ProtEX-MAX PD8-6300 Pulse Input Rate/Totalizer, Counter and Tachometer
Instruction Manual

MeterView Pro
USB Install

- Fully Approved Explosion-Proof Pulse Input Flow Rate/Totalizers
- Active Pulse, Square Wave, NPN, PNP, Switch, or Coil (Magnetic Pickup) Inputs
- Dual-Line 6-Digit Display, 0.60" (15.2 mm) & 0.46" (12.0 mm)
- CapTouch Through-Glass Button Programming
- Display Mountable at 0°, 90°, 180°, & 270°
- Isolated 5, 10 or 24 VDC Flowmeter Power Supply
- Gate Function for Rate Display of Slow Pulse Rates
- 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
- Display Rate & Total at the Same Time
- Rate in Units per Second, Minute, Hour, or Day
- Total, Grand Total or Non-Resettable Grand Total
- Front Panel or Remote Total Reset
- Password Protection for Total Reset
- Total Stored in Non-Volatile Memory
- Assign Any Relay or 4-20 mA Output for Rate or Total
- K-Factor, Internal Scaling, or External Calibration
- 4-20 mA Output Option Converts the Pulse Input to an Isolated 4-20 mA Output
- 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
- 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
- Password Protection
- Four 3/4" NPT Threaded Conduit Openings
- 3-Year Warranty

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

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Disclaimer

The information contained in this document is subject to change without notice. Precision Digital makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose. See Warranty Information and Terms & Conditions on www.predig.com for complete details.

⚠ **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.

Registered Trademarks

All trademarks mentioned in this document are the property of their respective owners.

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**

- The meter should only be connected to a computer while the computer and meter are both located in a safe area.

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Introduction

The ProtEX-MAX PD8-6300 is an explosion-proof, pulse input flow rate/totalizer ideal for flow rate, total and control applications. The totalizer features a dual-line display, with a main display 0.60" (15.2 mm) high, and a second display of 0.46" (12.0 mm) high superluminous LED digits, which can be read in any lighting condition, including direct sunlight. The totalizer is housed in a field-mountable, NEMA 4X/IP68 rated enclosure available in either aluminum or stainless steel for convenient indoor and outdoor installation.

The totalizer accepts a wide variety of pulse signals that can be displayed as flow rate, total and grand total. In fact, the ability to display flow rate and total at the same time, or other combinations of rate, total and grand total, is one of the most useful features of the dual-line display.

The ProtEX-MAX is available in two configurations: display only and fully loaded. Both versions include a 24 VDC power supply to power the flowmeter. A fully loaded ProtEX-MAX PD8-6300-6H7 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 purposes. 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.

One of the most useful applications for the PD8-6300 is to convert the pulse input from the flowmeter into an isolated 4-20 mA output all the while displaying flow rate and total on a big bright display as the following graphic illustrates:
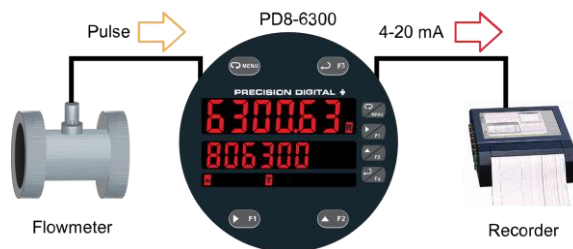
CapTouch Buttons

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
PD8-6300-6H0	5 Digital Inputs, 4 Digital Outputs, RS-485 Communications	No options
PD8-6300-6H7		4 relays 4-20 mA output

12-24 VDC Models

Model	Standard Features	Options Installed
PD8-6300-7H0	5 Digital Inputs, 4 Digital Outputs, RS-485 Communications	No options
PD8-6300-7H7		4 relays 4-20 mA output

Stainless Steel Enclosure
85-265 VAC Models

Model	Standard Features	Options Installed
PD8-6300-6H0-SS	5 Digital Inputs, 4 Digital Outputs, RS-485 Communications	No options
PD8-6300-6H7-SS		4 relays 4-20 mA output

12-24 VDC Models

Model	Standard Features	Options Installed
PD8-6300-7H0-SS	5 Digital Inputs, 4 Digital Outputs, RS-485 Communications	No options
PD8-6300-7H7-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.

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

Key Features

Front

Connections

Connections for PD8-6300-6H7 & PD8-6300-7H7
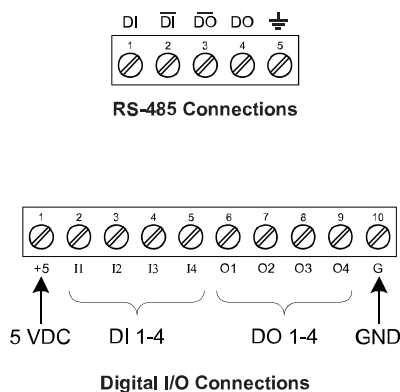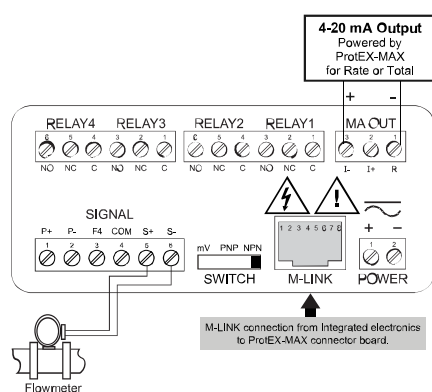
- Form C (SPDT) relays
- Two isolated supplies available even on 12/24 VDC input power models
- Removable terminal blocks
- 4 relays + isolated 4-20 mA output option
- Universal 85-265 VAC or 12/24 VDC input power
- Digital input (F4)

The Only Explosion-Proof Totalizer, Counter & Tachometer You Will Ever Need

The ProtEX-MAX PD8-6300 explosion-proof flow rate/totalizers are specifically designed for displaying flow rate and total from flowmeters with pulse outputs. The PD8-6300 has all the same features as our PD6300 1/8 DIN flow rate/totalizer, as a fully approved explosion-proof product. The product is certified by CSA as Explosion-Proof / Dust-Ignition-Proof / Flame-Proof, and is ATEX and IECEx certified as Dust-Ignition-Proof / Flame-Proof.

The first thing you will notice about the PD8-6300 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. The main display can be programmed to display flow rate, total, or grand total, and the second display can be programmed to display flow rate, total, grand total, engineering units, custom legends, or turned off.

Besides being suitable for hazardous areas, the number one feature that makes the PD8-6300 such a useful device is its built-in 5, 10 or 24 VDC power supply to drive the flowmeter 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.

ProtEX-MAX flow rate/totalizers can be programmed for a wide variety of totalizer applications. They can display total, grand total, or non-resettable grand total with a time base of seconds, minutes, hours or days. The user can program a totalizer conversion factor, a non-resettable grand total, password protection, and several total reset methods. 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 meter comes from the factory pre-calibrated for all pulse inputs, so the user need only set the mV / PNP / NPN switch in the appropriate position based on the input and also set the desired excitation voltage level. Once programming is completed, the meter can be locked with a password.
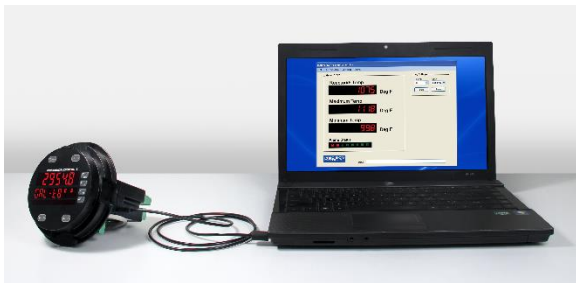
The ProtEX-MAX comes preloaded with free MeterView Pro programming software that connects and installs directly to your PC with a standard USB cable, also provided free with each instrument. This eliminates the need to insert CDs, install drivers, or download software from the internet. When you connect 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 Flow Rate, Total or Grand Total

The main display can be programmed to display flow rate, total, or grand total, and the second display can be programmed to display flow rate, total, grand total, engineering units, custom legends, or can be turned off. Both displays could also display relay set points, or max and min values. The following photographs show typical ways these flow rate/totalizers can be programmed.

Flow Rate Indicator   **Flow Totalizer**

Rate & Total   **Total & Grand Total**
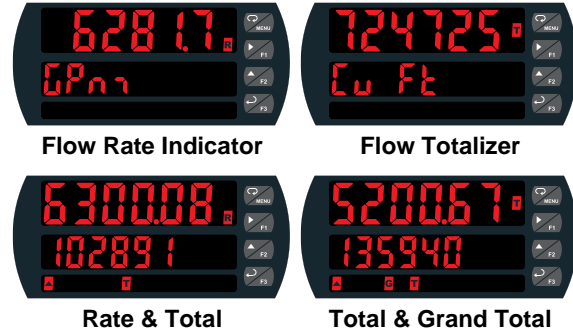
Easy to Use

The user-friendly dual-line display makes the ProtEX-MAX easy to set up & program. No jumpers to set for input selection. All setup & programming is done via the front panel.
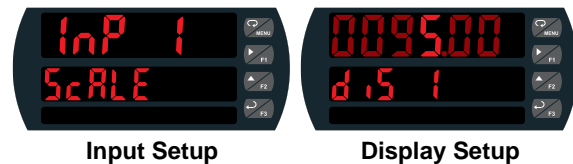
Input Setup   **Display Setup**

Totalizer Overflow Displays Total to 9 Digits

These flow rate/totalizers can display up to nine digits of total flow with the total overflow feature. In the diagram below, the flow totalizer is displaying 532,831,470 by toggling between a display of "oF 532" and "831470". Notice the (T with arrow ▲ symbol) is lit up indicating the display is in overflow mode.

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.

Rounding for Even Steadier Display

The rounding feature is used to give the user a steadier display with fluctuating signals. It causes the display to round to the nearest value according to the rounding value selected (1, 2, 5, 10, 20, 50, or 100). For example, with a rounding value of 10, and an input of 12346, the display would indicate 12350.

Rate/Totalizer Features

ProtEX-MAX flow rate/totalizers can be programmed for a wide variety of rate and totalizer applications. They can display rate, total, grand total, or a non-resettable grand total with a time base of seconds, minutes, hours or days. The user can program a totalizer conversion factor, a non-resettable grand total, password protection, and several total reset methods. The dual-line display can be programmed to display rate and total at the same time, or a variety of other rate, total and grand total combinations.

Display Rate & Total at Same Time

One of the most useful features of the ProtEX-MAX flow rate/totalizers is their ability to display both flow rate and total at the same time. Whereas a single-line display would have to toggle between the rate and the total, the ProtEX-MAX's dual-line display can display them both at the same time.

Totalizer Password Protection

The total and grand total can be password protected so they can be reset only by authorized personnel.

Total Password   **Grand Total Password**

Non-Resettable Grand Total

The user can set up the grand total to be non-resettable by entering a specific password. Once this is done, the grand total can never be reset.

Totalizer Conversion Factor

The user can enter a totalizer conversion factor that allows the meter to display total in different units than the rate. For instance, a customer could measure flow rate in gallons per minute and total in hundredths of acre-feet.

Rate in Units Per Sec, Min, Hr, or Day

The user may select a rate time base in units per second, minute, hour, or day. The time base is the amount of time over which the rate parameter will totalize. For example, if the rate was ten (and stayed constant for one minute) and the time base was in minutes, then the total would increase by ten every one minute.

Convert Pulse Input to Isolated 4-20 mA Output

One of the most useful applications for the PD8-6300 is to convert the pulse input from the flowmeter into an isolated 4-20 mA output all the while displaying flow rate and total on a big bright display as the following graphic illustrates:

Programming

The meter may either be scaled (5CALE) without applying an input, calibrated (CAL) by applying an input, or the K-Factor menu may be used to match the rate/totalizer with the flowmeter's k-factor (pulse/unit of measure).

Most flowmeter manufacturers provide the k-factor information with the flowmeter. Enter the K-Factor (FActor) menu and select the decimal point with highest resolution possible and program the k-factor value (i.e. pulses/gal). The meter will automatically calculate the flow rate using the k-factor and the time base selected.

Gate Function for Slow Pulse Rates

The gate function is used for displaying slow pulse rates. Using the programmable gate, the meter is able to display pulse rates as slow as 1 pulse every 999.9 seconds (0.001 Hz). The gate function can also be used to obtain a steady display reading with a fluctuating input signal.

