**ProtEX™ MAX**

CSA  ⟨Ex⟩  IECEx  C E

CapTouch™

**MeterView Pro**
USB Install

- Fully Approved Explosion-Proof Meter
- 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, and ±10 V Field Selectable Inputs with ±0.03% Accuracy
- Feet & Inches Display Ideal for Level Applications
- Dual-Line 6-Digit Display, 0.6" (15 mm) & 0.46" (12 mm)
- CapTouch Through-Glass Button Programming
- Display Mountable at 0°, 90°, 180°, & 270°
- Isolated 24 VDC @ 25 mA Transmitter Power Supply
- Easy Field Scaling in Engineering Units without Applying an Input
- 4 Relays with Interlocking Capability + Isolated 4-20 mA Output Option
- Free PC-Based, On-Board, MeterView Pro USB Programming Software
- SunBright Display Standard Feature; Great for Outdoor Applications
- Operating Temperature Range: -55 to 65°C (-67 to 149°F)
- CSA Certified as Explosion-Proof / Dust-Ignition-Proof / Flame-Proof
- ATEX and IECEx Certified as Dust-Ignition-Proof / Flame-Proof
- Input Power Options: 85-265 VAC / 90-265 VDC or 12-24 VDC / 12-24 VAC
- Display Input in Two Different Scales Simultaneously - Great for Level Applications
- Multi-Pump Alternation Control
- Round Horizontal Tank Function; Just Enter Diameter & Length
- 8-Point Linearization for Non-Linear Volume Measurements
- Password Protection
- Programmable Display, Function Keys & Digital Inputs
- Flanges for Wall or Pipe Mounting
- Explosion-Proof Aluminum or Stainless Steel NEMA 4X / IP68 Enclosures
- On-Board RS-485 Serial Communications
- Modbus® RTU Communication Protocol Standard
- Four 3/4" NPT Threaded Conduit Openings
- Stainless Steel Pipe Mounting Kit
- Stainless Steel Tag Available
- 3-Year Warranty

## PRECISION DIGITAL CORPORATION
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**www.predig.com**

**PRECISION DIGITAL**

# The Complete ⟨ProtEX™⟩ Series
## MAX

CSA  Ex  IECEx  CE

PD8-154
**4-Point Alarm Annunciator**

PD8-6100
**Strain Gauge Meter**

PD8-158
**8-Point Alarm Annunciator**

PD8-6200
**Analog Input Flow Rate/Totalizer**

PD8-765
**Process & Temperature Meter**

PD8-6210
**Analog Input Batch Controller**

PD8-6000
**Process Meter**

PD8-6262
**Analog Dual-Input Flow Rate/Totalizer**

PD8-6001
**Feet & Inches Level Meter**

PD8-6300
**Pulse Input Flow Rate/Totalizer**

PD8-6060
**Dual-Input Process Meter**

PD8-6310
**Pulse Input Batch Controller**

PD8-6080
**Modbus® Scanner with Dual Analog Input**

PD8-6363
**Pulse Dual-Input Flow Rate/Totalizer**

PD8-6081
**Feet & Inches Modbus® Scanner**

PD8-7000
**Temperature Meter**

Go to PREDIG.COM for details on the entire ProtEX-MAX Series Meters

**Disclaimer**

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> ⚠️ **CAUTION**

- Read complete instructions prior to installation and operation of the meter.

> ⚠️ **WARNINGS**

- Risk of electric shock or personal injury.
- 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.
- Failure to follow installation guidelines could result in death or serious injury. Make sure only qualified personnel perform the installation.
- Never remove the meter cover in explosive environments when the circuit is live.
- Cover must be fully engaged to meet explosion-proof/dust-ignition-proof/flame-proof requirements.

⚠️ **WARNING**

Cancer and Reproductive Harm
www.P65Warnings.ca.gov

**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. See Warranty Information and Terms & Conditions on www.predig.com for complete details.

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# FREE MeterView Pro Programming Software



*The meter can be powered from the USB connection. When using the USB connection, **DO NOT** apply AC or DC power to the meter.*

The easiest and quickest way to program your ProtEX-MAX meter is to use the FREE MeterView Pro programming software. This software is loaded into the meter and connects and installs directly to your PC with a USB cable. We recommend that the first thing you do after taking the meter out of the box is connect the ProtEX-MAX to your PC with the provided USB cable – do not use a different cable. **DO NOT** apply AC or DC power to the meter while your PC is connected to the meter as it will disrupt the USB connection. You don't even have to apply an input signal.

MeterView Pro programming software is intuitive, and most customers can get their meter programmed as they like without even looking in the manual.

> **Watch MeterView Pro Software Video at**
> **www.predig.com/meterviewpro**

In addition to programming, the software may be used for:

- Monitoring
- Datalogging using your PC
- Generating and saving programming files for later use

Once your meter is programmed the way you want it, you can wire it up for your application per the instructions in this manual and install it. If you find that you need to make adjustments to the programming after the meter is installed, you can use the programming buttons and the instructions in this manual to do so.

> ⚠️ **WARNING**

- When using the USB connection, the meter should only be connected to a computer when both devices are in a non-hazardous area.

# Table of Contents

# Table of Figures

# Introduction

The ProtEX-MAX PD8-6001 is an explosion-proof, multi-purpose, easy-to-use digital process meter featuring a bright, easy-to-read main display with convenient feet and inches designations. It is ideal for level applications requiring an easy-to-understand display, as it shows feet, inches, and fractions of an inch. Its superluminous LED digits make it easily readable in any lighting condition, including direct sunlight.

The PD8-6001 accepts current and voltage signals (e.g. 4-20 mA, 0-10 V). Three of the front panel buttons can be custom-programmed for a specific operation. The analog input can be scaled to display the process in two different scales. The main display indicates level in feet and inches with printed feet and inches designations, and the second display could be used to indicate some other scale, such as the volume in gallons or liters.

The ProtEX-MAX is available in two configurations: display only and fully loaded. Both versions include a 24 VDC power supply to power the transmitter. A fully loaded ProtEX-MAX PD8-6001-6H7 meter comes with four SPDT relays, a 4-20 mA output, five digital inputs and four digital outputs, and RS-485 serial communications.

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

# CapTouch Buttons

To make it possible to program and operate the ProtEX-MAX in a hazardous area, the programming buttons that are located behind the glass window can be operated without removing the cover by using the CapTouch through-glass buttons. The operator puts their finger on the glass over the button and the button is actuated.



# Ordering Information

## Aluminum Enclosure

### 85-265 VAC Models

| Model | Standard Features | Options Installed |
|---|---|---|
| PD8-6001-6H0 | 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications | No options |
| PD8-6001-6H7 | | 4 relays 4-20 mA output |

### 12-24 VDC Models

| Model | Standard Features | Options Installed |
|---|---|---|
| PD8-6001-7H0 | 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications | No options |
| PD8-6001-7H7 | | 4 relays 4-20 mA output |

## Stainless Steel Enclosure

### 85-265 VAC Models

| Model | Standard Features | Options Installed |
|---|---|---|
| PD8-6001-6H0-SS | 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications | No options |
| PD8-6001-6H7-SS | | 4 relays 4-20 mA output |

### 12-24 VDC Models

| Model | Standard Features | Options Installed |
|---|---|---|
| PD8-6001-7H0-SS | 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications | No options |
| PD8-6001-7H7-SS | | 4 relays 4-20 mA output |

## Accessories

| Model | Description |
|---|---|
| PDAPLUG75 | 3/4" Metal Conduit/Stopping Plug |
| PDA-SSTAG | Custom Stainless Steel Tag (see website for convenient ordering form) |
| PDA6848-SS | 2" U-Bolt Kit Stainless Steel |
| PDA7485-I | RS-232 to RS-485 isolated converter |
| PDA8485-I | USB to RS-485 isolated converter |

# Helpful Videos

There are several videos that will help you get a better understating of the features and functionality of the ProtEX-MAX products. Since the ProtEX-MAX meters have the same general features and functionality of the ProVu meters, appropriate videos for the ProVu meter are also included.

### ProtEX-MAX Products Overview

Learn about the complete line of ProtEX-MAX products.



predig.com/videos/ProtEXMAX_Overview

### MeterView Pro Programming Software

Learn how easy it is to program the ProVu (ProtEX-MAX) process meter using MeterView Pro software.



predig.com/videos/MVPro_SW

### MeterView Pro Software Demonstration

Learn how easy it is to program Precision Digital's ProVu (ProtEX-MAX) process meter for a level application using MeterView Pro PC-based programming software.



predig.com/videos/MVPro_Demo

### Connect to PC for Programming

Learn how to connect a ProVu (ProtEX-MAX) process meter to your PC and install free MeterView Pro programming software.



predig.com/videos/PC_Connect

### 4-20 mA Connections

This Tech Tips video shows how to make connections to power the transmitter with the ProVu's (ProtEX-MAX's) 24 VDC power supply.



predig.com/videos/4-20_mA_Connections

### Use ProtEX-MAX for Pump Control

Learn how to use the ProVu (ProtEX-MAX) meter as an explosion-proof pump controller. See how the four relays can be used to alternate two pumps and provide high and low alarms.



predig.com/videos/PumpControl

# Key Features

## Front
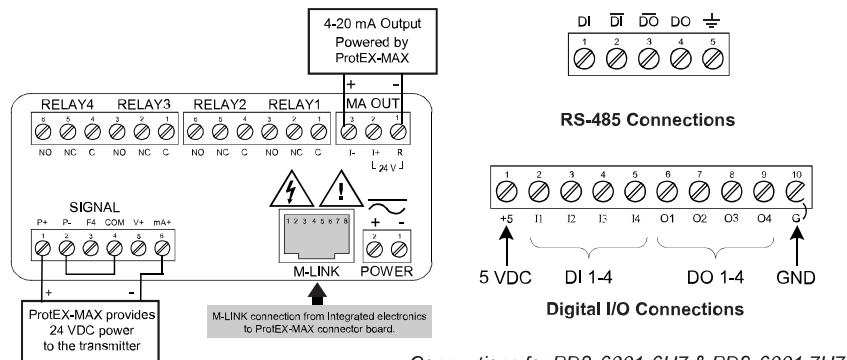


## Connections



*Connections for PD8-6001-6H7 & PD8-6001-7H7*

- Form C (SPDT) relays
- Two isolated supplies available even on 12/24 VDC input power models
- Removable terminal blocks
- 4 relays + isolated 4-20 mA output option
- Universal 85-265 VAC or 12/24 VDC input power
- Voltage or current inputs
- No jumpers needed for V/mA input selection
- Digital input (F4)

# The Only Explosion-Proof Process Meter You Will Ever Need

Front, back and in between, the PD8-6001 ProtEX-MAX Explosion-proof process meter boasts specifications, features and functionality that make it the only hazardous area process meter you will ever need. The front panel push-buttons can even be operated in a hazardous area without removing the cover by using the CapTouch through-glass feature.

The primary function of this meter is to display level from a 4-20 mA output transmitter in feet and inches format rather than the more common decimal format. The PD8-6001 has all the same features as our PD6001 1/8 DIN process meter, is certified by CSA as Explosion-Proof / Dust-Ignition-Proof / Flame-Proof and by ATEX and IECEx as Dust-Ignition-Proof / Flame-Proof. Besides being suitable for hazardous areas, the number one feature that makes the PD8-6001 such a useful device is its built-in 24 VDC power supply to drive the transmitter as illustrated by the above diagram. This feature not only saves the cost of an external power supply, but also greatly simplifies wiring. In addition, there is a second 24 VDC @ 25 mA power supply provided with the 4-20 mA output option, evident also in the above diagram.

The first thing you notice about the PD8-6001 is its modern looking, rugged, explosion-proof housing with convenient mounting flanges, available in aluminum or stainless steel. Housed inside this enclosure is a dual-line, 6-digit display with high-intensity LEDs that can be read in direct sunlight. It is ideal for level applications requiring an easy-to-understand display, as it shows feet, inches, and fractions of an inch. The main display indicates level in feet and inches with printed feet and inches designations, and the second display could be used to indicate some other scale, such as the volume in gallons or liters. This makes the PD8-6001 ideal for level and other applications where displaying a big number is required.

Other key features include four relays and 4-20 mA output option, advanced signal input conditioning like automatic round horizontal tank linearization, function keys, pump alternation capability, and Modbus RTU serial communications. Finally, all these features and capabilities can easily be programmed without removing the cover using CapTouch buttons in a hazardous area or with free MeterView Pro PC-based software in a safe area.

# Easy Programming Methods

The ProtEX-MAX can be programmed in a hazardous area with the through-glass CapTouch buttons without removing the cover, in a safe area with the front panel push buttons with the cover removed, or in a safe area with free, PC-based MeterView Pro software. MeterView Pro is resident on the ProtEX-MAX and is accessed by a provided USB cable, so it is by far the easiest way to program the ProtEX-MAX. The ProtEX-MAX can be calibrated either by applying a known signal or scaled by entering a desired value with the front panel buttons or MeterView Pro software. Most customers will use the scaling method because it is simpler and does not require a calibrated signal source. Selecting the input to be current or voltage is done with the front panel buttons or MeterView Pro software. Once programming is completed it can be locked with a password.
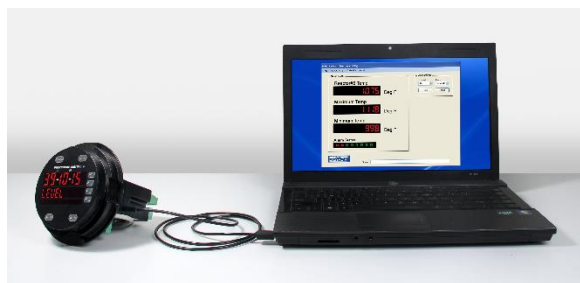


The ProtEX-MAX comes preloaded with free MeterView Pro programming software that connects and installs directly to your PC with a standard USB cable, also provided free with each instrument. This eliminates the need to insert CDs, install drivers, or download software from the internet. When you connect your ProtEX-MAX to your PC, MeterView Pro is downloaded to your PC, the software automatically selects the model you are programming, and you're ready to start programming immediately. Further simplifying the programming process, the ProtEX-MAX can be powered from the USB port, so no need to apply external power while programming your meter. In addition to programming, the software will also allow you to monitor, and datalog a ProtEX-MAX using your PC. You can also generate and save programming files for later use.

# Advanced Display Features

## Display Level the Way You Want

The PD8-6001 is the perfect meter for customers who prefer to see level measurements displayed in feet and inches ($12^{FT}11^{IN} 7/_{16}$) vs the more standard decimal format (12.953 feet). And for customers that want to see the level in feet and inches and also the actual volume in the tank, the PD8-6001's second display can be scaled to display the input in gallons, liters, barrels, etc.



Feet and Inches Display     Common Decimal Display

## Rounding for Even Steadier Display

The rounding feature is used to give the user a steadier feet and inches display with fluctuating signals. Rounding is used in addition to the filter function. Rounding is only applicable if the second display is setup to display level unit tags (d L-u). Rounding will round the second display to the nearest decimal value according to the rounding selected. The main display's level reading will be adjusted to match the rounded decimal value. See examples below:

| Rounding Selection | Actual Value | Second Display Value | Main Display Value |
|---|---|---|---|
| 1 | 12.093 | 12.093 | $12^{FT}1^{IN} 2/_{16}$ |
| | 12.953 | 12.953 | $12^{FT}11^{IN} 7/_{16}$ |
| 5 | 12.093 | 12.095 | $12^{FT}1^{IN} 2/_{16}$ |
| | 12.953 | 12.955 | $12^{FT}11^{IN} 7/_{16}$ |
| 10 | 12.093 | 12.090 | $12^{FT}1^{IN} 1/_{16}$ |
| | 12.953 | 12.950 | $12^{FT}11^{IN} 6/_{16}$ |
| 50 | 12.093 | 12.100 | $12^{FT}1^{IN} 3/_{16}$ |
| | 12.953 | 12.950 | $12^{FT}11^{IN} 6/_{16}$ |

## Dual-Line Makes All the Difference

The main display can be programmed to indicate PV, maximum (peak), minimum (valley), alternating maximum/minimum, one of four alarm set points, or Modbus input. The second display can be configured to display engineering units, set points, user defined messages, or simply turned off.

The ProtEX-MAX's dual-line display makes all the difference both when programming the instrument and when using it in the field. When programming the instrument, the dual-line display prompts for the needed information and also helps you keep track of where you are in the setup process. When using the instrument, the dual-line display provides more information such as displaying the input in two different scales like height and volume for a level application. We call this the Dual-Scale feature.

### Programming Assistance

The ProtEX-MAX's dual-line display makes programming the instrument much easier because the second display prompts for the needed information and also helps you keep track of where you are in the setup process.



The ProtEX-MAX is prompting for the value for Input 2 and displaying the default value of 20.00 mA. The "2" in 20.00 is brighter than the rest of the digits indicating that it is the number that will be changed by the Up arrow.



The ProtEX-MAX is now prompting for what the user wants Display 2 to be; that is the value that corresponds to 20 mA. In this case Display 2 is currently set to $20^{FT}\ 0^{IN}\ 0/_{16}$.

### Super-Bright Display

The ProtEX-MAX comes standard with a super-bright display, with LEDs that are visible even in direct sunlight. The display also has up to eight levels of adjustable intensity for optimum visibility in any lighting condition.

### Dual-Scale Display Feature

The ProtEX-MAX PD8-6001 has a rather unique, and very flexible dual-scale capability. This is of particular value in level applications where a second scaled display can represent the measured input in a different form (i.e. gallons & height). Both displays are independently scaled and are based on the 4-20 mA input signal.



**Height & Gallons**



**Height & Meters**



**Height & Percent**
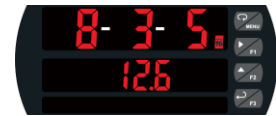


**Height & Barrels**

MeterView Pro can be used to program the ProtEX-MAX to display the input in two different scales:



11

# Physical Features

The ProtEX-MAX is designed for ease-of-use in safe and hazardous area applications, and is housed in a rugged NEMA 4X explosion-proof enclosure, available in either aluminum or stainless steel. The PD8-6060 can operate over a wide temperature range (-55 to 65°C / -67 to 149°F), includes removable screw terminal connectors, can have up to four relays and a 4-20 mA output, and features through-glass buttons for easy meter operation without the need to remove the cover. All of these features are backed by a 3-year warranty.

## Super-Bright LED Display

The ProtEX-MAX features a dual-line 6-digit display with super-bright LEDs, our brightest ever. These allow the display to be read in any lighting condition, even in direct sunlight.



## CapTouch Through-Glass Buttons

The ProtEX-MAX is equipped with four capacitive sensors that operate as through-glass buttons so that it can be programmed and operated without removing the cover (and exposing the electronics) in a hazardous area. These buttons can be disabled for security by selecting the DISABLE setting on the NO-CONTACT BUTTONS switch located on the back of the electronics module, inside the enclosure.

## Rugged, Heavy-Duty Enclosure

The ProtEX-MAX is housed in a rugged NEMA 4X, 7, & 9, IP68 aluminum or stainless steel enclosure, designed to withstand harsh environments in safe and hazardous areas.



# Wide Viewing Angle

Customers can't always look at the display from straight on, so the window and display module have been optimized to provide a wide viewing angle of approximately ± 40°; nearly twice that of the competition.



## Built-In Mounting Flanges

The ProtEX-MAX is equipped with two slotted flanges for wall mounting or NPS 1½" to 2½" or DN 40 to 65 mm pipe mounting.



## Flexible Mounting & Wiring

The ProtEX-MAX features four ¾" NPT threaded conduit openings so that wiring can be routed to the most convenient conduit connection(s).

## Rotatable Display

The ProtEX-MAX rotatable display, along with four available conduit connections, provide for numerous installation options. The display can be rotated in 90° increments. Rotate it 90° for horizontal mounting.



**Vertical Mounting**          **Horizontal Mounting**

## Perfect & Secure Fit Every Time

The internal cast rails ensure the ProtEX-MAX assembles together perfectly, quickly and securely; and everything lines up for optimal viewing every time. There are no standoffs to worry about breaking or getting out of alignment. The display module snaps into the built-in rails on the enclosure making assembly a snap, while pressing the display as close to the glass as possible to improve wide angle viewing. No tools are needed to install or remove it.

## Stainless Steel Tags

PDA-SSTAG is a laser etched stainless steel tag accessory for any of your Precision Digital meters. The tag features custom text for equipment identification, instruction, or whatever else is needed in your facility. Each tag comes with a stainless steel wire and lead seal for easy mounting wherever you need it.



