

# PD8-6210 Explosion-Proof Analog Input Batch Controller

## Instruction Manual



MeterView Pro

USB Install

- Fully Approved Explosion-Proof Batch Controllers
- 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, and  $\pm 10$  V Inputs with  $\pm 0.03\%$  Accuracy
- 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 24 VDC @ 25 mA Transmitter Power Supply
- Easy Field Scaling in Engineering Units without Applying an Input
- 4 Relays with Interlocking Capability + Isolated 4-20 mA Output
- Free PC-Based, On-Board, MeterView Pro USB Programming Software
- SunBright Display Standard Feature; Great for Outdoor Applications
- Start / Pause / Stop, Change Batch with Front Panel Buttons
- Display Batch Total, Rate, Grand Total, Count or Preset
- Single or Multi-Stage Batch Control (Up to 4 Relays)
- Front Panel or Remote Total Reset
- Automatic Overrun Correction
- Automatic or Manual Batch Control
- Low or High Flow Alarms while Batching
- 32-Point Linearization, Square Root Extraction and Programmable Exponent Function
- 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

## PRECISION DIGITAL CORPORATION

233 South Street • Hopkinton MA 01748 USA

Tel (800) 343-1001

[www.prediq.com](http://www.prediq.com)



# The Complete **ProtEX<sup>TM</sup>** Series MAX

SP 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<sup>®</sup> Scanner  
with Dual Analog Input**



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



PD8-6081  
**Feet & Inches  
Modbus<sup>®</sup> Scanner**



PD8-7000  
**Temperature Meter**

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



**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](http://www.predig.com) for complete details.

**CAUTION**

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

**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 controller 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](http://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](http://www.predig.com) for complete details.

**Registered Trademarks**

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

© 2025 Precision Digital Corporation.  
All rights reserved.

**FREE MeterView Pro Programming Software**

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

The easiest and quickest way to program your ProtEX-MAX batch controller is to use the FREE MeterView Pro programming software. This software is loaded into the controller and connects and installs directly to your PC with a USB cable. We recommend that the first thing you do after taking the controller 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 controller while your PC is connected to the controller 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 controller programmed as they like without even looking in the manual.

**Watch MeterView Pro Software Video at**  
[www.predig.com/meterviewpro](http://www.predig.com/meterviewpro)

In addition to programming, the software may be used to perform many useful tasks:

- Start, Pause, Stop the batch
- Change preset & pre-close settings
- Reset total & grand total
- Test the relays functionality
- Monitor the batch process
- Datalogging using your PC
- Generate & save program files for later use

Once your controller 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 controller is installed, you can use the programming buttons and the instructions in this manual to do so.

**WARNING**

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

## Table of Contents

Introduction.....	7
Ordering Information.....	7
Key Features.....	9
Specifications .....	16
General.....	16
Batch Controller Rate/Totalizer Display .....	17
Process Inputs .....	18
Relays.....	18
USB Connection.....	18
Isolated 4-20 mA Transmitter Output .....	19
RS-485 Serial Communications .....	19
Modbus® RTU Serial Communications.....	19
Digital Input (F4).....	19
Digital Inputs & Outputs .....	19
MeterView Pro Software .....	19
Enclosure.....	20
General Compliance Information .....	20
Electromagnetic Compatibility.....	20
Product Ratings and Approvals.....	21
EU Declaration of Conformity.....	22
Safety Information .....	22
Installation.....	22
Unpacking.....	22
Mounting.....	23
Installation Overview .....	25
MeterView Pro Software .....	25
Transmitter Supply Voltage Selection (P+, P-) .....	26
Connections .....	26
Required & Factory Wired Connection .....	26
PROVu Electronics Module Layout.....	27
USB Connection .....	27
Power Connections.....	28
Signal Connections.....	29
Relay Connections.....	29
Interlock Relay Feature.....	29
Switching Inductive Loads.....	30
RS-485 Connections.....	30
RS-485 Multi-Drop Connection .....	30
F4 Digital Input Connections.....	31
4-20 mA Output Connections.....	31
Analog Output Transmitter Power Supply .....	32
Remote Programming.....	32
Setup and Programming.....	33
Overview .....	33
LED Status Indicators .....	33
Programming Buttons .....	34
CapTouch Buttons .....	34
Display Functions and Messages .....	35
Main Menu.....	37
Setting Numeric Values .....	37
Setting Up the Batch Controller (SEtUP).....	37
Setting the Input Signal (InPUt).....	38
Setting the Totalizer & Batch Control Features (tOtAL).....	38
Setting the Input Units or Custom Tags (unItS).....	38
Setting the Decimal Point (dEc Pnt) .....	39
Programming the Batch Controller (PrOG).....	39
Setting the Display Parameter & Intensity (dSPLY) .....	42
Display Intensity (d-IntY).....	42

<b>Setting the Relay Operation (rELAY).....</b>	<b>43</b>
Relay Assignment (R55 iLn).....	44
Setting the Relay Action.....	45
Setting Batch Control Relays .....	45
Programming Alarm Set and Reset Points.....	45
Setting Fail-Safe Operation.....	45
Programming Time Delay .....	45
Relay Action for Loss of 4-20 mA Input (Loop Break) .....	45
Automatic Batch Control Operation.....	46
<b>Relay and Alarm Operation Diagrams.....</b>	<b>47</b>
High Alarm Operation (Set > Reset) .....	47
Low Alarm Operation (Set < Reset) .....	47
High Alarm with Fail-Safe Operation (Set > Reset).....	47
Low Alarm with Fail-Safe Operation (Set < Reset).....	47
Time Delay Operation .....	48
Total Relay Sampling Operation .....	48
<b>Relay Operation Details .....</b>	<b>49</b>
Overview .....	49
Relays Initialization .....	49
Fail-Safe Operation.....	49
Front Panel LEDs.....	49
Automatic Reset (R56 o) .....	49
Pump Alternation Control.....	49
Sample Relay Operation.....	50
Setting Up the Interlock Relay (Force On) Feature .....	50
Scaling the 4-20 mA Analog Output (R50t).....	51
<b>Reset Menu (rESEt).....</b>	<b>51</b>
<b>Manual Control Menu (Cntrl) .....</b>	<b>51</b>
<b>Setting Up the Password (PR55).....</b>	<b>52</b>
Protecting or Locking the Controller.....	52
Grand Total Reset Password & Non-Resettable Total.....	52
Making Changes to a Password Protected Controller.....	52
Disabling Password Protection .....	52
<b>Controller Operation .....</b>	<b>53</b>
Button Operation.....	53
CapTouch Buttons .....	53
Default Batch Control Operation.....	54
Batch Control Operation Example .....	54
Manual Batch Control .....	55
Automatic Batch Control .....	56
Setup with MeterView Pro .....	58
Operate with MeterView Pro .....	58
<b>Advanced Setup &amp; Programming.....</b>	<b>59</b>
<b>Advanced Features Menu .....</b>	<b>59</b>
Advanced Features Menu & Display Messages.....	59
Function Keys Operation .....	60
Digital Inputs Operation .....	60
Advanced Setup and Calibration.....	61
Maximum/Minimum Readings.....	61
Noise Filter (F iLEr) .....	61
Noise Filter Bypass (bYPR55).....	61
Rounding Feature (round).....	61
Modbus RTU Serial Communications (SEr iRL).....	61
Select Menu (SELEct).....	62
Programmable Function Keys User Menu (uSEr) .....	64
Internal Source Calibration (iEL) .....	65
<b>Troubleshooting .....</b>	<b>66</b>
Diagnostics Menu (d iRL).....	66
Testing the Display LEDs.....	66
Determining Software Version .....	66
<b>Reset Controller to Factory Defaults.....</b>	<b>66</b>
Factory Defaults & User Settings.....	67
<b>Troubleshooting Tips.....</b>	<b>69</b>

## Table of Figures

Figure 1. Enclosure Dimensions – Front View .....	23
Figure 2. Enclosure Dimensions – Side Cross Section View .....	23
Figure 3. Transmitter Supply Voltage Selection .....	26
Figure 4. Integrated ProVu Required Connections .....	26
Figure 5. ProVu Electronics Module Layout .....	27
Figure 6. USB Connection .....	27
Figure 11. Power Connections .....	28
Figure 12. Transmitter Powered by Internal Supply .....	29
Figure 13. Transmitter Powered by Ext. Supply or Self-Powered .....	29
Figure 14. Voltage Input Connections .....	29
Figure 15. Relay Connections .....	29
Figure 28. Interlock Connection .....	29
Figure 16. AC and DC Loads Protection.....	30
Figure 17. Low Voltage DC Loads Protection .....	30
Figure 15. RS-485 Diagnostic LEDs .....	30
Figure 22. Three-Wire RS-485 Connection .....	30
Figure 23. Digital Input and Output Connections .....	31
Figure 24. F4 Digital Input Connections .....	31
Figure 25. 4-20 mA Output Connections .....	31
Figure 26. Analog Output Supply Powering Other Devices.....	32

## Introduction

The ProtEX-MAX PD8-6210 is an explosion-proof analog input batch controller ideal for simplifying independent batch control operations where local control is preferred to expensive and expansive plant operation systems. The controller 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 controller 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 controller comes programmed for easy start, pause, stop, and batch size (preset) changes. The second display can be programmed to display rate, grand total, batch count, or preset by cycling the Stop (F3) button. Digital inputs come standard.

Single and multi-stage batching is possible with four (4) on-board relays. Each batch control relay may have a unique preclose amount when used for multi-stage batching. Manual start batching is default, but automatic batching with a restart after a programmed time delay from the completion of the last batch is also possible.

Overrun correction adjusts the closing of the batch control relays to adjust for inaccuracies from batch to batch. This increases accuracy over time as systems wear out. The overrun correction feature is capable of compensating for inaccuracies of up to 1% of the programmed preset value.

The controller accepts current and voltage signals (e.g. 4-20 mA, 0-10 V). The PD8-6210 batch controller comes with four SPDT relays, a 4-20 mA output, two 24 VDC power supplies, five digital inputs and four digital outputs, and RS-485 serial communications, making it an excellent addition to any system.