Total & Rate Alarms

The ProtEX-MAX can be equipped with four alarms (relays) that can be set up to activate on the rate or total. In the case of the rate, the relays can be programmed to trip on a high or low rate. In the case of the total, the relays can be programmed to trip when the total reaches a user-defined set point. A variety of reset modes are available and the user can also program time delays and fail-safe operation.

4-20 mA Output for Rate or Total

The 4-20 mA output can be assigned to the rate or total.

Total Stored in Non-Volatile Memory

Total and Grand Total values, and all programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.

Total Reset Capabilities

The user may reset the total via a CapTouch button, the F4 terminal at the back of the meter, an external contact closure on the digital inputs, automatically via user selectable preset value and time delay, or through serial communications.

Total Reset via CapTouch Button

The three through-glass CapTouch button function keys can be programmed to reset the total and grand total. This makes it possible for the user to reset either the total or the grand total without opening the enclosure cover and without the need for external devices. Of course, if the total or grand total is password protected, they will not reset when the function key is pressed.

Total Reset via F4 Terminal

The PD8-6300 includes a digital input (referred to as the F4 terminal) located on the back of the electronics module as standard that can be used to reset the total or grand total, among other things. This is the preferred method for externally resetting the total or grand total because it does not interfere with the operation of the CapTouch buttons for programming as described below in the Total Reset via Digital Input section.

Total Reset via Digital Input

In addition to the F4 digital input described above, the PD8-6300 also includes four digital inputs that can be used to reset the total or grand total. However, if a digital input is used to reset the total, or for some other purpose, the corresponding through-glass CapTouch button will function as a programming key.

Total Reset via Preset Value

The total and grand total can be programmed for automatic reset based on a preset value determined by the user. In the automatic reset mode, a programmable time delay is available to reset the total or grand total after the assigned preset is reached.

Total Reset via Serial Communications

The total and grand total can be reset via serial communications such as a Modbus command or MeterView Pro.

Sampling Function (Total Triggered Timed Relay)

The sampling function allows the operator to set a set point for a "sampling" relay. When the program total reaches that set point, it will close that relay's contacts for a preset period of time (0.1 to 5999.9 seconds). An example of its use may be for wastewater sampling. When the wastewater total reaches a preset total interval (i.e. every 10,000 gallons), the relay contacts would close for a preset time, and by some means (light, horn, etc.) alert someone to take a sample, or provide the trigger to automatically take a sample of the wastewater. The utility of this function can, of course, be expanded beyond sampling and be used whenever a timed relay output closure is required when the rate or a total interval reaches a certain set point.

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 PD8-6300 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.
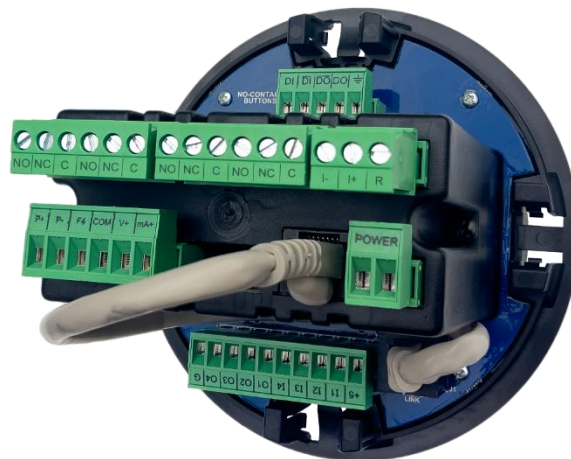
Note: The above photograph is representative of the back of the PD8-6300 in every regard except for the signal input connector. See *Signal Connections* on page *29* for actual input signal connections.

USB Port MeterView Pro
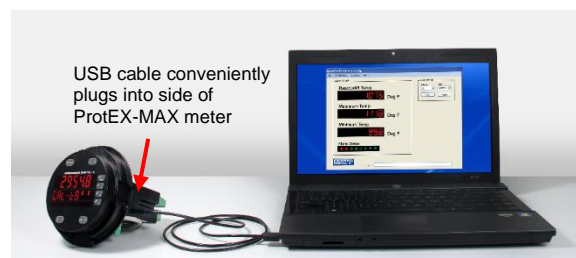
USB cable conveniently plugs into side of ProtEX-MAX meter

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.

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
Display Intensity	Eight user selectable intensity levels. Default intensity is six.
Display Update Rate	Rate: 10/sec to 1/100 sec (it is a function of Low Gate setting)
	Total: 10/second (fixed)
LED Status Indicators	See *LED Status Indicators* on page *33* for details.
Overrange	Display flashes 999999
Display Assignment	Display Line 1: Rate, total, grand total, alternate (rate/total, rate/grand total, rate/units, total/units, and grand total/units), set points, max/min, Modbus input and more.
	Display Line 2: Same as Display Line 1; plus units, tag 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.
Recalibration	All ranges are calibrated at the factory to read frequency in Hz. No recalibration required.
Max/Min Display	Max/min readings reached by the process are stored until reset by the user or until power to the meter is cycled.
Rounding	Select 1, 2, 5, 10, 20, 50, or 100
	(e.g. rounding = 10, value = 123.45, display = 123.50).
Password	Three programmable passwords restrict modification of programmed settings and two prevent resetting the totals.
	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.
	Total: Prevents resetting the total manually
	Gtotal: Prevents resetting the grand total manually
Non-Volatile Memory	Total and Grand Total values, and all programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
Power Options	85-265 VAC 50/60 Hz; 90-265 VDC, 20 W max; 12-24 VDC, 12-24 VAC, 15 W max. Powered over USB for configuration only.
Fuse	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse

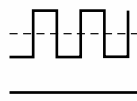|	
Isolation	4 kV input/output-to-power line
	500 V input-to-output or output-to-P+ supply
Overvoltage Category	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
Environmental	T6 Class operating temperature range Ta = -55 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 13.73 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 *22* for additional details
	Pipe Mounting: Optional pipe mounting kit (PDA6848) allows for pipe mounting. Sold separately. See *Pipe Mounting Instructions* on page *23* 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	6.4" x 8.0" x 8.5" (163 mm x 202 mm x 215 mm) (W x H x D)
Weight	Aluminum: 14.7 lbs (6.7 kg)
	Stainless Steel: 23.5 lbs (10.7 kg)
Warranty	3 years parts & labor. See Warranty Information and Terms & Conditions on www.predig.com for complete details.

Pulse Inputs

Inputs	Field selectable: Pulse or square wave 0-5 V, 0-12 V, or 0-24 V @ 30 kHz; TTL; open collector 4.7 kΩ pull-up to 5 V @ 30 kHz; NPN or PNP transistor, switch contact 4.7 kΩ pull-up to 5 V @ 40 Hz; Modbus PV (Slave)
Isolated Flowmeter Power Supply	Terminals P+ & P-: 24 VDC $\pm$10%. All models flowmeter supply rated @ 25 mA max. All models selectable for 24, 10, or 5 VDC supply (Internal J4 jumper).
Low Voltage Mag Pickup (Isolated)	Sensitivity: 40 mVp-p to 8Vp-p
Minimum Input Frequency	0.001 Hz Minimum frequency is dependent on high gate setting.
Maximum Input Frequency	30,000 Hz (10,000 for low voltage mag pickup)
Input Impedance	Pulse input: Greater than 300 kΩ @ 1 kHz. Open collector/switch input: 4.7 kΩ pull-up to 5 V.
Input Threshold	Low: 1.6 V, High: 3.3 V — 3.3 V, 1.6 V, 0 V
Accuracy	$\pm$0.03% of calibrated span $\pm$1 count
Temperature Drift	Rate display is not affected by changes in temperature.
Multi-Point Linearization	2 to 32 points
Low-Flow Cutoff	0.1 to 999,999 (0 disables cutoff function). Point below at which display always shows zero.
Decimal Point	Up to five decimal places or none: dddddd, ddddd, dddd, ddd, dd, or dddddd
Calibration	May be calibrated using K-factor, internal calibration, or by applying an external calibration signal.
K-Factor	Field programmable K-factor converts input pulses to rate in engineering units. May be programmed from 0.00001 to 999,999 pulses/unit.
Calibration Range	Input 1 signal may be set anywhere in the range of the meter; input 2 signal may be set anywhere above or below input 1 setting. Minimum input span between any two inputs is 0.10 Hz. An error message will appear if the input 1 and input 2 signals are too close together.
Filter	Programmable contact de-bounce filter: 40 to 999 Hz maximum input frequency allowed with low speed filter.
Time Base	Second, minute, hour, or day
Gate	Low gate: 0.1-99.9 seconds High gate: 2.0-999.9 seconds

Rate/Totalizer

Display Assignment	Display lines 1 & 2 may be assigned to rate, total, grand total, alternate rate/total, alternate rate/grand total, set points, alternate rate/units, alternate total/units, alternate grand total/units, display Hi, display Lo, display Hi/Lo, display Modbus, display units (line 2) and display off (line 2).
Rate Display Indication	-99999 to 999999, lead zero blanking. "R" LED illuminates while displaying rate or frequency.
Total Display & Total Overflow	0 to 999,999; automatic lead zero blanking. "T" LED is illuminated while displaying total or grand total. Up to 999,999,999 with total-overflow feature. "oF" is displayed to the left of total overflow and ▲ LED is illuminated.
Alternating Display	Either display may be programmed to alternate between rate and total or rate and grand total every 10 seconds.
Total Decimal Point	Up to five decimal places or none: dddddd, ddddd, dddd, ddd, dd, or dddddd Total decimal point is independent of rate decimal point.
Totalizer	Calculates total based on rate and field programmable multiplier to display total in engineering units. Time base must be selected according to the time units in which the rate is displayed.
Totalizer Rollover	Totalizer rolls over when display exceeds 999,999,999. Relay status reflects display.
Total Over-flow Override	Program total reset for automatic with 0.1 second delay and set point 1 for 999,999
Totalizer Presets	Four, user selectable under setup menu. Any set point can be assigned to total and may be programmed anywhere in the range of the meter for total alarm indication.
Programmable Delay On Release	0.1 and 999.9 seconds; applied to the first relay assigned to total or grand total. If the meter is programmed to reset total to zero automatically when the preset is reached, then a delay will occur before the total is reset.
Total Reset	User selectable via CapTouch button, F4 terminal at back of meter, external contact closure on digital inputs, automatically via user selectable preset value and time delay, or through serial communications
Total Reset Password	Total and grand total passwords may be entered to prevent resetting the total or grand total from the programming or CapTouch buttons.
Non-Resettable Total	The grand total can be programmed as a non-resettable total by entering the password "050873".
Non-Volatile Memory	Total and Grand Total values, and all programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.

⚠ CAUTION

- Once the Grand Total has been programmed as "non-resettable" the feature **<u>CANNOT</u>** be disabled.

Relays

Rating	Rating: 4 SPDT (Form C) internal and rated 3 A @ 30 VDC and 125/250 VAC resistive load, Total current: 4 A max (total of all relays), 1/14 HP (≈ 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.
Relay Assignment	Relays may be assigned to rate, total, grand total, or Modbus input.
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 • Latching (requires manual acknowledge) with or without clear • Pump alternation control (2-4 relays) • Sampling (based on set point and time) • Off (disable unused relays and enable Interlock feature) • Manual on/off control mode
Relay Reset (Acknowledge)	User selectable via front panel button, F4 digital input, external contact closure on digital inputs, automatically via user selectable preset value and time delay, 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. ***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® 10/11
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	Rate/process, total, grand total, max, min, set points 1-4, or manual control mode
Scaling Range	1.000 to 23.000 mA for any display range.
Calibration	Factory calibrated: 0.0 to 1000.0 = 4-20 mA output
Analog Out Programming	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break
Accuracy	±0.1% FS ±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%. Used to power the 4-20 mA output. All models rated @ 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	Reset total, 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 reset totals, 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	5 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/meterviewpro
System Requirements	Microsoft® Windows® 10/11
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: ASTM A413 LM6 die-cast aluminum, copper-free, enamel coated SS Models: ASTM A743 CF8M investment-cast 316 stainless steel
Gasket	Fluoroelastomer
Rating	NEMA 4X, IP68 Explosion-proof
Color	AL: Blue 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	6.4" x 8.0" x 8.5" (163 mm x 202 mm x 215 mm) (W x H x D)
Weight	AL: 14.7 lbs (6.7 kg) SS: 23.5 lbs (10.7 kg)
ATEX	⟨Ex⟩ II 2 G D Ex db IIC Gb Ex tb IIIC Db IP66/IP68 Tamb: -55°C to +85°C Certificate Number: Sira 19ATEX1252U
IECEx	Ex db IIC Gb Ex tb IIIC Db IP66/IP68 Tamb: -55°C to +85°C Certificate Number: IECEx SIR 19.0075U
CSA	Class I, Division 1, Groups A, B, C, D Class II, Division 1, Group E, F, G Class III Ex db IIC Gb Ex tb IIIC Db Class I, Zone 1, AEx db IIC Gb Zone 21, AEx tb IIIC Db IP66/IP68/TYPE 4X Tamb: -55°C to +85°C Certificate Number: CSA19.80011200U
UL	Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, G Class III Class I, Zone 1, AEx db IIC Gb Zone 21, AEx tb IIIC Db Ex db IIC Gb Ex tb IIIC Db IP66/IP68/TYPE 4X Tamb: -55°C to +85°C 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 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
Immunity	EN 61326-1 Measurement, control, and laboratory equipment EN 61000-6-2 EMC heavy industrial generic immunity standard
RFI - Amplitude Modulated	80 -1000 MHz 10 V/m 80% AM (1 kHz) 1.4 - 2.0 GHz 3 V/m 80% AM (1 kHz) 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 70%V for 25 periods
Voltage Interruptions	<5%V for 250 periods

Note: Testing was conducted on meters with cable shields grounded at the point of entry representing installations designed to optimize EMC performance.