## Removable Screw Terminals

Industrial applications require screw terminal connections for easy field wiring and the ProtEX-MAX goes one step further in convenience by also making them removable.



## USB Port for MeterView Pro



USB cable conveniently plugs into side of ProtEX-MAX meter

## Hazardous Area Approvals

The ProtEX-MAX is certified by CSA as Explosion-Proof / Dust-Ignition-Proof / Flame-Proof, and is ATEX and IECEx certified as Dust-Ignition-Proof / Flame-Proof.

## Wide Operating Temperature Range

The ProtEX-MAX can operate from -55 to 65°C (-67 to 149°F) meaning it can be installed in a wide variety of indoor and outdoor industrial applications.

# Transmitter Power Supplies

## Meter Powers the Transmitter

One of the most useful standard features of the PD8-6001 is its built-in isolated, 24 V @ 25 mA power supply to power the transmitter. This feature saves money by eliminating an external power supply and also simplifies wiring by reducing the number of devices in the loop. It can be configured for 5, 10, or 24 V (default) by means of a simple internal jumper. This power supply is even available on meters that are powered from DC power (24 V @ 25 mA). To use an external power supply instead of the internal power supply, simply make connections to different terminals on the ProtEX-MAX.

The following diagram illustrates how to wire the ProtEX-MAX so it will power the transmitter:
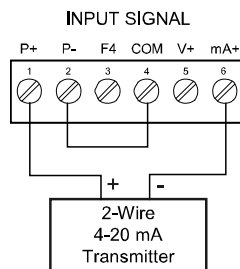


## Meter Powers 4-20 mA Output

Not only can the ProtEX-MAX power the 4-20 mA input signal, but an additional power supply of 24 V @ 25 mA is provided with the 4-20 mA output option to power the 4-20 mA output.
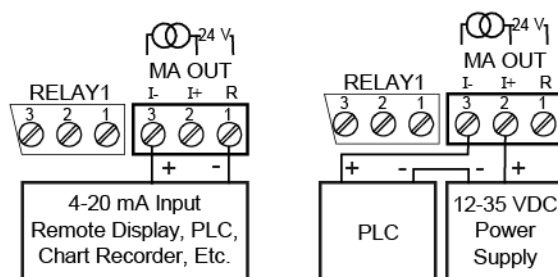


## Fuse Prevents Current Overload

Another very useful aspect of the ProtEX-MAX is that the current input is protected against current overload by a resettable fuse. 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.

# Input Signal Conditioning

To satisfy applications that require scaling in ways other than the usual 2-point linear method, the PD8-6001 is available with multi-point linearization and round horizontal tank volume calculation capabilities. These features are most appropriate for the second display's decimal format.

## Round Horizontal Tank Linearization

This function automatically calculates the volume in a round horizontal tank with flat ends and allows that reading to be displayed on the meter's second display. The user can now display level in feet and inches on the main display and volume on the second display. This feature is only available on PV2 since PV1 is the designated level indicator.
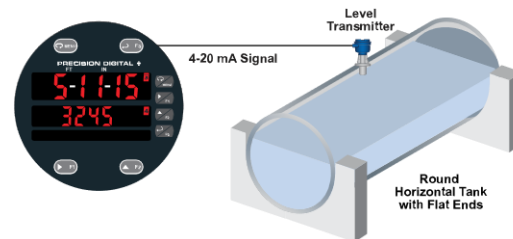


## Using MV Pro for RHT Function
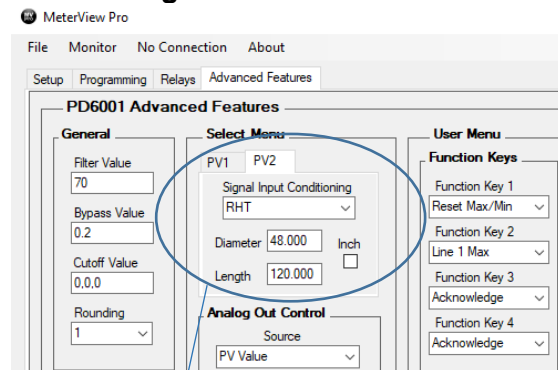


Round Horizontal Tank Function

User need only enter the diameter and length of the tank.

## Multi-Point Linearization

Multi-point linearization capability is available for the main and second displays, but it is most commonly used on the second display to display volume of non-linear tanks. This allows the user to display both level in feet and inches and volume on one meter. Up to eight calibration points may be entered for the second display. These points may be entered with the front panel buttons, or with MeterView Pro Software.

### Using MV Pro for Multi-Point Linearization



14
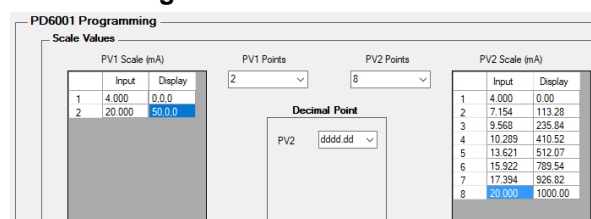
## Exp-Proof Dual-Pump Alternation

The ProtEX-MAX can be used as an explosion-proof pump controller when combined with a continuous level transmitter. The most common pump control application is shown below: controlling and alternating two pumps and providing high and low-level alarms. In addition, the ProtEX-MAX provides the 24 V to power the transmitter.
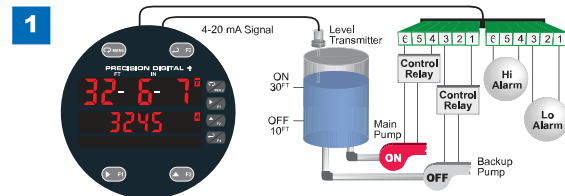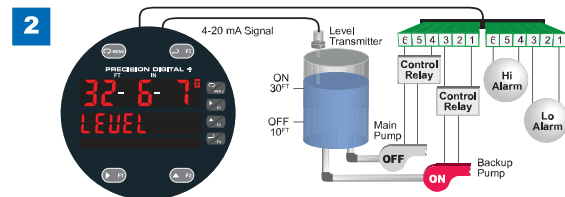
**1**



Relay #4 turns the main pump on at 30$^{FT}$ and turns it off at 10$^{FT}$.

**2**



With the Pump Alternation feature activated, the next time the level reaches 30$^{FT}$, relay #3 transfers and starts the backup pump.

**3**



If the backup pump is not able to keep up, and the level reaches 40 $^{FT}$, relay #4 transfers and starts the main pump as well.

**4**



Relay #2 trips the High Level Alarm at 45$^{FT}$ and resets at 42$^{FT}$.

**5**
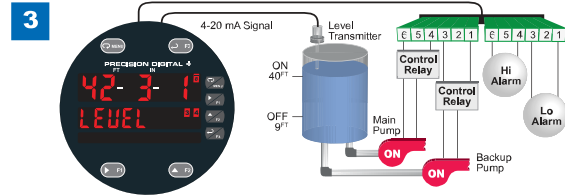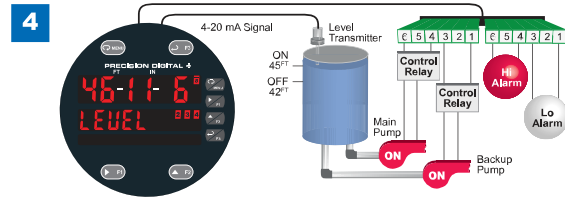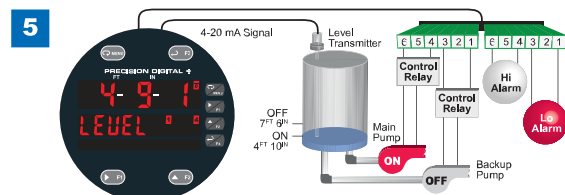


Relay #1 trips the Low Level Alarm at 4$^{FT}$10$^{IN}$ and resets at 7$^{FT}$6$^{IN}$.

Learn how to use the ProVu (ProtEX-MAX) meter as an explosion-proof pump controller. See how the four relays can be used to alternate two pumps and provide high and low alarms.

predig.com/videos/PumpControl

# Useful Tools

### PD9501 Multi-Function Calibrator



This PD9501 Multi-Function Calibrator has a variety of signal measurement and output functions, including voltage, current, thermocouple, and RTD.

### PD9502 Low-Cost Signal Generator



The PD9502 is a low-cost, compact, simple to use 4-20 mA or 0-10 VDC signal generator. It can easily be set for 0-20 mA, 4-20 mA, 0-10 V or 2-10 V ranges. Signal adjustment is made with a one-turn knob. A 15-27 VDC wall plug is provided with the instrument. Optional USB power bank is available.

# Specifications

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

## General

| | |
|---|---|
| **Display** | Display Line 1: 0.60" (15 mm) high, red LEDs |
| | Display Line 2: 0.46" (12 mm) high, red LEDs |
| | 6 digits each (-99999 to 999999), with lead zero blanking |
| **Feet & Inches Range** | -9$^{FT}$11$^{IN}$ (15/16 or 7/8) to 99$^{FT}$11$^{IN}$ (15/16 or 7/8) |
| **Display Intensity** | Eight user selectable intensity levels. Default intensity is six. |
| **Display Update Rate** | 5/second (200 ms) |
| **LED Status Indicators** | See *LED Status Indicators* on page *33* for details. |
| **Overrange** | Display flashes 999999 |
| **Underrange** | Display flashes -99999 |
| **Display Assignment** | Display Line 1: PV1, max/min, max & min, set points, or Modbus input |
| | Display Line 2: PV2, percent of PV1, set points, PV1 level in feet & unit/tag, max/min, max & min, Modbus, engineering units, or turned off |
| **Programming Methods** | Four CapTouch through-glass buttons when cover is installed. Mechanical buttons can be used with the cover removed. Free PC-based USB MeterView Pro programming software. |
| **Noise Filter** | Programmable from 2 to 199 (0 will disable filter) |
| **Filter Bypass** | Programmable from 0.1 to 99.9% of calibrated span |
| **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. |
| **Rounding** | Select 1, 2, 5, 10, 20, 50, or 100 |
| | (e.g. rounding = 10, actual value = 12.093, Line 2 display = 12.090, Line 1 display = 12$^{FT}$1$^{IN}$ $^1/_{16}$) |
| **Password** | Three programmable passwords restrict modification of programmed settings. Pass 1: Allows use of function keys and digital inputs. Pass 2: Allows use of function keys, digital inputs and editing set/reset points. Pass 3: Restricts all programming, function keys, and digital inputs |
| **Power Options** | 85-265 VAC 50/60 Hz; 90-265 VDC, 20 W max; 12-24 VDC, 12-24 VAC, 15 W max. Powered over USB for configuration only |

| | |
|---|---|
| **Non-Volatile Memory** | All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost. |
| **Fuse** | Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse |
| **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** | T6 Class operating temperature range Ta = -55 to 60ºC |
| | T5 Class operating temperature range Ta = -55 to 65ºC |
| | Storage temperature range: -55 to 85ºC (-67 to 185ºF) |
| | Relative humidity: 0 to 90% non-condensing |
| **Max Power Dissipation** | Maximum power dissipation limited to 15.1 W |
| **Connections** | Power, signal, relays, mA out: Removable screw terminal blocks accept 12 to 22 AWG wire |
| | RS-485: Removable screw terminal block accepts 16 to 30 AWG wire |
| | Digital I/O: Removable screw terminal blocks accept 16 to 30 AWG wire |
| **Mounting** | Wall Mounting: Four (4) mounting holes provided for mounting meter to wall. See *Wall Mounting Instructions* on page *23* for additional details. |
| | Pipe Mounting: Optional pipe mounting kit (PDA6848) allows for pipe mounting. Sold separately. See *Pipe Mounting Instructions* on page *24* for additional details. |
| **Tightening Torque** | Power, signal, relays, mA out terminals: 5 lb-in (0.56 Nm) |
| | Digital I/O and RS-485: 2.2 lb-in (0.25 Nm) |
| **Overall Dimensions** | 6.42" x 7.97" x 8.47" (W x H x D) (163 mm x 202 mm x 215 mm) |
| **Weight** | Aluminum: 14.7 lbs (6.67 kg) Stainless Steel: 23.5 lbs (10.66 kg) |
| **Warranty** | 3 years parts & labor. See Warranty Information and Terms & Conditions on www.predig.com for complete details. |

## Process Inputs

| | |
|---|---|
| **Inputs** | Field selectable: 0-20 mA, 4-20 mA<br>±10 V (0-5 V, 1-5 V, 0-10 V)<br>Modbus PV (Slave) |
| **Isolated Transmitter Power Supply** | Terminals P+ & P-: 24 VDC ± 10%. Isolated from the input at >500 V and from the power line at 4 kV. Jumper selectable for 24, 10, or 5 VDC supply (internal jumper J4). All models transmitter supply rated @ 25 mA max. |
| **Accuracy** | ±0.03% of calibrated span ±1 count |
| **Temperature Drift** | 0.005% of calibrated span/°C max from 0 to 65°C ambient, 0.01% of calibrated span/°C max from -40 to 0°C ambient |
| **Input Signal Conditioning** | Linear or round horizontal tank volume calculation |
| **Multi-Point Linearization** | 2 to 32 points for PV or PV1<br>2 to 8 points for PV2 (Dual-scale Level feature) |
| **Round Horizontal Tank** | Diameter & Length:<br>999.999 inch or cm calculates volume in gallons or liters respectively |
| **Low-Height Cutoff** | $0^{FT}1^{IN}(^0/_{16}$ or $^0/_8)$ to $99^{FT}11^{IN}(^{15}/_{16}$ or $^7/_8)$ $(0^{FT}0^{IN}(^0/_{16}$ or $^0/_8)$ disables cutoff function) |
| **Decimal Point** | Up to five decimal places or none:<br>(PV2 only) *dddddd*, *ddddd*, *dddd*, *ddd*, *dd*, or *dddddd* |

| **Calibration Range** | Input Range | Minimum Span Input 1 & 2 |
|---|---|---|
| | 4-20 mA | 0.15 mA |
| | ±10 V | 0.10 V |
| | An error message will appear if the input 1 and input 2 signals are too close together | |

| | |
|---|---|
| **Input Impedance** | Voltage ranges: greater than 500 k$\Omega$<br>Current ranges: 50 - 100 $\Omega$ (depending on internal resettable fuse impedance) |
| **Input Overload** | Current input protected by an internal resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed. |
| **HART Transparency** | The meter does not interfere with existing HART communications; it displays the 4-20 mA primary variable and it allows the HART communications to pass through without interruption. The meter is not affected if a HART communicator is connected to the loop. The meter does not display secondary HART variables. |

## Relays

| | |
|---|---|
| **Rating** | 4 SPDT (Form C) internal and rated 3 A @ 30 VDC and 125/250 VAC resistive load; 1/14 HP ($\approx$ 50 W) @ 125/250 VAC for inductive loads |
| **Noise Suppression** | Noise suppression is recommended for each relay contact switching inductive loads. See *Switching Inductive Loads* on page *30* for details. |
| **Deadband** | 0-100% of span, 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) and/or manual reset<br>• Latching (requires manual acknowledge) with or without clear<br>• Pump alternation control (2-4 relays)<br>• Sampling (based on set point and time)<br>• Off (disable unused relays and enable Interlock feature)<br>• Manual on/off control mode |
| **Relay Reset (Acknowledge)** | User selectable via front panel button, F4 digital input, external contact closure on digital inputs, or through serial communications |
| **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<br>*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 |

## USB Connection

| | |
|---|---|
| **Function** | Programming only |
| **Compatibility** | USB 2.0 Standard, Compliant |
| **Connector Type** | Micro-B receptacle |
| **Cable** | USB A Male to Micro-B Cable |
| **Driver** | Microsoft® Windows® XP/Vista/7/8/10 |
| **Power** | USB port provides power to the meter. ***DO NOT*** apply AC or DC power to the meter while the USB port is in use. |

## Isolated 4-20 mA Transmitter Output

| | |
|---|---|
| **Output Source** | Process variable (PV), max, min, set points 1-4, Modbus input, or manual control mode |
| **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** | ± 0.1% of span ± 0.004 mA |
| **Temperature Drift** | 0.4 µA/°C max from 0 to 65°C ambient, 0.8 µA/°C max from -40 to 0°C ambient *Note: Analog output drift is separate from input drift.* |
| **Isolated Transmitter Power Supply** | Terminals I+ & R: 24 VDC ±10%. Isolated from the input at >500 V. Used to power the 4-20 mA output. All models @ 25 mA max. |
| **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 |

## RS-485 Serial Communications

| | |
|---|---|
| **Compatibility** | EIA-485 |
| **Connectors** | Removable screw terminal connector |
| **Max Distance** | 3,937' (1,200 m) max |
| **Status Indication** | Separate LEDs for Power (P), Transmit (TX), and Receive (RX) |

## Modbus® RTU Serial Communications

| | |
|---|---|
| **Slave Id** | 1 – 247 (Meter address) |
| **Baud Rate** | 300 – 19,200 bps |
| **Transmit Time Delay** | Programmable between 0 and 199 ms |
| **Data** | 8 bit (1 start bit, 1 or 2 stop bits) |
| **Parity** | Even, Odd, or None with 1 or 2 stop bits |
| **Byte-To-Byte Timeout** | 0.01 – 2.54 second |
| **Turn Around Delay** | Less than 2 ms (fixed) |

*Note: Refer to the ProtEX-MAX Modbus Register Tables located at www.predig.com for details.*

## Digital Input (F4)

| | |
|---|---|
| **Function** | Remote operation of front-panel buttons, acknowledge/reset relays, reset max/min values. See *Function Keys & Digital I/O Available* Settings on page *56* for a complete list of capabilities. |
| **Contacts** | 3.3 VDC on contact. Connect normally open contacts across F4 to COM |
| **Logic Levels** | Logic High: 3 to 5 VDC Logic Low: 0 to 1.25 VDC |

## Digital Inputs & Outputs

| | |
|---|---|
| **Function** | Terminals provided for remote operation of all four programming / operation buttons. Other uses include acknowledge/reset relays and reset max/min values. See *Function Keys & Digital I/O Available Settings* on page 56 for a complete list of capabilities. |
| **Channels** | 4 digital inputs & 4 digital outputs |
| **Digital Input Logic High** | 3 to 5 VDC |
| **Digital Input Logic Low** | 0 to 1.25 VDC |
| **Digital Output Logic High** | 3.1 to 3.3 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. Connect normally open push buttons across +5 V & DI 1-4. |

**⚠ WARNING**

- **DO NOT** use +5 V terminal to power external devices.

## MeterView Pro Software

| | |
|---|---|
| **Availability** | Download directly from meter or from www.predig.com/download_software |
| **System Requirements** | Microsoft® Windows® XP/Vista/7/8/10 |
| **Communications** | USB 2.0 (for programming only) (USB A Male to Micro-B Cable) RS-485 to USB converter (programming, monitoring, and data logging) |
| **Configuration** | Configure meters one at a time |
| **Power** | USB port provides power to the meter. *DO NOT apply AC or DC power to the meter while the USB port is in use.* |

## Enclosure

| | |
|---|---|
| **Material** | AL Models:<br>ASTM A413 LM6 die-cast aluminum, copper-free, enamel coated<br>SS Models:<br>ASTM A743 CF8M investment-cast 316 stainless steel |
| **Gasket** | Fluoroelastomer |
| **Rating** | NEMA 4X, IP68 Explosion-proof |
| **Color** | AL: Blue<br>SS: Silver |
| **Window** | Borosilicate glass |
| **Conduits** | Four ¾" NPT threaded conduit openings |
| **Conduit Stopping Plugs** | Sold separately |
| **Flanges** | Two built-in flanges for wall and pipe mounting |
| **Tamper-Proof Seal** | Cover may be secured with tamper-proof seal |
| **Overall Dimensions** | 6.42" x 7.97" x 8.47" (W x H x D)<br>(163 mm x 202 mm x 215 mm) |
| **Weight** | AL: 14.7 lbs (6.67 kg)<br>SS: 23.5 lbs (10.66 kg) |
| **ATEX** | ⟨Ex⟩ II 2 G D<br>Ex db IIC Gb<br>Ex tb IIIC Db<br>IP66/IP68<br>Tamb: -55°C to +85°C<br>Certificate Number: Sira 19ATEX1252U |
| **IECEx** | Ex db IIC Gb<br>Ex tb IIIC Db<br>IP66/IP68<br>Tamb: -55°C to +85°C<br>Certificate Number: IECEx SIR 19.0075U |
| **CSA** | Class I, Division 1, Groups A, B, C, D<br>Class II, Division 1, Group E, F, G<br>Class III<br>Ex db IIC Gb<br>Ex tb IIIC Db<br>Class I, Zone 1, AEx db IIC Gb<br>Zone 21, AEx tb IIIC Db<br>IP66/IP68/TYPE 4X<br>Tamb: -55°C to +85°C<br>Certificate Number: CSA19.80011200U |
| **UL** | Class I, Division 1, Groups A, B, C, D<br>Class II, Division 1, Groups E, F, G<br>Class III<br>Class I, Zone 1, AEx db IIC Gb<br>Zone 21, AEx tb IIIC Db<br>Ex db IIC Gb<br>Ex tb IIIC Db<br>IP66/IP68/TYPE 4X<br>Tamb: -55°C to +85°C<br>Certificate Number: E518920 |

Note: The above approvals are for the enclosure only. See next page for approvals on the entire instrument.

