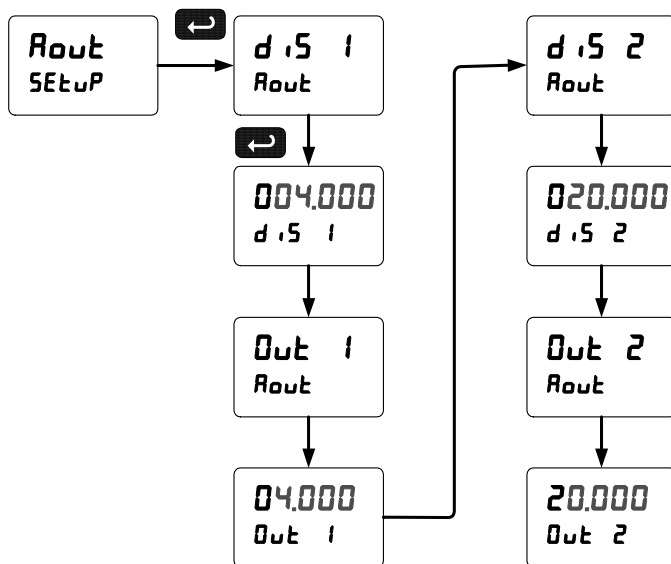


### Scaling the 4-20 mA Analog Output (*Rout*)

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.

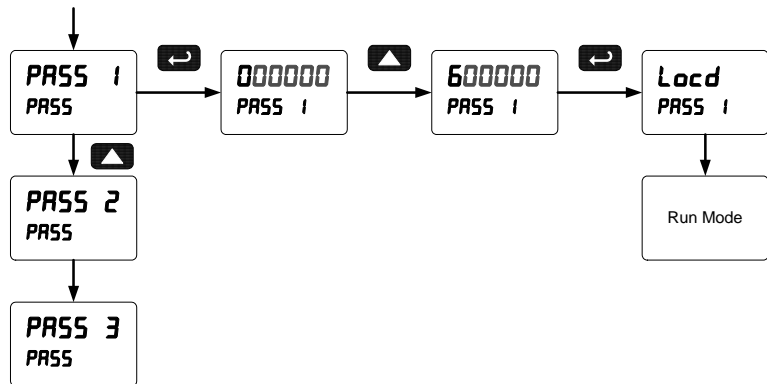
Pass 1: Allows use of the F1–F3 function keys  
 Pass 2: Allows use of the F1–F3 function keys and changing the set/reset points  
 Pass 3: Restricts all programming and F1–F3 keys

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.

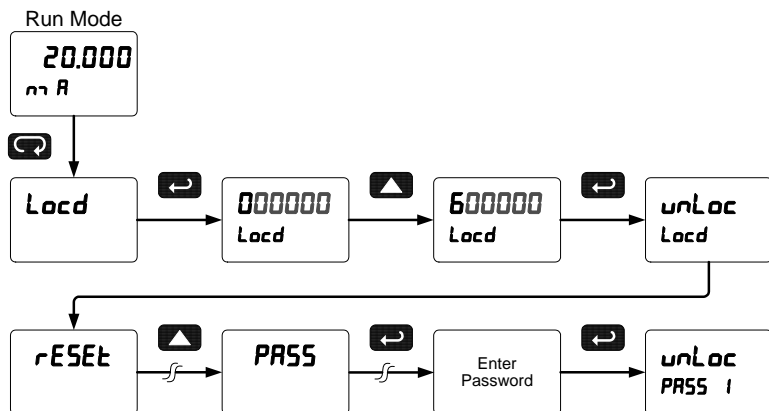
Model:	
Serial Number:	
Password 1:	__ __ __ __ __ __
Password 2:	__ __ __ __ __ __
Password 3:	__ __ __ __ __ __

## 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 meter 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.



If the correct six-digit password is entered, the meter displays the message *unLoc* (*unlocked*) and the protection is disabled until a new password 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.

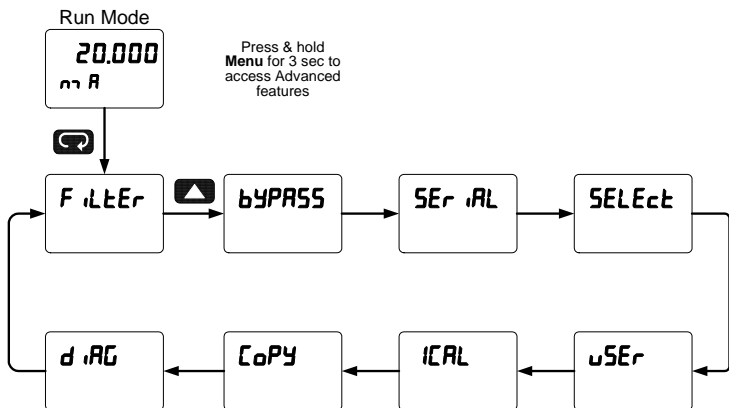
### Did you forget the password?