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	⟨Ex⟩ 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 four 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.

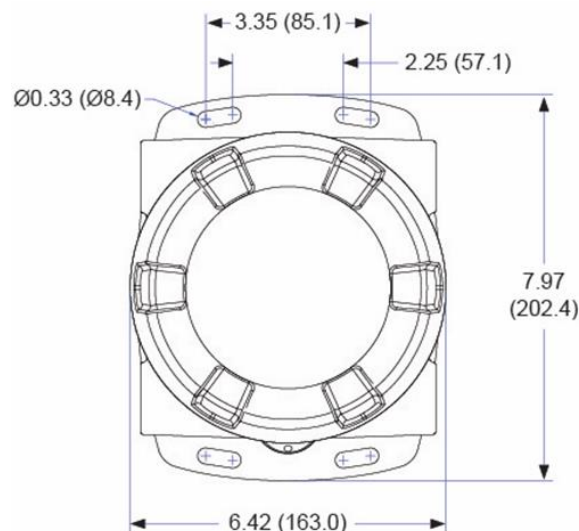## Mounting Dimensions

All units: inches (mm)

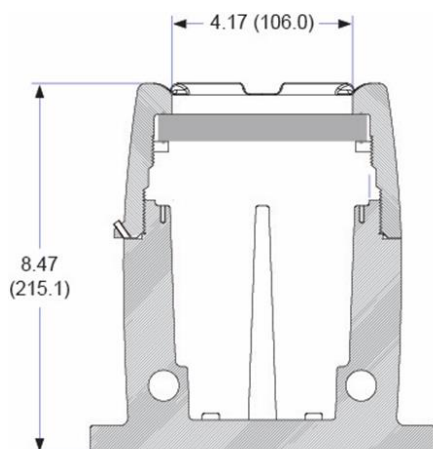**Figure 1. Enclosure Dimensions – Front View**

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 cast-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 7.0" 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.

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).
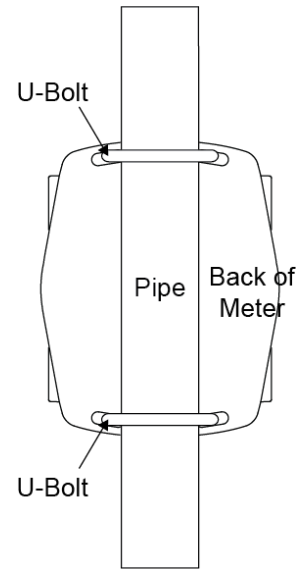

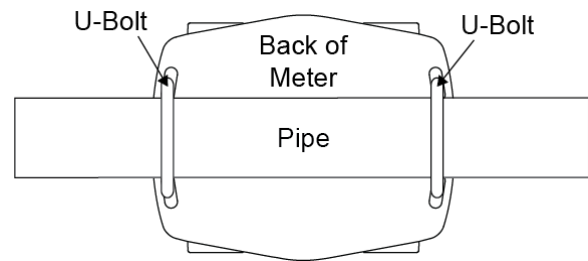To mount the meter using a U-Bolt kit, follow these instructions:

- 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.
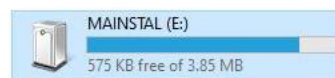
⚠ **WARNINGS**

- 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."
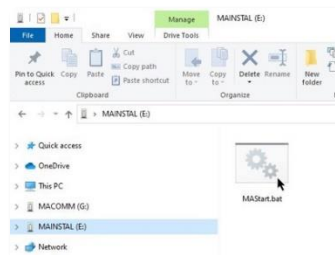
4. If there is an update available, click the "Update" button to install the new version. Otherwise, click "Configure" to begin programming your meter.
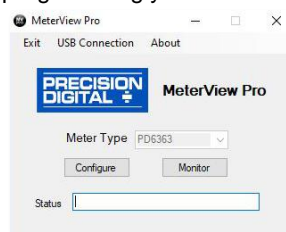
Note: If you decide to update your MeterView Pro software, once the installation has completed, you will be asked if you want to update the setup files located on the meter itself. This way, you will always have the most current version on the meter for future installs.

⚠ **WARNING**

- **DO NOT** unplug the meter while the new installation files are being written to it. The meter will display ᴜꜱʀ ᴜᴘᴅ 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.

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

To access the voltage selection jumper:

1. Remove all the connectors.
2. Unscrew the back cover.
3. Slide the back cover about 1 inch.
4. Configure the J4 jumper, located behind the input signal connector, for the desired excitation voltage as shown.
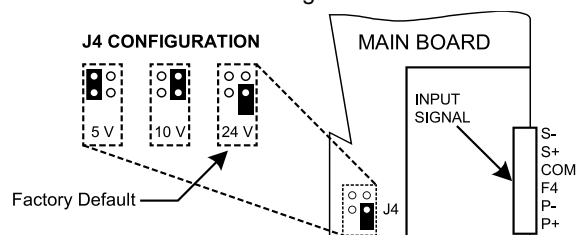

Figure 3: Flowmeter Supply Voltage Selection

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.
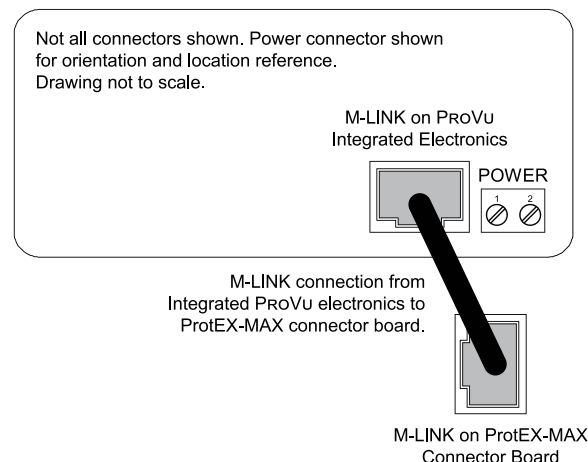
Figure 4. Integrated PROVU Required Connections

PROVU Electronics Module Layout for PD8-6300-6H7 and PD8-6300-7H7*
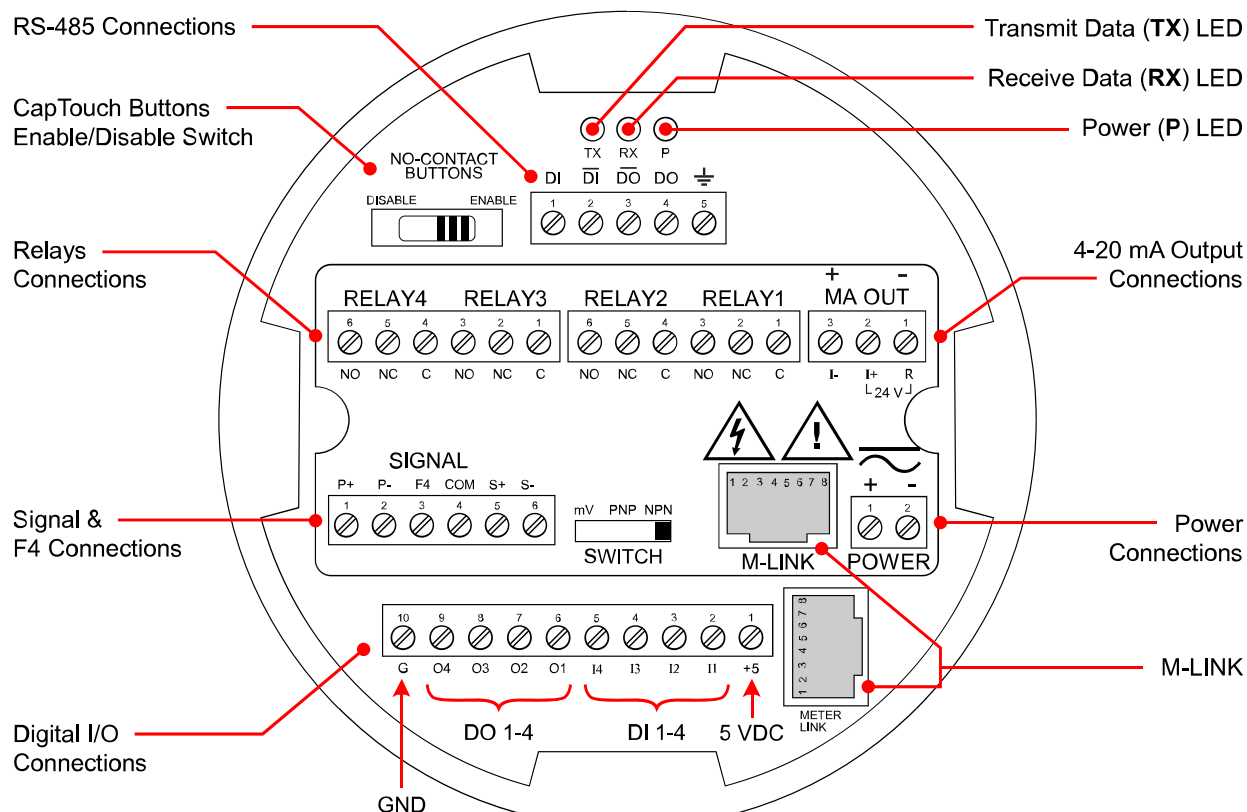
* For models PD8-6300-6H0 and PD8-6300-7H0 the upper set of connectors (RELAYs & MA OUT) are not present

Figure 5. PROVU Electronics Module Layout

USB Connection
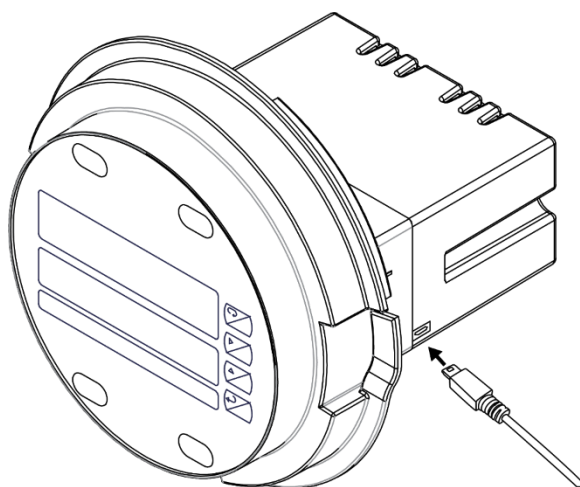
Figure 6. USB Connection

⚠️ **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.
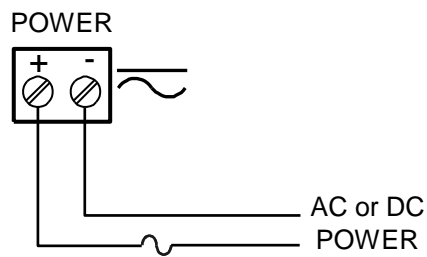
Figure 7: Power Connections

Signal Connections

Signal connections are made to a six-terminal connector labeled SIGNAL. The COM (common) terminal is the return for the input signals.

The following figures show examples of signal connections.