# General Compliance Information

## Electromagnetic Compatibility

| | |
|---|---|
| Emissions | EN 55022<br>Class A ITE emissions requirements |
| Radiated Emissions | Class A |
| AC Mains Conducted Emissions | Class A |
| Immunity | EN 61326-1<br>Measurement, control, and laboratory equipment<br>EN 61000-6-2<br>EMC heavy industrial generic immunity standard |
| RFI - Amplitude Modulated | 80 -1000 MHz 10 V/m 80% AM (1 kHz)<br>1.4 - 2.0 GHz 3 V/m 80% AM (1 kHz)<br>2.0 - 2.7 GHz 1 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 | 30 A/m 70%V for 0.5 period |
| Voltage Dips | 40%V for 5 & 50 periods<br>70%V for 25 periods |
| Voltage Interruptions | <5%V for 250 periods |

## Product Ratings and Approvals

| | |
|---|---|
| **CSA** | Class I, Division 1, Groups B, C, D |
| | Class II, Division 1, Groups E, F, G |
| | Class III, Division 1, T5 |
| | Class III, Division 1, T6 (Ta max = 60°C) |
| | Ex db IIC T5 |
| | Ex db IIC T6 (Ta max = 60°C) |
| | Ex tb IIIC T90°C |
| | Ta = -55°C to +65°C |
| | Enclosure: Type 4X & IP66 / IP68 |
| | CSA Certificate: CSA 12 2531731 |
| **ATEX** | Ⓔ II 2 G D |
| | Ex db IIC T* Gb |
| | Ex tb IIIC T90°C Db IP68 |
| | Ta = -55°C to +*°C |
| | *T6 = -55°C to +60°C |
| | *T5 = -55°C to +65°C |
| | Certificate Number: Sira 12ATEX1182X |
| **IECEx** | Ex db IIC T* Gb |
| | Ex tb IIIC T90°C Db IP68 |
| | Ta = -55°C to +*°C |
| | *T6 = -55°C to +60°C |
| | *T5 = -55°C to +65°C |
| | Certificate Number: IECEx SIR 12.0073X |

***ATEX/IECEx Specific Conditions of Use:***

1. The equipment label and epoxy coating may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.

2. Flameproof joints are not intended to be repaired.

3. All entry closure devices shall be suitably certified as "Ex d", "Ex t" and "IP66/68" as applicable. Suitable thread sealing compound (non-setting, non-insulating, non-corrosive, not solvent based, suitable for the ambient rating) must be used at the NPT conduit entries to achieve the IPx8 rating while maintaining the Ex protection concept.

### Year of Construction
This information is contained within the serial number with the first four digits representing the year and month in the YYMM format.

### For European Community
The ProtEX-MAX must be installed in accordance with the ATEX directive 2014/34/EU, the product manual, and the product certificate Sira 12ATEX1182X.

# EU Declaration of Conformity

For shipments to the EU and UK, a Declaration of Conformity was printed and included with the product. For reference, a Declaration of Conformity is also available on our website www.predig.com/docs.

# Safety Information

> ⚠ CAUTION
- Read complete instructions prior to installation and operation of the meter.

> ⚠ WARNINGS
- Risk of electric shock or personal injury.
- Hazardous voltages exist within enclosure. Installation and service should be performed only by trained service personnel.
- Service requiring replacement of internal components must be performed at the factory.
- In hazardous areas, conduit and conduit/stopping plugs require the application of non-setting (solvent free) thread sealant. It is critical that all relevant hazardous area guidelines be followed for the installation or replacement of conduit or plugs.

# Installation

*Install in accordance with applicable local and national regulations (e.g. NEC).*

**For Installation in USA**
The ProtEX-MAX must be installed in accordance with the National Electrical Code (NEC) NFPA 70.

**For Installation in Canada**
The ProtEX-MAX must be installed in accordance with the Canadian Electrical Code CSA 22.1. All power supplies below 36 V and all signal input circuits must be supplied from a CSA Certified Class 2 source.

**For European Community**
The ProtEX-MAX must be installed in accordance with the ATEX directive 2014/34/EU, the product manual, and the product certificate Sira 12ATEX1182X.

> ⚠ WARNINGS
- Disconnect from supply before opening enclosure.
- Keep cover tight while circuits are live.
- Conduit seals must be installed within 18" (450 mm) of the enclosure.
- Use suitably certified and dimensioned cable entry device and/or plug.
- Cable must be suitable for 90°C.

Wiring connectors are accessed by opening the enclosure. To access electrical connectors, remove the electronics module. Connectors are on the rear of the electronics module.

# 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.

# Cover Jam Screw



The cover jam screw should be properly installed once the meter has been wired and tested in a safe environment. The cover jam screw is intended to prevent the removal of the meter cover in a hazardous environment without the use of tools. Using a M2 hex wrench, turn the screw clockwise until the screw contacts the meter. Turn the screw an additional 1/4 to 1/2 turn to secure the cover.

> ⚠ CAUTION
- Excess torque may damage the threads, screw head, and wrench.

# Mounting

The ProtEX-MAX has two slotted mounting flanges that may be used for pipe mounting or wall mounting.

Refer to *Figure 1* and *Figure 2* below.

⚠ **WARNING**

- Do not attempt to loosen or remove flange bolts while the meter is in service.

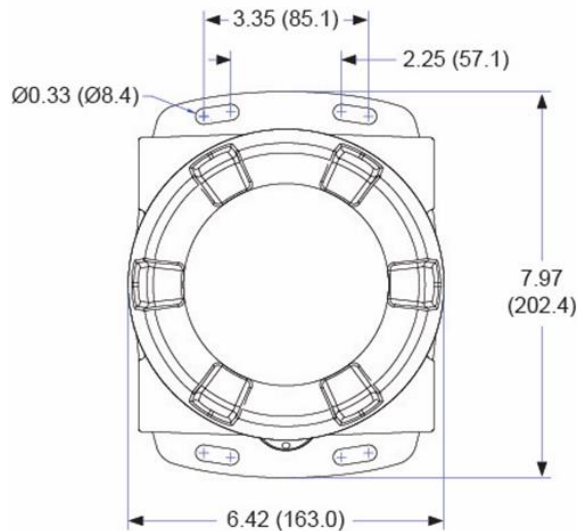## Mounting Dimensions

All units: inches (mm)
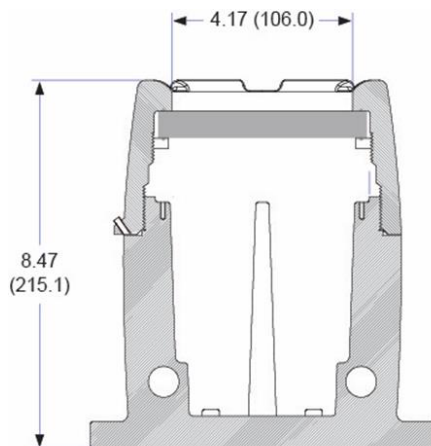


**Figure 1. Enclosure Dimensions – Front View**



**Figure 2. Enclosure Dimensions – Side Cross Section View**

Download free 3-D CAD files of these instruments to simplify your drawings!
predig.com/documentation-cad

## Wall Mounting Instructions

The meter can be mounted to any wall or flat surface using the four provided mounting holes located in the built-in flanges. In addition, the internal electronic assembly can be rotated to allow the enclosure to be mounted in any position. To mount the meter to a wall, follow these instructions:

- Prepare a section of wall approximately 7" x 8.5" (178 mm x 216 mm) for meter mounting by marking with a pencil the mounting holes (shown in *Figure 1*) on the wall.
- Select the appropriate mounting screws for the mounting surface to be used. The mounting holes diameter is shown on *Figure 1*.
  **Note:** Mounting screws are not included.
- Using a drill bit slightly smaller than the girth of the mounting screws, pre-drill holes at the mounting locations previously marked.
- Insert mounting screws into the four mounting holes and screw them into the pre-drilled holes.

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## Pipe Mounting Instructions



The meter can also be mounted to a pipe using an optional U-Bolt kit. This kit includes two U-bolts, the necessary hardware, and is available in 316 stainless steel (PDA6848-SS)
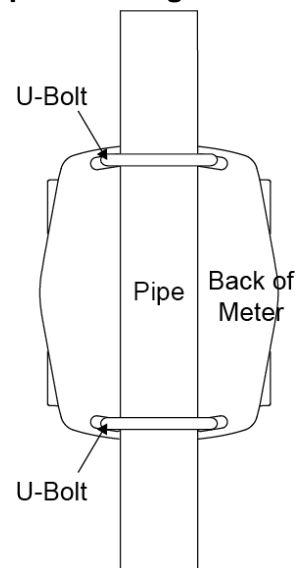


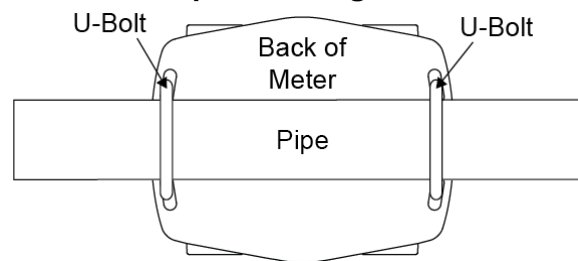To mount the meter using a U-Bolt kit, follow these instructions:

- Orient the groove on the back of the instrument with the pipe and secure it to the pipe with the two U-bolts and hardware provided.



## Vertical Pipe Mounting



## Horizontal Pipe Mounting

## Installation Overview

We recommend the following sequence for getting the meter into service:

1. **DO NOT** apply AC or DC power to the meter.
2. Connect the meter to the PC with the USB cable provided. **DO NOT** use a different USB cable.
3. If MeterView Pro (MVPro) is already installed in your computer, then the program will launch automatically in most systems. If the program does not start automatically, double-click on the MVPro icon.
4. If MVPro is not installed, follow the instructions provided below.
5. Use MVPro to configure the meter for your application.
6. Disconnect the USB cable from the meter.
7. Apply power and signal and check operation of the meter.
8. Install the meter and put into service.
9. Make any programming adjustments using the programming buttons.

## MeterView Pro Software

The easiest and quickest way to program your ProtEX-MAX meter is to use the FREE MeterView Pro programming software. This software is loaded into the meter and connects and installs directly to your PC with the USB cable provided. **DO NOT** use a different USB cable. We recommend that the first thing you do after taking the meter out of the box is connect the ProtEX-MAX to your PC with the provided USB cable. **DO NOT** apply AC or DC power to the meter while your PC is connected to the meter as it will disrupt the USB connection. It is not necessary to apply an input signal.

MeterView Pro programming software is intuitive, and most customers can get their meter programmed as they like without even looking in the manual.

> **Watch MeterView Pro Software Video at**
> **www.predig.com/meterviewpro**

### MeterView Pro Installation

1. Connect one end of the provided USB cable to the meter and the other end to the computer. The computer will automatically install the driver software it needs to talk to the meter. Follow the on-screen instructions and allow sufficient time for the process to complete. This can take a few minutes. If the process is interrupted, then it could leave the system in an unstable condition.
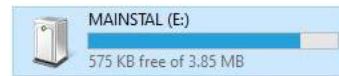
### ⚠ WARNINGS

- Only one meter may be connected at a time. Attaching multiple meters will cause a conflict with the meter software.
- **DO NOT** apply AC or DC power to the meter when using the USB connection.
- When using the USB connection, the meter should only be connected to a computer when both devices are in a non-hazardous area.

2. Once the driver is installed, an AutoPlay dialog should appear for the drive "MAINSTAL." Click "Open folder to view files."
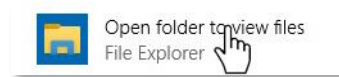


If the computer does not display an AutoPlay dialog for the drive "MAINSTAL," you should open My Computer and double-click on the drive labeled "MAINSTAL."



3. Double-click on the file named "MAStart." The program will open a few windows and install two programs on your computer. Simply follow the on-screen instructions until you see one of the dialogs below. If you receive a "User Account Control" warning, click "Yes."
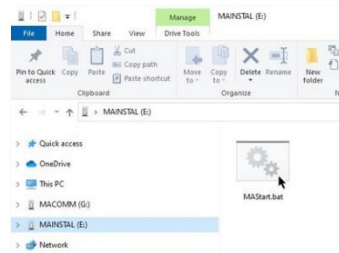


4. If there is an update available, click the "Update" button to install the new version. Otherwise, click "Configure" to begin programming your meter.
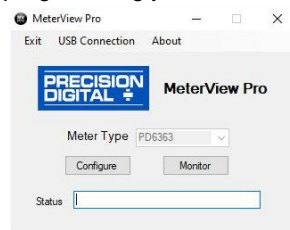


**Note:** If you decide to update your MeterView Pro software, once the installation has completed, you will be asked if you want to update the setup files located on the meter itself. This way, you will always have the most current version on the meter for future installs.

### ⚠ WARNING

- **DO NOT** unplug the meter while the new installation files are being written to it. The meter will display ⊔ᴚ ᴵᴱ during the process and you will receive an on-screen notification once the process is complete.
- Do not disconnect and reconnect the meter rapidly. Allow at least 10 seconds from disconnection before reconnecting USB to the meter.

## 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.
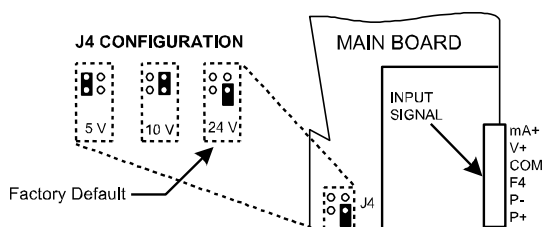4. Configure the J4 jumper, located behind the input signal connector, for the desired excitation voltage as shown.



**Figure 3. Transmitter Supply Voltage Selection**

## Connections

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

> ⚠ **CAUTION**

- 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.

> ⚠ **WARNINGS**

- Observe all safety regulations. Electrical wiring should be performed in accordance with all agency requirements and applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.
- Static electricity can damage sensitive components.
- Observe safe handling precautions for static-sensitive components.
- Use proper grounding procedures/codes.
- If the instrument is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on any lead or terminal.
- Follow all fusing and wiring precautions requirements for the instrument integrated to the PD8 Series model number being connected.

To access the connectors, remove the enclosure cover. The electronics module is snapped into the back of the enclosure and is removed by pulling it straight out. Signal connections are made to de-pluggable connectors on the back of the electronics module.

Some connectors may be provided already connected. These connections are required for proper operation of the ProtEX-MAX, and should not be removed unless instructed to by this manual.

Grounding connections are made to the two ground screws provided on the base – one internal and one external.

After all connections have been completed and verified, apply power to the unit.

### Required & Factory Wired Connection

The ProtEX-MAX comes with a pre-wired connection. This connection is detailed below and must be maintained in order for the instrument to function properly.



**Figure 4. Integrated PROVU Required Connections**

26
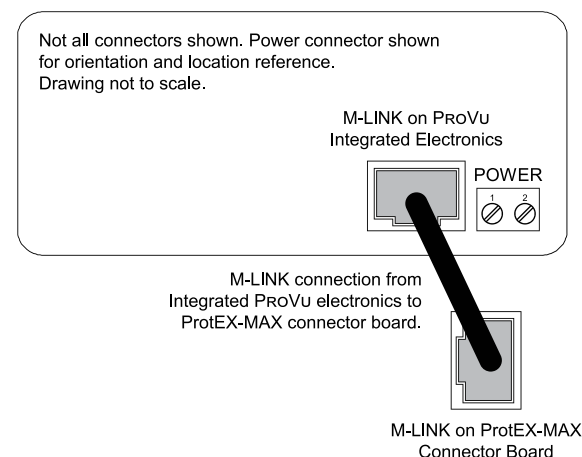
## ProVu Electronics Module Layout for PD8-6001-6H7 and PD8-6001-7H7*



RS-485 Connections

CapTouch Buttons
Enable/Disable Switch

Relays
Connections

Signal &
F4 Connections

Digital I/O
Connections

GND

Transmit Data (**TX**) LED

Receive Data (**RX**) LED

Power (**P**) LED

4-20 mA Output
Connections

Power
Connections
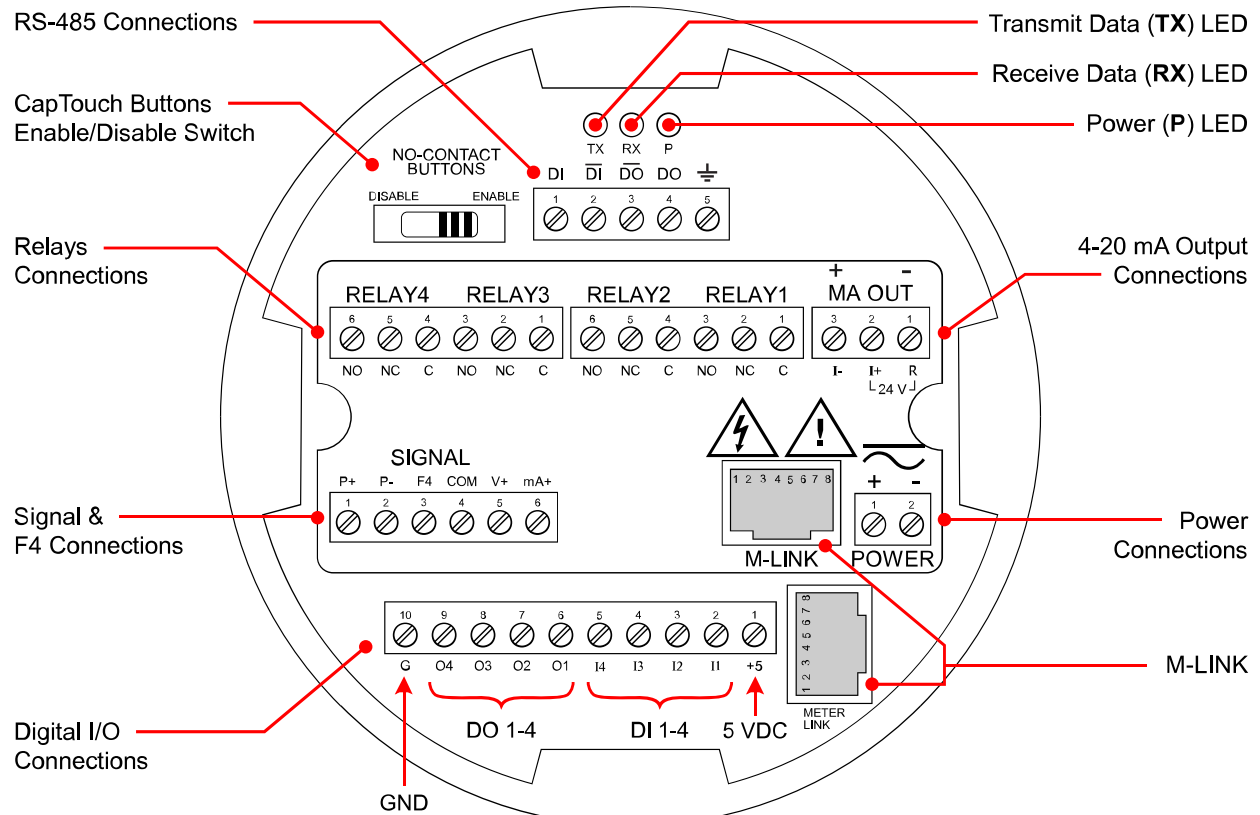
M-LINK

\* For models PD8-6001-6H0 and PD8-6001-7H0 the upper set of connectors (RELAYs & MA OUT) are not present

**Figure 5. ProVu Electronics Module Layout**

## USB Connection
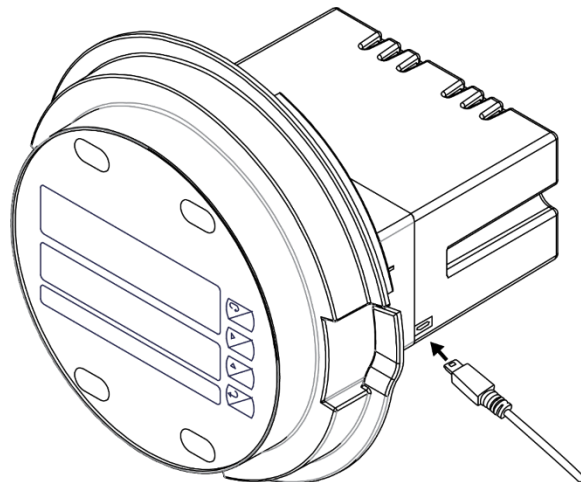


**Figure 6. USB Connection**

⚠ **WARNINGS**
- **DO NOT** disconnect the RJ45 M-LINK connector cable. Otherwise the instrument will not function properly.
- The meter should only be connected to a computer while it is located in a safe area.