## CapTouch Buttons

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



## Ordering Information

### Aluminum Enclosure

#### 85-265 VAC Models

Model	Standard Features
<a href="#">PD8-6210-6H7</a>	4 relays, 4-20 mA output, 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications

#### 12-24 VDC Models

Model	Standard Features
<a href="#">PD8-6210-7H7</a>	4 relays, 4-20 mA output, 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications

### Stainless Steel Enclosure

#### 85-265 VAC Models

Model	Standard Features
<a href="#">PD8-6210-6H7-SS</a>	4 relays, 4-20 mA output, 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications

#### 12-24 VDC Models

Model	Standard Features
<a href="#">PD8-6210-7H7-SS</a>	4 relays, 4-20 mA output, 5 Digital Inputs, 4 Digital Outputs, RS-485 Communications

### Accessories

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

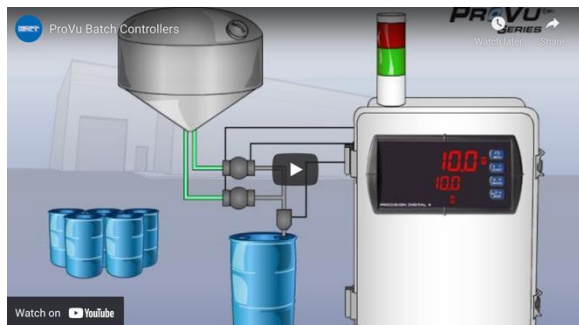


## Helpful Videos

There are several videos that will help you get a better understanding 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 controller are also included.

### ProVu Batch Controllers

These provide simple batch control with features like preclose relays and automatic overrun correction.



<https://www.predig.com/videos/KN6Y6R0I1OE>

### ProVu Function Keys Tutorial

Learn how the ProVu's function keys increase the utility of the ProVu.



<https://www.predig.com/videos/WMBYKlavW-Q>

### Connect a ProVu to a PC Using MeterView Pro

Learn how easy it is to use MeterView Pro software.



[https://www.predig.com/videos/PC\\_Connect](https://www.predig.com/videos/PC_Connect)

### MeterView Pro USB Programming Software

Learn how easy it is to program a ProVu PD6000 process meter.



[https://www.predig.com/videos/MVPro\\_SW](https://www.predig.com/videos/MVPro_SW)

### 4-20 mA Connections

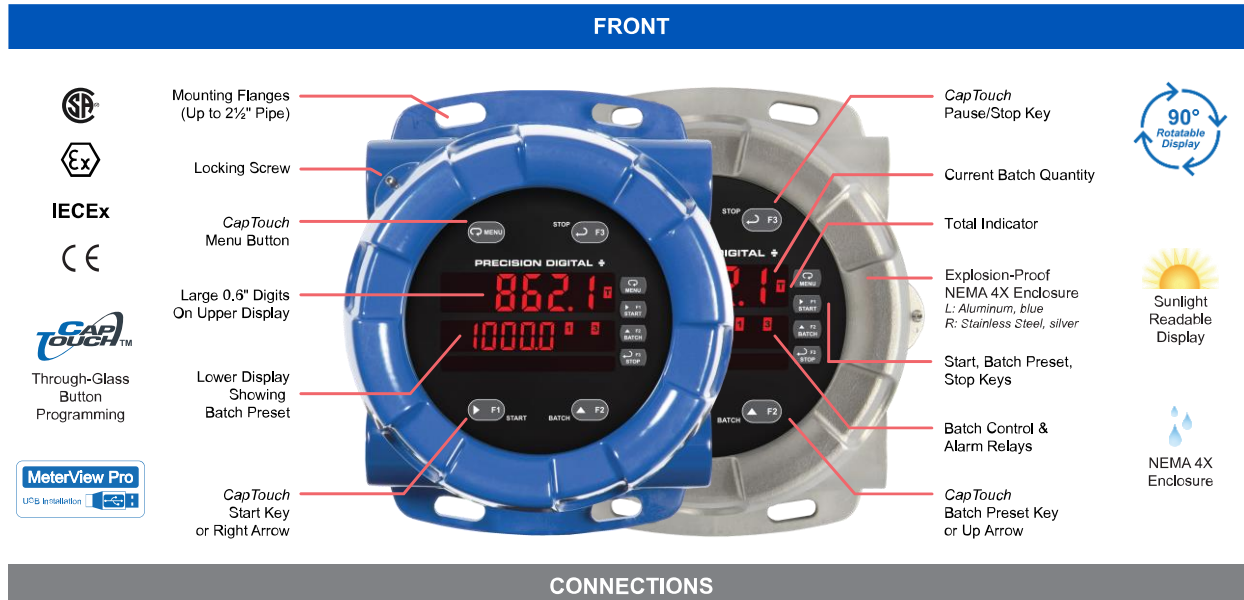
This Tech Tips video shows how to make connections to power the transmitter with the ProVu's (ProtEX-MAX's) 24 VDC power supply.



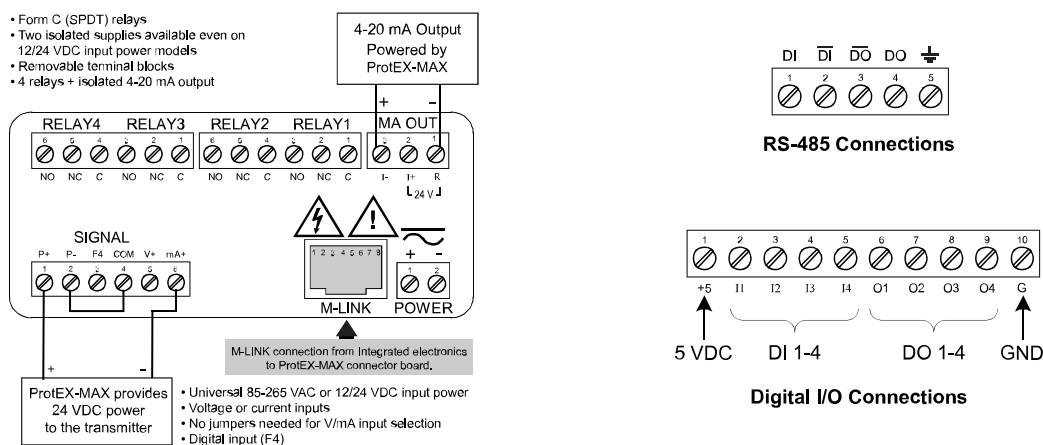
[predig.com/videos/4-20\\_mA\\_Connections](https://www.predig.com/videos/4-20_mA_Connections)



## Key Features



## CONNECTIONS



Connections for PD8-6210-6H7 & PD8-6210-7H7

## The Only Explosion-Proof Batch Controller You Will Ever Need

The ProtEX-MAX PD8-6210 explosion-proof batch controllers are specifically designed for displaying flow rate and total from flowmeters with analog outputs.

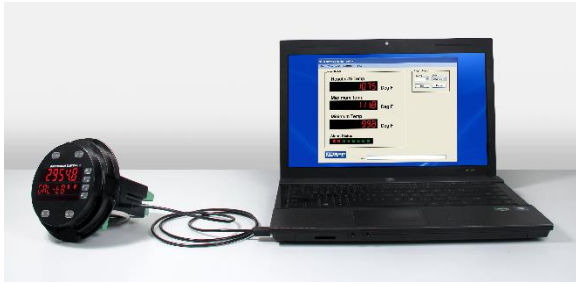
The first thing you notice about the PD8-6210 is its modern looking, rugged, explosion-proof housing with convenient mounting flanges, available in aluminum or stainless steel. Housed inside this enclosure is a dual-line, 6-digit display that is usually setup to show the current batch quantity and the batch preset on the two lines. START, BATCH, and STOP buttons (which can be operated remotely or without removing the cover) come setup by default for batch control operation. The START button starts the batch. The BATCH button shows the preset value. The STOP button pauses or stops the batch.

The PD8-6210 is certified by CSA as Explosion-Proof / Dust-Ignition-Proof / Flame-Proof and is ATEX and IECEx Certified as Dust-Ignition-Proof / Flame-Proof.

One of the more convenient features of the PD8-6210 is its through-glass CapTouch buttons which allow the controller to be operated without removing its cover. Just put your finger on the glass over the button to actuate it. The PD8-6210 can also provide 5, 10, or 24 VDC to power the flowmeter.

A ProtEX-MAX batch controller can be programmed for a wide variety of applications. Setup is easy for single or multi-stage batching. Automatic overrun correction keeps the batch size accurate, even over time. The PD8-6210 can display the number of batches that have been run and the total amount of product that has been batched. These features and capabilities can easily be programmed without removing the cover using CapTouch buttons in a hazardous area or with free MeterView Pro PC-based software in a safe area.

## Easy Programming Methods

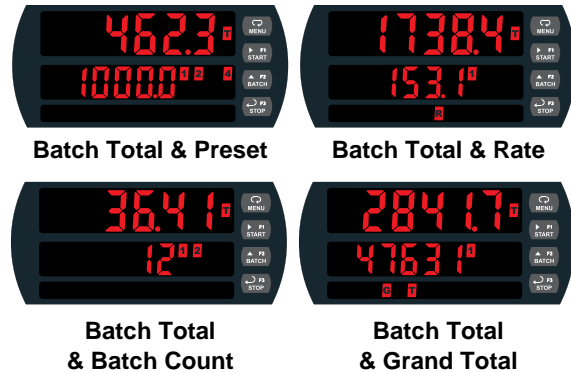


The ProtEX-MAX can be programmed in a hazardous area with the through-glass CapTouch buttons without removing the cover, in a safe area with the front panel push buttons with the cover removed, or in a safe area with free, PC-based MeterView Pro software. MeterView Pro is resident on the ProtEX-MAX and is accessed by a provided USB cable, so it is by far the easiest way to program the ProtEX-MAX. The ProtEX-MAX can be calibrated either by applying a known signal or scaled by entering a desired value with the front panel buttons or MeterView Pro software. Most customers will use the scaling method because it is simpler and does not require a calibrated signal source. Selecting the input to be current or voltage is done with the front panel buttons or MeterView Pro software. Once programming is completed it can be locked with a password. The ProtEX-MAX comes preloaded with free MeterView Pro programming software that connects and installs directly to your PC with a standard USB cable, also provided free with each instrument. This eliminates the need to insert CDs, install drivers, or download software from the internet. When you connect your ProtEX-MAX to your PC, MeterView Pro is downloaded to your PC, the software automatically selects the model you are programming, and you're ready to start programming immediately. Further simplifying the programming process, the ProtEX-MAX can be powered from the USB port, so no need to apply external power while programming your controller. 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

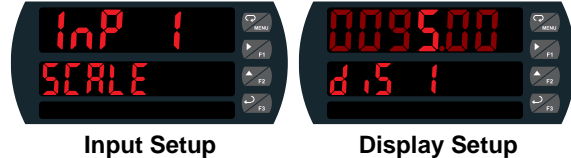
### Display What You Want

The most common setup for these batch controllers is to display the batch total on the main display and batch preset on the second display. This allows the user to monitor the batch as it progresses and compare it to the total batch size. Other possible setups include displaying the batch total and flow rate, batch total and batch count, and batch total and grand total.