Setup and programming is performed through the programming buttons or MeterView Pro software.
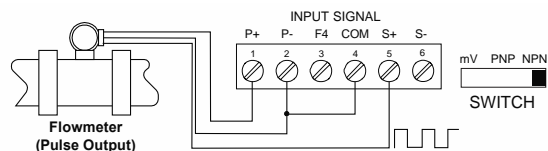
Figure 8: Flowmeter Powered by Internal Power Supply
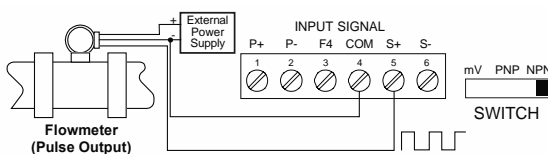
Figure 9: Flowmeter Powered by External Supply
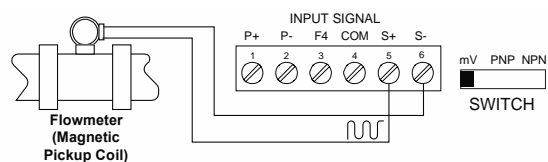
Figure 10: Self-Powered Magnetic Pickup Coil Flowmeter
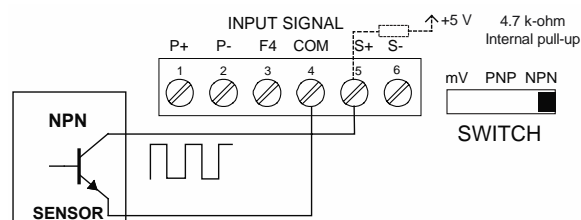
Figure 11: NPN Open Collector Input
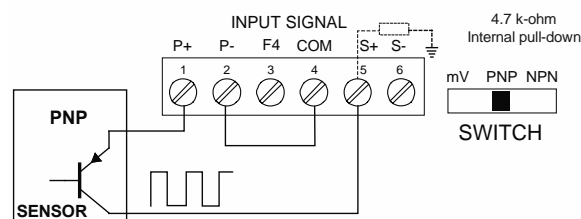
Figure 12: PNP Sensor Powered by Internal Supply
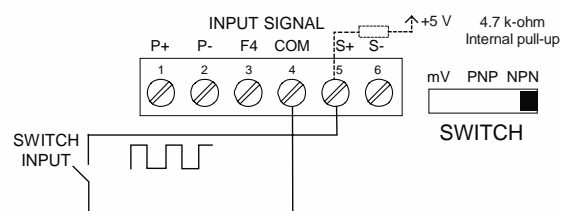
Figure 13: Switch Input Connections

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.
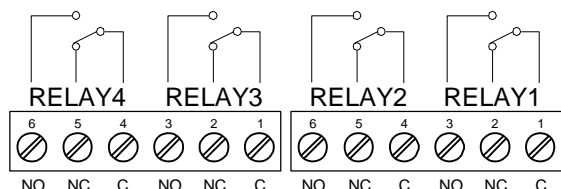
Figure 14: Relay Connections

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.
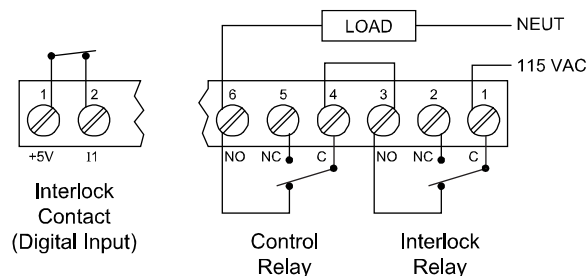
Figure 15: Interlock Connections

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:
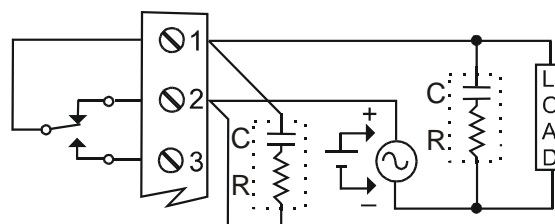
Figure 16: AC and DC Loads Protection

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.
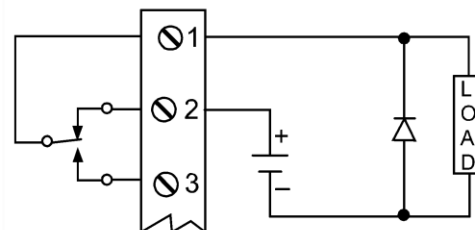
> Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

Figure 17: 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* (𝖲𝖤𝗋 𝗂𝖠𝖫) 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.

TX   RX   P

Figure 18. 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 (𝖲𝖤𝗋 𝗂𝖠𝖫) menu is displayed and press Enter, 𝖠𝖽𝖽𝗋𝖤𝖲 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 Connection

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.
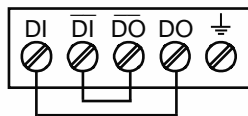
Figure 19. Three-Wire RS-485 Connection

Digital I/O Connections

The ProtEX-MAX has a 10-position terminal block for connecting digital inputs and outputs.
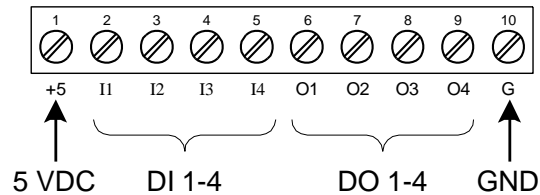
Figure 20. Digital Input and Output Connections

> **⚠ 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 to reset the total, 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.
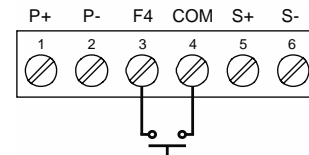
Figure 21. F4 Digital Input Connections

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 22: 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.
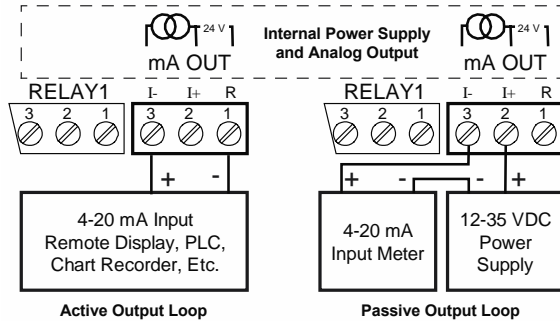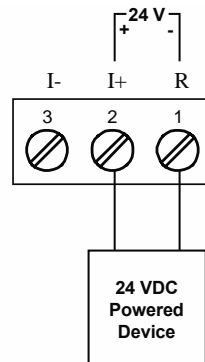
Figure 23. Analog Output Supply Powering Other Devices

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.

Setup and Programming

> The meter may either be scaled (SCALE) without applying an input, calibrated (CAL) by applying an input, or you may use the K-Factor menu to match the rate/totalizer with a flowmeter's k-factor (pulse/unit of measure).
>
> The meter comes factory calibrated to NIST standards, so for initial setup, it is recommended to use the K-Factor method or (SCALE) function.

Overview

There is one switch, located to the right of the input connector, which must be configured according to the input level and type. The jumper J4 located inside the meter, behind the connector, is used to select the excitation voltage (24 V*, 10 V or 5 V) which is supplied to the P+ and P- wiring terminals.
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.

*Default setting

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
R	Steady	Rate
T	Steady	Total
G & T	Steady	Grand Total
▲	Steady	Total overflow. ("oF" is displayed to the left of total overflow and ▲ LED is illuminated)
M	Flashing	Analog output in manual control mode

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
5EtuP	Setup	Enter *Setup* menu
InPut	Input	Enter *Input* selection menu
totRL	Total	Enable or disable totalizer features
un tS	Units	Select the display units/tags
rRtE	Rate	Select the display units for rate
totRL	Total	Select the display units for total
GtotRL	Grand Total	Select the display units for grand total
dEc Pt	Decimal point	Set decimal point for rate, total, grand total
ProG	Program	Enter the *Program* menu
InCRL	Input Calibration	Enter the *Input Calibration* menu
FRctor	K-factor Scaling	Programs unit to convert input pulse to rate in engineering units
5CRLE	Scale	Enter the *Scale* menu
CRL	Calibrate	Enter the *Calibrate* 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
t tb	Total time base	Program total time base
t CF	Total conversion factor	Program total conversion factor
t rSt	Total reset	Program total reset mode: auto or manual
Gt tb	Grand total time base	Program grand total time base
Gt CF	Grand total conversion factor	Program grand total conversion factor

Display Functions & Messages

Display	Parameter	Action/Setting Description
Gt rSt	Grand total reset	Program grand total reset mode: auto or manual
Ruto	Automatic	Press Enter to set automatic total reset
t dLY	Time delay	Program time delay for total auto reset
n Rn	Manual	Press Enter to reset total manually
d5PLRY	Display	Enter the *Display* menu
L nE 1	Line 1	Press Enter to assign the Upper display parameter (default: PV or rate)
L nE 2	Line 2	Press Enter to assign the lower display parameter (default: total)
d- IntY	Display intensity	Set display intensity level from 1 to 8
rELRY	Relay	Enter the *Relay* menu
R55 Gn	Assignment	Assign relays to rate, total, grand total, or Modbus
R5 Gn 1	Assign 1	Relay 1 assignment
rRtE	Rate	Assign relay to rate
totRL	Total	Assign relay to total
G totRL	Grand total	Assign relay to grand total
rLY 1	Relay 1	Relay 1 setup
Rct 1	Action 1	Set relay 1 action
Ruto	Automatic	Set relay for automatic reset
R-n Rn	Auto-manual	Set relay for automatic & manual reset any time
LRtcH	Latching	Set relay for latching operation (relays assigned to rate)
Lt-CLr	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared (relays assigned to rate)
RLtErn	Alternate	Set relay for alternation control (relays assigned to rate)
5Rn PL	Sampling	Set relay for sampling operation
OFF	Off	Disable relay and front panel status LED (Select Off to enable Interlock feature)
5Et 1	Set 1	Program set point 1

Display Functions & Messages

Display	Parameter	Action/Setting Description
rSt 1	*Reset 1*	Program reset point 1
rLY 2	*Relay 2*	Relays 2-4 setup
FA iLSF	*Fail-safe*	Enter *Fail-safe* menu
FLS 1	*Fail-safe 1*	Set relay 1 fail-safe operation
on	*On*	Enable fail-safe operation
oFF	*Fail-safe off*	Disable fail-safe operation
dELAY	*Delay*	Enter relay *Time Delay* menu
dLY 1	*Delay 1*	Enter relay 1 time delay setup
On 1	*On*	Set relay 1 On time delay
OFF 1	*Off*	Set relay 1 Off time delay
Aout	*Analog output*	Enter the *Analog output* scaling menu
d iS 1	*Display 1*	Program display 1 value
Out 1	*Output 1*	Program output 1 value (e.g. 4.000 mA)
d iS 2	*Display 2*	Program display 2 value
Out 2	*Output 2*	Program output 2 value (e.g. 20.000 mA)
rESEt	*Reset*	Press Enter to access the *Reset* menu
rSt H i	*Reset high*	Press Enter to reset max display
rSt Lo	*Reset low*	Press Enter to reset min display
rSt HL	*Reset high & low*	Press Enter to reset max & min displays
rSt t	*Reset total*	Press Enter to reset total
rSt Gt	*Reset grand total*	Press Enter to reset grand total
Contrl	*Control*	Enter *Control* menu
Auto	*Automatic*	Press Enter to set meter for automatic operation
nJAn	*Manual*	Press Enter to manually control relays or analog output operation
PASS	*Password*	Enter the *Password* menu
PASS 1	*Password 1**	Set or enter Password 1* (*1, 2, or 3)
totAL	*Total password*	Set or enter password for manual reset
GtotAL	*Grand total password*	Set or enter password for manual reset

Display Functions & Messages

Display	Parameter	Action/Setting Description
nonrSt	*Non-resettable*	Non-resettable grand total set after entering "050873" for Gtotal password
unLoc	*Unlocked*	Program password to lock meter
Locd	*Locked*	Enter password to unlock meter
999999	*Flashing display*	Overrange condition

Main Menu

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

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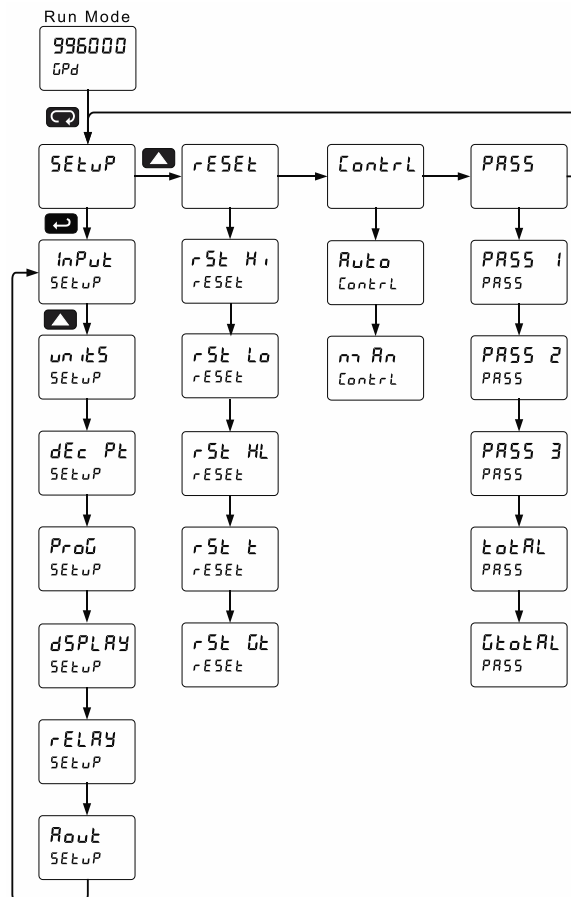
Setting Numeric Values

The numeric values are set using the Right and Up arrow buttons. Press Right arrow to select next digit and Up arrow to increment digit value. The digit being changed is displayed brighter than the rest.