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 ILT	Filter	Set noise filter value
bYPASS	Bypass	Set filter bypass value
SERIAL	Serial	Set serial communication parameters
ADDR	Address	Set meter address
BAUD	Baud rate	Select baud rate
TR DEL	Transmit delay	Set transmit delay for serial communication
SELECT	Select	Enter the Select menu (function, cutoff, out)
FUNCTION	Math Function	Select linear, square root, programmable exponent, or round horizontal tank function
LINEAR	Linear	Set meter for linear function and select number of linearization points
NOPTS	Number of points	Set meter for 2 to 32-point linearization
SQRT	Square root	Set meter for square root extraction
PROGRAM E	Programmable exponent	Set meter for programmable exponent and enter exponent value
RT	Round horizontal tank	Set meter for round horizontal tank volume calculation
DIAM	Diameter	Enter the tank's diameter in inches
LENGTH	Length	Enter the tank's length in inches
CUTOFF	Cutoff	Set low-flow cutoff
ANALOG Pr	Analog output programming	Program analog output parameters
SOURCE	Source	Select source for the 4-20 mA output
OVERRANGE	Overrange	Program mA output for display overrange
UNDERRANGE	Underrange	Program mA output for display underrange
MAX	Maximum	Program maximum mA output allowed
MIN	Minimum	Program minimum mA output allowed

Display	Parameter	Action/Setting
CALIB	<i>Calibrate</i>	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 mA	<i>4 mA output</i>	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 mA	<i>20 mA output</i>	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
USER	<i>User I/O</i>	Assign function keys and digital I/O
F1	<i>F1 function key</i>	Assign F1 function key
F2	<i>F2 function key</i>	Assign F2 function key
F3	<i>F3 function key</i>	Assign F3 function key
L1 I	<i>Logic level input 1</i>	Assign logic level input 1 – 8, if expansion modules are connected
L1 O	<i>Logic level output 1</i>	Assign logic level output 1 – 8, if expansion modules are connected
ICAL	<i>Internal source calibration</i>	Enter internal source calibration (used for scaling the meter without a signal source)
C CAL	<i>Current calibration</i>	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
C Lo	<i>Current low</i>	Calibrate low current input (e.g. 4 mA)
C Hi	<i>Current high</i>	Calibrate high current input (e.g. 20 mA)
V CAL	<i>Voltage calibration</i>	Calibrate voltage input
V Lo	<i>Voltage low</i>	Calibrate low voltage input (e.g. 0 V)
V Hi	<i>Voltage high</i>	Calibrate high voltage input (e.g. 10 V)
COPY	<i>Copy</i>	Enter copy function
SEND	<i>Send</i>	Send meter settings to another meter
DONE	<i>Done</i>	Copy function completed
DIAG	<i>Diagnostics</i>	Display parameter settings
INPUT	<i>Input</i>	Input selection
FUNCTION	<i>Function</i>	Function selected
SCALE	<i>Scale</i>	Scaling parameter
CUTOFF	<i>Cutoff</i>	Cutoff value

Display	Parameter	Action/Setting
<i>dSPLY</i>	<i>Display</i>	Display assignments
<i>rELAY</i>	<i>Relays</i>	Relay settings
<i>Rout</i>	<i>Analog output</i>	Analog output scaling
<i>RoutPr</i>	<i>Analog output programming</i>	Analog output programming
<i>SERIAL</i>	<i>Serial</i>	Serial communication settings
<i>LED t</i>	<i>LED test</i>	Test all LEDs
<i>Info</i>	<i>Information</i>	Display software and S/N information

### Noise Filter (*FILT*)

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*)

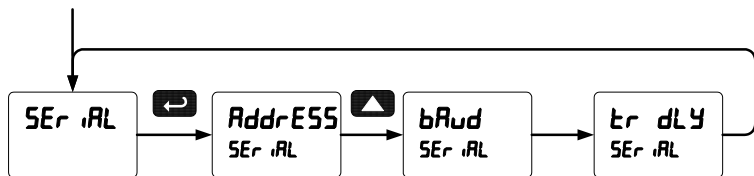
The noise filter bypass changes the behavior of the meter so that small variations in the signal are filtered out but large abrupt changes in the input signal are displayed immediately. The bypass value determines the minimum amount of signal change to be displayed immediately. All signal changes smaller 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 (SEr iRL)