### Easy to Use

The user-friendly dual-line display makes the PROVu easy to set up & program. No jumpers to set for input selection. All setup & programming are done via the front panel.



### 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 "83 1470". 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.

## Batch Controller Capabilities

A ProtEX-MAX batch controller can be programmed for a wide variety of single or multi-stage batching applications and set up to run in either manual or automatic operation. Batch size can be displayed on the controller and is easily programmed and changed if needed. The controller can even display the number of batches that have been run. Automatic overrun correction keeps the batch size accurate, even over time and with system wear. The controller can display the rate with a time base of seconds, minutes, hours or days. The user can program a conversion factor, configure a non-resettable grand total, and configure password protection.

### Manual or Automatic Batch Control

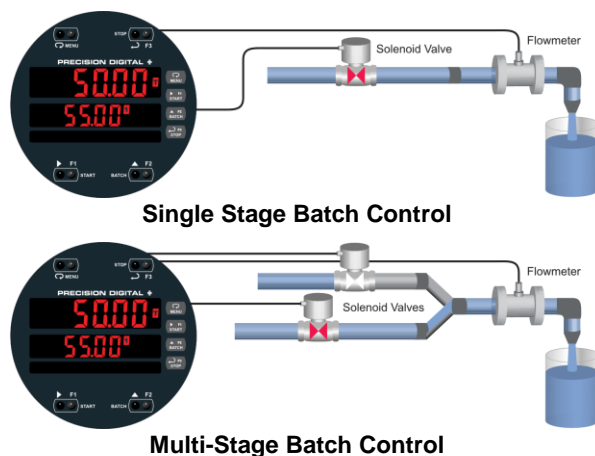
Batches may be started manually with the START front panel button, or with a remote digital input trigger. Batches may also be programmed to start automatically after a 0 to 999.9 second delay after the end of the last completed batch. A manually stopped batch will only restart after the START button is pressed or digital input triggered.

### Automatic Overrun Correction

The ProtEX-MAX batch controller will correct for batch overrun or shortages automatically. By tracking the amount the batch was off by, the controller will automatically adjust the batch by modifying the batch relay deactivation time.

### Single and Multi-Stage Batching

The ProtEX-MAX can be used as a single or multi-stage batch controller. Relays assigned to the total act as batch control relays, with additional relays beyond the first including a preclose value. The preclose deactivates the relay before the batch is finished, to allow slower fill rates and a more accurate batch finish. Each additional stage batching relay has an individually programmable preclose amount.



## Quick Preset Changes

The front panel BATCH key is configured by default to access the preset menu. The preset may be changed quickly and easily between batches without the need to enter setup menus.

## 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.

## Total Conversion Factor

The user can enter a conversion factor that allows the controller to display total in different units than the rate. For instance, an operator could measure flow rate in gallons per minute and grand total in millions of gallons.

## Grand Total & Rate Alarms

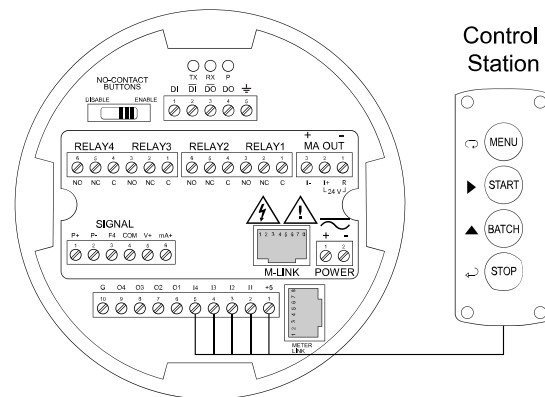
The ProtEX-MAX's four internal relays can be set up to alarm when the grand total reaches a user-defined set point or when the rate is above or below a certain value. Rate alarms are only activated when the batching process is running. A variety of reset modes are available and the user can also program time delays and fail-safe operation.

## F4 Digital Input

The digital input can be used for a variety of functions such as starting or stopping a batch, resetting the total, or resetting an alarm relay. This is ideal for installations where the controller is inaccessible behind a cover, or where an additional function key is needed for customized operation.

## Remote Operation of Controller

There are four digital inputs that can be programmed to mimic the MENU, START, BATCH, and STOP buttons that could be controlled by a control station\* suitable for location in a hazardous area.



\* Control station must be approved for hazardous locations

## 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 ProtEX-MAX can operate over a wide temperature range (-55 to 65°C / -67 to 149°F), includes removable screw terminal connectors, and features through-glass buttons for easy controller 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  $\pm 40^\circ$ ; 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.

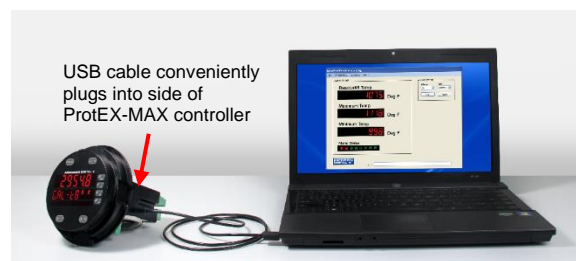


## Removable Screw Terminals

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



# USB Port MeterView Pro



## Hazardous Area Approvals

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

## Wide Operating Temperature Range

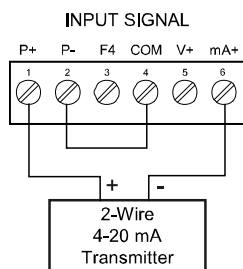
The ProtEX-MAX can operate from -55 to 65°C (-67 to 149°F) meaning it can be installed in a wide variety of indoor and outdoor industrial applications.

## Transmitter Power Supplies

### Controller Powers Transmitter

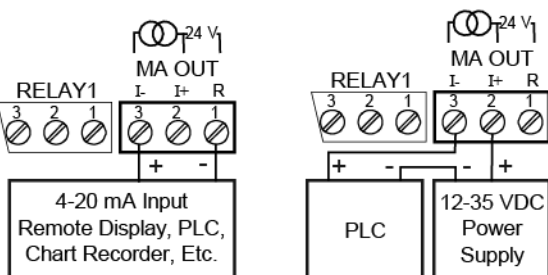
One of the most useful standard features of the PD8-6210 is its built-in isolated, 24 V @ 25 mA power supply to power the transmitter. This feature saves money by eliminating an external power supply and also simplifies wiring by reducing the number of devices in the loop. It can be configured for 5, 10, or 24 V (default) by means of a simple internal jumper. This power supply is even available on controllers that are powered from DC power (24 V @ 25 mA). To use an external power supply instead of the internal power supply, simply make connections to different terminals on the ProtEX-MAX.

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



### Controller Powers 4-20 mA Output

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



### Fuse Prevents Current Overload

Another very useful aspect of the ProtEX-MAX is that the current input is protected against current overload by a resettable fuse. The fuse limits the current to a safe level when it detects a fault condition, and automatically resets itself when the fault condition is removed.

## Useful Tools

### PD9501 Multi-Function Calibrator



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

### PD9502 Low-Cost Signal Generator



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

#### WARNING

- These devices do not carry hazardous area approvals and are thus not suitable for location in hazardous areas.

## Specifications

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

### General

<b>Display</b>	Display Line 1: 0.60" (15.2 mm) high, red LEDs Display Line 2: 0.46" (12.0 mm) high, red LEDs 6 digits each (-99999 to 999999), with lead zero blanking
<b>Display Intensity</b>	Eight user selectable intensity levels. Default is six.
<b>Display Update Rate</b>	5/second (200 ms)
<b>LED Status Indicators</b>	See <i>LED Status Indicators</i> on page 33 for details
<b>Overrange</b>	Display flashes 999999
<b>Underrange</b>	Display flashes -99999
<b>Default Display Assignment</b>	Line 1 displays batch total. Line 2 displays batch preset, and can be switched to show grand total, or batch count with the STOP key.
<b>Custom Display Assignment</b>	Display lines 1 and 2 may be assigned to rate, total, grand total, batch count, preset, set points, units (second display only), alternating R & T, R & GT, preset & rate, max & min, or a Modbus display register. Any rate/total/grand total display may be programmed to alternate with a custom unit or tag.
<b>Alternating Display</b>	Displays alternate every 10 seconds when display is selected, or the batch is paused.
<b>Programming Methods</b>	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.
<b>Noise Filter</b>	Programmable from 2 to 199 (0 will disable filter)
<b>Filter Bypass</b>	Programmable from 0.1 to 99.9% of calibrated span
<b>Recalibration</b>	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
<b>Max/Min Display</b>	Max/min readings reached by the process are stored until reset by the user or until power to the controller is cycled.
<b>Rounding</b>	Select 1, 2, 5, 10, 20, 50, or 100 (e.g. rounding = 10, value = 123.45, display = 123.50)
<b>Password</b>	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 Password: Prevents resetting the total manually Gtotal Password: Prevents resetting the grand total manually