Press and hold Up to auto-increment the display value. If negative numbers are allowed, the first digit position will include a negative symbol (-) after the 9.

Press the Enter button, at any time, to accept a setting or Menu button to exit without saving changes.
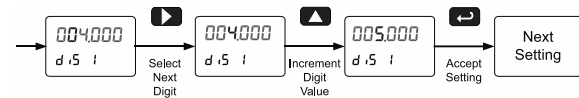
Setting Up the Rate/Totalizer Meter (5EtuP)

The *Setup* menu is used to select:

1. Enable or disable totalizer features
2. Units for Rate, Total, and Grand Total
3. Decimal point position
4. Input Calibration
5. Display parameter and intensity
6. Relay operation
7. 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.
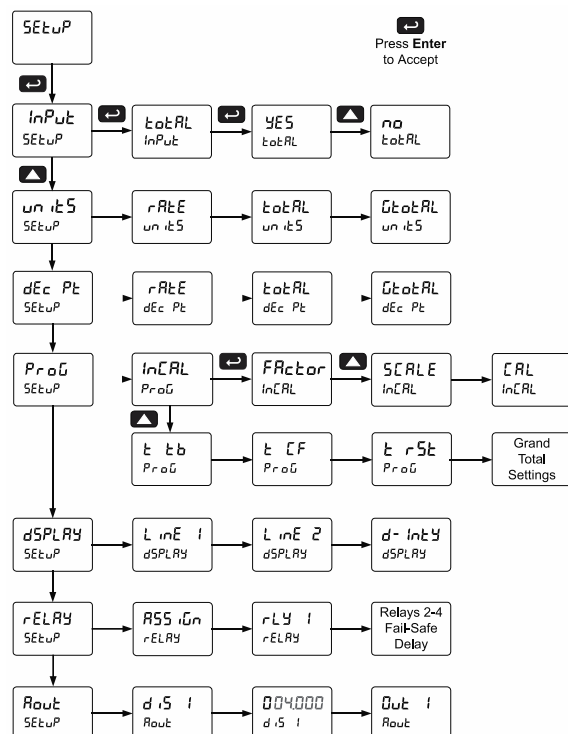
Setting the Input Signal (InPut)

There is a switch, located to the right of the input connector, which must be configured according to the input level and type. For location of this switch, see *Signal Connections* on page *29*.

Jumper J4 located inside the meter, behind the input signal connector, is used to select the excitation voltage (24 V [Default setting], 10 V or 5 V) which is supplied to the P+ and P- wiring terminals. For location of this switch, see *Flowmeter Supply Voltage Selection (P+, P-)* on page *25*.

Enter the Input menu to enable or disable the totalizer features.

Setting the Totalizer Features (totRL)

Enable or disable the totalizer features by selecting "YES" or "no" after the input type has been set up. If the totalizer features are disabled, most totalizer features and functions are hidden from the menus.

Note: The totalizer continues working in the background.

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Setting the Display Units or Custom Tags (un it5)

Use this menu to enter the unit or custom tag that will be displayed if:

1.   Alternating rate, total, or grand total and units is selected in the un it5 menu, or

2.   d un it is selected as the line 2 parameter.

See the *Setting the Display Parameter & Intensity* (d5PLAY) flow chart on page *42* to access the display menu to show the unit or tag on 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		5	S
A	A		t	t
b	b		u	u
C	C		u	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		°	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 may be set with up to five decimal places or with no decimal point at all. The rate, total, and grand total decimal points are independent.

The decimal point selection should be made prior to scaling, calibrating or programming the meter. Pressing the right arrow moves the decimal point one place to the right until no decimal point is displayed, then it moves to the leftmost position.

Pressing the up arrow moves the decimal point to the left.

Programming the Rate/Totalizer (ProG)

The meter may either be scaled (5CALE) without applying an input, calibrated (CAL) by applying an input, or you may use the K-Factor menu to match the rate/totalizer with a flowmeter's k-factor (pulse/unit of measure). The meter comes factory calibrated to NIST standards, so for initial setup, it is recommended to use the (5CALE) function.

The *Program* menu contains the following menus:

1.   K-Factor calibration
2.   Scale without a signal source
3.   Calibrate with a calibrated signal source
4.   Total time base & conversion factor
5.   Grand total time base & conversion factor
6.   Total reset mode for total & grand total

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

Note: The **Scale**, **Calibrate**, and **K-Factor** 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 54 for details.
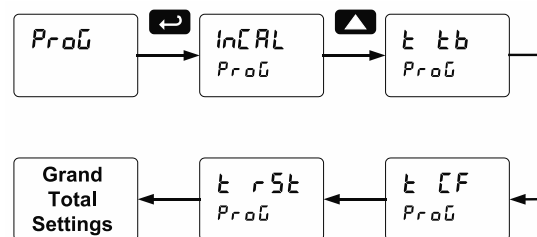
Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu. See *Advanced Features Menu* on page *52*.

K-Factor Calibration (FActor)

The meter may be calibrated using the *K-Factor* function. Most flowmeter manufacturers provide this information with the device. Enter the *K-Factor* (FActor) menu and select the decimal point with highest resolution possible and program the k-factor value (*i.e.* pulses/gal). The meter will automatically calculate the flow rate using the k-factor and the time base selected.

Multi-Point Calibration & Scaling

The meter is set up at the factory for 2-point linear calibration. The number of points for multi-point calibration/scaling is set up in the *Advanced Features* menu. Up to 32 linearization points may be selected. *See Multi-Point Linearization (LinEAr) menu on page 54* for details.

Scaling the Meter (SCALE)

The pulse inputs can be scaled to display the process variable in engineering units.

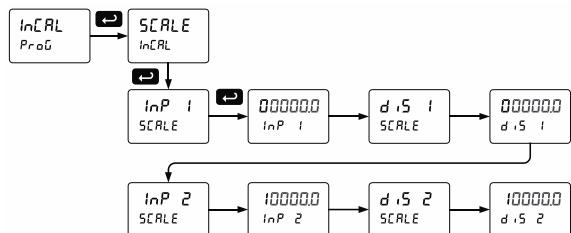A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.

Note: The display values (diS 1 and diS 2) need to be in units of measure per second. For example, if the rate at 1000 Hz is 13.20 gal/min, this must be converted to gal/sec. In this scenario, the numbers input into the SCALE menu would be as follows:

InP 1: 0.0
diS 1: 0.00
InP 2: 1000.0
diS 2: 0.22

Set the time base to minutes (see *Time Base, Total Conversion Factor & Total Reset*) and the meter will display 13.20 gal/min at 1000 Hz.

> For instructions on how to program numeric values see *Setting Numeric Values* on page *37*.

Error Message (Error)

An error message indicates that the calibration or scaling process was not successful. After the error message is displayed, the meter reverts to input 2 during calibration or scaling, 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. Minimum input span requirements not maintained.
3. Input 1 signal inadvertently applied to calibrate input 2*.

*Not relevant when scaling the meter.

> For instructions on how to program numeric values see *Setting Numeric Values* on page *37*.

Minimum Input Span

The minimum allowed input span is 0.10 Hz, which is the minimum difference between input 1 and input 2 signals required to complete the calibration or scaling of the meter.

Time Base, Total Conversion Factor & Total Reset

The time base, total conversion factor, and total reset menus are located in the *Program* menu.

The total and grand total have their own independent settings. This means that one can be displaying the value in gallons while the other displays in million gallons, liters, m^3, etc.
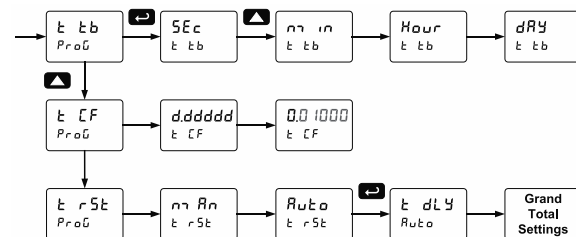
Time Base

The time base is the amount of time over which the rate parameter should accrue. For example, if the rate was ten and the time base was in minutes, then the total would increase by ten every one minute.

Total & Grand Total Conversion Factor

The total & grand total conversion factor is the amount by which the rate is multiplied before it is added to the total or grand total. For example, if the rate was 1000 gallons per minute and the total conversion factor was 0.001, the total would increase by 1 every minute. This is useful, for instance, if you want to show rate in gallons and total in thousands of gallons.

Total & Grand Total Reset

The totals can be programmed for automatic or manual reset. In the automatic reset mode, a programmable time delay is available to reset the total or grand total after the assigned preset is reached. The totals can also be reset via the front panel button, via a switch across the F4 terminal, digital inputs, or via a Modbus command.

Non-Resettable Totalizer

The total and grand total can be password-protected to prevent unauthorized resets. The grand total can be programmed as a non-resettable total, see *Total Reset Password & Non-Resettable Total* on page *51* for details.

Calibrating the Meter with External Source (CAL)

To scale the meter without a signal source, refer to *K-Factor Calibration* on page *39* or *Scaling the Meter* on page *40*.

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.
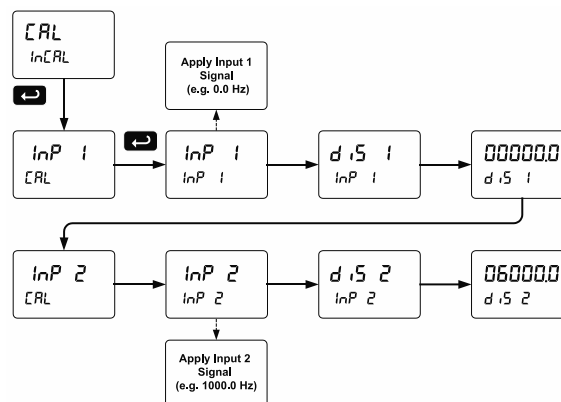
Notes:

1. The display values (dis 1 and dis 2) need to be in units of measure per second.
2. Inputs for the above example are:
   Input 1: 0.0 Hz; Display 1: 0.0 gallons/second
   Input 2: 1000.0 Hz; Display 2: 6000.0 gallons/second
3. After calibration in gallons per second, you can change the time base to display the rate in gallons per minute, per hour, or per day.

There is no need to warm up the meter before performing the calibration procedure.

Setting the Display Parameter & Intensity (dSPLAY)

Display line 1 (L inE 1) can be programmed to display:

1. Rate value
2. Total or grand total
3. Relay set points
4. Max & min values
5. Modbus input
6. Display rate and units
7. Rate and total
8. Rate and grand total
9. Total and units
10. Grand total and units

Display line 2 (L inE 2) can be programmed to display:

1. Rate value
2. Total or grand total
3. Relay set points
4. Max & min values
5. Engineering units or custom legends
6. Modbus input
7. Off (no display)
8. Display rate and units
9. Rate and total
10. Rate and grand total
11. Total and units
12. Grand total and units

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

Display Flow Rate, Total or Grand Total

Line 1 can be programmed to display flow rate, total, or grand total, and line 2 can be programmed to display flow rate, total, grand total, engineering units, custom legends, or be turned off. Both lines can also display relay set points, or max and min values.