### Power Connections

Power connections are made to a two-terminal connector labeled POWER. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention. There are separate models for low voltage and high voltage power. See *Ordering Information* on page *7* for details.

POWER

AC or DC
POWER
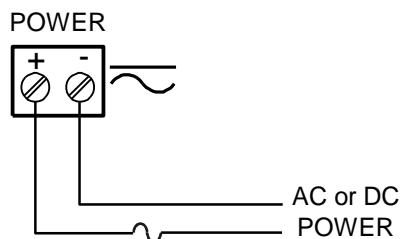
Required External Fuse:
5 A max, 250 V Slow Blow

**Figure 7. Power Connections**

## Signal Connections

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

### Current (mA) Connections

The following figures show examples of current connections.

There are no switches or jumpers to set up for current inputs. Setup and programming is performed through the programming buttons or MeterView Pro software.
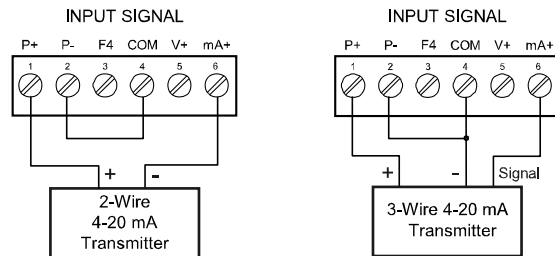


**Figure 8. Transmitter Powered by Internal Supply**
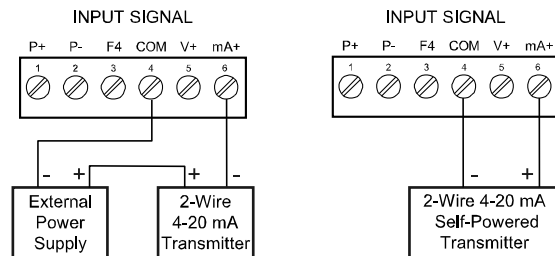


**Figure 9. Transmitter Powered by External Supply or Self-Powered**

The current input is protected against current overload by an internal 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.

### Voltage (V) Connections

The following figures show examples of voltage connections.

There are no switches or jumpers to set up for voltage inputs. Setup and programming is performed through the programming buttons or MeterView Pro software.
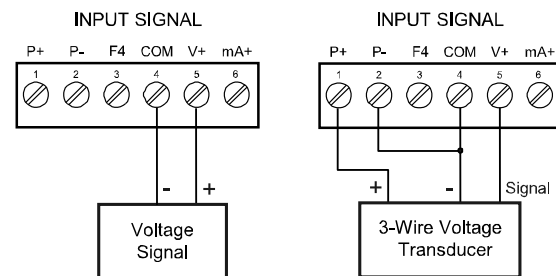


**Figure 10. Voltage Input Connections**

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

## Relay Connections

Relay connections are made to two six-terminal connectors labeled RELAY1 – RELAY4. 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.
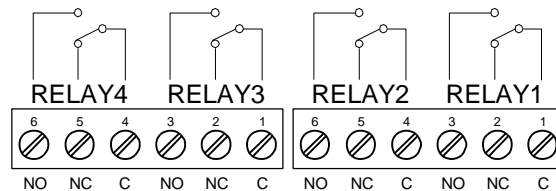


**Figure 11. Relay Connections**

## Switching Inductive Loads

The use of snubbers to suppress electrical noise is strongly recommended when switching inductive loads to prevent disrupting the microprocessor's operation. The snubbers 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 12. 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.
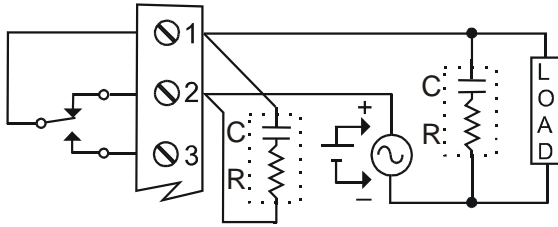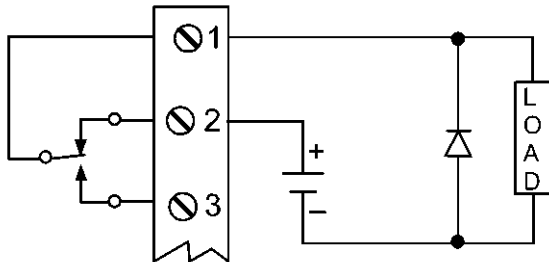
**Figure 13. Low Voltage DC Loads Protection**

## RC Networks (Snubbers) 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.

**Note:** Relays are de-rated to 1/14th HP (50 watts) with an inductive load.

## RS-485 Connections



The RS-485 connections are made to a five terminal connector used for Modbus RTU serial communications. The RS-485 terminals include Transmit Data (DO) and (/DO), Receive Data (DI) and (/DI), and Signal Ground. See *Modbus® RTU Serial Communications (5Er ،RL )* on page *54* for more information.

There are three diagnostic LEDs: Transmit Data (TX), Receive Data (RX) and Power (P) to show when the meter is transmitting and receiving data from other devices.



**Figure 14. RS-485 Diagnostic LEDs**

## RS-485 Multi-Drop Connection

When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) can be programmed between 1 and 247. The transmit delay can be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop bits.

**To change the meter address:**

1.  Press and hold the Menu button for three seconds to access Advanced Features menu of the meter.
2.  Press Up arrow until Serial (5Er ،RL ) menu is displayed and press Enter, RddrES is displayed.
3.  Press Enter to change meter address using Right and Up arrow buttons. Press Enter to accept.
4.  Press Menu button to exit and return to Run Mode.

### Three-Wire Connections

In order to wire the five pins for use as a three-wire half-duplex RS-485 connection, it is necessary to create a jumper connection between DI to DO and /DI to /DO- as shown below.
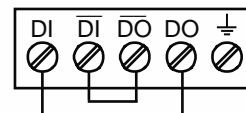


**Figure 15. Three-Wire RS-485 Connections**

## Digital I/O Connections



Digital inputs and outputs are provided in order to expand the functionality of the meter. Digital input connections are made via a push button or switch to the appropriate digital input terminal and the +5 VDC terminal. Digital output connections are made by wiring from the appropriate digital output terminal to the ground terminal.
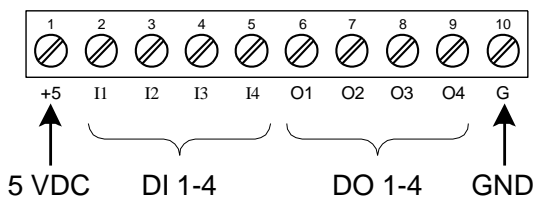


**Figure 16. Digital Input and Output Connections**

⚠ **IMPORTANT**

The onboard digital inputs (1-4) are configured at the factory to function identically to the front panel pushbuttons (Menu, F1, F2, & F3) in order to work with the CapTouch buttons. Changing the programming of the digital inputs will affect the function of the CapTouch buttons.

If you wish to change the behavior of the digital inputs, re-assign F1-F3 to the desired function, then change the corresponding digital input to match.

⚠ **WARNING**

• **DO NOT** disconnect the RJ45 M-LINK connector cable. Otherwise the instrument will not function properly.

## F4 Digital Input Connections

A digital input, F4, is standard on the meter. This digital input should be connected with a normally open contact across F4 and COM, or with an active low signal applied to F4. It can be used for remote operation of front-panel buttons, to acknowledge/reset relays, or to reset max/min values. See *Function Keys & Digital I/O Available Settings* on page *56* for a complete list of capabilities.
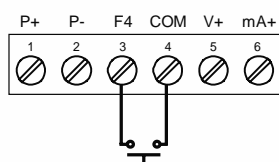


**Figure 17. F4 Digital Input Connections**

## 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.
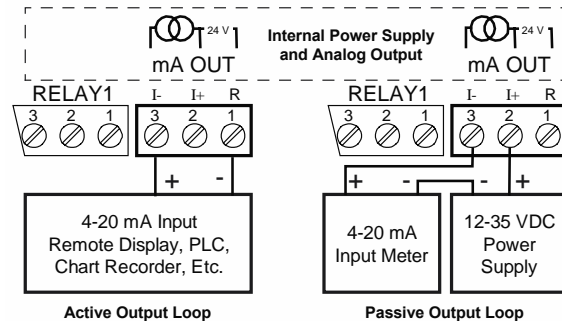


**Figure 18. 4-20 mA Output Connections**

## Analog Output 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.
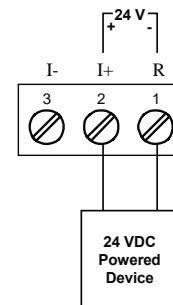


**Figure 19. Analog Output Supply Powering Other Devices**

### Remote Programming

The meter can be operated via the programming buttons or a remote control station with required approvals to be located in a hazardous area using the digital inputs and outputs.

## Interlock Relay Feature

As the name implies, the interlock relay feature reassigns one, or more, alarm/control relays for use as interlock relay(s). Interlock contact(s) are wired to digital input(s) and activate the interlock relay. This feature is enabled by configuring the relay, and the corresponding digital input(s), see *Setting Up the Interlock Relay (Force On) Feature* on page *49*.

In the example below, an Interlock Contact switch is connected to a digital input, which will be used to force on (energize) the Interlock Relay. The Interlock Relay and the Control Relay are connected in series with the load.

• When the Interlock Contact is closed (safe), the Interlock Relay energizes, allowing power to flow to the Control Relay; the corresponding front panel LED is on.
• When the Interlock Contact is open, the corresponding front panel LED flashes (locked out), the Interlock Relay is de-energized, preventing power from flowing to the Control Relay and the load.
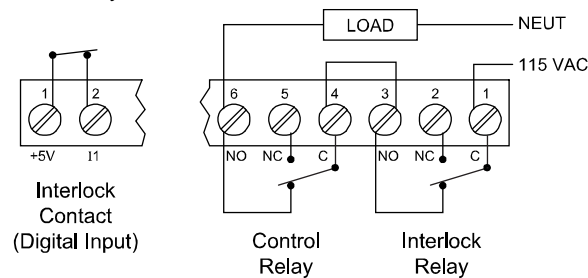


**Figure 20. Interlock Connections**

# Setup and Programming

> There is **no need to recalibrate** the meter when first received from the factory. The meter is **factory calibrated** prior to shipment for milliamps and volts with calibration equipment that is certified to NIST standards.

## Overview

There are no jumpers to set for the meter input selection.

Setup and programming is done using MeterView Pro or through the programming buttons.

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

## LED Status Indicators



| LED | State | Indication |
|-----|-------|------------|
| 1-4 | Steady | Alarm condition based on set and reset points, independent of relay status in certain configurations. (Available on all meter configurations, including those without relays installed) |
| 1-4 | Flashing | Relay interlock switch open |
| 1-4 & M | Flashing | Relay in manual control mode |
| T | Flashing | Meter in Tare mode |
| M | Flashing | Analog output in manual control mode |
| $\overline{8}$ | Steady | Eighths of an inch |
| $\overline{16}$ | Steady | Sixteenths of an inch |

| Symbol | Description |
|--------|-------------|
| FT | Feet value |
| IN | Inches value |
| -   -  | Designation separators |

## Programming Buttons

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

- 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 or hold 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.

# CapTouch Buttons

The ProtEX-MAX is equipped with four capacitive sensors that operate as through-glass buttons so that they can be operated without removing the cover (and exposing the electronics) in a hazardous area or harsh environment.

CapTouch buttons are designed to protect against false triggering and can be disabled for security by selecting DISABLE on the switch labeled NO-CONTACT BUTTONS located on the connector board.

To actuate a button, press one finger to the window directly over the marked button area. When the cover is removed or replaced, the CapTouch buttons can be used after the meter completes a self-calibrating routine. The sensors are disabled when more than one button is pressed, and they will automatically re enable after a few seconds. When the cover is removed, the four mechanical buttons located on the right of the faceplate are used.

The CapTouch Buttons are configured by default to duplicate the function of the front panel mechanical pushbuttons associated with the integrated meter.

## CapTouch Button Tips:
- Keep the glass window clean.
- Tighten the cover securely.
- Use a password to prevent tampering.

# 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 Functions & Messages | | |
|---|---|---|
| **Display** | **Parameter** | **Action/Setting Description** |
| SEtuP | Setup | Enter Setup menu |
| InPut | Input | Enter Input selection menu |
| ṅ ̇A | 4-20 mA | Set meter for 4-20 mA input |
| UoLt | 0-10 VDC | Set meter for ±10 VDC input |
| d-SCAL | Dual-scale | Press Enter to select dual-scale display for some level applications (Select Yes or No) |
| un ̇t5 | Units | Select the display units/tags |
| dEc Pt | Decimal point | Set decimal point |
| PU 2 | PV2 | PV2 decimal point (Level) |
| ProG | Program | Enter the Program menu |
| SCALE | Scale | Enter the Scale menu |
| SCALE 1 | Scale 1 | Enter the Scale menu for PV1 |
| SCAL 2 | Scale 2 | Enter the Scale menu for PV2 |
| CAL | Calibrate | Enter the Calibration menu |
| InP 1 | Input 1 | Calibrate input 1 signal or program input 1 value |
| d ̇S 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 ̇S 2 | Display 2 | Program display 2 value (up to 32 points) |
| Error | Error | Error, calibration not successful, check signal or programmed value |
| dSPLAY | Display | Enter the Display menu |
| L ̇nE 1 | Display line 1 | Press Enter to access Line 1 display format and parameter options (default: PV) |
| Forṅt | Format | Format fractional inches to either eighths (1/8) or sixteenths (1/16) |
| PARAṅ | Parameter | Press Enter to assign the Main display parameter (default: PV) |
| dSEt 1* | Display set 1* | Display relay 1 (*through 4) set point |
| d H ̇ | Display high | Display high value |
| d Lo | Display low | Display low value |

| Display Functions & Messages | | |
|---|---|---|
| **Display** | **Parameter** | **Action/Setting Description** |
| d HL | Display hi/low | Alternate between high/low value |
| ṅ buS | Display Modbus | Display Modbus input register |
| d PU | Display PV | Select to display PV |
| L ̇nE 2 | Display line 2 | Press Enter to assign the Line 2 display parameter (default: engineering units) |
| d un ̇t | Display unit | Display units on line 2 |
| d PU2 | Display PV2 | Select to display PV2 (dual-scale display) |
| d PCt | Display PCT | Select to display percent of PV1 (dual-scale display) |
| d L-u | Display Level Units | Select to display PV1 level in decimal units on display line 2 |
| d oFF | Display off | Turn off display line 2 |
| d- ̇ntY | Display intensity | Set display intensity level from 1 to 8 |
| rELAY | Relay | Enter the Relay menu |
| rLY 1* | Relay 1* | Relay 1 (*through 4) setup |
| Act 1 | Action 1 | Set relay 1 action |
| Auto | Automatic | Set relay for automatic reset |
| A-ṅAṅ | Auto-manual | Set relay for automatic & manual reset any time |
| 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 |
| SAṅ ̇PL | Sampling | Set relay for sampling operation |
| OFF | Off | Disable relay and front panel status LED (Select Off to enable Interlock feature) |
| SEt 1 | Set 1 | Program set point 1 |
| rSt 1 | Reset 1 | Program reset point 1 |
| FA ̇LSF | Fail-safe | Enter Fail-safe menu |
| FLS 1 | Fail-safe 1 | Set relay 1 fail-safe operation |
| on | On | Enable fail-safe operation |
| oFF | Off | Disable fail-safe operation |
| FLS 2 | Fail-safe 2 | Set relays 2-4 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 |

<table>
<tr><td colspan="3" align="center">**Display Functions & Messages**</td></tr>
<tr><td>**Display**</td><td>**Parameter**</td><td>**Action/Setting Description**</td></tr>
<tr><td>OFF 1</td><td>*Off 1*</td><td>Set relay 1 Off time delay</td></tr>
<tr><td>dLY 2</td><td>*Delay 2*</td><td>Enter relays 2-4 time delay setup</td></tr>
<tr><td>brERK</td><td>*Loop break*</td><td>Set relay condition if loop break detected</td></tr>
<tr><td>brERK1*</td><td>*Loop break 1\**</td><td>Set relay 1 (*through 4) condition if loop break detected</td></tr>
<tr><td>iGnorE</td><td>*Ignore*</td><td>Ignore loop break condition (Processed as a low signal condition)</td></tr>
<tr><td>On</td><td>*On*</td><td>Relay goes to alarm condition when loop break is detected</td></tr>
<tr><td>OFF</td><td>*Off*</td><td>Relay goes to non-alarm condition when loop break is detected</td></tr>
<tr><td>Rout</td><td>*Analog output*</td><td>Enter the *Analog output* scaling menu</td></tr>
<tr><td>diS 1</td><td>*Display 1*</td><td>Program display 1 value</td></tr>
<tr><td>Out 1</td><td>*Output 1*</td><td>Program output 1 value (e.g. 4.000 mA)</td></tr>
<tr><td>diS 2</td><td>*Display 2*</td><td>Program display 2 value</td></tr>
<tr><td>Out 2</td><td>*Output 2*</td><td>Program output 2 value (e.g. 20.000 mA)</td></tr>
<tr><td>rESEt</td><td>*Reset*</td><td>Press Enter to access the *Reset* menu</td></tr>
<tr><td>rSt Hi</td><td>*Reset high*</td><td>Press Enter to reset max display</td></tr>
<tr><td>rSt Lo</td><td>*Reset low*</td><td>Press Enter to reset min display</td></tr>
<tr><td>rSt HL</td><td>*Reset high & low*</td><td>Press Enter to reset max & min displays</td></tr>
<tr><td>Contrl</td><td>*Control*</td><td>Enter *Control* menu</td></tr>
<tr><td>Ruto</td><td>*Automatic*</td><td>Press Enter to set meter for automatic operation</td></tr>
<tr><td>nァRn</td><td>*Manual*</td><td>Press Enter to manually control relays or analog output operation</td></tr>
<tr><td>PRSS</td><td>*Password*</td><td>Enter the *Password* menu</td></tr>
<tr><td>PRSS 1</td><td>*Password 1*</td><td>Set or enter Password 1</td></tr>
<tr><td>PRSS 2</td><td>*Password 2*</td><td>Set or enter Password 2</td></tr>
<tr><td>PRSS 3</td><td>*Password 3*</td><td>Set or enter Password 3</td></tr>
<tr><td>unLoc</td><td>*Unlocked*</td><td>Program password to lock meter</td></tr>
<tr><td>Locd</td><td>*Locked*</td><td>Enter password to unlock meter</td></tr>
<tr><td>999999<br>-99999</td><td>*Flashing*</td><td>Over/under range condition</td></tr>
</table>

## Main Menu

The main menu consists of the most commonly used functions: *Setup*, *Reset, Control,* 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/F3.
- The display moves to the next menu every time a setting is accepted by pressing Enter/F3.
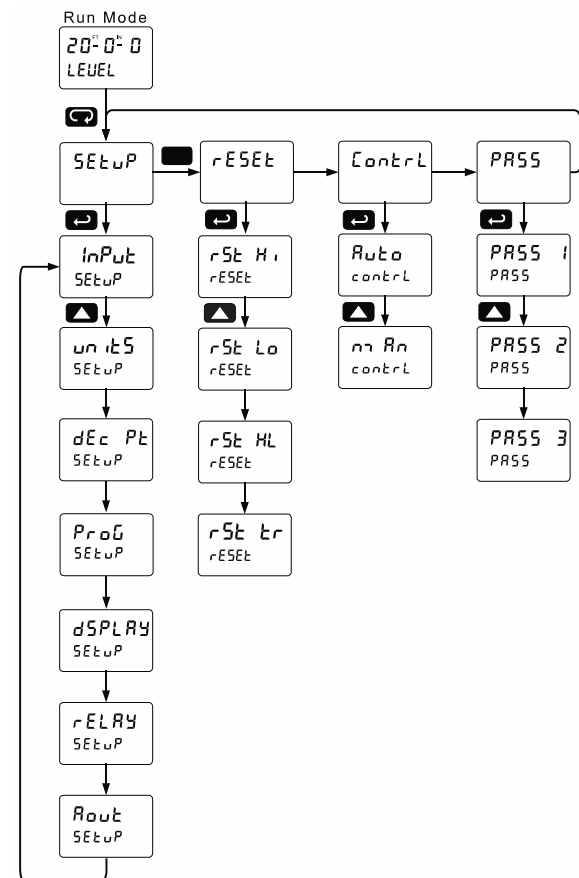
## Setting Numeric Values

The numeric values on PV1 (main display) 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. The leading zero in any of the unit designations is omitted. Because of this, if the leading zero of any unit designation is the currently selected unit, none of the digits will be brighter than any other. Pressing the Up arrow will increment the value to 1.