<b>Non-Volatile Memory</b>	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.
<b>Power Options</b>	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.
<b>Fuse</b>	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 controllers may share one 5 A fuse
<b>Normal Mode Rejection</b>	Greater than 60 dB at 50/60 Hz
<b>Isolation</b>	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
<b>Overvoltage Category</b>	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
<b>Environmental</b>	T6 Class operating temperature range Ta = -55 to 60°C T5 Class operating temperature range Ta = -55 to 65°C Storage temperature range: -55 to 85°C (-67 to 185°F) Relative humidity: 0 to 90% non-condensing
<b>Max Power Dissipation</b>	Maximum power dissipation limited to 13.73 W
<b>Connections</b>	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.
<b>Mounting</b>	Wall Mounting: Four (4) mounting holes provided for mounting controller to wall. See <i>Wall Mounting Instructions</i> on page 23 for additional details. Pipe Mounting: Optional pipe mounting kit (PDA6848) allows for pipe mounting. Sold separately. See <i>Pipe Mounting Instructions</i> on page 24 for additional details.
<b>Tightening Torque</b>	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)
<b>Overall Dimensions</b>	6.4" x 8.0" x 8.5" (163 mm x 202 mm x 215 mm) (W x H x D)
<b>Weight</b>	Aluminum: 14.7 lbs (6.7 kg) Stainless Steel: 23.5 lbs (10.7 kg)
<b>Warranty</b>	3 years parts & labor. See Warranty Information and Terms & Conditions on <a href="http://www.predig.com">www.predig.com</a> for complete details.



## Batch Controller Rate/Totalizer Display

<b>Rate Display Indication</b>	-99999 to 999999, lead zero blanking. "R" LED illuminates while displaying rate.
<b>Batch Total &amp; Grand Total Display</b>	0 to 999,999; automatic lead zero blanking. "T" LED is illuminated while displaying batch total. "GT" LEDs are illuminated while displaying grand total. Up to 999,999 for batch total/preset. Up to 999,999,999 with grand total-overflow feature. "oF" is displayed to the left of grand total overflow and ▲ LED is illuminated.
<b>Batch Total Decimal Point</b>	Up to five decimal places or none: dddddd, dddddd, dddd, ddd, dd, or dddddd. Total decimal point is independent of rate decimal point.
<b>Totalizer</b>	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.
<b>Time Base</b>	Second, minute, hour, or day
<b>Batch Control Mode</b>	Automatic or manual batch control
<b>Manual Batch</b>	The operator must press the START button every time a new batch is started. Press STOP to pause the batch and either press START to resume or STOP to stop the incomplete batch.
<b>Automatic Batch</b>	Once the START button is pressed, the batches will run automatically until the STOP button is pressed twice. The time delay between batches is entered during the setup.
<b>Batch Time Delay</b>	Programmable up to 999.9 seconds. This is the time delay between batches for automatic batch control. Allow sufficient time to put in place an empty container.
<b>Batch Preset</b>	The F2 key is assigned to the preset. The preset value is the total volume to be batched in each cycle.
<b>Batch Pre-Close</b>	The pre-close value is equal to the volume amount before reaching the preset value (batch size).
<b>Single or Multi-Stage</b>	Single Stage: Only relay 1 is used. Multi-Stage: Two or more relays are used to control the batch with more precision; this is done using multiple presets or using the pre-close feature.
<b>Multiple Presets</b>	Each relay de-energizes at its own preset value.
<b>Remote Operation</b>	Start / Stop / Batch Size buttons may be operated remotely using a hazardous area-approved control station
<b>Start</b>	The F1 key is assigned to START batch. Press START to start a new batch in manual mode or a set of batches in automatic mode.
<b>Pause / Stop</b>	The F3 key is assigned to PAUSE / STOP. Press F3 once to pause and press it again to stop the batch process.

<b>Automatic Overrun Correction</b>	Adjusts the closing of the batch control relays to compensate for inaccuracies from batch to batch. The overrun correction feature is capable of compensating for inaccuracies of up to 1% of the programmed preset value. To achieve an accurate batch, the flow rate must be slowed down, such that the total most-right digit increments at a rate of less than 10 counts/second. The use of a dual-stage batch control is recommended.
<b>Count Up or Count Down</b>	Batch total and grand total can set to count up or count down, independently.
<b>Start / Stop Batch</b>	The F4 digital input is assigned to start & stop the batch, it is located on the input signal connector. An external push-button can be connected between terminal F4 and COM. Press the button once to start the batch and press it again to stop the batch.
<b>High or Low Flow Alarm</b>	The user may program any alarm for high or low trip point. The alarm detection is active only while the batch is running. Unused alarm LEDs and relays may be disabled (turned off).
<b>Grand Totalizer Rollover</b>	Grand totalizer rolls over when display exceeds 999,999,999. Relay status reflects display.
<b>Grand Total Overflow</b>	The grand total can display up to 999,999,999 using the overflow feature. After the value exceeds 999,999 a 3-digit value with the prefix "oF" toggles every 10 seconds. The overflow feature can be disabled by setting a grand total alarm that automatically resets the grand total when 999,999 is reached.
<b>Grand Total Alarms</b>	Up to three, user selectable under setup menu. Any set point can be assigned to grand total and may be programmed anywhere in the range of the controller for grand total alarm indication. Relay 1 should always be assigned to batch.
<b>Programmable Delay on Release</b>	0.1 and 999.9 seconds; applied to the first relay assigned to total or grand total. If the controller is programmed to reset total to zero automatically when the preset is reached, then a delay will occur before the total is reset.
<b>Grand Total Reset</b>	Via front panel button, external contact closure on digital inputs, automatically via user selectable preset value and time delay, or through serial communications.
<b>Grand Total Reset Password</b>	Grand total passwords may be entered to prevent resetting the grand total from the front panel.
<b>Non-Resetable Grand Total</b>	The grand total can be programmed as a non-resetable total by entering the password "050873".

### CAUTION

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

## Process Inputs

<b>Inputs</b>	Field selectable: 0-20, 4-20 mA ±10 V (0-5, 1-5, 0-10 V) Modbus PV (Slave)	
<b>Isolated Transmitter Power Supply</b>	Terminals P+ & P-: 24 VDC ± 10%. Isolated from the input at >500 V and from the power line at 4 kV. Jumper selectable for 24, 10, or 5 VDC supply (internal jumper J4). All models transmitter supply rated @ 25 mA max.  Refer to <i>Figure 3. Transmitter Supply Voltage Selection</i> on page 26 and <i>Figure 19. 4-20 mA Output Connections</i> on page 31	
<b>Accuracy</b>	±0.03% of calibrated span ±1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span	
<b>Temperature Drift</b>	0.005% of calibrated span/°C max from 0 to 65°C ambient, 0.01% of calibrated span/°C max from -40 to 0°C ambient	
<b>Input Signal Conditioning</b>	Linear, square root, or programmable exponent	
<b>Multi-Point Linearization</b>	2 to 32 points	
<b>Programmable Exponent</b>	User selectable from 1.0001 to 2.9999 for open channel flow	
<b>Low-Flow Cutoff</b>	0.1 to 999,999 (0 disables cutoff function). Point below at which the display always shows zero.	
<b>Decimal Point</b>	Up to five decimal places or none: dddddd, dddddd, dddd, ddd, dd, or dddddd	
<b>Calibration Range</b>	Input Range	Minimum Span
	4-20 mA	0.15 mA
	±10 V	0.10 V
	An error message will appear if the input 1 and input 2 signals are too close together.	
<b>Input Impedance</b>	Voltage ranges: greater than 500 kΩ Current ranges: 50 - 100 Ω (depending on resettable fuse impedance)	
<b>Input Overload</b>	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.	
<b>HART Transparency</b>	The controller does not interfere with existing HART communications; it displays the 4-20 mA primary variable and it allows the HART communications to pass through without interruption. The controller is not affected if a HART communicator is connected to the loop. The controller does not display secondary HART variables.	

## Relays

<b>Rating</b>	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
<b>Noise Suppression</b>	Noise suppression is recommended for each relay contact switching inductive loads; see <i>Switching Inductive Loads</i> on page 30 for details.
<b>Relay Assignment</b>	Relays may be assigned to batch control total, sampling, rate, or grand total alarms.
<b>Pre-Close</b>	0-100% of batch size, individually user programmable for each additional batch control relay beyond the first.
<b>Alarm Deadband</b>	0-100% of span, user programmable
<b>High or Low Flow Alarm</b>	User may program any alarm for high or low trip point. The alarm detection is active only while the batch is running. Unused alarm LEDs and relays may be disabled (turn off).
<b>Relay Operation</b>	<ul style="list-style-type: none"> <li>Manual or automatic batch control</li> <li>Automatic (non-latching)<sup>1</sup> and/or manual alarm reset (acknowledge)</li> <li>Latching (requires manual acknowledge) with or without clear</li> <li>Pump alternation control (N/A to batch)</li> <li>Sampling (based on set point and time)</li> <li>Off (disable unused relays and enable Interlock feature)</li> <li>Manual on/off control mode</li> </ul>
<b>Relay Reset (Acknowledge)</b>	User selectable via programming buttons, F4 digital input, external contact closure on digital inputs, automatically via user selectable preset value and time delay, or through serial communications.
<b>Alarm Time Delay</b>	0 to 999.9 seconds, on & off relay time delays. Programmable and independent for each relay.
<b>Fail-Safe Operation</b>	Programmable and independent for each relay. <b>Note:</b> Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.
<b>Alarm Auto Initialization</b>	When power is applied to the controller, relays will reflect the state of the input to the controller. <sup>1</sup>

1. Alarms are active only when the batch is running.

## USB Connection

<b>Function</b>	Programming only
<b>Compatibility</b>	USB 2.0 Standard, Compliant
<b>Connector Type</b>	Micro-B receptacle
<b>Cable</b>	USB A Male to Micro-B Cable
<b>Driver</b>	Microsoft® Windows® 10/11
<b>Power</b>	USB port provides power to the controller for configuration only. <b>DO NOT</b> apply AC or DC power to the controller while the USB port is in use.