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.*



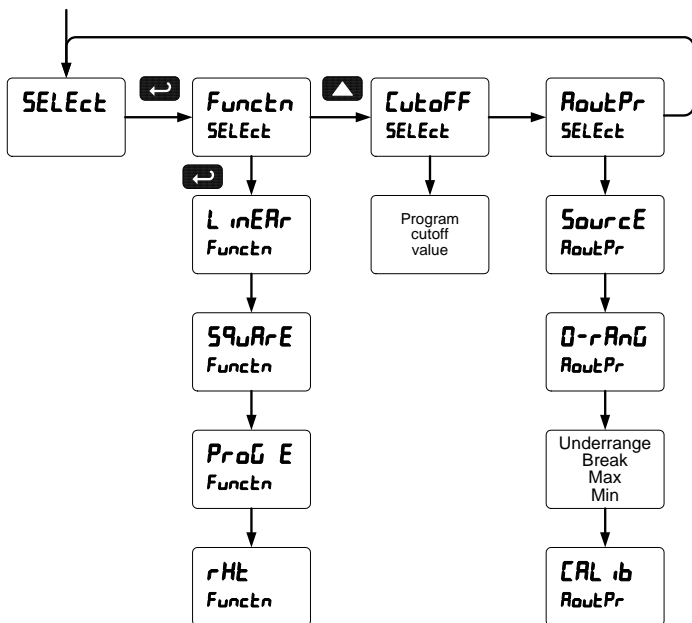
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The address may be programmed from 1 to 247. The transmit delay may be set between 0 and 199 ms.

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.

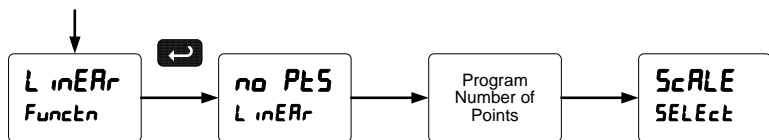
The square root function can be used to linearize the signal from a differential pressure transmitter and display flow rate in engineering units.

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)

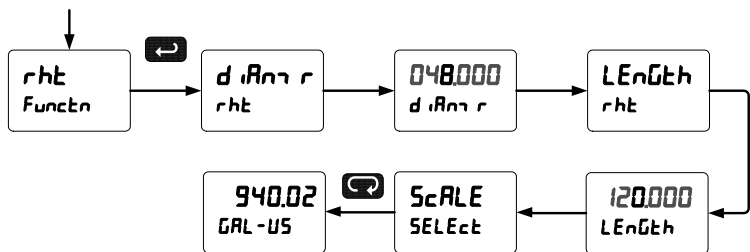
Meters are set up at the factory for linear function with 2-point linearization. Up to 32 linearization points can be selected under the linear function.



### 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.

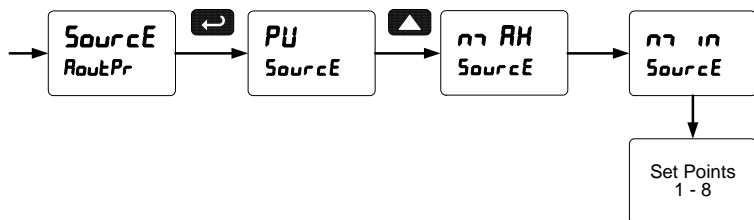
### Analog Output Programming (RoutPr)

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.

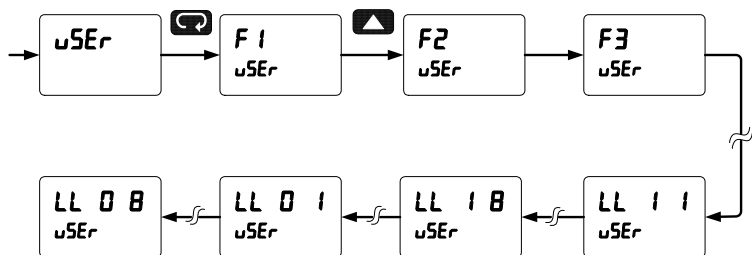


#### Analog Output Calibration

To perform the analog output calibration it's recommended to use a milliamp meter with a resolution of at least 0.1  $\mu\text{A}$  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
<i>RcH</i>	Acknowledge relays	<i>b ũ L0</i>	Min on big display
<i>rESEt</i>	Reset menu	<i>b ũ HL</i>	Max/min big display
<i>rSt H i</i>	Reset max	<i>L ũtLE</i>	Little display menu
<i>rSt L0</i>	Reset min	<i>L ũt H i</i>	Max on little display
<i>rSt HL</i>	Reset max & min	<i>L ũt L0</i>	Min on little display
<i>rELAY</i>	Relay menu	<i>L ũt HL</i>	Max/min little display
<i>SEt i</i>	Set point 1 - 8	<i>d ũRBL</i>	Disable function key
<i>rLY d</i>	Disable all relays	<i>r ũnu</i>	Menu button
<i>rLY E</i>	Enable all relays	<i>r ũht</i>	Right arrow button
<i>ũ HoLd</i>	Relays output hold	<i>uP</i>	Up arrow button
<i>dSPLY</i>	Display menu	<i>EntEr</i>	Enter button
<i>b ũ</i>	Big display menu	<i>RLn i</i>	Alarm 1 – 8
<i>b ũ H i</i>	Max on big display		

## Internal Source Calibration ( $i\text{CR}$ )

- 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.