Flow Rate Indicator   **Flow Totalizer**

Rate & Total   **Total & Grand Total**
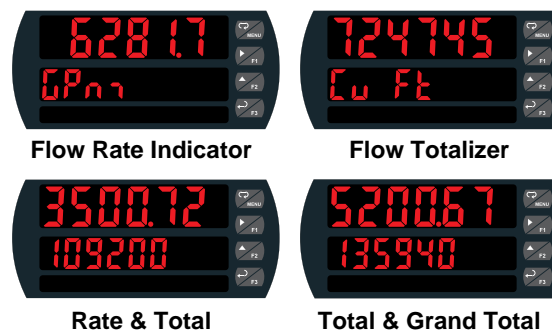
Display Toggling Between Reading & Units

The PD8-6300 can be programmed so that line 1 and line 2 toggle between the reading and their engineering units. For instance, line 1 displays flow rate, line 2 displays total, and the display toggles to show their units.

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.
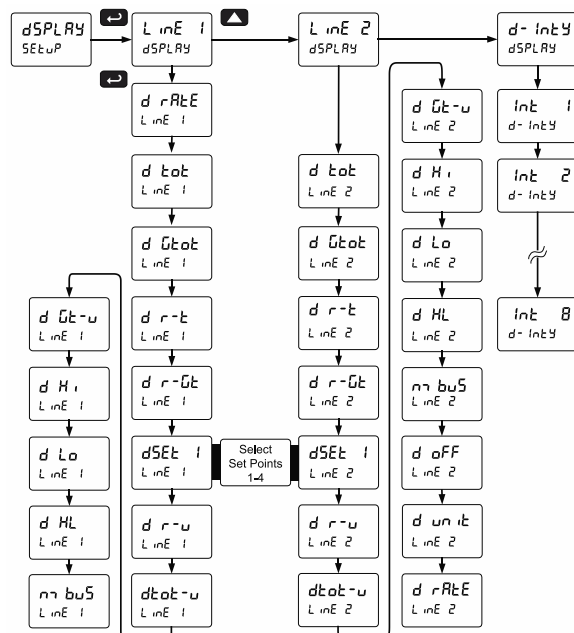
Setting the Relay Operation (rELAY)

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 assignment
   a. Rate for low and high alarm
   b. Total
   c. Grand total
   d. Modbus input
2. 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. Alternation control (automatic reset only)
   f. Sampling (the relay is activated for a user-specified time)
   g. Off (relay state controlled by Interlock feature)
3. Set and reset points
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)
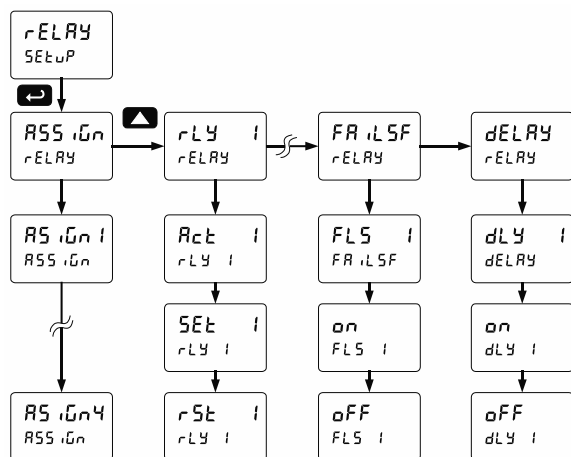
Note: The setup of relays 2-4 follows the same pattern shown here for relay 1.

Relay Assignment (ASSiGn)

The relays can be assigned to any of the following parameters:
1. Rate for low or high alarm indication
2. Total for alarm indication
3. Grand total for alarm indication
4. Modbus input
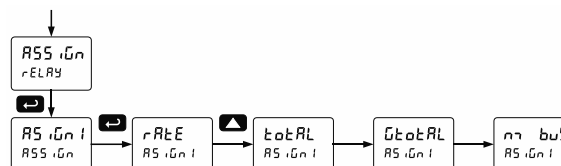
Setting the Relay Action

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. 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.

43
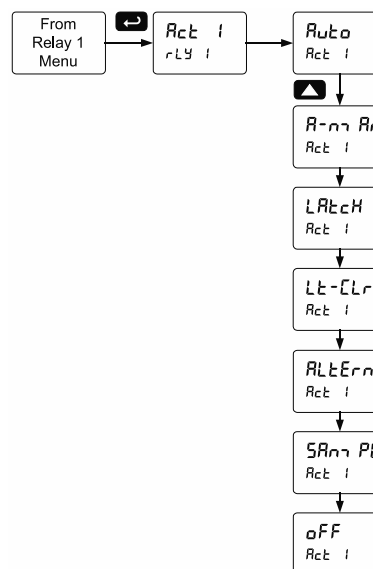
Programming Set and Reset Points

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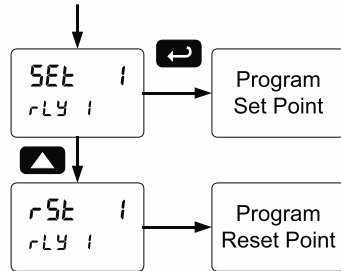
Note: Changes are not saved until the reset point has been accepted.

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 and Alarm Operation Diagrams

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

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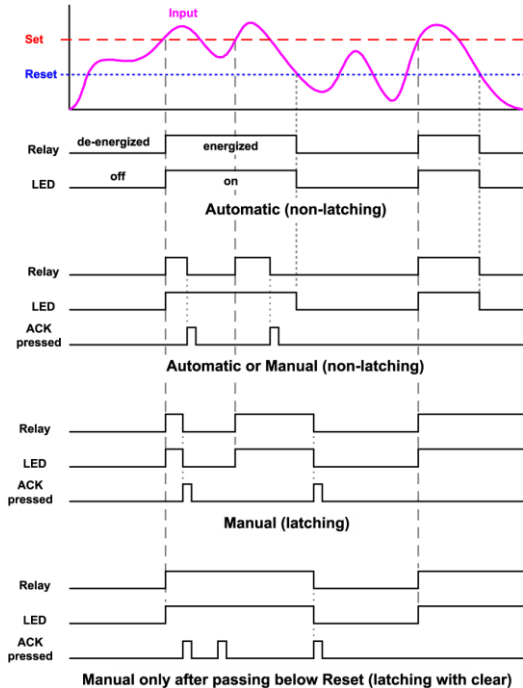
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

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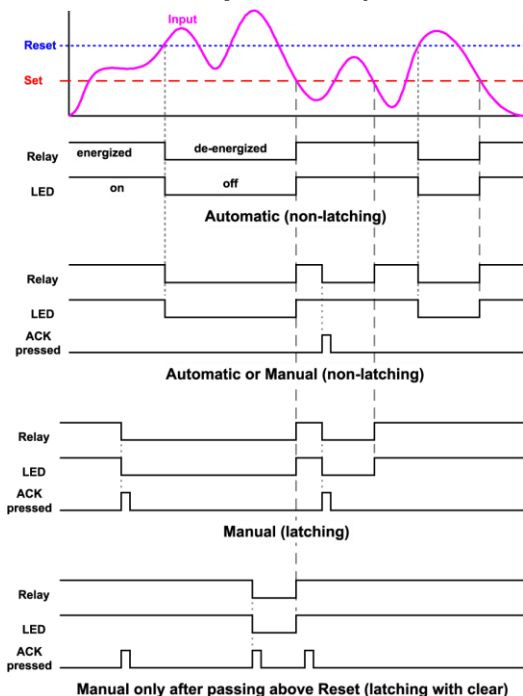
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

High Alarm with Fail-Safe Operation (Set > Reset)
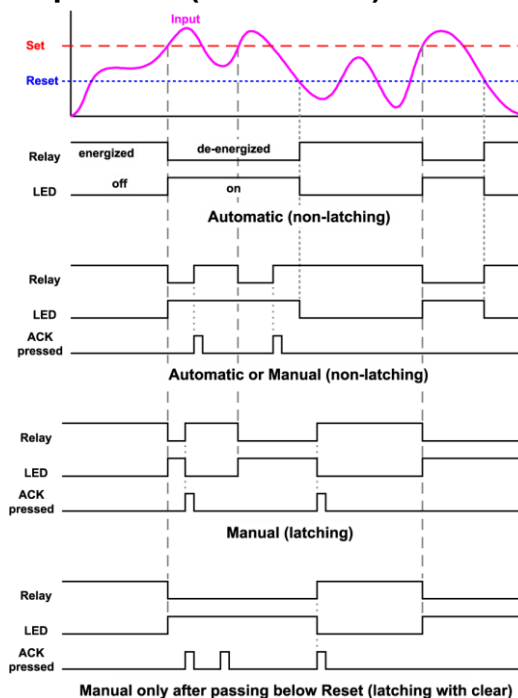
Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

Low Alarm with Fail-Safe Operation (Set < Reset)
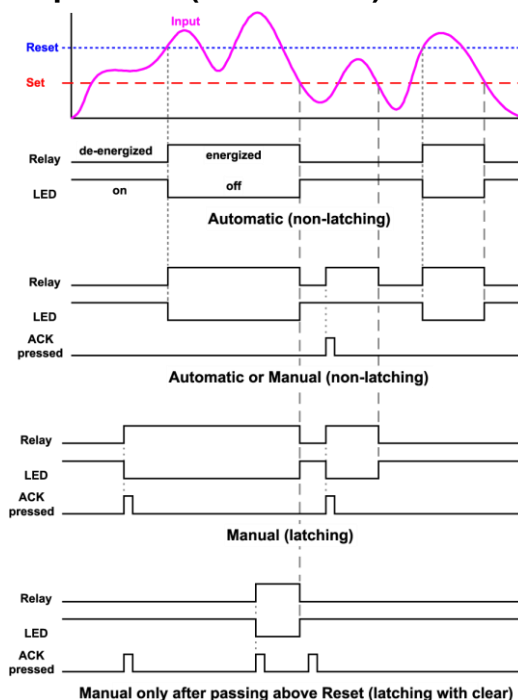
Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

Time Delay Operation

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

On Time Delay
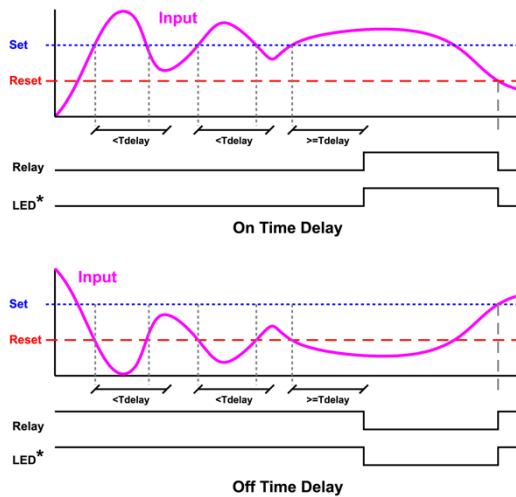
Off Time Delay

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

Note: If "Automatic or Manual (Я-ก ๅЯก)" reset mode is selected, the LED follows the reset point and not the relay state when the relay is acknowledged.

Total Relay Sampling Operation
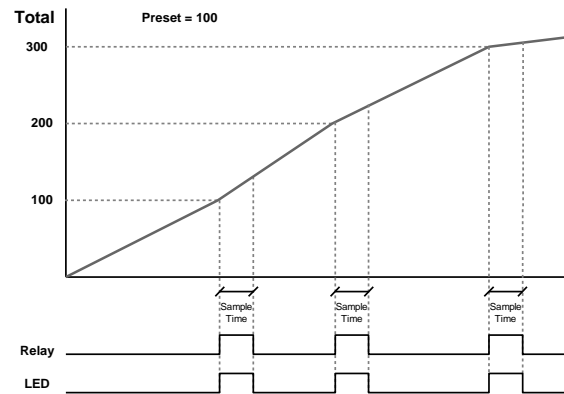
When the total reaches the preset, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the preset value is added to the total.

Relay Operation Details

Overview

The four-relays option for the meters expands its usefulness beyond simple indication to provide users with alarm and control functions. Typical applications include high and low flow alarms and basic batch control. 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. Alternation Control for up to 4 Relays

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	1000	500	499	Off
2	LO	700	900	499	On
3	LO	250	400	499	Off
4	HI	450	200	499	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 reflects 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-nRn)

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).