## Isolated 4-20 mA Transmitter Output

<b>Output Source</b>	Rate/process, total, grand total, max, min, set points 1-4, Modbus register, or manual control mode		
<b>Scaling Range</b>	1.000 to 23.000 mA for any display range		
<b>Calibration</b>	Factory calibrated: 4.000 to 20.000 = 4-20 mA output		
<b>Analog Out Programming</b>	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break		
<b>Accuracy</b>	$\pm 0.1\%$ FS $\pm 0.004$ mA		
<b>Temperature Drift</b>	0.4 $\mu\text{A}/^\circ\text{C}$ max from 0 to 65°C ambient, 0.8 $\mu\text{A}/^\circ\text{C}$ max from -40 to 0°C ambient <b>Note:</b> Analog output drift is separate from input drift.		
<b>Isolated Transmitter Power Supply</b>	Terminals I+ & R: 24 VDC $\pm 10\%$ . Isolated from the input at 500 V and from the power line at 4 kV. Used to power the 4-20 mA output. All models rated @ 25 mA max.		
<b>External Loop Power Supply</b>	35 VDC maximum		
<b>Output Loop Resistance</b>	Power supply	Minimum	Maximum
	24 VDC	10 $\Omega$	700 $\Omega$
	35 VDC (external)	100 $\Omega$	1200 $\Omega$

## RS-485 Serial Communications

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

## Modbus® RTU Serial Communications

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

**Note:** Refer to the ProtEX-MAX Modbus Register Tables located at [www.prediq.com](http://www.prediq.com) for details.

## Digital Input (F4)

<b>Function</b>	Start/Stop batch, remote operation of front-panel buttons, acknowledge/reset relays, reset max/min values. See <i>Function Keys &amp; Digital I/O Available Settings</i> on page 64 for a complete list of capabilities.
<b>Contacts</b>	3.3 VDC on contact. Connect normally open contacts across F4 to COM.
<b>Logic Levels</b>	Logic High: 3 to 5 VDC Logic Low: 0 to 1.25 VDC

## Digital Inputs & Outputs

<b>Function</b>	Terminals provided for remote operation of all four programming / operation buttons. Other uses include acknowledge/reset relays and reset max/min values. See <i>Function Keys &amp; Digital I/O Available Settings</i> on page 64 for a complete list of capabilities.		
<b>Channels</b>	5 digital inputs & 4 digital outputs		
<b>Digital Input Logic High</b>	3 to 5 VDC		
<b>Digital Input Logic Low</b>	0 to 1.25 VDC		
<b>Digital Output Logic High</b>	3.1 to 3.3 VDC		
<b>Digital Output Logic Low</b>	0 to 0.4 VDC		
<b>Source Current</b>	10 mA maximum output current		
<b>Sink Current</b>	1.5 mA minimum input current		
<b>+5 V Terminal</b>	To be used as pull-up for digital inputs only. 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

<b>Availability</b>	Download directly from controller or from <a href="http://www.prediq.com/meterviewpro">www.prediq.com/meterviewpro</a>
<b>System Requirements</b>	Microsoft® Windows® 10/11
<b>Communications</b>	USB 2.0 (for programming only) (USB A Male to Micro-B Cable) RS-485 to USB converter (programming, monitoring, batch control, and data logging)
<b>Configuration</b>	Configure controllers one at a time
<b>Power</b>	USB port provides power to the controller for configuration only. <b>DO NOT</b> apply AC or DC power to the controller while the USB port is in use.
<b>Batch Control</b>	Use MeterView Pro to control the batch, change the preset, reset totals, and test the relays.
<b>Data Logging</b>	Use MeterView Pro for data logging of the batch process.

## Enclosure

<b>Material</b>	AL Models: ASTM A413 LM6 die-cast aluminum, copper-free, enamel coated SS Models: ASTM A743 CF8M investment-cast 316 stainless steel
<b>Gasket</b>	Fluoroelastomer
<b>Rating</b>	NEMA 4X, IP68 Explosion-proof
<b>Color</b>	AL: Blue SS: Silver
<b>Window</b>	Borosilicate glass
<b>Conduits</b>	Four ¾" NPT threaded conduit openings
<b>Conduit Stopping Plugs</b>	Sold separately
<b>Flanges</b>	Two built-in flanges for wall and pipe mounting
<b>Tamper-Proof Seal</b>	Cover may be secured with tamper-proof seal
<b>Overall Dimensions</b>	6.4" x 8.0" x 8.5" (163 mm x 202 mm x 215 mm) (W x H x D)
<b>Weight</b>	AL: 14.7 lbs (6.7 kg) SS: 23.5 lbs (10.7 kg)
<b>ATEX</b>	II 2 G D Ex db IIC Gb Ex tb IIIC Db IP66/IP68 Tamb: -55°C to +85°C Certificate Number: Sira 19ATEX1252U
<b>IECEX</b>	Ex db IIC Gb Ex tb IIIC Db IP66/IP68 Tamb: -55°C to +85°C Certificate Number: IECEX SIR 19.0075U
<b>CSA</b>	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
<b>UL</b>	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

<b>Emissions</b>	EN 55022 Class A ITE emissions requirements
<b>Radiated Emissions</b>	Class A
<b>AC Mains Conducted Emissions</b>	Class A
<b>Immunity</b>	EN 61326-1 Measurement, control, and laboratory equipment EN 61000-6-2 EMC heavy industrial generic immunity standard
<b>RFI - Amplitude Modulated</b>	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)
<b>Electrical Fast Transients</b>	±2kV AC mains, ±1kV other
<b>Electrostatic Discharge</b>	±4kV contact, ±8kV air
<b>RFI - Conducted</b>	10V, 0.15-80 MHz, 1kHz 80% AM
<b>AC Surge</b>	±2kV Common, ±1kV Differential
<b>Surge</b>	1KV (CM)
<b>Power-Frequency Magnetic Field</b>	30 A/m 70%V for 0.5 period
<b>Voltage Dips</b>	40%V for 5 & 50 periods 70%V for 25 periods
<b>Voltage Interruptions</b>	<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

<b>CSA</b>	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
<b>ATEX</b>	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
<b>IECEX</b>	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](http://www.predig.com/docs).

## Safety Information

### ⚠ CAUTION

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

### ⚠ 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 controller from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier.

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

## Cover Jam Screw



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

### ⚠ CAUTION

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

## Mounting

The ProtEX-MAX has two slotted mounting flanges that may be used for pipe mounting or wall mounting. Refer to *Figure 1* and *Figure 2* below.

### **⚠ WARNING**

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

## Mounting Dimensions

All units: inches (mm)

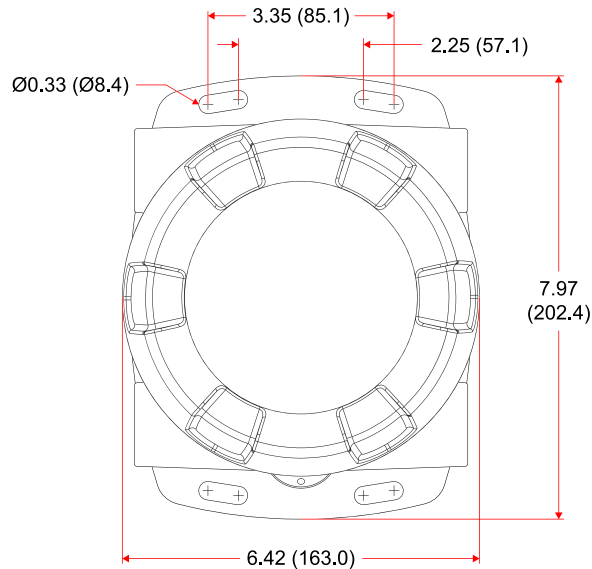


Figure 1. Enclosure Dimensions – Front View

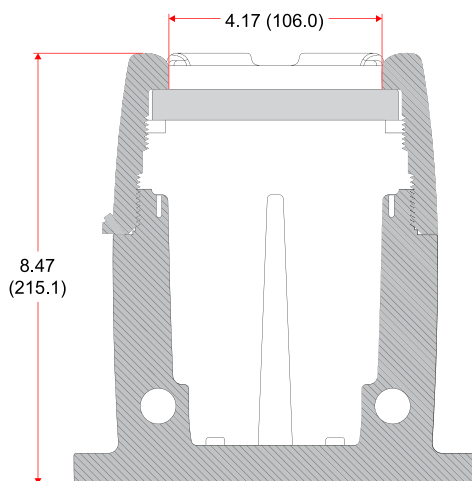


Figure 2. Enclosure Dimensions – Side Cross Section View

## Wall Mounting Instructions

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

- Prepare a section of wall approximately 7.0" x 8.5" (178 mm x 216 mm) for controller 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.



Download free 3-D CAD files of these instruments to simplify your drawings!

[predig.com/documentation-cad](http://predig.com/documentation-cad)

## Pipe Mounting Instructions



The controller 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](#)).

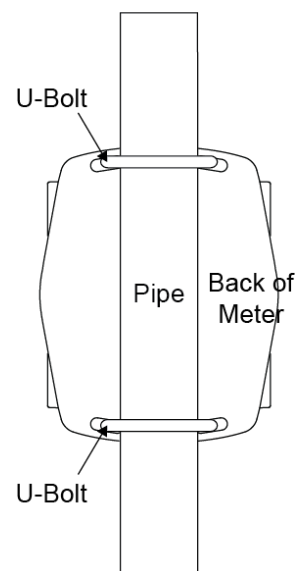


To mount the controller using a U-Bolt kit, follow these instructions:

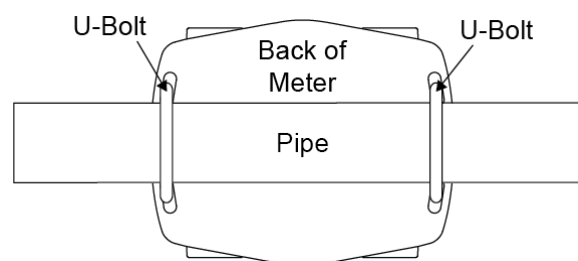
- Orient the groove on the back of the instrument with the pipe and secure it to the pipe with the two U-bolts and hardware provided.