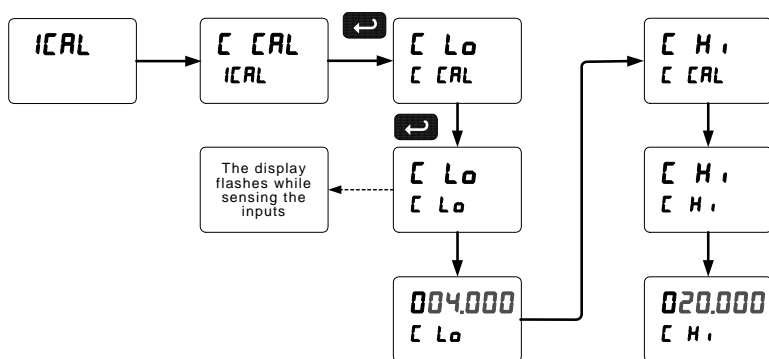
The *Internal calibration* menu is part of the *Advanced Features* menu.

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 (  $i\text{CR}$  ) and press Enter.
3. The meter displays either current calibration (  $i\text{CR}$  ) or voltage calibration (  $v\text{CR}$  ), 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 (Ⓒ 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 (Ⓒ Hi). 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
±10 VDC	0.10 VDC

## Meter Copy Function (COPY)

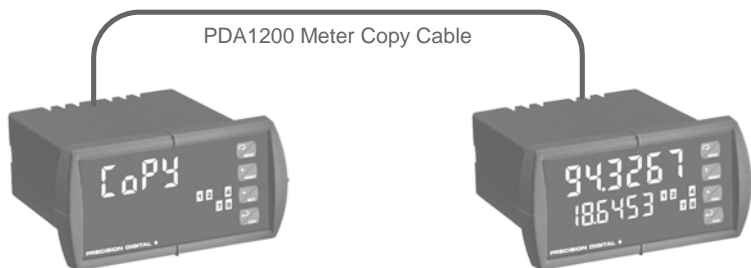
The *Copy* function is used to copy (or clone) all the settings from one meter to other meters requiring exactly the same setup and programming (*i.e.* type of input, scaling, decimal point, filter, bypass, etc.).



### 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.



**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!**

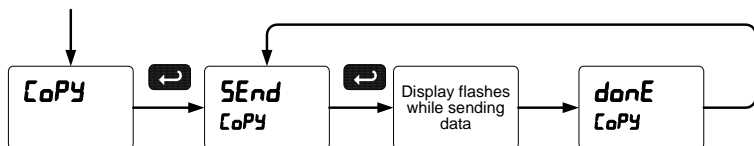
*Do not connect the two meters to the same signal source while cloning. Internal calibration may be affected.*

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 *SEnd*. Press Enter, the display flashes while sending data. The message *donE* is displayed when copying is completed.







7. The Clone meter displays the message *CoPY rE* 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
	Press to enter or exit Programming Mode, view settings, or exit max/min readings
	Press to reset max/min readings or other parameter/function assigned through the <i>User</i> menu
	Press to display max/min readings or other parameter/function assigned through the <i>User</i> menu
	Press to acknowledge relays or other parameters/function assigned through the <i>User</i> 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.

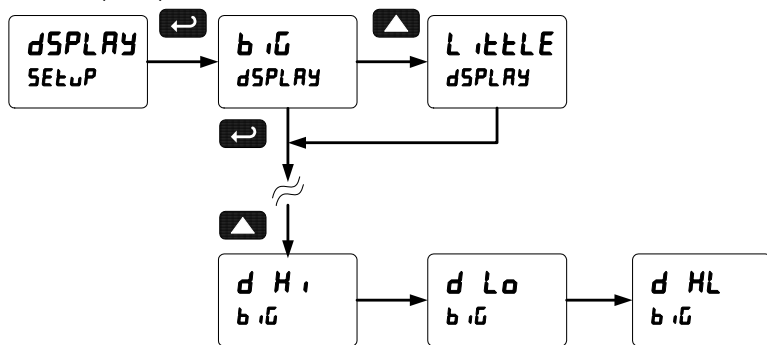
Any of the F1-F3 function keys (buttons) and the digital inputs can be programmed to reset the max & min readings. The meters are set at the factory to display the max reading by pressing the Up arrow/F2 button and to use the Right arrow/F1 button to access the *Reset* menu.