The range of numeric values for each unit designation is from 0-99 for feet, 0-11 for inches and either 0-7 or 0-15 for fractional inches depending on whether the desired display is in eighths ($^1/_8$) or sixteenths ($^1/_{16}$) mode.

Press and hold up arrow to auto-increment the display value.

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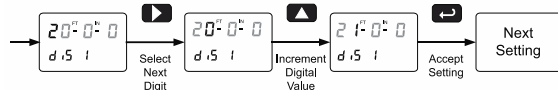


## Setting Up the Meter (SEtuP)

The *Setup* menu is used to select:
1.  Input signal the meter will accept
2.  Dual-scale feature for some level applications
3.  Select the display units/tags
4.  Decimal point position
5.  Programming Menu
6.  Display parameter and intensity
7.  Relay operation
8.  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.
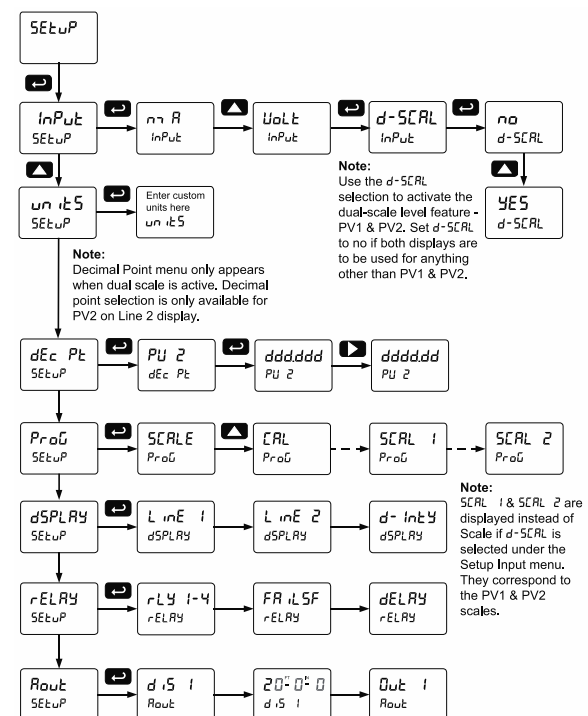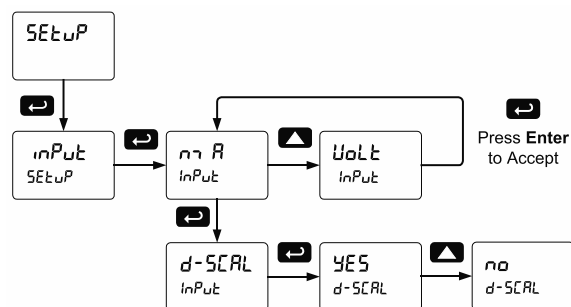
## Setting the Input Signal ( *InPut* )

Enter the *Input* menu to set up the meter to display current (*mA*) or voltage (*Volt*) 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.

After selecting *mA* or *Volt* input, *d-SCAL* is displayed; press Enter to select "*Yes*" or "*No*". Selecting "*Yes*" enables the dual-scale feature, which allows for the Scale (*SCALE*) and Units (*un it5*) menus to be used to scale the same input in two different scales for PV1 & PV2.



Set *d-SCAL* to NO if both displays are to be used for anything other than PV1 & PV2.

## Setting the Input Units or Custom Tags (*un it5*)

Enter the display unit or custom tag that will be displayed if *d un it* is selected as the line 2 parameter. See the *Setting the Display Parameter & Intensity* (*dSPLAY*) flow chart on page *41* to access the display menu to show the unit or tag on display line 2.

The engineering units or custom legends can be set using the following 7-segment character set:

| Display | Character | | Display | Character |
|---|---|---|---|---|
| 0 | 0 | | H | K |
| 1 | 1 | | L | L |
| 2 | 2 | | m | m |
| 3 | 3 | | n | n |
| 4 | 4 | | O | O |
| 5 | 5 | | o | o |
| 6 | 6 | | P | P |
| 7 | 7 | | q | q |
| 8 | 8 | | r | r |
| 9 | 9 | | S | S |
| A | A | | t | t |
| b | b | | u | u |
| C | C | | V | V |
| c | c | | w | w |
| d | d | | X | X |
| E | E | | Y | Y |
| F | F | | Z | Z |
| G | G | | - | - |
| g | g | | / | / |
| H | H | | ] | ] |
| h | h | | [ | [ |
| I | I | | = | = |
| i | i | | o | Degree(<) |
| J | J | | | Space |

**Notes:**

1. Degree symbol represented by (<) if programming with MeterView Pro.
2. The letters "m" and "w" use two 7-segment LEDs each; when selected the characters to the right are shifted one position.
3. Press and hold up arrow to auto-scroll the characters in the display.

## Setting the Decimal Point (dEc Pt)

The decimal point on PV2 (display line 2) may be set only if the dual-scale level feature is selected. It 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, and then it moves to the leftmost position. Pressing the Up arrow moves the decimal point one place to the left.
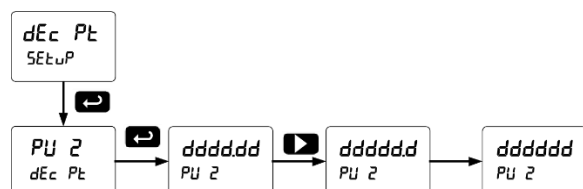


## Programming the Meter (ProG)

The meter may either be scaled (SCALE) without applying an input or calibrated (CAL) by applying an input. The meter comes factory calibrated to NIST standards, so for initial setup, it is recommended to use the (SCALE) function.

The Program menu contains the Scale (SCALE) and the Calibrate (CAL) menus.

Process inputs may be scaled or calibrated to any display within the range of the meter.

The PD8-6001 is a single input meter with dual-scale capability.

If the dual-scale level feature is selected in the *Setup* menu, the *Scale 1* and *Scale 2* menus are enabled for PV1 & PV2 respectively.

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

**Note:** The **Scale** and **Calibrate** functions are exclusive of each other. The meter uses the last function programmed. Only one of these methods can be employed at a time. The Scale and Calibrate functions can use up to 32 points (default is 2). The number of points should be set in the Advanced menu prior to scaling and calibration of the meter. See Multi-Point Linearization (L inEAr) menu on page 55 for details.

## Program Menu for Single Scale Process
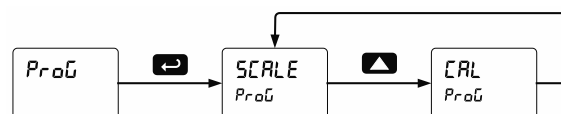


## Program Menu for Dual-Scale Level Applications
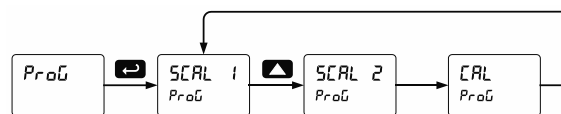


Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu. See *Advanced Features Menu* on page *52*.

## 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 for PV1 and up to 8 linearization points may be selected for PV2. See *Multi-Point Linearization* (L inEAr) *menu on page 55 for details*.

## Scaling the Meter (SCALE)

The process input (4-20 mA, ±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.
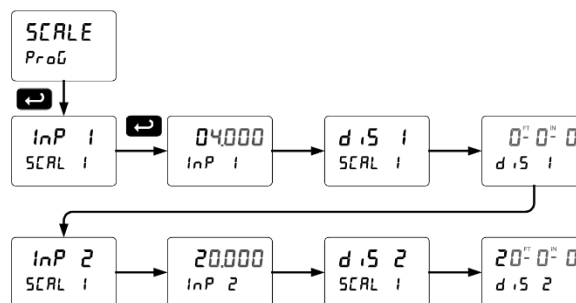


⚠ **IMPORTANT**

- **Reverse Scaling**
  The meter can be scaled so that 4 mA represents the high end of the process value range being measured by the transmitter and 20 mA represents the low end of the process value range.

## Dual-Scale for Level Applications

The analog input can be displayed in two different scales, by enabling the dual-scale feature (**d-SCAL**) in the *Setup - Input* menu. See *Setting the Input Signal* (**InPut**) on page *38*.

To enable the dual-scale feature for level applications displaying height and volume, you must select **d-SCAL** in the Input selection menu.

### Scaling the Input for PV1 (SCAL 1)



### Scaling the Input for PV2 (SCAL 2)



### Error Message (Error)

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

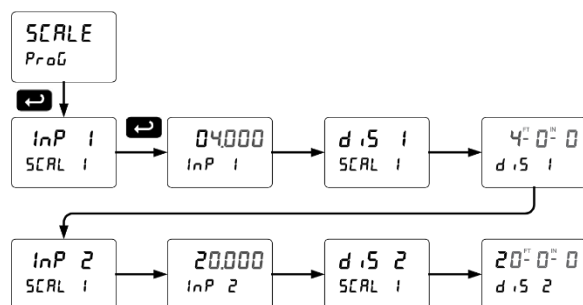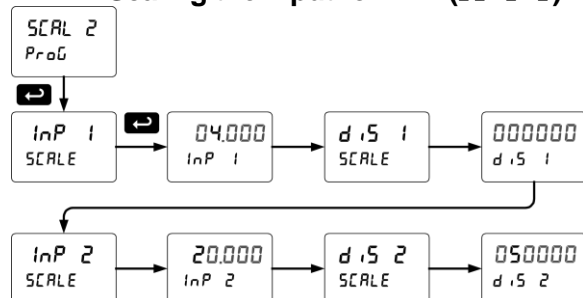After the error message is displayed, the meter reverts to the input prior to the failure during calibration or scaling and to input 1 during internal calibration, allowing the appropriate input signal to be applied or programmed.

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)

> **Note:** To scale the meter without a signal source refer to *Scaling the Meter (SCALE)* on page *39.*

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.
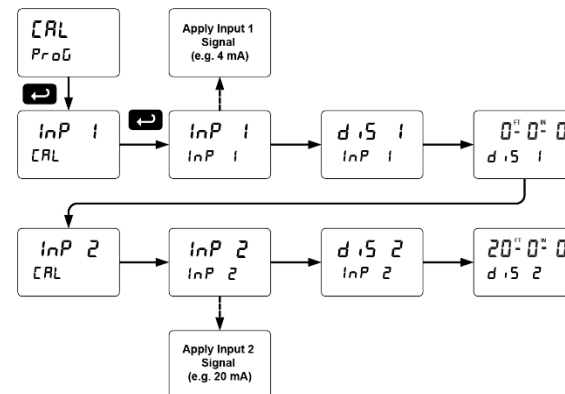


**Note:** Inputs for the above example are:
Input 1: 4 mA; Display 1: $0^{FT}0^{IN}(^0/_{16}$ or $^0/_8)$
Input 2: 20 mA; Display 2: $20^{FT}0^{IN}(^0/_{16}$ or $^0/_8)$

> Warm up the meter for at least 15 minutes before performing calibration to ensure specified accuracy.

## Setting the Display Parameter & Intensity (dSPLAY)

The main display (LinE 1) can be programmed to display:

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

The secondary display (LinE 2) can be programmed to display:

1. Unit or tag
2. Process value 2 (PV2)
3. Percent of PV1 (PCT)
4. Relay set points
5. Level value in feet with unit or tag
6. Max & min values
7. Engineering units or custom legends
8. Modbus input
9. Off (no display)

After setting up the input and display, press the Menu button to exit programming and skip the rest of the setup menu.

## Display Intensity (d-IntY)

The meter has eight display intensity levels to give the best performance under various lighting conditions. Select intensity 8 for outdoor applications. The default intensity is 6.

## Display Parameter Menu
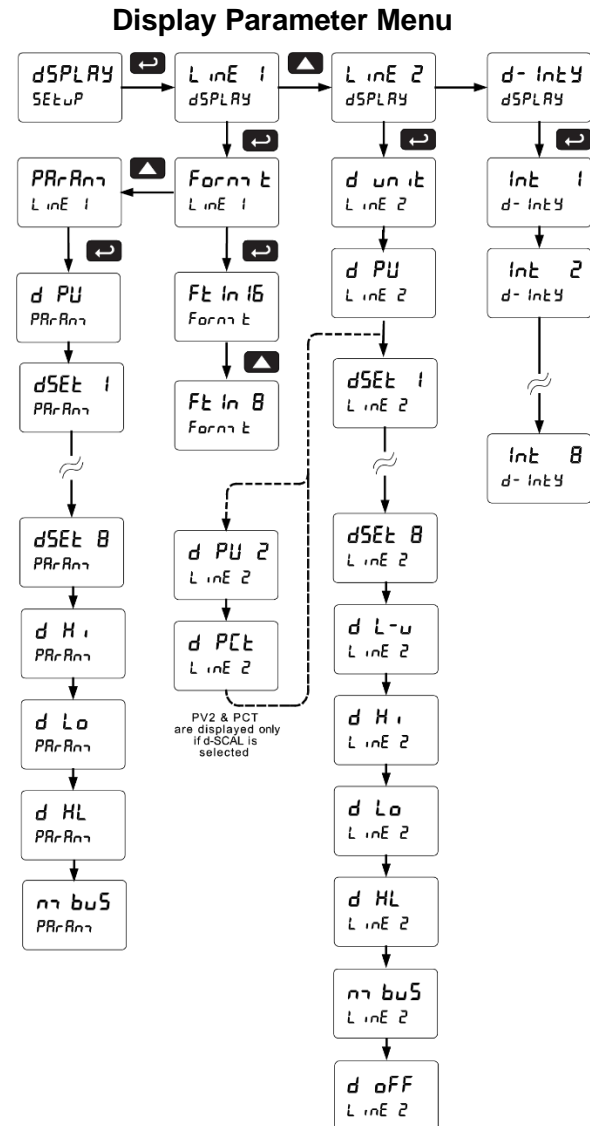


## Dual-Scale Display Feature

The PD8-6001 has a rather unique, and very flexible dual-scale capability- a second scaled display that can represent the measured input in a different form (i.e. feet & gallons). This is of particular value in level applications. Both displays are independently scaled and are based on the 4-20 mA input signal. This function can be used for feet & gallons, feet & meters, feet & percent, feet & barrels, and more.



**Height & Gallons**          **Height & Meters**



**Height & Percent**          **Height & Barrels**

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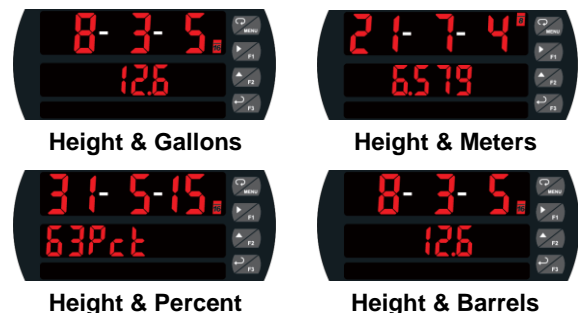
## Setting the Relay Operation (rELAY)

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 state controlled by Interlock feature)
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)



Note: The setup of relays 2-4 follows the same pattern shown here for relay 1.
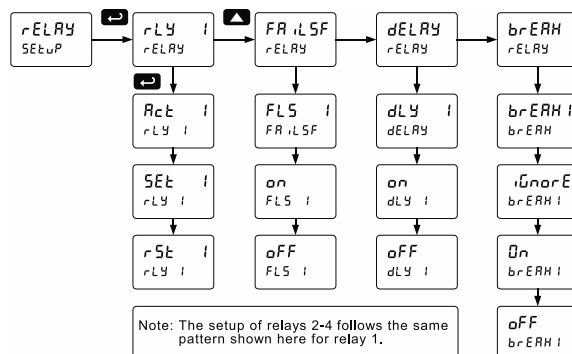
## Setting the Relay Action

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 state controlled by Interlock feature)

The following graphic shows relay 1 action setup; relay 2-4 are set up in a similar fashion.
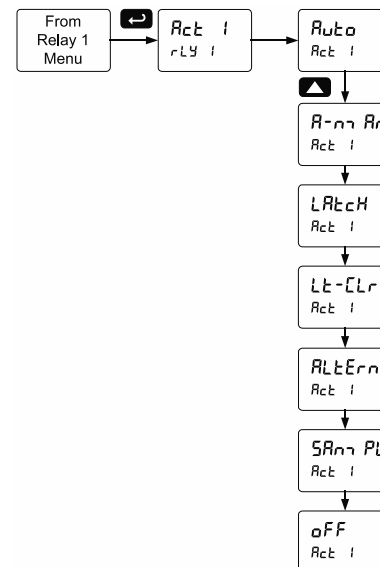
### Programming Set and Reset Points

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.
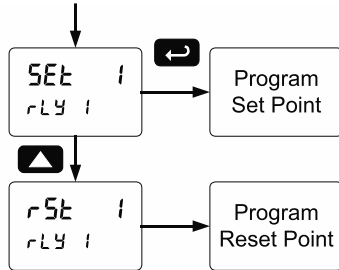


**Note:** Changes are not saved until the reset point has been accepted.

### 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)

A loop break condition is triggered when the 4-20 mA input signal drops below 0.005 mA.  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 (Processed as a low signal condition)

The following graph shows the loop break relay operation for a high alarm relay.
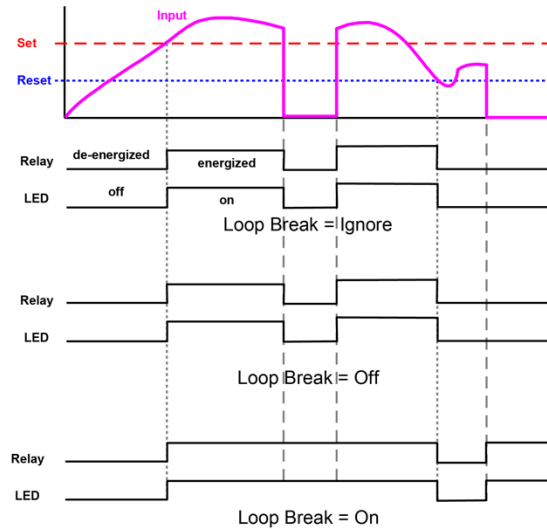


## Relay and Alarm Operation Diagrams

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

### High Alarm Operation (Set > Reset)
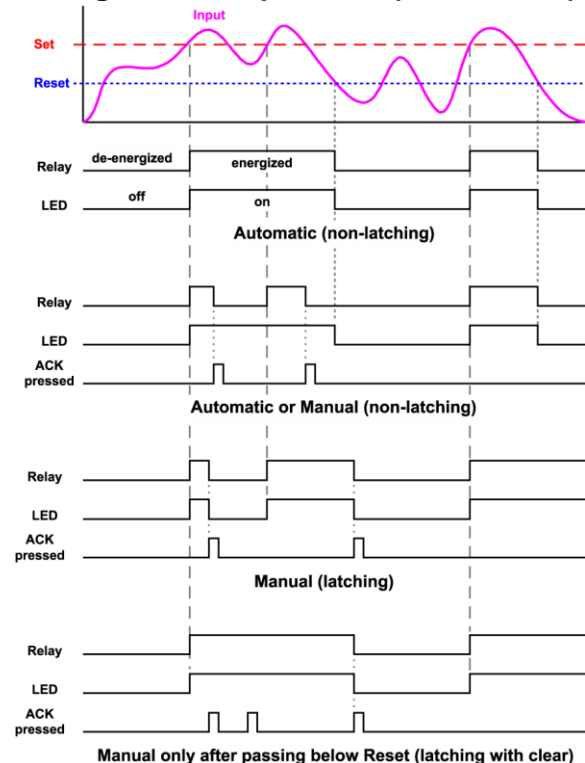


For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

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## Low Alarm Operation (Set < Reset)
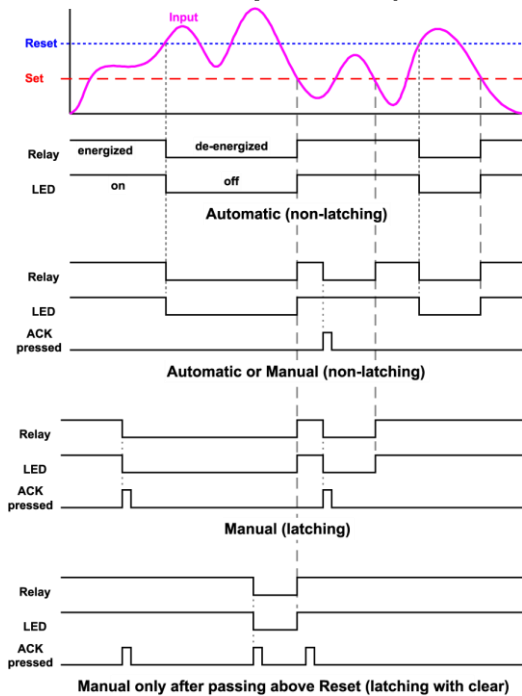


For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point and then go below it.