## Vertical Pipe Mounting



## Horizontal Pipe Mounting





## Installation Overview

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

1. **DO NOT** apply AC or DC power to the controller.
2. Connect the controller 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 controller for your application.
6. Disconnect the USB cable from the controller.
7. Apply power and signal and check operation of the controller.
8. Install the controller 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 controller is to use the FREE MeterView Pro programming software. This software is loaded into the controller 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 controller 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 controller while your PC is connected to the controller 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 controller programmed as they like without even looking in the manual.

Watch MeterView Pro Software Video at  
[www.prediq.com/meterviewpro](http://www.prediq.com/meterviewpro)

## MeterView Pro Installation

1. Connect one end of the provided USB cable to the controller and the other end to the computer. The computer will automatically install the driver software it needs to talk to the controller. 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.

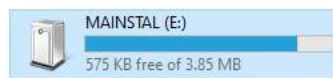
### ⚠ WARNINGS

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

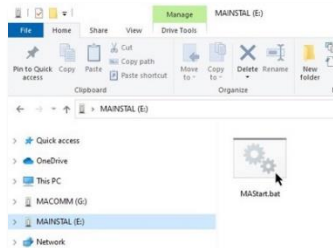
2. Once the driver is installed, an AutoPlay dialog should appear for the drive "MAINSTAL." Click "Open folder to view files."



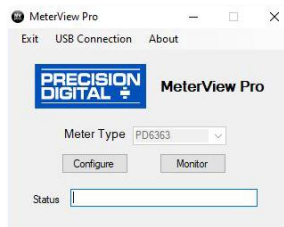
If the computer does not display an AutoPlay dialog for the drive "MAINSTAL," you should open My Computer and double-click on the drive labeled "MAINSTAL."



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 controller.



**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 controller itself. This way, you will always have the most current version on the controller for future installs.

### ⚠ WARNING

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

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

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

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

To access the voltage selection jumper:

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

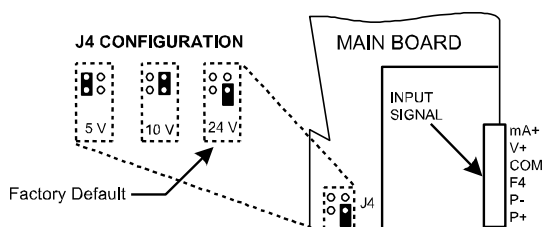


Figure 3. Transmitter Supply Voltage Selection

## Connections

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

### 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 controller 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 controller 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.

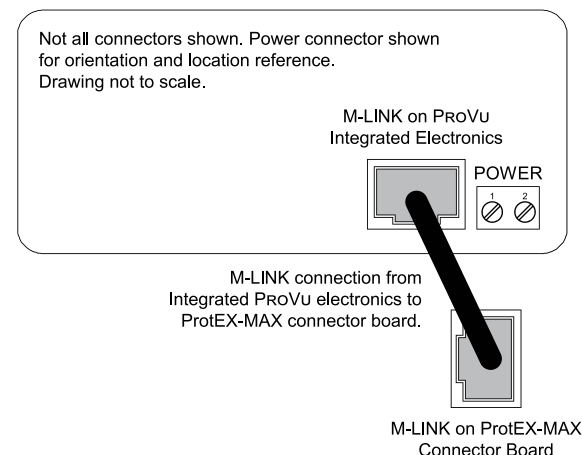


Figure 4. Integrated ProVu Required Connections

### ProVu Electronics Module Layout for PD8-6210-6H7 and PD8-6210-7H7

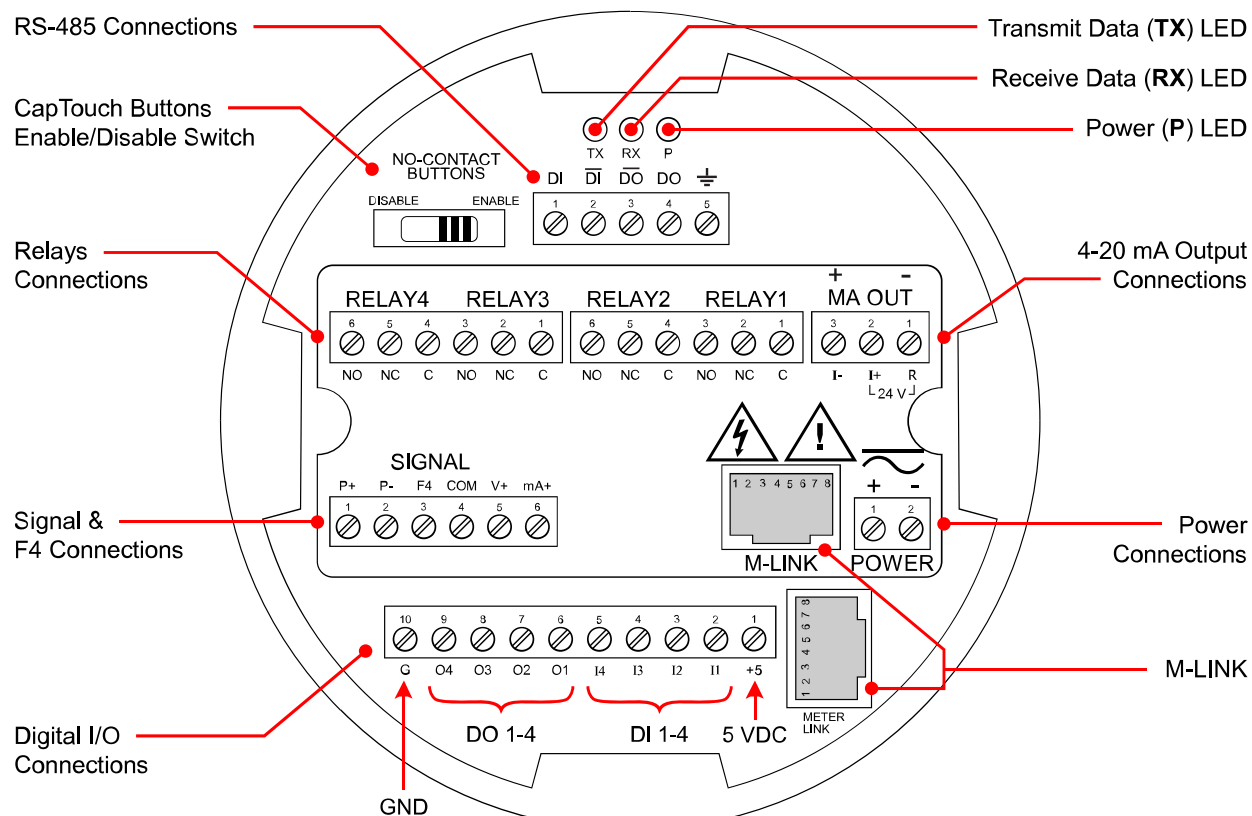


Figure 5. ProVu Electronics Module Layout

### USB Connection

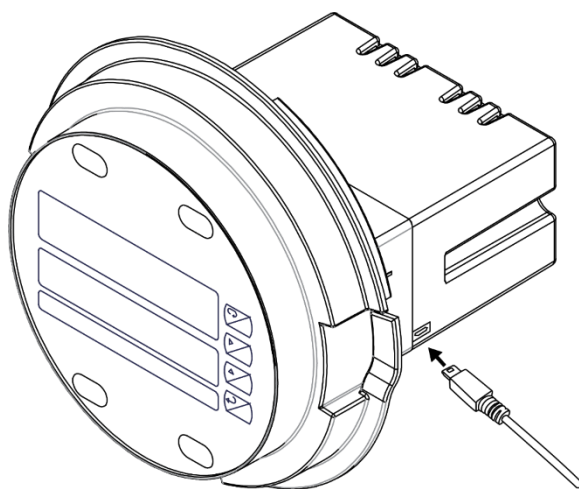


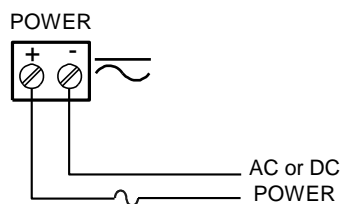
Figure 6. USB Connection

#### ⚠ WARNINGS

- **DO NOT** disconnect the RJ45 M-LINK connector cable. Otherwise the instrument will not function properly.
- When using the USB connection, the controller should only be connected to a computer when both devices are in a non-hazardous area.

## Power Connections

Power connections are made to a two-terminal connector labeled POWER. The controller 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.



Required External Fuse:  
5 A max, 250 V Slow Blow

**Figure 7. Power Connections**



## Signal Connections

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

### Current and Voltage Connections

The following figures show examples of current and voltage connections.

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

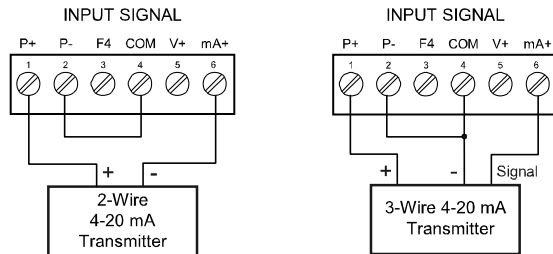


Figure 8. Transmitter Powered by Internal Supply

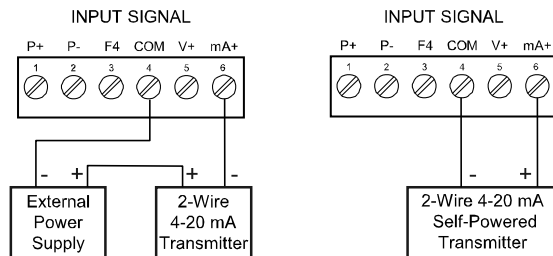


Figure 9. Transmitter Powered by Ext. Supply or Self-Powered

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

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

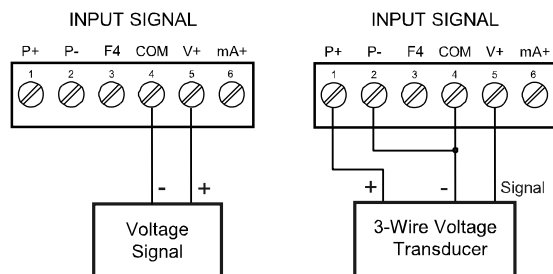


Figure 10. Voltage Input Connections

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

## Relay Connections

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

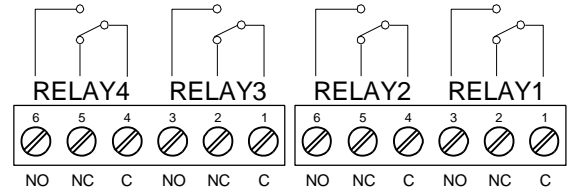


Figure 11. Relay Connections

## 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 50.

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.