### To display max reading using function key with factory defaults:

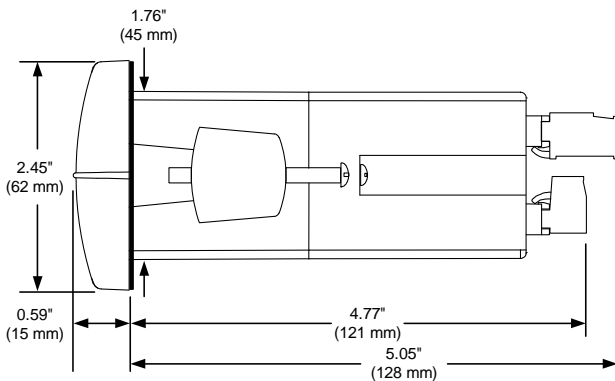
1. Press Up arrow/F2 button to display maximum reading since the last reset/power-up.
2. To reset max/min press Right arrow/F1 button to access the Reset menu. The max & min displays are reset to actual values.
3. Press Menu to exit max/min display reading.

### To display max/min readings continuously:

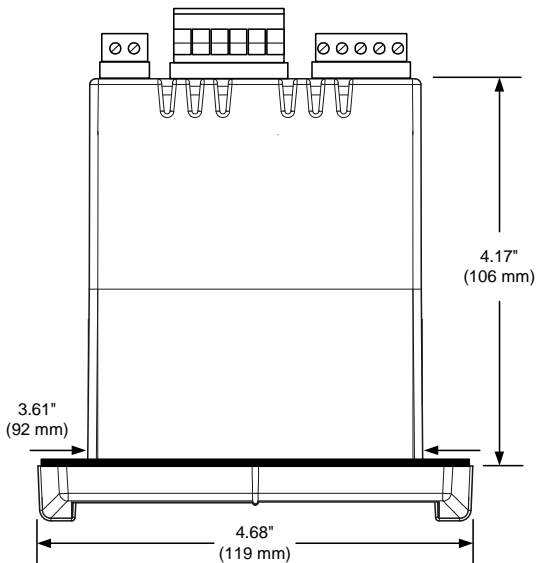
Assign either display to Max (*d H i*), Min (*d L o*), or toggle between Max and Min (*d H L*).



# 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 iRL)**

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:

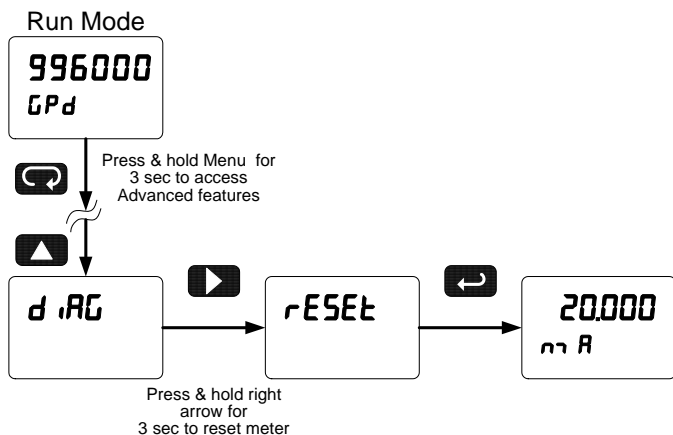
1. Go to the *Diagnostics* menu (d iRL) and press Enter button.
2. Press Up arrow button and scroll to Information menu ( iRF).
3. Press Enter to access the software number (5Ft), version (tEr), and serial number (5n) information. Write down the information as it is displayed. Continue pressing Enter 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.



## 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	<i>inP u t</i>	4-20 mA	
Filter	<i>F i l t e r</i>	10	
Bypass	<i>b y P A S S</i>	0.2	
Function	<i>F u n c t i o n</i>	Linear	
Number of points	<i>n o P t s</i>	2	
Programming	<i>P r o g</i>	Scale	
Input 1	<i>inP 1</i>	4.000 mA	
Display 1	<i>d i s 1</i>	4.000	
Input 2	<i>inP 2</i>	20.000 mA	
Display 2	<i>d i s 2</i>	20.000	
Decimal point	<i>d d d d d</i>	3 places	
Cutoff value	<i>C u t o f f</i>	0.000 (disabled)	
Display assignment	<i>d S P L A Y</i>		
Big display (Main)	<i>b i g</i>	PV: Process variable	
Little display (Small)	<i>L i t t l e</i>	Eng units: mA	
Display intensity	<i>d - i n t e n s</i>	6	
Relay 1 action	<i>R e l 1</i>	Automatic	
Relay 1 set point	<i>S E t 1</i>	7.000	
Relay 1 reset point	<i>r S e t 1</i>	6.000	
Relay 2 action	<i>R e l 2</i>	Automatic	
Relay 2 set point	<i>S E t 2</i>	10.000	
Relay 2 reset point	<i>r S e t 2</i>	9.000	
Relay 3 action	<i>R e l 3</i>	Automatic	
Relay 3 set point	<i>S E t 3</i>	13.000	