2. Remotely via a normally open push button wired to the F4 terminal.
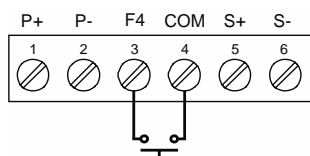
3. Remotely via a normally open push button wired to one of the digital inputs and the +5 V terminal on the digital I/O connections.
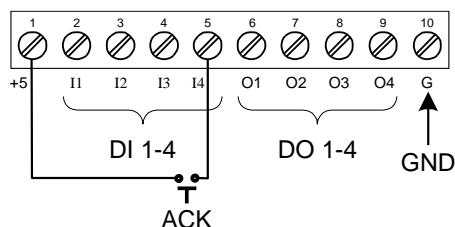
When the ACK button or the assigned digital input is closed, all relays programmed for manual reset are acknowledged.

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.
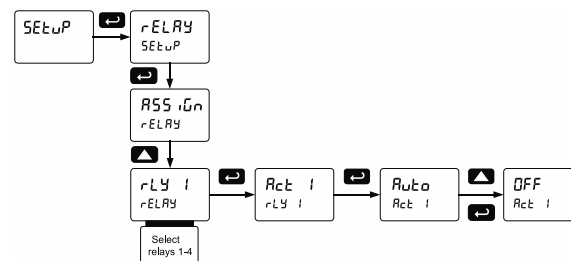
2. In the Advanced features – *User* menu program any of the digital inputs to *Force On* any of the internal relays (1-4).
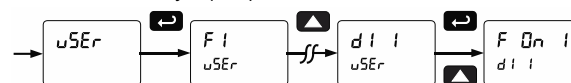
3. Connect a switch or dry contact between the +5V terminal and the corresponding digital input (dI-1 to dI-4) terminal.
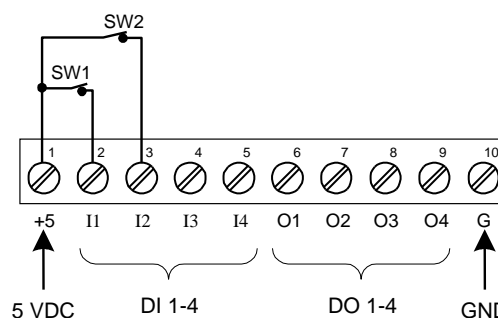
Interlock Relay Operation Example

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.

Scaling the 4-20 mA Analog Output (Rout)

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

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

The *Analog Output* menu is used to program the 4-20 mA output based on display values.
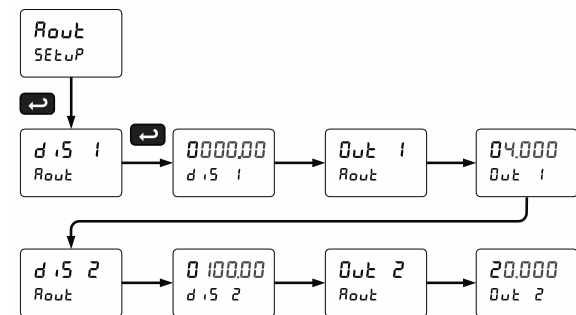
For further details, see *Setting Numeric Values* on page *37*.

Reset Menu (rESEt)

The *Reset* menu is used to reset the totals, 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 the 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.
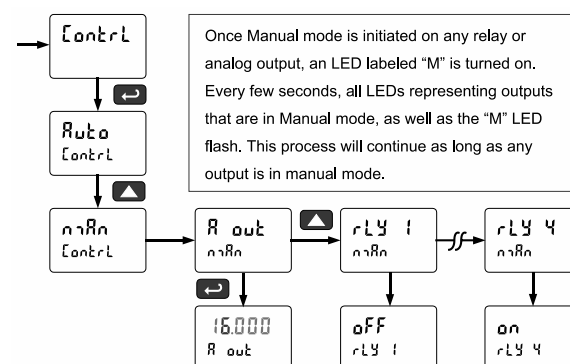
Setting Up the Password (PASS)

The *Password* menu is used for programming three levels of security to prevent unauthorized changes to the programmed parameter settings and to program the non-resettable totalizer.

> 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.
> Total: Prevents resetting the total manually
> Gtotal: Prevents resetting the grand total manually

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*.
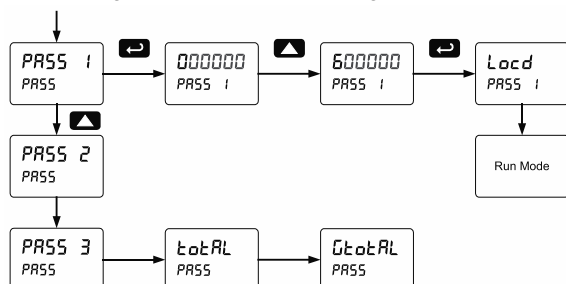
Total Reset Password & Non-Resettable Total

The total and the grand total can be password-protected to prevent unauthorized total resets.

The grand total can be programmed as a non-resettable total by entering the password "050873".

⚠ **CAUTION**

- Once the Grand Total has been programmed as "non-resettable" the feature **CANNOT** be disabled.

Making Changes to a Password Protected Meter

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

Disabling Password Protection

To disable the password protection, access the *Password* menu and enter the correct password twice, as shown below. The meter is now unprotected until a new password is entered.
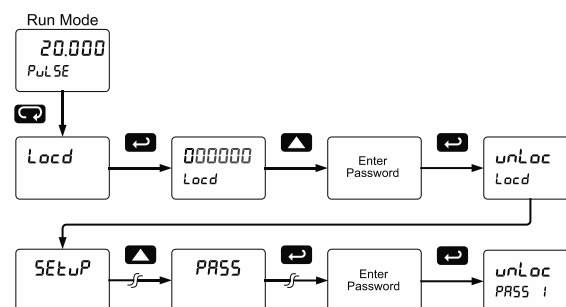
If the correct six-digit password is entered, the meter displays the message unLoc (unlocked) and the protection is disabled until a new password is programmed.

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

> **Did you forget the password?**
> The password may be disabled by entering a master password 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.

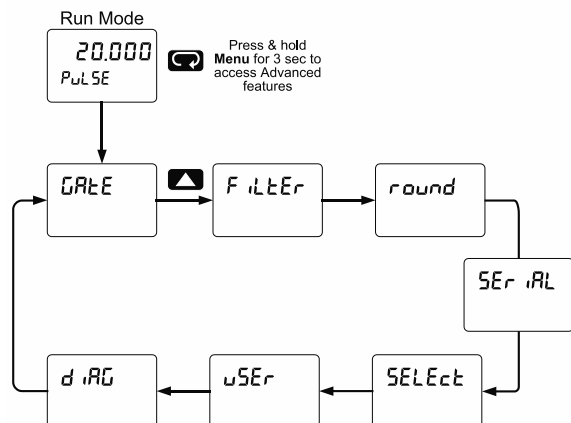| Display	Parameter	Action/Setting
GAtE	Gate	Enter Gate function menu
Lo G	Low gate	Program Low gate value
Hi G	High gate	Program High gate value
FiLtEr	Filter	Enter the Filter menu
Lo SPd	Low speed	Set the contact de-bounce filter value
Hi SPd	High speed	Select high speed filter
round	Round	Set the rounding value for display variables
SErIAL	Serial	Set serial communication parameters
SLAU Id	Slave ID	Set slave ID or meter address
bAud	Baud rate	Select baud rate
tr dLY	Transmit delay	Set transmit delay for serial communication
PArItY	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 only, other functions are not applicable to pulse input
LinEAr	Linear	Set meter for linear function and select number of linearization points

Display	Parameter	Action/Setting
no PtS	Number of points	Set meter for 2 to 32-point linearization
CutoFF	Cutoff	Set low-flow cutoff
Count	Count	Set the totals to count up or down from a set value
tot C	Total count	Set the total to count up to or down from the programmed total value
Gtot C	Grand total count	Set the grand total to count up or down from from the programmed grand total value
AoutPr	Analog output programming	Program analog output parameters
SourcE	Source	Select source for the 4-20 mA output
O-rAnG	Overrange	Program mA output for display overrange
u-rAnG	Underrange	Program mA output for display underrange
nAX	Maximum	Program maximum mA output allowed
nin	Minimum	Program minimum mA output allowed
CALib	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 nA	4 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 nA	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 function key
F2	F2 function key	Assign F2 function key
F3	F3 function key	Assign F3 function key
F4	F4 function	Assign F4 function (digital input)
di 1	Digital input 1	Assign digital input 1-4
dO 1	Digital output 1	Assign digital output 1-4
dIAG	Diagnostics	Display parameter settings
LEd t	LED test	Test all LEDs (press menu to exit test)
InFo	Information	Display software number and version
ErASE	Erase	Erase MeterView Pro software stored in meter's memory

Gate Function (GAtE)

The gate function is used for displaying slow pulse rates. Using the programmable gate, the meter is able to display pulse rates as slow as 1 pulse every 999.9 seconds (0.001 Hz). The gate function can also be used to obtain a steady display reading with a fluctuating input signal.

The gate function (GAtE) is the first option in the Advanced Features menu. There are two settings for the GAtE, low gate (Lo G) and high gate (Hi G).

Low Gate (Lo G)

For most applications, low gate setting should be left at 1.0 second. Increase low gate setting to obtain a steadier rate display. The rate display will update in accordance with the low gate setting, for example if low gate is set at 10.0, the display will update every 10 seconds; changes in rate between updates will not be reflected until next display update.

High Gate (Hi G)

Set the high gate value to correspond to the highest expected pulse period (lowest pulse rate). For instance, if the meter must display a rate when there is 1 pulse coming into the meter every 10 seconds, set the high gate to 11.0 seconds. When the signal is removed from the meter, the display will show the last reading for 11 seconds; then it will read zero.

Gate Settings

Slow Pulse Rate		
Low Gate* (sec)	High Gate (sec)	Min Freq** (Hz)
1.0	2.0	0.5000
1.0	10.0	0.1000
1.0	20.0	0.0500
1.0	100.0	0.0100
1.0	200.0	0.0050
1.0	400.0	0.0025
1.0	800.0	0.0012
1.0	999.9	0.0010
*The low gate setting corresponds to the display update rate and is used to stabilize the display reading with a fluctuating signal.		
**The minimum frequency is dependent on high gate setting.		

Contact De-Bounce Filter (F iLtEr)

The filter function (F iLtEr) can be used for applications where the meter is set up to count pulses generated by switch contacts. The filter value can be set anywhere between 2 and 50, the higher the value, the greater the filtering.

The filter function (F iLtEr) is the second option in the Advanced Features menu. There are two settings, Hi SPd (high speed) and Lo SPd (low speed), press **ENTER** when Lo SPd is displayed to enable the filter function. Program the filter value, so that there are no extra counts when a contact closure is completed.

Filter Settings

Contact De-Bounce Filter		
Filter Setting	Speed Setting	Max Freq (Hz)
2	Lo SPd	999
4	Lo SPd	499
8	Lo SPd	249
16	Lo SPd	124
32	Lo SPd	62
40	Lo SPd	50
50	Lo SPd	40
N/A	Hi SPd	30,000

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. This setting affects the last two digits, regardless of decimal point position.

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. More detailed instructions are provided with each optional serial communications adapter.
2. Refer to the ProtEX-MAX Modbus Register Tables located at www.predig.com for details.
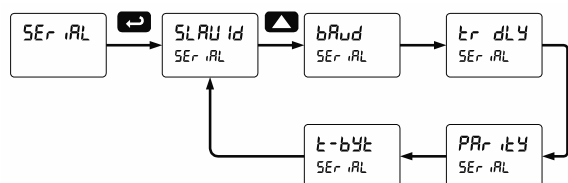
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) may be programmed between 1 and 247. The transmit delay may be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop bits.

Select Menu (5ELEct)

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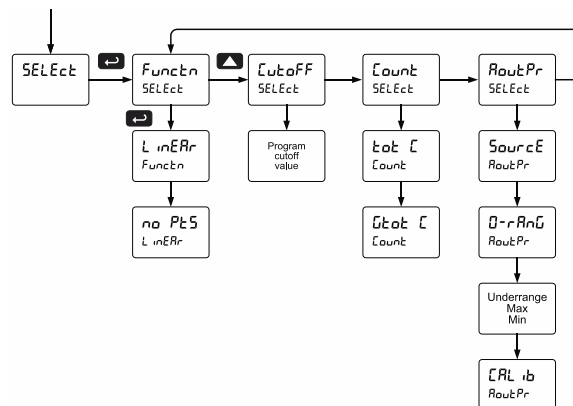
Input Signal Conditioning (Functn)

The *Function* menu is used to select the input signal conditioner applied to the input: linear, where 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 inEAr)

Meters are set up at the factory for linear function with 2-point linearization. Up to 32 linearization points can be selected under the linear function. The multi-point linearization can be used to linearize the display for non-linear signals.
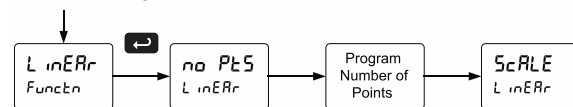
Low-Flow Cutoff (CutoFF)

The low-flow cutoff feature allows the meter to be programmed so that it always displays zero at very low flow rates.