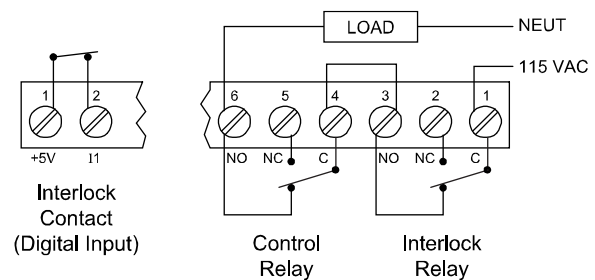


Figure 12. Interlock Connection

## Switching Inductive Loads

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

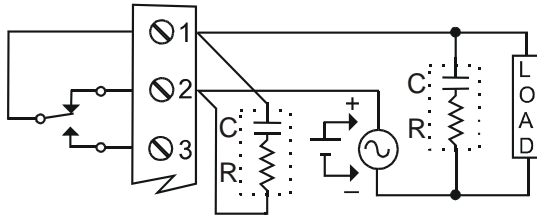


Figure 13. AC and DC Loads Protection

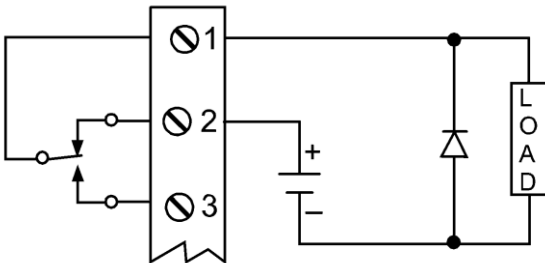
Choose R and C as follows:

R: 0.5 to 1  $\Omega$  for each volt across the contacts

C: 0.5 to 1  $\mu\text{F}$  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 controller'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 14. Low Voltage DC Loads Protection

## RC Networks Available from Precision Digital

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

**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 (5E r iL)* on page 61 for more information.

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



Figure 15. RS-485 Diagnostic LEDs

## RS-485 Multi-Drop Connection

When using more than one controller in a multi-drop mode, each controller must be provided with its own unique address. The controller 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 controller address:

1. Press and hold the Menu button for three seconds to access Advanced Features menu of the controller.
2. Press Up arrow until Serial (5E r iL) menu is displayed and press Enter, Address is displayed.
3. Press Enter to change controller 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.

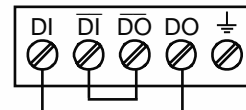


Figure 16. Three-Wire RS-485 Connection

## Digital I/O Connections



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

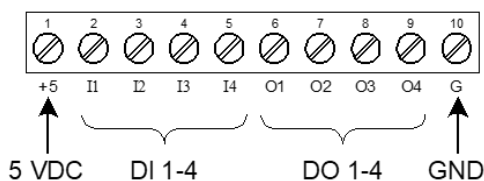


Figure 17. Digital Input and Output Connections

### 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 controller. 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 start/stop the batch, reset the total, acknowledge/reset relays, or to reset max/min values. See *Function Keys & Digital I/O Available Settings* on page 64 for a complete list of capabilities.

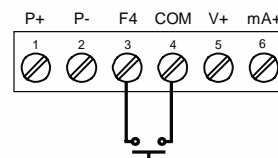


Figure 18. F4 Digital Input Connections

## 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.

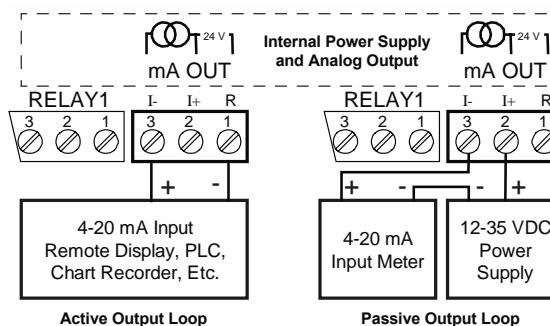


Figure 19. 4-20 mA Output Connections

## Analog Output Transmitter Power Supply

The internal 24 VDC power supply powering the analog output may be used to power other devices if the analog output is not used. The I+ terminal is the +24 V and the R terminal is the return.

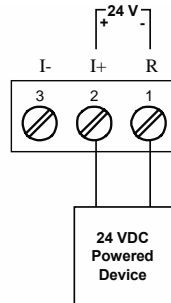
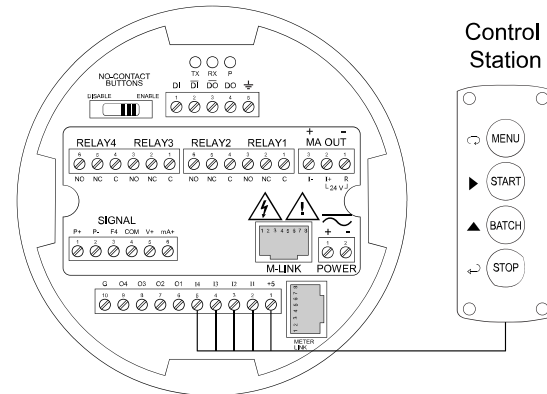


Figure 20. Analog Output Supply Powering Other Devices

## Remote Programming

The controller 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.



\* Control station must be approved for hazardous locations



## Setup and Programming

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

### Overview

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

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





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





### LED Status Indicators



LED	State	Indication
1-4	Steady	Alarm condition based on set and reset points, independent of relay status in certain configurations.
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	Description
 	<b>Menu</b>
 	<b>START</b> Right Arrow/F1

Button	Description
 	<b>BATCH</b> Up Arrow/F2
 	<b>STOP</b> Enter/F3

- Press the Menu button to enter or exit the Programming Mode at any time.
- Press the Right arrow button to move to the next digit during digit or decimal point programming.
- Press 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 controller.

## 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 and Messages

The controller 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 and Messages		
Display	Parameter	Action/Setting Description
ሂፔትሆፕ	Setup	Enter Setup menu
ከፑህት	Input	Enter Input selection menu
ህዕረት	0-10 VDC	Set input for ±10 VDC input
ጠገዳ	4-20 mA	Set input for 4-20 mA input
ፎቲዲ	Total	Enable or disable totalizer features
ህክሪያ	Units	Select the display units/tags
ጥይድ	Rate	Select the display units for rate
ፎቲዲ	Total	Select the display units for total
ፎቲዲ	Grand Total	Select the display units for grand total
ወርህ	Decimal point	Set decimal point for rate, total, grand total
ፕሮግራም	Program	Enter the Program menu
ከፎካሊ	Input Calibration	Enter the Input Calibration menu
ሂፎካሊ	Scale	Enter the Scale menu
ካሊብሬት	Calibrate	Enter the Calibrate menu
ከፑ 1	Input 1	Calibrate input 1 signal or program input 1 value
ወርህ 1	Display 1	Program display 1 value
ከፑ 2	Input 2	Calibrate input 2 signal or program input 2 value (up to 32 points)
ወርህ 2	Display 2	Program display 2 value (up to 32 points)
Error	Error	Error, calibration not successful, check signal or programmed value
ፎቲዲ	Total time base	Enter totalizer time base for seconds, minutes, hours or day.
ፎቲዲ	Total conversion factor	Enter the conversion factor decimal point and the conversion factor.
ጠገዳ	Batch mode	Automatic or manual batch control
ፎቲዲ	Time delay	Set time delay for automatic batch restart
ፎቲዲ	Grand total time base	Program grand total time base

Display Functions and Messages		
Display	Parameter	Action/Setting Description
ፎቲዲ	Grand total conversion factor	Program grand total conversion factor
ፎቲዲ	Grand total reset	Program grand total reset mode: auto or manual
ወርህ	Display	Enter the Display menu
ፎቲዲ 1	Display Line 1	Press Enter to assign the main display parameter (default: PV or rate)
ፎቲዲ 2	Display Line 2	Press Enter to assign the second display parameter (default: total)
ወርህ	Display intensity	Set display intensity level from 1 to 8
ጥይድ	Relay	Enter the Relay menu
ጥይድ	Assignment	Assign relays to rate, total (batch control), grand total, or Modbus controlled.
ጥይድ 1	Assign 1	Relay 1-2 assignment
ፎቲዲ	Total	Assign relay to batch control
ፎቲዲ	Grand total	Assign relay to grand total
ጥይድ	Modbus	Assign relay to Modbus input
ጥይድ	Rate	Assign relay to rate
ፕሮግራም	Batch total relay pre-close	For relays beyond the first assigned to total, a pre-close amount may be entered.
ጥይድ 1	Relay 1	Relay 1 setup
ጥይድ 1	Action 1	Set relay 1 action <sup>1</sup>
ጥይድ	Automatic	Set relay for automatic reset
ጥይድ	Auto-manual <sup>1</sup>	Set relay for automatic & manual reset any time <sup>1</sup> (relays assigned to rate)
ጥይድ	Latching <sup>1</sup>	Set relay for latching operation (relays assigned to rate) <sup>1</sup>
ጥይድ	Latching-cleared <sup>1</sup>	Set relay for latching operation with manual reset only after alarm condition has cleared (relays assigned to rate) <sup>1</sup>
ጥይድ	Alternate	Not applicable to batch controller
ጥይድ	Sampling	Set relay for sampling operation (rate or GT)
ጥይድ	Off	Disable relay and front panel status LED (Select Off to enable Interlock feature)
ፕሮግራም	Preset	Set batch preset
ፎቲዲ 1	Set 1	Program set point 1