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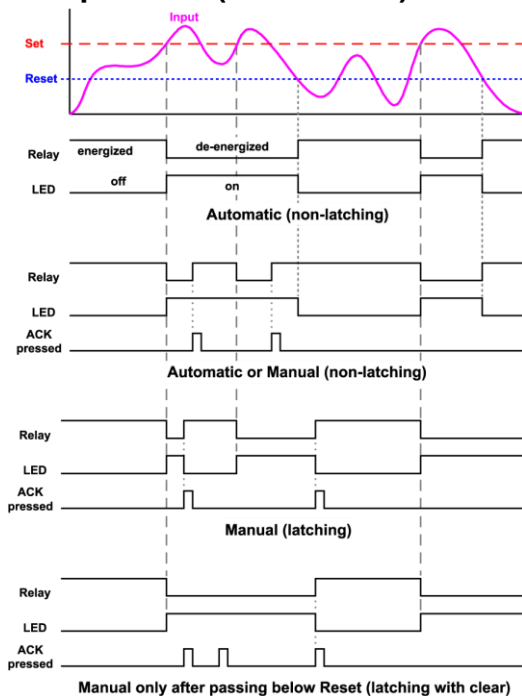


**Note:** Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

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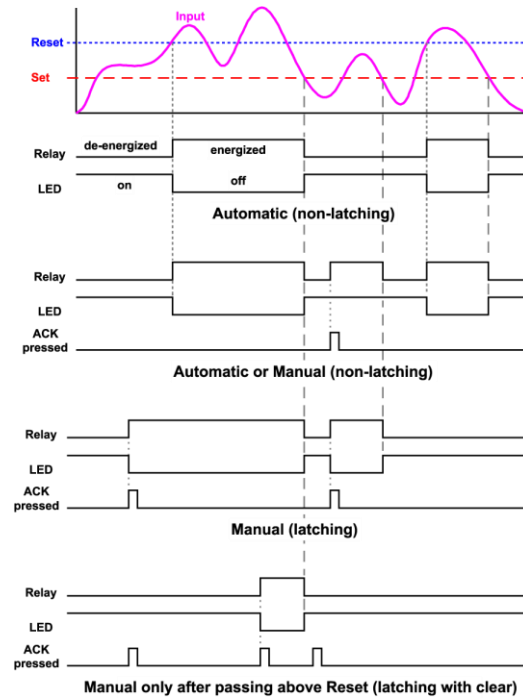


**Note:** Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

## Time Delay Operation

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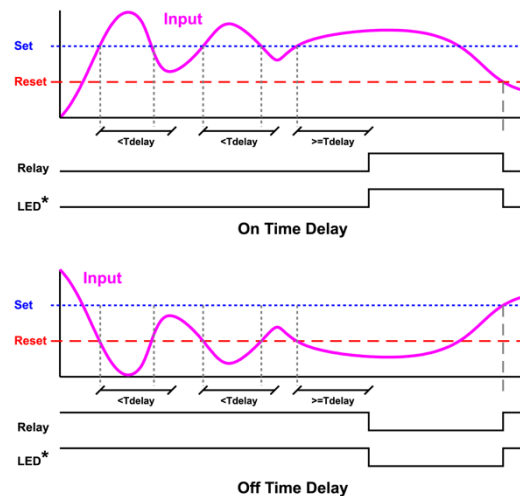


When the signal crosses the set point, the *On* time delay timer starts and the relay trips when the time delay has elapsed. If the signal drops below the set point (high alarm) before the time delay has elapsed, the *On* time delay timer resets and the relay does not change state. The same principle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

**Note:** If "Automatic or Manual (ዪ·ስ·ዪስ)" reset mode is selected, the LED follows the reset point and not the relay state when the relay is acknowledged.

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## Pump Alternation Control Operation



*LEDs indicate the relay status*
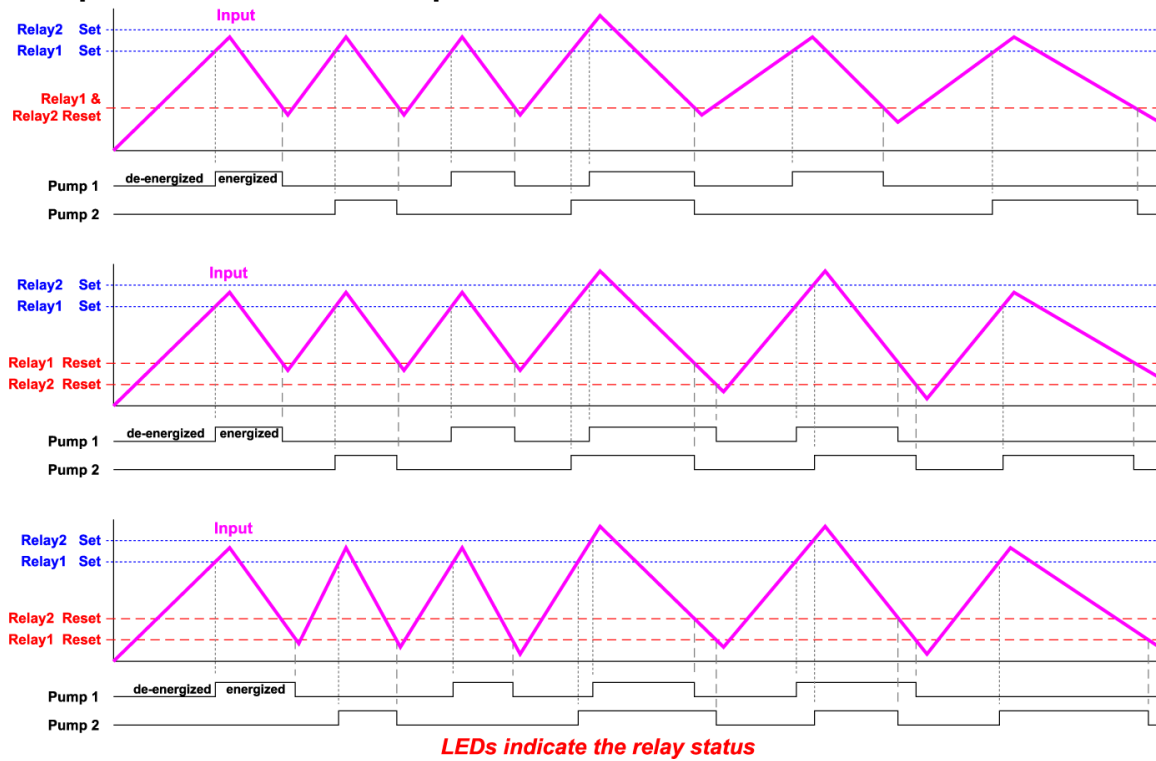
## Relay Sampling Operation
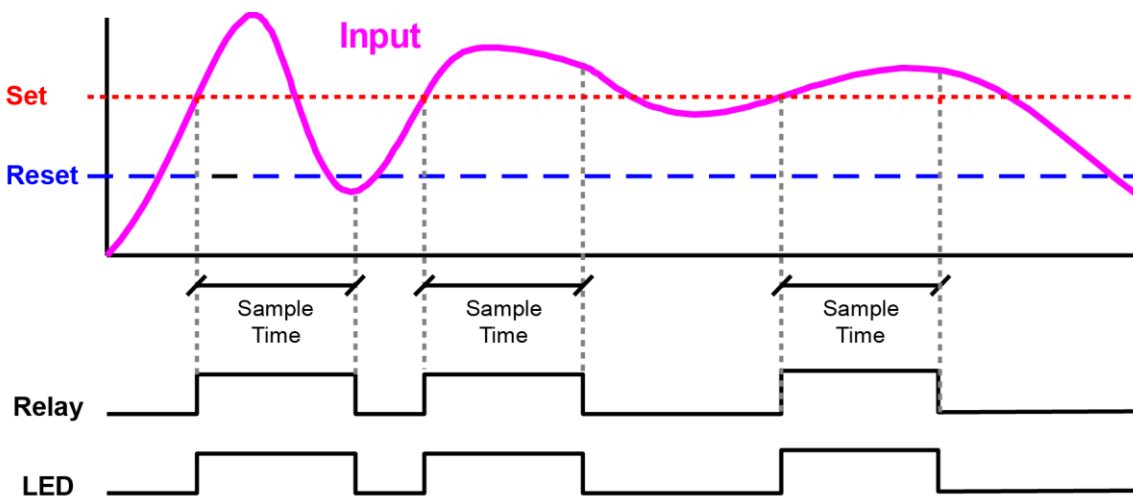


When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

The sample time can be programmed between 0.1 and 5999.9 seconds.

# Relay Operation Details

## Overview

The four-relays option for the meter expands its usefulness beyond simple indication to provide users with alarm and control functions. Typical applications include high and low temperature, level, pressure or flow alarms, control applications such as simple on/off pump control, and pump alternation control for up to 4 pumps. There are four basic ways the relays can be used:

1. High and Low Alarms with Latching or Non-Latching Relays
2. Simple On/Off Control with 100% Adjustable Deadband
3. Sampling (Based on Time)
4. Pump Alternation Control for up to 4 Pumps

## Relays Auto Initialization

When power is applied to the meter, the front panel LEDs and alarm relays will reflect the state of the input to the meter. The following table indicates how the alarm LEDs and relays will react on power-up based on the set and reset points:

| Alarm # | HI or LO Alarm | Set Point | Reset Point | Power-Up Reading | Relay & LED |
|---------|----------------|-----------|-------------|------------------|-------------|
| 1 | HI | $10^{FT}0^{IN}0/_{16}$ | $5^{FT}0^{IN}0/_{16}$ | $4^{FT}11^{IN}15/_{16}$ | Off |
| 2 | LO | $7^{FT}0^{IN}0/_{16}$ | $9^{FT}0^{IN}0/_{16}$ | $4^{FT}11^{IN}15/_{16}$ | On |
| 3 | LO | $2^{FT}6^{IN}0/_{16}$ | $4^{FT}0^{IN}0/_{16}$ | $4^{FT}11^{IN}15/_{16}$ | Off |
| 4 | HI | $4^{FT}6^{IN}0/_{16}$ | $2^{FT}0^{IN}0/_{16}$ | $4^{FT}11^{IN}15/_{16}$ | On |

## Fail-Safe Operation

The following table indicates how the relays behave based on the fail-safe selection for each relay:

| Fail-Safe Selection | Non-Alarm State | | Alarm State | | Power Failure |
|---------------------|------|----|------|----|---------------|
| | **NO** | NC | **NO** | NC | |
| Off | Open | Closed | Closed | Open | Relays go to non-alarm state |
| On | Closed | Open | Open | Closed | Relays go to alarm state |

**Note:** NO = Normally Open, NC = Normally Closed. This refers to the condition of the relay contacts when the power to the meter is off.

## Front Panel LEDs

The alarm status LEDs on the front panel are available on all meters, even those without relays installed, and provide status indication for the following:

| LED | Status |
|-----|--------|
| 1 | Alarm 1 |
| 2 | Alarm 2 |
| 3 | Alarm 3 |
| 4 | Alarm 4 |

The meter is supplied with four alarm points that include front panel LEDs to indicate alarm conditions. This standard feature is particularly useful for alarm applications that require visual-only indication. The LEDs are controlled by the set and reset points programmed by the user. When the display reaches a set point for a high or low alarm, the corresponding alarm LED will turn on. When the display returns to the reset point the LED will go off. The front panel LEDs respond differently for latching and non-latching relays.

For non-latching relays, the LED is always off during normal condition and always on during alarm condition, regardless of the state of the relay (e.g. Relay acknowledged after alarm condition).

For latching relays, the alarm LEDs reflect the status of the relays, regardless of the alarm condition. The following tables illustrate how the alarm LEDs function in relation to the relays and the acknowledge button (Default: F3 key assigned to ACK).

## Latching and Non-Latching Relay Operation

The relays can be set up for latching (manual reset) or non-latching (automatic reset) operation.

| Relay terminology for following tables | |
|----------------------------------------|---|
| **Terminology** | **Relay Condition** |
| On | Alarm (Tripped) |
| Off | Normal (Reset) |
| Ack | Acknowledged |

The On and Off terminology does not refer to the status of the relay's coil, which depends on the fail-safe mode selected.

⚠ **WARNING**

- In latching relay mode, if Fail-Safe is off, latched relays will reset (unlatch) when power is cycled.

## Non-Latching Relay (Auto)

In this application, the meter is set up for automatic reset (non-latching relay). Acknowledging the alarm while it is still present has no effect on either the LED or the relay. When the alarm finally goes away, the relay automatically resets and the LED also goes off.

| Automatic reset only | | |
|---|---|---|
| **Condition** | **LED** | **Relay** |
| Normal | Off | Off |
| Alarm | On | On |
| Ack (No effect) | On | On |
| Normal | Off | Off |

## Non-Latching Relay with Manual Reset (A-niAn)

In this application, the meter is set up for automatic and manual reset at any time (non-latching relay). The LED and the relay automatically reset when the meter returns to the normal condition.

In addition, the relay can be manually reset while the alarm condition still exists, but the LED will stay on until the meter returns to the normal condition.

| Automatic + manual reset at any time | | |
|---|---|---|
| **Condition** | **LED** | **Relay** |
| Normal | Off | Off |
| Alarm | On | On |
| Normal | Off | Off |
| Next Alarm | On | On |
| Ack | On | Off |
| Normal | Off | Off |

## Latching Relay (LAtcH)

In this application, the meter is set up for manual reset at any time. Acknowledging the alarm even if the alarm condition is still present resets the relay and turns off the LED.

| Manual reset any time | | |
|---|---|---|
| **Condition** | **LED** | **Relay** |
| Normal | Off | Off |
| Alarm | On | On |
| Ack | Off | Off |

## Latching Relay with Clear (Lt-CLr)

In this application, the meter is set up for manual reset only after the signal passes the reset point (alarm condition has cleared). Acknowledging the alarm while it is still present has no effect on either the LED or the relay. When the alarm is acknowledged after it returns to the normal state, the LED and the relay go off. Notice that the LED remains on, even after the meter returns to the normal condition. This is because, for latching relays, the alarm LED reflects the status of the relay, regardless of the alarm condition.

| Manual reset only after alarm condition has cleared | | |
|---|---|---|
| **Condition** | **LED** | **Relay** |
| Normal | Off | Off |
| Alarm | On | On |
| Ack (No effect) | On | On |
| Normal | On | On |
| Ack | Off | Off |

## Acknowledging Relays

There are three ways to acknowledge relays programmed for manual reset:

1. Via the programmable front panel function keys F1-F3 (Example: F3 assigned to ACK).

F3

2. Remotely via a normally open push button wired to the F4 terminal.

P+   P-   F4   COM   V+   mA+
1    2    3    4     5    6
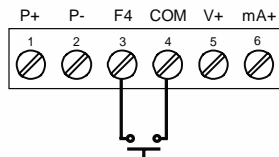
3. Remotely via a normally open push button wired to one of the digital inputs and the +5 V terminal on the digital I/O connections.

1   2   3   4   5   6   7   8   9   10
+5   I1   I2   I3   I4   O1   O2   O3   O4   G
DI 1-4          DO 1-4   GND
ACK
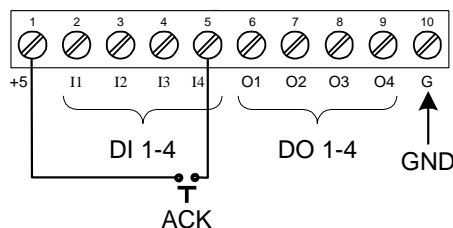
When the ACK button or the assigned digital input is closed, all relays programmed for manual reset are acknowledged.

## Pump Alternation Control Applications (ALtErn)

For pump control applications where two or more similar pumps are used to control the level of a tank or a well, it is desirable to have all the pumps operate alternately. This prevents excessive wear and overheating of one pump over the lack of use of the other pumps.

Up to 4 relays can be set up to alternate every time an on/off pump cycle is completed. The set points and reset points can be programmed, so that the first pump on is the first pump off.

## Application #1: Pump Alternation Using Relays 1 & 2

1. Relays 1 and 2 are set up for pump alternation.
2. Relays 3 and 4 are set up for low and high alarm indication.

### Set and Reset Point Programming

| Relay | Set Point | Reset Point | Function |
|---|---|---|---|
| 1 | $30^{FT}0^{IN}\,^0/_{16}$ | $10^{FT}0^{IN}\,^0/_{16}$ | Controls pump #1 |
| 2 | $35^{FT}0^{IN}\,^0/_{16}$ | $5^{FT}0^{IN}\,^0/_{16}$ | Controls pump #2 |
| 3 | $4^{FT}0^{IN}\,^0/_{16}$ | $9^{FT}0^{IN}\,^0/_{16}$ | Controls low alarm |
| 4 | $40^{FT}0^{IN}\,^0/_{16}$ | $29^{FT}0^{IN}\,^0/_{16}$ | Controls high alarm |

## Pump Alternation Operation

1. Pump #1 turns on when level reaches $30^{FT}$, when level drops below $10^{FT}$, pump #1 turns off.
2. The next time level reaches $30^{FT}$, pump #2 turns on, when level drops below $10^{FT}$, pump #2 turns off.
3. If the level doesn't reach $35^{FT}$, pump #1 and pump #2 will be operating alternately.
4. If pump #1 cannot keep the level below $35^{FT}$, pump #2 will turn on at $35^{FT}$, then as the level drops to $10^{FT}$, pump #1 turns off, pump #2 is still running and shuts off below $5^{FT}$.
5. Notice that with the set and reset points of pump #2 outside the range of pump #1, the first pump on is the first pump to go off. This is true for up to 4 alternating pumps, if setup accordingly.
6. Relay #3 will go into alarm if the level drops below $4^{FT}$ and relay #4 will go into alarm if the level exceeds $40^{FT}$.