**Model PD6000 Analog Input Process Meter**
**Instruction Manual**

<b>Parameter</b>	<b>Display</b>	<b>Default Setting</b>	<b>User Setting</b>
Relay 3 reset point	<i>rSE 3</i>	12.000	
Relay 4 action	<i>Act 4</i>	Automatic	
Relay 4 set point	<i>SEt 4</i>	20.000	
Relay 4 reset point	<i>rSE 4</i>	19.000	
Fail-safe relay 1	<i>FLS 1</i>	Off	
Fail-safe relay 2	<i>FLS 2</i>	Off	
Fail-safe relay 3	<i>FLS 3</i>	Off	
Fail-safe relay 4	<i>FLS 4</i>	Off	
On delay relay 1	<i>On 1</i>	0.0 sec	
Off delay relay 1	<i>OFF 1</i>	0.0 sec	
On delay relay 2	<i>On 2</i>	0.0 sec	
Off delay relay 2	<i>OFF 2</i>	0.0 sec	
On delay relay 3	<i>On 3</i>	0.0 sec	
Off delay relay 3	<i>OFF 3</i>	0.0 sec	
On delay relay 4	<i>On 4</i>	0.0 sec	
Off delay relay 4	<i>OFF 4</i>	0.0 sec	
Loop break relay 1	<i>Ignore</i>	Ignore	
Loop break relay 2	<i>Ignore</i>	Ignore	
Loop break relay 3	<i>Ignore</i>	Ignore	
Loop break relay 4	<i>Ignore</i>	Ignore	
Display 1 analog out	<i>d iS 1</i>	4.000	
Output 1 value	<i>Out 1</i>	4.000 mA	
Display 2 analog out	<i>d iS 2</i>	20.000	
Output 2 value	<i>Out 2</i>	20.000 mA	
Source analog output	<i>Source</i>	Process Variable	
Overrange output	<i>o-rRH</i>	21.000 mA	
Underrange output	<i>u-rRH</i>	3.000 mA	
Loop break output	<i>brEAL</i>	1.000 mA	
Maximum output	<i>rr RH</i>	23.000 mA	



**Model PD6000 Analog Input Process Meter** **Instruction Manual**

<b>Parameter</b>	<b>Display</b>	<b>Default Setting</b>	<b>User Setting</b>
Minimum output	<i>rr rH</i>	0.000 mA	
Serial address	<i>AddrE5</i>	001	
Baud rate	<i>bAud</i>	2400	
Transmit delay	<i>tr dLY</i>	10 ms	
F1 function key	<i>F1</i>	Reset max & min	
F2 function key	<i>F2</i>	Big display: Max (Hi)	
F3 function key	<i>F3</i>	Acknowledge relays	
Logic level input 1	<i>LL 1 1</i>	Menu	
Logic level input 2	<i>LL 1 2</i>	Right arrow	
Logic level input 3	<i>LL 1 3</i>	Up arrow	
Logic level input 4	<i>LL 1 4</i>	Enter	
Logic level output 1	<i>LL 0 1</i>	Disabled	
Logic level output 2	<i>LL 0 2</i>	Disabled	
Logic level output 3	<i>LL 0 3</i>	Disabled	
Logic level output 4	<i>LL 0 4</i>	Disabled	
Password 1	<i>PR55 1</i>	000000 (unlocked)	
Password 2	<i>PR55 2</i>	000000 (unlocked)	
Password 3	<i>PR55 3</i>	000000 (unlocked)	

## Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, <i>Lcd</i> is displayed	Meter is password-protected, enter correct six-digit password to unlock
Meter displays error message during calibration ( <i>Error</i> )	Check: <ol style="list-style-type: none"> <li>Signal connections</li> <li>Input selected in <i>Setup</i> menu</li> <li>Minimum input span requirements</li> </ol>
Meter displays <ul style="list-style-type: none"> <li>• <i>999999</i></li> <li>• <i>-99999</i></li> </ul>	Check: <ol style="list-style-type: none"> <li>Input selected in <i>Setup</i> menu</li> <li>Corresponding signal at Signal connector</li> </ol>
Display is unstable	Check: <ol style="list-style-type: none"> <li>Input signal stability and value</li> <li>Display scaling vs. input signal</li> <li>Filter and bypass values (increase)</li> </ol>
Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: <ol style="list-style-type: none"> <li>Math function selected: Linear, square root, etc.</li> <li>Scaling or calibration</li> </ol>
Display does not respond to input changes, reading a fixed number	Check: <ol style="list-style-type: none"> <li>Display assignment, it might be displaying max, min, or set point.</li> </ol>
Display alternates between <ol style="list-style-type: none"> <li>1. <i>H i</i> and a number</li> <li>2. <i>L o</i> and a number</li> </ol>	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: <ol style="list-style-type: none"> <li>Fail-safe in <i>Setup</i> menu</li> <li>Wiring of relay contacts</li> </ol>
Relay and status LED do not respond to signal	Check: <ol style="list-style-type: none"> <li>Relay action in <i>Setup</i> menu</li> <li>Set and reset points</li> </ol>
Meter not communicating with application programs	Check: <ol style="list-style-type: none"> <li>Serial adapter and cable</li> <li>Serial settings</li> <li>Meter address and baud rate</li> </ol>
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 mA	20 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
4 mA	4 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
999999 -999999	Flashing display	Overrange condition Underrange condition
ACK	Acknowledge	Acknowledge relays
Act 1	Action 1	Set relay 1 action
AddrES	Address	Set meter address
ALARM 1	Alarm 1	Assign digital output to Alarm 1-8
ALTERNATE	Alternate	Set relay for pump alternation control
Auto-manual	Auto-manual	Set relay for automatic & manual reset
ANALOG	Analog output	Enter the <i>Analog output</i> scaling menu
ANALOG Pr	Analog output programming	Enter analog output programming
AUTO	Automatic	Press Enter to set automatic operation
BAUD	Baud rate	Select baud rate
BIG	Big display	Press Enter to assign the main display parameter (default: PV)
BIG HI	Max on big display	Assign digital input to display max on the main display
BIG HL	Max/min big display	Assign digital input to toggle max/min on the main display
BIG LO	Min on big display	Assign digital input to display min on the main display
BRK	Loop break	Set relay condition if loop break detected
BYPASS	Bypass	Set filter bypass value
CAL	Current calibration	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
CH	Current high	Calibrate high current input (e.g. 20 mA)
CL	Current low	Calibrate low current input (e.g. 4 mA)