The cutoff value may be programmed from 0.1 to 999999. The meter will display zero below the cutoff value. Programming the cutoff value to zero disables the cutoff feature.

Analog Output Programming (RoutPr)

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

1. Source: Source for generating the 4-20 mA output (e.g. rate)
2. Overrange: Analog output value with display in overrange condition
3. Underrange: Analog output value with display in underrange condition
4. Max: Maximum analog output value allowed regardless of input
5. Min: Minimum analog output value allowed regardless of input
6. 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 rate/process variable, total, grand total, maximum or minimum value reached by the rate/process, one of the set points, or the Modbus PV input.
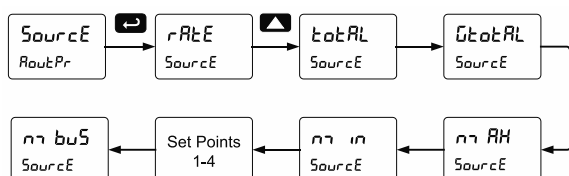
Analog Output Calibration

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

Analog Output Calibration Procedure

1. Wire the PD8-6300 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 22: 4-20 mA Output Connections* on page *32* 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 (RoutPr) → Calibration (CAL ib) menu and press **Enter**.
4. The display will show 4 mA. The PD8-6300 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 PD8-6300 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 total, reset grand total, 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. reset total, reset grand total, alarms, relay acknowledgement, reset or display max, min). The digital outputs can be used to trigger external alarms or lights to indicate these specific events.
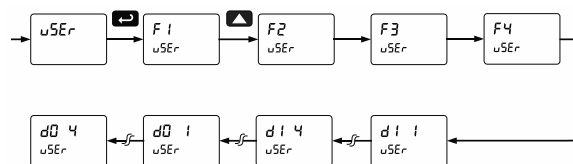
Function Keys & Digital I/O Available Settings

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

Function Keys & Digital I/O Available Settings	
Display	**Description**
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 Hi	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 Hi	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
Ln2 Gt	Display the grand total on line 2

Function Keys & Digital I/O Available Settings	
Display	**Description**
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 about interlock relays.
Contrl	Directly access the control menu
diSAbL	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
rSt t	Reset the total
rSt Gt	Reset the grand total
rSt Hi	Reset the stored maximum display value
rSt Lo	Reset the stored minimum display value
rSt HL	Reset the stored maximum & minimum display values
mEnu	Mimic the menu button functionality (digital inputs only)
riGHt	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)
ALm 1	Provide indication when alarm 1 (*through 4) has been triggered (digital outputs only)

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 *56*.

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

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* (u5Er) on page *56* for details.

See the table under *Button Operation* on page *57*, which 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* (u5Er) on page *56* for details.

Total Reset Capabilities

The user may reset the total via a CapTouch button, the F4 terminal at the back of the meter, an external contact closure on the digital inputs, automatically via user selectable preset value and time delay, or through serial communications.
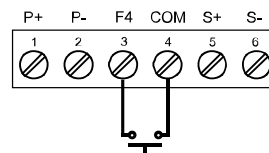
Total Reset via CapTouch Button

The three through-glass CapTouch button function keys can be programmed to reset the total and grand total. This makes it possible for the user to reset either the total or the grand total without opening the enclosure cover and without the need for external devices. Of course, if the total or grand total is password protected, they will not reset when the function key is pressed.

Total Reset via F4 Terminal

The PD8-6300 includes a digital input (referred to as the F4 terminal) located on the back of the electronics module as standard that can be used to reset the total or grand total, among other things. This is the preferred method for externally resetting the total or grand total because it does not interfere with the operation of the CapTouch buttons for programming as described below in the Total Reset via Digital Input section.

Total Reset via Digital Input

In addition to the F4 digital input described above, the PD8-6300 also includes four digital inputs that can be used to reset the total or grand total. However, if a digital input is used to reset the total, or for some other purpose, the corresponding through-glass CapTouch button will function as a programming key.

Total Reset via Preset Value

The total and grand total can be programmed for automatic reset based on a preset value determined by the user. In the automatic reset mode, a programmable time delay is available to reset the total or grand total after the assigned preset is reached.

Total Reset via Serial Communications

The total and grand total can be reset via serial communications such as a Modbus command or MeterView Pro.

Maximum/Minimum Readings

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

1. Display briefly by assigning to the F1-F3 function keys, F4 (digital input) 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), F4 (digital input), and the digital inputs can be programmed to reset the max & min readings. The meters are set at the factory to display the max reading by pressing the Up arrow/F2 button and to use the Right arrow/F1 button to access the *Reset* menu.

To display max reading using function key with factory defaults:

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

To display max/min readings continuously:

Assign either display to Max (d H ι), Min (d Lo), or toggle between Max and Min (d HL) every 10 seconds.
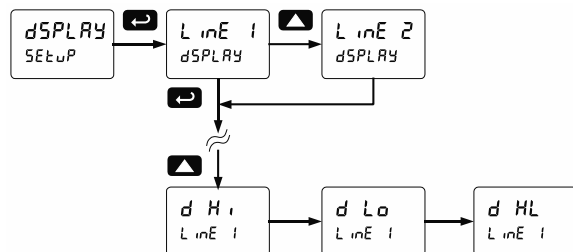
Totalizer Overflow Displays Total to 9 Digits

These flow rate/totalizers can display up to nine digits of total flow with the total overflow feature.
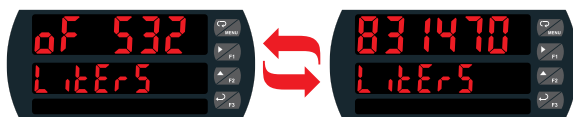
In the diagrams above, the flow totalizer is displaying 532,831,470 by toggling between a display of "oF 532" and "83 1470". Notice the T with arrow ▲ symbol is lit up indicating the display is in overflow mode.

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 iAG)

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 iAG) 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 (inFo) 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 iAG) and press Enter button.
2. Press Up arrow button and scroll to Information menu (inFo).
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 iAG) 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.
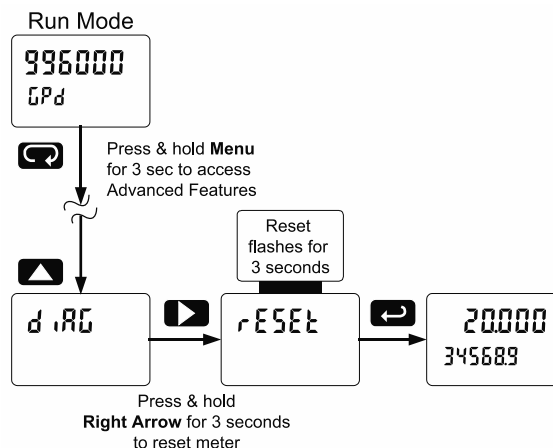
Factory Defaults & User Settings

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

Factory Defaults & User Settings		
Parameter	**Display**	**Default Setting**
Input type	inPut	Pulse
Total	YES	Total enabled
Units	un itS	Rate / total / gr. total pulse / pulse / pulse
Filter	F iLtEr	Hi Spd
K-factor	FActor	1.000
Function	Functn	Linear
Number of points	no PtS	2
Input 1	inP 1	00000.0
Display 1	d iS 1	00000.0
Input 2	inP 2	10000.0
Display 2	d iS 2	10000.0
Decimal point	dddddd	1 place
Cutoff value	CutoFF	0.0 (disabled)

Factory Defaults & User Settings

Parameter	Display	Default Setting
Display assignment	d5PLAY	
Display line 1	L inE 1	Rate/Process
Display line 2	L inE 2	Total value
Display intensity	d-intY	6
Total time base	t tb	Second
Total conversion factor	t CF	1.000
Total reset	t r5t	Manual
Grand total time base	Gt tb	Second
Grand total conversion factor	Gt CF	1.000
Grand total reset	Gt r5t	Manual
Relay 1 assignment	A5 iGn1	Total
Relay 2 assignment	A5 iGn2	Total
Relay 3 assignment	A5 iGn3	Rate
Relay 4 assignment	A5 iGn4	Rate
Relay 1 action	Act 1	Automatic
Relay 1 set point	5Et 1	100.0
Relay 1 reset point	r5t 1	000.0
Relay 2 action	Act 2	Automatic
Relay 2 set point	5Et 2	200.0
Relay 2 reset point	r5t 2	000.0
Relay 3 action	Act 3	Automatic
Relay 3 set point	5Et 3	300.0
Relay 3 reset point	r5t 3	250.0
Relay 4 action	Act 4	Automatic
Relay 4 set point	5Et 4	400.0
Relay 4 reset point	r5t 4	350.0
Fail-safe relay 1	FL5 1	Off
Fail-safe relay 2	FL5 2	Off
Fail-safe relay 3	FL5 3	Off
Fail-safe relay 4	FL5 4	Off
On delay relay 1	On 1	0.0 sec
Off delay relay 1	OFF 1	0.0 sec
On delay relay 2	On 2	0.0 sec
Off delay relay 2	OFF 2	0.0 sec

Factory Defaults & User Settings

Parameter	Display	Default Setting
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
Display 1 analog out	d i5 1	0.0
Output 1 value	Out 1	4.000 mA
Display 2 analog out	d i5 2	1000.0
Output 2 value	Out 2	20.000 mA
Source analog output	5ourcE	Rate/process
Overrange output	O-rAnG	21.000 mA
Underrange output	u-rAnG	3.000 mA
Maximum output	mAX	23.000 mA
Minimum output	m in	1.000 mA
Slave ID (Address)	5LAuE id	247
Baud rate	bAud	9600
Transmit delay	tr dLY	50 ms
Parity	PAr itY	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	d i 1	Menu
Digital input 2	d i 2	Right arrow
Digital input 3	d i 3	Up arrow
Digital input 4	d i 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	PA55 1	000000 (unlocked)
Password 2	PA55 2	000000 (unlocked)
Password 3	PA55 3	000000 (unlocked)
Total password	totAL	000000 (unlocked)
Grand total password	GtotAL	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-Flow 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-flow cutoff value. To prevent the display from showing a negative value, set the low-flow cutoff to a value greater than zero.
Meter displays error message during calibration (Error)	Check: 1. Signal connections 2. Minimum input span requirements
Meter displays 1. 99999 2. -9999	Check: 1. Input selected in *Setup* menu 2. Corresponding signal at Signal connector
Display is unstable	Check: 1. Input signal stability and value 2. Display scaling vs. input signal 3. Filter and gate values
Display response is too slow	Check filter and gate values
Display reading is not accurate	Check scaling or calibration
Display does not respond to input changes, reading a fixed number	Check the display assignment, it might be displaying max, min, or set point.
Display alternates between 1. Hi and a number 2. Lo and a number	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: 1. Fail-safe in *Setup* menu 2. Wiring of relay contacts
Relay and status LED do not respond to signal	Check: 1. Relay action in *Setup* menu 2. Set and reset points
Flashing relay status LEDs	Relays in manual control mode or relay interlock switches opened.
Meter not communicating with application programs	Check: 1. M-Link Connector installed between PROVU electronics and ProtEX-MAX connector board. See *Figure 4*: Integrated PROVU Required Connections on page *25* 2. Serial settings 3. Meter address and baud rate
If the display locks up or the meter does not respond at all	Cycle the power to reboot the microprocessor.
CapTouch buttons do not respond	1. Check if slide switch on connector board is in DISABLE position, switch to ENABLE. 2. Be sure to hold the initial CapTouch button for 5 seconds to wake it up.

Troubleshooting Tips

Symptom	Check/Action
Serial Communications Power (P) LED Indicator is off	Check: 1. Modular cable connection 2. Power to the device
If only the TX (or DATA IN) data status LED is flashing when serial communications attempted	Check: 1. Serial cable 2. Instrument address & baud rate 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 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.

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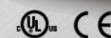### Helios Series

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