## Application #2: Pump Alternation Using Relays 3 & 4

1. Relays 1 and 2 are set up for low and high alarm indication.
2. Relays 3 and 4 are set up for pump alternation.

### Set and Reset Point Programming

| Relay | Set Point | Reset Point | Function |
|---|---|---|---|
| 1 | $4^{FT}10^{IN}\,^0/_{16}$ | $7^{FT}6^{IN}\,^0/_{16}$ | Controls low alarm |
| 2 | $45^{FT}0^{IN}\,^0/_{16}$ | $42^{FT}0^{IN}\,^0/_{16}$ | Controls high alarm |
| 3 | $40^{FT}0^{IN}\,^0/_{16}$ | $9^{FT}0^{IN}\,^0/_{16}$ | Controls backup pump |
| 4 | $30^{FT}0^{IN}\,^0/_{16}$ | $10^{FT}0^{IN}\,^0/_{16}$ | Controls main pump |

### Pump Alternation Visual Representation

The following graphics provide a visual representation of a typical pump alternation application with high and low alarm monitoring:

1.  Relay #4 turns the main pump on at 30$^{FT}$ and turns it off at 10$^{FT}$.
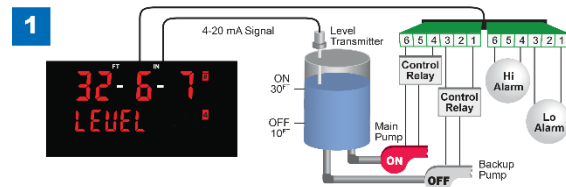


2.  With the Pump Alternation feature activated, the next time the level reaches 30$^{FT}$, relay #3 transfers and starts the backup pump.
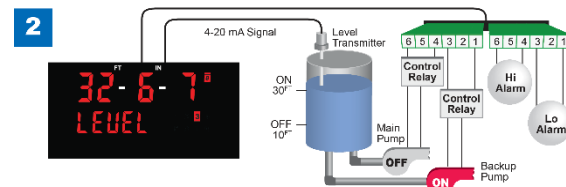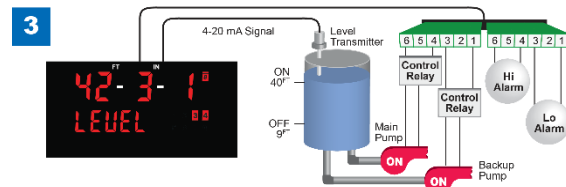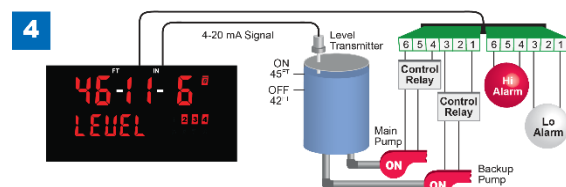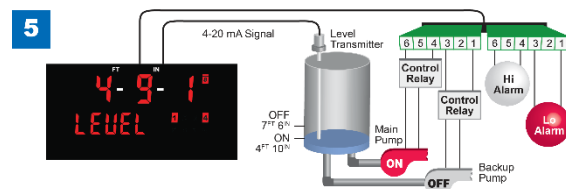


3.  If the backup pump is not able to keep up, and the level reaches 40$^{FT}$, relay #4 transfers and starts the main pump as well.



4.  Relay #2 trips the High Level Alarm at 45$^{FT}$ and resets at 42$^{FT}$.



5.  Relay #1 trips the Low Level Alarm at 4$^{FT}$10$^{IN}$ and resets at 7$^{FT}$6$^{IN}$.



## Setting Up the Interlock Relay (Force On) Feature

Relays 1-4 can be set up as interlock relays. To set up the relays for the interlock feature:

1.  Access the *Setup – Relay – Action* menu and set the action to off.
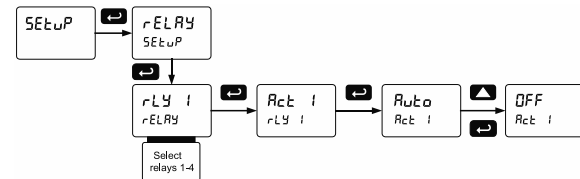


2.  In the Advanced features – *User* menu program any of the digital inputs to *Force On* any of the internal relays (1-4).



3.  Connect a switch or dry contact between the +5V terminal and the corresponding digital input (dI-1 to dI-4) terminal.
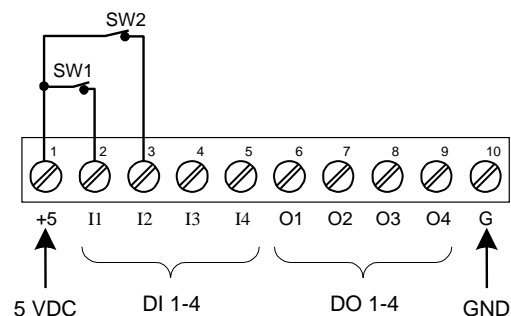


## Interlock Relay Operation Example

Relays 1 & 2 are configured to energize (their front panel LEDs are steady on) when SW1 & SW2 switches (above) are closed. If the contacts to these digital inputs are opened, the corresponding front panel LEDs flash indicating this condition. The processes being controlled by the interlock relay will stop, and will re-start only after the interlock relay is re-activated by the digital inputs (switches).

**Note:** If multiple digital inputs are assigned to the same relay, then the corresponding logic is (AND) – i.e. both switches must be closed to activate the relay.

⚠ **IMPORTANT**

*   If the digital inputs are assigned to the *Interlock Function*, then they cannot be used to program the meter remotely.

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## Scaling the 4-20 mA Analog Output (Aout)

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 further details, see *Setting Numeric Values* on page *37*, *Analog Output Value for Loss of 4-20 mA Input (Loop Break)* on page *56*.
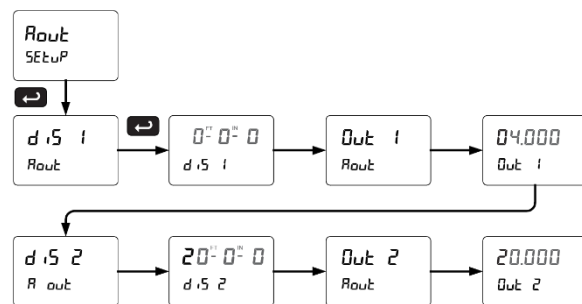


## Reset Menu (rESEt)

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" (rSt HL).

## Manual Control Menu (Contrl)

The *Manual 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.



> Once Manual mode is initiated on any relay or analog output, an LED labeled "M" is turned on. Every few seconds, all LEDs representing outputs that are in Manual mode, as well as the "M" LED flash. This process will continue as long as any output is in manual mode.
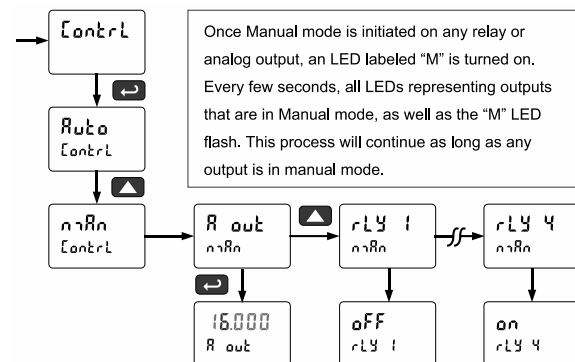
## Setting Up the Password (ᏢᎪᎦᎦ)

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 function keys and digital inputs
Pass 2: Allows use of function keys, digital inputs and editing set/reset points
Pass 3: Restricts all programming, function keys, and digital inputs

### 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* on page *37*.



### Making Changes to a Password Protected Meter

If the meter is password protected, the meter will display the message ᏞᎧᏟᎠ (*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.
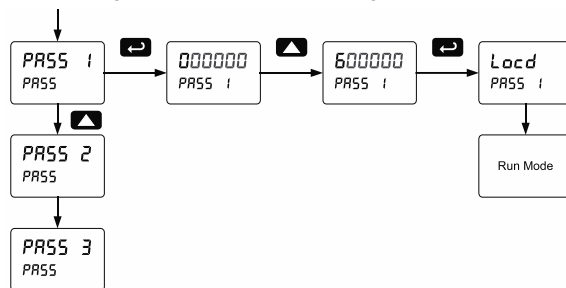
### Disabling Password Protection

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.
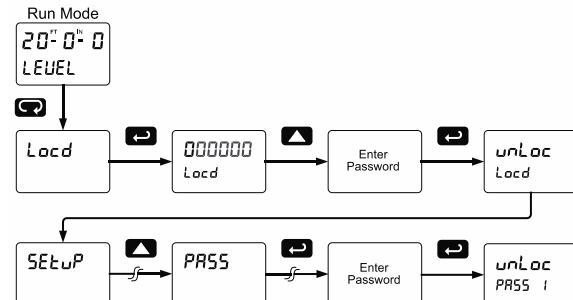


If the correct six-digit password is entered, the meter displays the message ᏌᏁᏞᎧᏟ (*unlocked*) and the protection is disabled until a new password is programmed.

If the password entered is incorrect, the meter displays the message ᏞᎧᏟᎠ (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 once. 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.
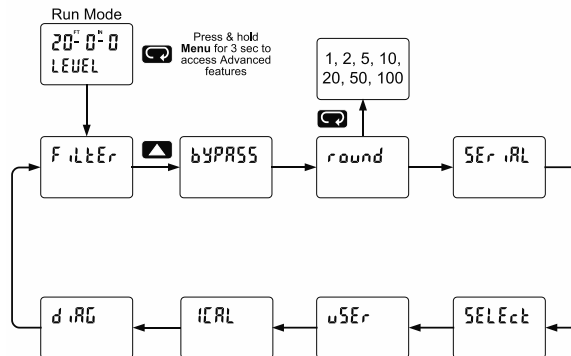
### Advanced Features Menu & Display Messages

| Display | Parameter | Action/Setting |
|---|---|---|
| FiltEr | Filter | Set noise filter value |
| bYPRSS | Bypass | Set filter bypass value |
| round | Round | Set the rounding value for display variables |
| SEriRL | Serial | Set serial communication parameters |
| SLRU id | Slave ID | Set slave ID or meter address |
| bRud | Baud rate | Select baud rate |
| tr dLY | Transmit delay | Set transmit delay for serial communication |
| PRr itY | Parity | Select parity Even, Odd, or None with 1 or 2 stop bits |
| t-bYt | Time byte | Set byte-to-byte timeout |
| SELEct | Select | Enter the Select menu (function, cutoff, out) |
| Functn | Input signal conditioning | Select linear or round horizontal tank function |
| PU 1 | PV1 | Select PV1 number of linearization points |
| L inERr | Linear | Set meter for linear function and select number of linearization points |
| no PtS | Number of points | Set PV1 for 2 to 32-point linearization Set PV2 for 2 to 8-point linearization |
| PU 2 | PV2 | Select PV2 number of linearization points |

### Advanced Features Menu & Display Messages

| Display | Parameter | Action/Setting |
|---|---|---|
| rht | Round horizontal tank | Set meter for round horizontal tank volume calculation |
| Inch | Dimension | Enter dimension in inches to calculate volume in gallons |
| cm | Dimension | Enter dimension in centimeters to calculate volume in liters |
| diRm⌐r | Diameter | Enter the tank's diameter in inches or centimeters |
| LEnGth | Length | Enter the tank's length in inches or centimeters |
| CutoFF | Cutoff | Program Low-Height Cutoff Value for PV 1 |
| RoutPr | Analog Output Program | Enter *Analog Output Programmable* parameters menu |
| SourcE | Source | Select source for the 4-20 mA output |
| O-rRnG | Overrange | Program mA output for display overrange |
| u-rRnG | Underrange | Program mA output for display underrange |
| brERK | Break | Set analog output value if input loop break is detected |
| m⌐RX | Maximum | Program maximum mA output allowed |
| m⌐ in | Minimum | Program minimum mA output allowed |
| CRL ib | Calibrate | Calibrate 4-20 mA output (internal reference source used for scaling the output) |
| 4 m⌐R | 4 mA output | Enter mA output value read by milliamp meter with at least 0.001 mA resolution |
| 20 m⌐R | 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 |
| F1* | F1 function key | *Assign F1-F4 function key |
| RcH | Acknowledge | Acknowledge relays |
| rESEt | Reset | Enter *Reset* menu |
| rSt Hi | Reset Max | Reset Maximum |
| rSt Lo | Reset Min | Reset Minimum |
| rSt HL | Reset Max-Min | Reset Maximum & Minimum |
| rELRY | Relay | Relay menu |
| SEt 1* | Set Points 1-4 | *Set Points 1-4 |
| rLY d | Relay Disable | Relay Disable (all relays) |

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**Advanced Features Menu & Display Messages**

| Display | Parameter | Action/Setting |
|---|---|---|
| rLY E | *Relay Enable* | Relay Enable (all relays) |
| O HoLd | *Output Hold* | Hold current relay states and analog output as they are until a button assigned to *enable relays* (rLY E) is pressed |
| d HoLd | *Display Hold* | Hold the current display value, relay states, and analog output momentarily while the function key or digital input is active. The process value will continue to be calculated in the background. |
| Ln1 Hi | *Line 1 High* | Max on line 1 |
| Ln1 Lo | *Line 1 Low* | Min on line 1 |
| Ln1 HL | *Line 1 High/Low* | Max/min line 1 |
| Ln2 Hi | *Line 2 High* | Max on line 2 |
| Ln2 Lo | *Line 2 Low* | Min on line 2 |
| Ln2 HL | *Line 2 High/Low* | Max/min line 2 |
| F On 1* | *Force On Relay 1* | *Force relay 1-4 on |
| Contrl | *Control* | Control Menu |
| diSAbL | *Disable* | Disable the selected function key or digital I/O |
| dI 1 | *Digital input 1* | Assign digital input 1 – 4 |
| dO 1 | *Digital output 1* | Assign digital output 1 – 4 |
| ICAL | *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 Hi | *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 Hi | *Voltage high* | Calibrate high voltage input (e.g. 10 V) |
| diAG | *Diagnostics* | Display parameter settings |
| LEd t | *LED test* | Test all LEDs |
| InFo | *Information* | Display software number and version |
| ErASE | *Erase* | Erase MeterView Pro software stored in meter's memory |

## Noise Filter (FiLtEr)

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.

## Rounding Feature (round)

The rounding feature is used to give the user a steadier display with fluctuating signals. Rounding is used in addition to the filter function.

Rounding causes the display to round to the nearest value according to the rounding selected. See examples below:

| Rounding Selection | Actual Value | Second Display Value | Main Display Value |
|---|---|---|---|
| 1 | 12.093 | 12.093 | 12$^{FT}$1$^{IN}$ 2/16 |
| | 12.953 | 12.953 | 12$^{FT}$11$^{IN}$ 7/16 |
| 5 | 12.093 | 12.095 | 12$^{FT}$1$^{IN}$ 2/16 |
| | 12.953 | 12.955 | 12$^{FT}$11$^{IN}$ 7/16 |
| 10 | 12.093 | 12.090 | 12$^{FT}$1$^{IN}$ 1/16 |
| | 12.953 | 12.950 | 12$^{FT}$11$^{IN}$ 6/16 |
| 50 | 12.093 | 12.100 | 12$^{FT}$1$^{IN}$ 3/16 |
| | 12.953 | 12.950 | 12$^{FT}$11$^{IN}$ 6/16 |

## Modbus® RTU Serial Communications (5Er iAL)

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

The meter may be connected to a PC for initial configuration via the on-board USB connection. For ongoing digital communications with a computer or other data terminal equipment, use the RS-485 connection with the appropriate serial converter; see *Ordering Information* on page *7* for details.

> ⚠ **CAUTION**
> - **DO NOT** connect any equipment to the RJ45 M-LINK connector. Otherwise damage will occur to the equipment and the meter.
> - **DO NOT** disconnect the RJ45 connector located to the left of the power terminal block. Doing so will disable the on-board digital I/O, and the RS-485 serial communications.

**Notes:**
1. Refer to the ProtEX-MAX Modbus Register Tables located at www.predig.com for details.
2. Changes made to the Serial menu are initialized after the menu key is pressed or after navigating through the remainder of the serial parameters (i.e. pass the t-byte parameter).
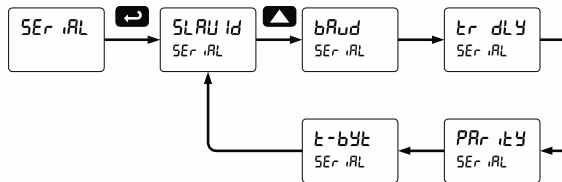
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) may be programmed between 1 and 247. The transmit delay may be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop bits.

## Select Menu (5ELEct)

The *Select* menu is used to select the input signal conditioner applied to the input (linear or round horizontal tank), low-height cutoff, and analog output programming. The multi-point linearization is part of the linear function selection.
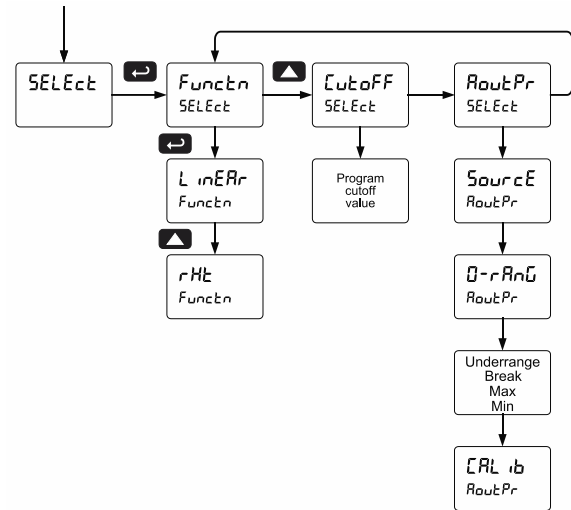
## Input Signal Conditioning (Functn)

The *Function* menu is used to select the input signal conditioner applied to the input: linear 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.

## Multi-Point Linearization (L ɪnЕЯr)

Multi-point linearization capability is available for the main (PV1) and second (PV2) displays, but it is most commonly used on the second display to display volume of non-linear tanks. This allows the user to display both level in feet and inches and volume on one meter.

Up to 32 linearization points may be entered for PV1 and up to eight for PV2. These points may be entered with the front panel buttons, or with MeterView Pro Software.

The menus for PV1 and PV2 are activated by selecting the dual-scale feature.
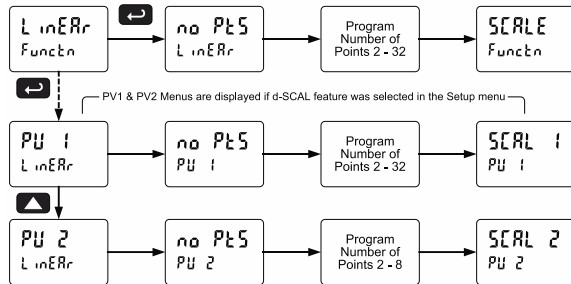


### Using MV Pro for Multi-Point Linearization

Using MeterView Pro software increases the speed and accuracy of entering multiple linearization points. The points can be manually entered into MeterView Pro or imported from a spreadsheet. Files can be saved for later use.

The following screen shot from MeterView Pro shows PV1 with the standard two-point scaling method and PV2 with six points of linearization:
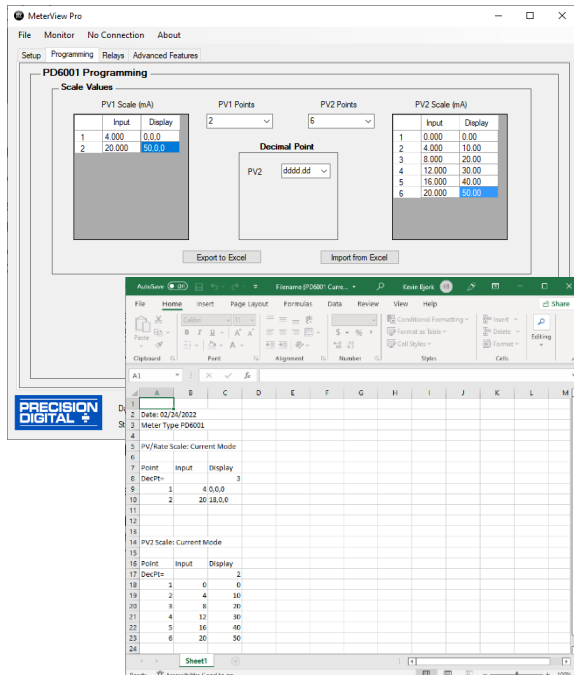


**Note:** Scale values can also be imported from an Excel spreadsheet.

## Round Horizontal Tank Linearization (rНᵗ)
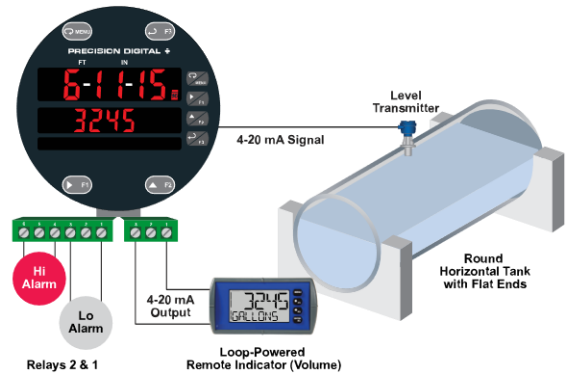


This function automatically calculates the volume in a round horizontal tank with flat ends and allows that reading to be displayed on the meter's second display. The user can now display level in feet and inches on the main display and volume on the second display. This feature is only available on PV2 since PV1 is the designated level indicator.