Display	Parameter	Action/Setting Description
CAL	Calibrate	Enter the <i>Calibration</i> menu
CAL ib	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
Control	Control	Enter <i>Control</i> 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 <i>Time Delay</i> menu
diag	Diagnostics	Display parameter settings
diameter	Diameter	Enter the tank's diameter in inches
display	Display intensity	Set display intensity level from 1 to 8
DIS 1	Display 1	Program display 1 value
DIS 2	Display 2	Program display 2 value (up to 32 points)
DISABLE	Disable	Disable function key
DELAY 1	Delay 1	Enter relay 1 time delay setup (1-8)
DONE	Done	Copy function completed
DISPLAY	Display	Enter the <i>Display</i> menu
ENTER	Enter button	Assign digital input to Enter button
Error	Error	Error, calibration not successful, check signal or programmed value
F1	F1 function key	Assign F1 function key
F2	F2 function key	Assign F2 function key
F3	F3 function key	Assign F3 function key
FAILSF	Fail-safe	Enter <i>Fail-safe</i> menu
FILTER	Filter	Set noise filter value
FLS 1	Fail-safe 1	Set relay 1 fail-safe operation (1-8)

Display	Parameter	Action/Setting Description
<i>FORCE</i>	<i>Force</i>	Force analog output value for loop break
<i>FUNCTION</i>	<i>Math Function</i>	Select linear, square root, programmable exponent, or round horizontal tank function
<i>ICAL</i>	<i>Internal source calibration</i>	Enter internal source calibration (used for scaling the meter without a signal source)
<i>IGNORE</i>	<i>Ignore</i>	Ignore loop break condition
<i>INFO</i>	<i>Information</i>	Display software and S/N information
<i>INP 1</i>	<i>Input 1</i>	Calibrate input 1 signal or program input 1 value
<i>INP 2</i>	<i>Input 2</i>	Calibrate input 2 signal or program input 2 value (up to 32 points)
<i>INPUT</i>	<i>Input</i>	Enter <i>Input</i> selection menu
<i>LATCH</i>	<i>Latching</i>	Set relay for latching operation
<i>LED t</i>	<i>LED test</i>	Test all LEDs
<i>LENGTH</i>	<i>Length</i>	Enter the tank's length in inches
<i>LINEAR</i>	<i>Linear</i>	Set meter for linear function and select number of linearization points
<i>LITTLE</i>	Max on little display	Assign digital input to display max on the small display
<i>LITTLE</i>	Max/min little display	Assign digital input to toggle max/min on the small display
<i>LITTLE</i>	Min on little display	Assign digital input to display min on the small display
<i>LITTLE</i>	<i>Little display</i>	Press Enter to assign the small display parameter (default: engineering units)
<i>LL 1 1</i>	<i>Logic level input 1</i>	Assign logic level input 1 – 8, if expansion modules are connected
<i>LL 0 1</i>	<i>Logic level output 1</i>	Assign logic level output 1 – 8, if expansion modules are connected
<i>LOCK</i>	<i>Locked</i>	Enter password to unlock meter
<i>LATCH-CLEAR</i>	<i>Latching-cleared</i>	Set relay for latching operation with manual reset only after alarm condition has cleared
<i>4-20 mA</i>	<i>4-20 mA</i>	Set meter for 4-20 mA input