Set the display for the desired decimal point and engineering units before entering the round horizontal tank function. Select units, inches or cm for the tank dimensions. Enter the diameter and the length in inches and the results are calculated automatically in US gallons; if centimeters, the results are liters.

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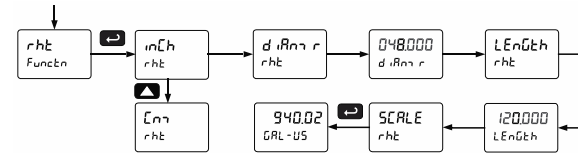


**Note:** After Scale is displayed continue pressing the Enter button until the meter completes the scaling of the input and display values.

**Changing the Volume from Gallons to Liters**

In the above graphic, entering 48" for the diameter and 120" for the length of the round horizontal tank, the meter automatically calculates that the volume of the tank is 940.02 gallons.

1. Convert gallons to liters
   1 US gallon = 3.7854 L
   940.02 gal = 3558.4 L
2. Go to the *Setup* menu and change the decimal point to 1 decimal.
3. Go to the *Program – Scale* menu and press Enter until d ɪѕ 2 is shown on the main display.
4. Press Enter and change the display 2 value to 3558.4.
5. The meter is now displaying the volume in liters.

**Note:** The display can be scaled to display the volume in any engineering units.

## Low-Height Cutoff (𝐶𝑢𝑡𝑜𝐹𝐹)

The low-height cutoff feature allows the meter to be programmed so that the display will always read zero below a certain point for whatever reason the user desires. The cutoff can be disabled to display negative values.

The cutoff value may be programmed from $0^{FT}1^{IN}(^0/_{16}$ or $^0/_8)$ to $99^{FT}11^{IN}(^{15}/_{16}$ or $^7/_8)$. The meter will display zero below the cutoff value. Programming the cutoff value to $0^{FT}0^{IN}(^0/_{16}$ or $^0/_8)$ disables the cutoff feature.

## Analog Output Programming (𝐴𝑜𝑢𝑡𝑃𝑟)

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, one of the set points, or the Modbus PV input.
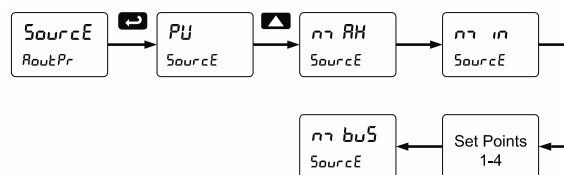


### Analog Output Value for Loss of 4-20 mA Input (Loop Break)

The 𝐴𝑜𝑢𝑡𝑃𝑟 - Break menu is used to force the analog output to go to a user-specified mA value if a break condition is detected in the 4-20 mA input loop. Selecting Ignore causes the mA output to go to the minimum value.

## Analog Output Calibration

To perform the analog output calibration, it is 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.

## Analog Output Calibration Procedure

1. Wire the PD8-6001 4-20 mA output to a current loop that includes a power supply (internal or external 12 to 24 VDC), and the mA input on the digital meter. See *Figure 18. 4-20 mA Output Connections* on page *31* for details.
2. Turn on all devices. Allow for a 15 to 30 minute warm-up.
3. Go to the Advanced Features menu, navigate to Select (𝑆𝐸𝐿𝐸𝑐𝑡) and choose Analog Output Programming (𝐴𝑜𝑢𝑡𝑃𝑟) → Calibration (𝐶𝐴𝐿𝑖𝑏) menu and press **Enter**.
4. The display will show 4 𝑚𝐴. The PD8-6001 mA output should now be close to 4 mA. Press Enter and the display will show 04.000. Enter the actual value read by the digital mA meter and press **Enter**.
5. The display will show 20 𝑚𝐴. The PD8-6001 mA output should now be close to 20 mA. Press **Enter** and the display will show 20.000. Enter the actual value read by the digital mA meter and press **Enter**.
6. The meter will now calculate the calibration factors and store them.
7. Press **Menu** to exit and return to Run mode.

## Programmable Function Keys User Menu (𝑢𝑆𝐸𝑟)

The *User* menu allows the user to assign the front programming buttons function keys F1, F2, and F3, the digital input F4 (located on the input signal connector), and four digital inputs (located on the digital I/O connector) to access most of the menus or to activate certain functions immediately (e.g. reset max & min, hold relay states, etc.). This allows the meter to be greatly customized for use in specialized applications.

The four digital outputs can be assigned to a number of actions and functions executed by the meter (i.e. alarms, relay acknowledgement, reset max, min, or max & min, tare, and reset tare). The digital outputs can be used to trigger external alarms or lights to indicate these specific events.
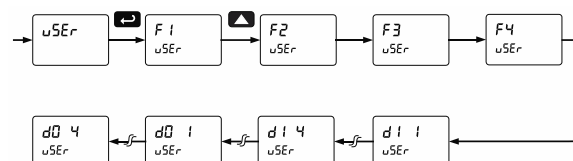
## Function Keys & Digital I/O Available Settings

Refer to the following table for descriptions of each available function key or digital I/O setting.

| Display | Description |
|---|---|
| r5t Hı | Reset the stored maximum display value |
| r5t Lo | Reset the stored minimum display value |
| r5t HL | Reset the stored maximum & minimum display values |
| tArE | Capture tare and zero the display |
| r5t tr | Reset captured tare and resume normal operation |
| rELAY | Directly access the relay menu |
| SEt 1* | Directly access the set point menu for relay 1 (*through 4) |
| rLY d | Disable all relays until a button assigned to *enable relays* (rLY E) is pressed |
| rLY E | Enable all relays to function as they have been programmed |
| O HoLd | Hold current relay states and analog output as they are until a button assigned to *enable relays* (rLY E) is pressed |
| d HoLd | Hold the current display value, relay states, and analog output momentarily while the function key or digital input is active. The process value will continue to be calculated in the background. |
| Ln1 Hı | Display maximum display value on line 1 |
| Ln1 Lo | Display minimum display value on line 1 |
| Ln1 HL | Display maximum & minimum display values on line 1 |
| Ln2 Hı | Display maximum display value on line 2 |
| Ln2 Lo | Display minimum display value on line 2 |
| Ln2 HL | Display maximum & minimum display values on line 2 |
| F On 1* | Force relay 1 (*through 4) into the on state. This function is used in conjunction with a digital input to achieve interlock functionality. See *Setting Up the Interlock Relay (Force On)* Feature on page *49* for details. |
| Contrl | Directly access the control menu |
| dıSAbL | Disable the selected function key or digital I/O |
| AcH | Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching |
| rESEt | Directly access the reset menu |
| nıEnu | Mimic the menu button functionality (digital inputs only) |
| rıGHt | Mimic the right arrow/F1 button functionality (digital inputs only) |
| uP | Mimic the up arrow/F2 button functionality (digital inputs only) |
| EntEr | Mimic the enter/F3 button functionality (digital inputs only) |
| ALnı 1* | Provide indication when alarm 1 (*through 4) has been triggered (digital outputs only) |

## Internal Source Calibration ( ICAL )

> The meter is **factory calibrated** prior to shipment for milliamps and volts with calibration equipment that is certified to NIST standards.

The use of calibrated signal sources is necessary to calibrate the internal source of the meter. The meter's internal source is what allows the user to scale the meter without applying a signal.

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

**Notes:**
1. 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.
2. 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 (C 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 (C 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.

The following graphic shows the calibration of the current input. The voltage input is calibrated in a similar way.
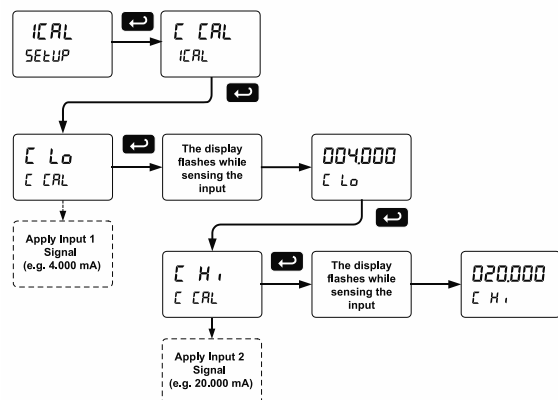


**Tips:**

- 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 the input prior to the failure 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*.

*Not relevant when scaling the meter.*

### 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.

# Meter Operation

When installed, the primary way to operate the meter is with the CapTouch through-glass buttons that allow the user to perform various operations without removing the cover and exposing the electronics to the hazardous environment. The user can also operate the meter by connecting a suitable control station or switch to one of the digital inputs that can be used to perform various operations on the meter based on the Programmable Function Keys. Finally, certain operations can be performed on the meter with MeterView Pro software or through Modbus commands.

The two default operations that can be performed with the meter's CapTouch buttons are:

1. Display the maximum and minimum readings
2. Acknowledge the relays

In addition, the user can program the CapTouch Buttons to perform a variety of useful operations by reassigning them to other functions per *Function Keys & Digital I/O Available Settings* on page *57*.

## Button Operation

The following table shows the default operations for the F1, F2, and F3 CapTouch Buttons, Displaying and resetting the maximum and minimum values and resetting the relays:

| 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 *User* menu |
|  | Press to display max/min readings or other parameter/function assigned through the *User* menu |
|  | Press to acknowledge relays or other parameters/function assigned through the *User* menu |

## CapTouch Buttons

## CapTouch Buttons

The ProtEX-MAX is equipped with four capacitive sensors that operate as through-glass buttons so that it can be programmed and operated without removing the cover (and exposing the electronics) in a hazardous area.

These buttons can be disabled for security by selecting DISABLE on the switch labeled NO-CONTACT BUTTONS located on the connector board.



To actuate a button, press one finger to the window directly over the marked button area. When the cover is removed or replaced, the CapTouch buttons can be used after the meter completes a self-calibrating routine. The sensors are disabled when more than one button is pressed, and they will automatically re-enable after a few seconds. When the cover is removed, the four mechanical buttons located on the right of the faceplate are used.

The CapTouch Buttons are configured by default to duplicate the function of the front panel mechanical pushbuttons associated with the integrated meter.

### CapTouch Button Tips:

- Keep the glass window clean.
- Tighten the cover securely.
- Use a password to prevent tampering.

## Function Keys Operation

During operation, the programmable function keys operate according to the way they have been programmed in the *Advanced Features – User* menu. See *Programmable Function Keys User Menu (uSEr)* on page *56* for details.

The table on page *58* shows the factory default settings for F1, F2, and F3.

## Digital Inputs Operation

Five (5) digital inputs, F4, DI-1 to DI-4, come standard on the meter. These digital inputs are programmed identically to function keys F1, F2, and F3. The inputs are triggered with a contact closure to +5 V in the case of digital inputs 1-4 or with an active high signal, see *Digital I/O Connections* on page *31* for details. The F4 is triggered with a contact closure to COM or with an active low signal. During operation, digital inputs operate according to the way they are programmed in the Advanced Features – User menu. See *Programmable Function Keys User Menu (uSEr)* on page *56* for details.

## 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 Hi), Min (d Lo), or toggle between Max and Min (d HL) every 10 seconds.
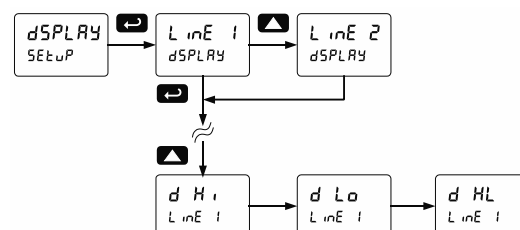
# Troubleshooting

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 ىAG)

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

This menu allows the user to test the functionality of all the meter LEDs, check the meter's software and version information, and erase the MeterView Pro software installation files from the meter. 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* on page *52*.

## Testing the Display LEDs

To test all LEDs on the display:
1. Go to the *Diagnostics* menu (d ىAG) and press Enter button.
2. Press Up arrow button and scroll to *LED Test* menu (LEd t)
3. Press the Enter button to activate the LED Test. The meter will cycle through all digits, decimal points, and relay indicators to enable the operator to check that all LEDs are functioning properly.
4. Press the Enter button again to access the *Information* menu ( ىnFo) or press the Menu button to return to Run Mode.

## Determining Software Version

To determine the software version of a meter:
1. Go to the *Diagnostics* menu (d ىAG) and press Enter button.
2. Press Up arrow button and scroll to Information menu ( ىnFo).
3. Press Enter to access the software number (SFt) and version (UEr) 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* on page *52*.
2. Press Up arrow to go to *Diagnostics* (d ىAG) menu
3. Press and hold Right arrow for three 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.
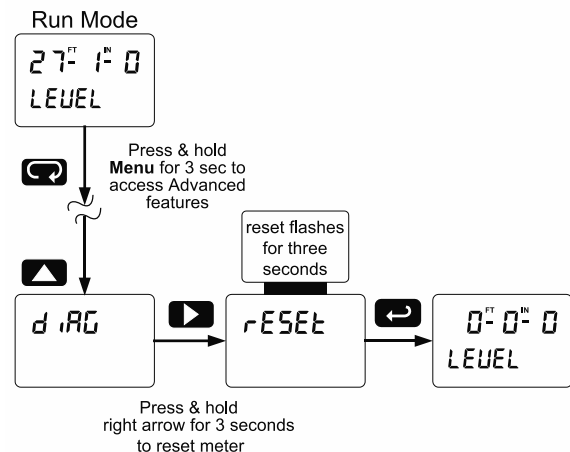
## Factory Defaults & User Settings

The following table shows the factory setting for most of the programmable parameters on the meter.

| Parameter | Display | Default Setting |
|---|---|---|
| Input type | InPut | 4-20 mA |
| Dual-scale feature | d-SCAL | No (Single scale) |
| Filter | FiLtEr | 70 |
| 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 | $4^{FT}0^{IN}0/16$ |
| Input 2 | InP 2 | 20.000 mA |
| Display 2 | diS 2 | $20^{FT}0^{IN}0/16$ |
| Decimal point | ddddd | 3 places |
| Cutoff value | CutoFF | 0.0 (disabled) |
| Display assignment | dSPLAY | |
| Display line 1 (Main) | LinE 1 | PV: Process variable |
| Display line 2 (Second) | LinE 2 | Eng unit default= level |
| Display intensity | d-IntY | 6 |
| Relay 1 action | Act 1 | Automatic |
| Relay 1 set point | SEt 1 | $1^{FT}0^{IN}0/16$ |
| Relay 1 reset point | rSt 1 | $0^{FT}6^{IN}0/16$ |
| Relay 2 action | Act 2 | Automatic |
| Relay 2 set point | SEt 2 | $2^{FT}0^{IN}0/16$ |
| Relay 2 reset point | rSt 2 | $1^{FT}6^{IN}0/16$ |
| Relay 3 action | Act 3 | Automatic |
| Relay 3 set point | SEt 3 | $3^{FT}0^{IN}0/16$ |
| Relay 3 reset point | rSt 3 | $2^{FT}6^{IN}0/16$ |
| Relay 4 action | Act 4 | Automatic |
| Relay 4 set point | SEt 4 | $4^{FT}0^{IN}0/16$ |
| Relay 4 reset point | rSt 4 | $3^{FT}6^{IN}0/16$ |
| Fail-safe relay 1 | FLS 1 | Off |
| Fail-safe relay 2 | FLS 2 | Off |
| Fail-safe relay 3 | FLS 3 | Off |
| Fail-safe relay 4 | FLS 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 |

| Parameter | Display | Default Setting |
|---|---|---|
| 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 | diS 1 | $4^{FT}0^{IN}0/16$ |
| Output 1 value | Out 1 | 4.000 mA |
| Display 2 analog out | diS 2 | $20^{FT}0^{IN}0/16$ |
| 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 | brEAK | 1.000 mA |
| Maximum output | mAX | 23.000 mA |
| Minimum output | min | 1.000 mA |
| Slave ID (Address) | SLAV id | 247 |
| Baud rate | bAud | 9600 |
| Transmit delay | tr dLY | 50 ms |
| Parity | PArity | Even |
| Byte-to-byte timeout | t-bYt | 010 (0.1 sec) |
| F1 function key | F1 | Reset max & min |
| F2 function key | F2 | Line 1: Max (Hi) |
| F3 function key | F3 | Acknowledge relays |
| F4 function | F4 | Acknowledge relays |
| Digital input 1 | di 1 | Menu |
| Digital input 2 | di 2 | Right arrow |
| Digital input 3 | di 3 | Up arrow |
| Digital input 4 | di 4 | Enter |
| Digital output 1 | dO 1 | Alarm 1 |
| Digital output 2 | dO 2 | Alarm 2 |
| Digital output 3 | dO 3 | Alarm 3 |
| Digital output 4 | dO 4 | Alarm 4 |
| Password 1 | PASS 1 | 000000 (unlocked) |
| Password 2 | PASS 2 | 000000 (unlocked) |
| Password 3 | PASS 3 | 000000 (unlocked) |

# Troubleshooting Tips

This meter is a highly sophisticated instrument with an extensive list of features and capabilities. If the programming buttons are used to program the meter, it may be a difficult task to keep everything straight. That is why we strongly recommend the use of the free MeterView Pro software for all programming activities. A USB cable is provided with the meter for programming with MeterView Pro software.

If you have programmed the meter with the programming buttons and it is not working as intended, try re-programming the meter using MeterView Pro software.

| Symptom | Check/Action |
|---|---|
| No display at all | Check power at power connector |
| Not able to change setup or programming, Locd is displayed | Meter is password-protected, enter correct six-digit password to unlock or Master Password of 508655 |
| Meter does not respond to input change | If a *Low-Height Cutoff* Value has been programmed, the meter will display zero below that point, regardless of the input – which can appear like the meter is not responding to an input change. Check to make sure the problem is not being caused by an undesired low-height cutoff value.<br>To prevent the display from showing a negative value, set the low-height cutoff to a value greater than zero. |
| Meter displays error message during calibration (Error) | Check:<br>1. Signal connections<br>2. Input selected in *Setup* menu<br>3. Minimum input span requirements |
| Meter displays<br>1. 999999<br>2. -99999 | Check:<br>1. Input selected in *Setup* menu<br>2. Corresponding signal at Signal connector |
| Display is unstable | Check:<br>1. Input signal stability and value<br>2. Display scaling vs. input signal<br>3. Filter and bypass values (increase) |
| Display response is too slow | Check filter and bypass values |
| Display reading is not accurate | Check:<br>1. Input signal conditioner selected: Linear, etc.<br>2. Scaling or calibration |
| Display does not respond to input changes, reading a fixed number | Check display assignment, it might be displaying max, min, or set point. |
| Display alternates between<br>1. Hi and a number<br>2. Lo and a number | Press Menu to exit max/min display readings. |
| Relay operation is reversed | Check:<br>1. Fail-safe in *Setup* menu<br>2. Wiring of relay contacts |
| Relay and status LED do not respond to signal | Check:<br>1. Relay action in *Setup* menu<br>2. Set and reset points |
| Flashing relay status LEDs | Relays in manual control mode or relay interlock switches opened. |
| Meter not communicating with application programs | Check:<br>1. M-Link Connector installed between PROVU electronics and ProtEX-MAX connector board. See *Figure 4*: Integrated PROVU Required Connections on page *26*<br>2. Serial settings<br>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. |
| CapTouch buttons do not respond | 1. Check if slide switch on connector board is in DISABLE position, switch to ENABLE.<br>2. Be sure to hold the initial CapTouch button for 5 seconds to wake it up. |
| Serial Communications Power LED Indicator is off | Check:<br>1. Modular cable connection<br>2. Power to the device |

## Troubleshooting Tips

| Symptom | Check/Action |
|---|---|
| If only the TX (or DATA IN) data status LED is flashing when serial communications attempted | Check<br>1. Serial cable<br>2. Instrument address & baud rate<br>3. Program address & baud rate |
| If both data status LEDs (TX and RX) are off when trying to communicate | Remove all unnecessary cables and instruments from the bus. Try getting the system to work with only one device (to ease troubleshooting) and then expand the system one device at a time. |
| Communications slow | Increase the baud rate |
| Random communication errors | 1. Increase the TX delay time<br>2. Decrease the baud rate |
| Other symptoms not described above | Call Technical Support for assistance |

**Note:** Certain sequences of events can cause unexpected results. To solve these issues, it is best to start fresh from factory defaults and use the manual as a step by step programming guide, rather than a random approach to programming. To reset the meter to factory defaults, see Reset Meter to Factory Defaults on page 60. In addition, for best results, we recommend using the free MeterView Pro software for all programming needs.

**NOTES**

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