Display	Parameter	Action/Setting Description
$\overline{Rn}$	<i>Manual</i>	Press Enter to manually control relays or analog output operation
$\overline{RH}$	<i>Maximum</i>	Program maximum mA output allowed
$\overline{Enu}$	Menu button	Assign digital input to Menu button
$\overline{rn}$	<i>Minimum</i>	Program minimum mA output allowed
$\overline{PtS}$	<i>Number of points</i>	Set meter for 2 to 32-point linearization
$\overline{HoLd}$	Relays output hold	Assign digital input to hold all relays state hold
$\overline{OFF}$	<i>Off</i>	Disable relay and front panel status LED, turn relays off, program off time delay
$\overline{OFF 1}$	<i>Off 1</i>	Set relay 1 Off time delay (1-8)
$\overline{On}$	<i>On</i>	Enable fail-safe operation, turn relays on, program on time delay
$\overline{On 1}$	<i>On 1</i>	Set relay 1 On time delay (1-8)
$\overline{O-rAnG}$	<i>Overrange</i>	Program mA output for display overrange
$\overline{Out 1}$	<i>Output 1</i>	Program output 1 value (e.g. 4.000 mA)
$\overline{Out 2}$	<i>Output 2</i>	Program output 2 value (e.g. 20.000 mA)
$\overline{PASS}$	<i>Password</i>	Enter the <i>Password</i> menu
$\overline{PASS 1}$	<i>Password 1</i>	Set or enter Password 1 (Allows use of the F1–F3 function keys)
$\overline{PASS 2}$	<i>Password 2</i>	Set or enter Password 2 (Allows use of the F1–F3 function keys and changing the set/reset points)
$\overline{PASS 3}$	<i>Password 3</i>	Set or enter Password 3 (Restricts all programming & F1–F3 keys)
$\overline{Prog}$	<i>Program</i>	Enter the <i>Program</i> menu
$\overline{Prog E}$	<i>Programmable exponent</i>	Set meter for programmable exponent and enter exponent value
$\overline{rELAY}$	<i>Relay</i>	Enter the <i>Relay</i> menu
$\overline{rESEt}$	<i>Reset</i>	Press Enter to access the <i>Reset</i> menu
$\overline{rht}$	<i>Round horizontal tank</i>	Set meter for round horizontal tank volume calculation

Display	Parameter	Action/Setting Description
<i>r</i> <i>RIGHT</i>	Right arrow	Assign digital input to Right arrow button
<i>r</i> <i>LY 1</i>	<i>Relay 1</i>	Relay 1 setup (1-8)
<i>r</i> <i>LY d</i>	Disable relay	Assign digital input to disable all relays
<i>r</i> <i>LY E</i>	Enable relay	Assign digital input to enable all relays
<i>r</i> <i>SE 1</i>	<i>Reset 1</i>	Program reset point 1 (1-8)
<i>r</i> <i>SE H i</i>	<i>Reset high</i>	Press Enter to reset max display
<i>r</i> <i>SE HL</i>	<i>Reset high &amp; low</i>	Press Enter to reset max & min displays
<i>r</i> <i>SE Lo</i>	<i>Reset low</i>	Press Enter to reset min display
<i>S</i> <i>AMPL PL</i>	<i>Sampling</i>	Set relay for sampling operation
<i>S</i> <i>CALE</i>	<i>Scale</i>	Enter the <i>Scale</i> menu
<i>S</i> <i>EL Ect</i>	<i>Select</i>	Enter Select menu (function, cutoff, output programming)
<i>S</i> <i>End</i>	<i>Send</i>	Send meter settings to another meter
<i>S</i> <i>Er iAL</i>	<i>Serial</i>	Set serial communication parameters
<i>S</i> <i>Et 1</i>	<i>Set 1</i>	Program set point 1 (1-8)
<i>S</i> <i>EtUP</i>	<i>Setup</i>	Enter <i>Setup</i> menu
<i>S</i> <i>OURCE</i>	<i>Source</i>	Select source for the 4-20 mA output
<i>S</i> <i>QUARE</i>	<i>Square root</i>	Set meter for square root extraction
<i>t</i> <i>r dLY</i>	<i>Transmit delay</i>	Set transmit delay for serial communication
<i>u</i> <i>nLoc</i>	<i>Unlocked</i>	Program password to lock meter
<i>u</i> <i>P</i>	Up arrow	Assign digital input to Up arrow button
<i>u</i> <i>-r RnG</i>	<i>Underrange</i>	Program mA output for display underrange
<i>u</i> <i>SER</i>	<i>User I/O</i>	Assign function keys and digital I/O
<i>U</i> <i>CAL</i>	<i>Voltage calibration</i>	Calibrate voltage input
<i>U</i> <i>H i</i>	<i>Voltage high</i>	Calibrate high voltage input (e.g. 10 V)
<i>U</i> <i>Lo</i>	<i>Voltage low</i>	Calibrate low voltage input (e.g. 0 V)
<i>U</i> <i>oLE</i>	<i>0-10 VDC</i>	Set meter for $\pm 10$ VDC input