Display Functions and Messages		
Display	Parameter	Action/Setting Description
Reset 1	Reset 1	Program reset point 1
Relay 2	Relay 2	Relays 2-4 setup.
Fail-safe	Fail-safe	Enter <i>Fail-safe</i> menu
Fail-safe 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 <i>Time Delay</i> menu
Delay 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
break	Loop break	Set relay condition if loop break detected (For mA input only)
Ignore	Ignore	Ignore loop break condition (Processed as a low signal condition)
On	On	Relay goes to alarm condition when loop break is detected
Off	Off	Relay goes to non-alarm condition when loop break is detected
Route	Analog output	Enter the <i>Analog output</i> scaling menu
Display 1	Display 1	Program display 1 value
Output 1	Output 1	Program output 1 value (e.g. 4.000 mA)
Display 2	Display 2	Program display 2 value
Output 2	Output 2	Program output 2 value (e.g. 20.000 mA)
Reset	Reset	Press Enter to access the <i>Reset</i> menu
Reset Hi	Reset high	Press Enter to reset max display
Reset Lo	Reset low	Press Enter to reset min display
Reset HL	Reset high & low	Press Enter to reset max & min displays
Reset t	Reset total	Press Enter to reset total
Reset Gt	Reset grand total	Press Enter to reset grand total
Reset bc	Reset batch count	Press Enter to reset batch count

Display Functions and Messages		
Display	Parameter	Action/Setting Description
Control	Control	Enter Manual Control menu
Auto	Automatic	Press Enter to set controller for automatic operation
man	Manual	Press Enter to manually control relays or analog output operation
PR55	Password	Enter the <i>Password</i> menu
PR55 1	Password 1	Set or enter Password 1
PR55 2	Password 2	Set or enter Password 2
PR55 3	Password 3	Set or enter Password 3
total	Total password	Set or enter password for manual reset
Grand total	Grand total password	Set or enter password for manual reset
non-reset	Non-resettable	Non-resettable grand total set after entering "050873" for Gtotal password
unlock	Unlocked	Program password to lock controller
lock	Locked	Enter password to unlock controller
999999 -999999	Flashing display	Overrange condition Underrange condition

#### IMPORTANT

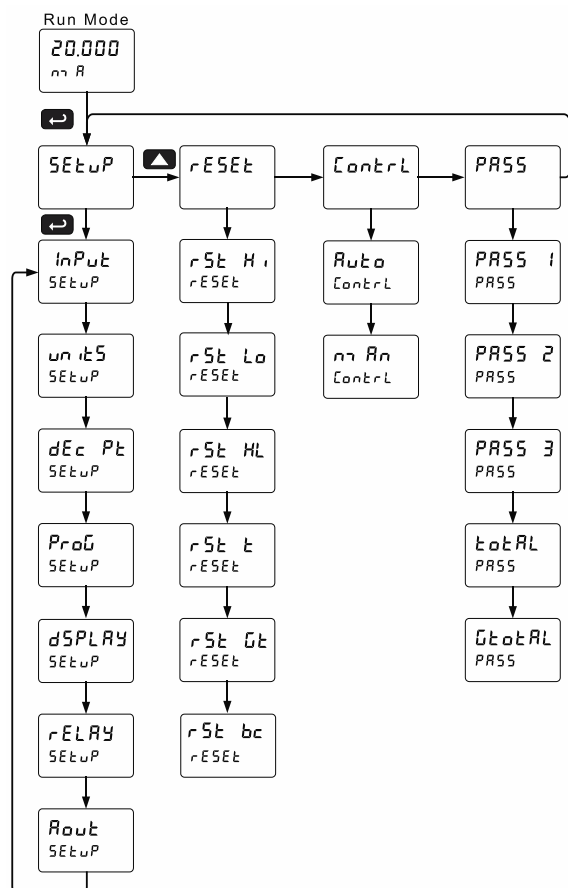
- During operation, only the STOP button will function, to stop/pause the batch. As a result, relay alarms cannot be manually reset.



## Main Menu

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

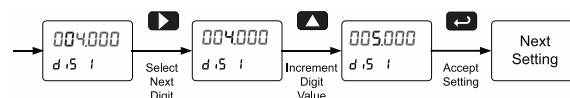
- Press Menu button when a batch is not running to enter Programming Mode then press the Up arrow button to scroll main menu.
- Press Menu, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing Enter are not saved.
- Changes to the settings are saved to memory only after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



## Setting Numeric Values

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

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

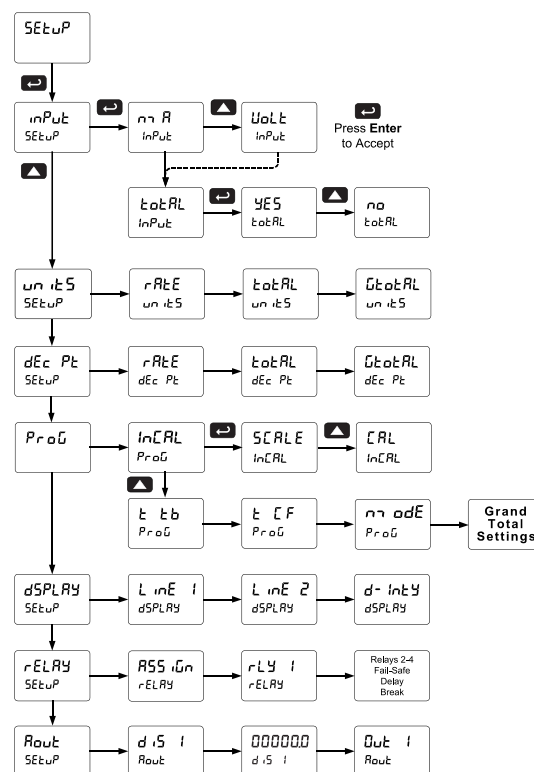


## Setting Up the Batch Controller (SEtUP)

The *Setup* menu is used to select:

- Input signal the controller will accept
- Enable or disable totalizer and batching features
- Select the display units/tags
- Decimal point position
- Program menu for scaling or calibration, totalizer setup, manual or automatic batch mode
- Display parameter and intensity
- Relay operation
- 4-20 mA analog output scaling

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



## Setting the Input Signal (InPut)

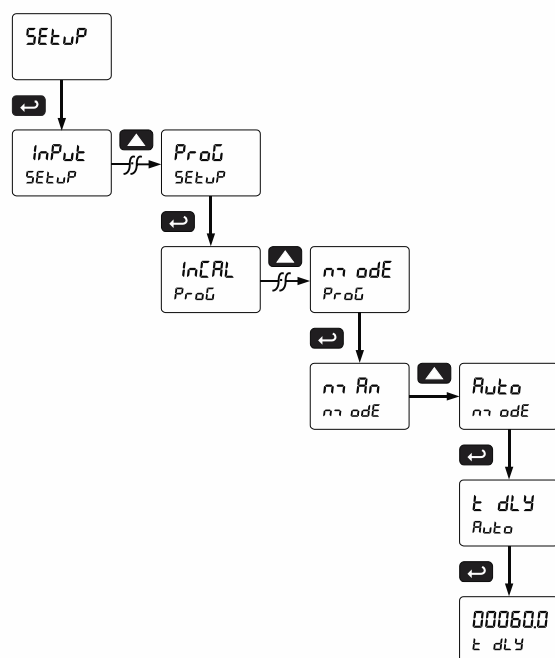
Enter the *Input* menu to set up the controller to accept current (mA) or voltage (VDC) inputs.

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

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

## Setting the Totalizer & Batch Control Features (Totalizer)

After the input type is entered, set the *Totalizer* parameter to "YES" to enable batch control (this is set by default). If the *Totalizer* features are disabled, most batching features and functions are hidden from the menus.



## Setting the Input Units or Custom Tags (Units)

Enter the input unit or custom tag that will be displayed if alternating rate, total, or grand total and units is selected in the *Units* menu, or *Second display* parameter. See the *Setting the Display Parameter & Intensity (dSPILAY)* flow chart on page 42 to access the display menu to show the unit or tag on the second display. The engineering units or custom legends can be set using the following 7-segment character set:

Display	Character
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	A
b	b
C	C
c	c
d	d
E	E
F	F
G	G
g	g
H	H
h	h
I	I
i	i
J	J

Display	Character
K	K
L	L
m	m
n	n
O	O
o	o
P	P
q	q
r	r
S	S
t	t
u	u
V	V
w	w
X	X
Y	Y
Z	Z
-	-
/	/
[	[
]	]
=	=
Degree(<)	Degree(<)
Space	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 controller.

Press the Up arrow to move the decimal point one place to the left. Press the Right arrow to move the decimal point one place to the right.

## Programming the Batch Controller (Prog)

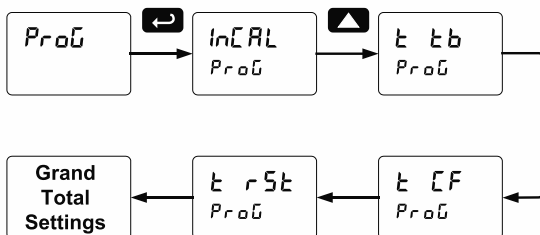
The controller may either be scaled (SCALE) without applying an input or calibrated (CAL) by applying an input. The controller comes factory calibrated to NIST standards, so for initial setup, it is recommended to use the (SCALE) function.

The *Program* menu contains the following menus:

1. Input Calibration
  - a. Scale without a signal source
  - b. Calibrate with a signal source
2. Total time base & conversion factor
3. Batch mode
  - a. Manual batch control
  - b. Automatic batch control
4. Grand total time base & conversion factor
5. Grand total reset mode
  - a. Manual reset
  - b. Automatic reset with time delay

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

**Note:** The Scale and Calibrate functions are exclusive of each other. The controller 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 controller. See *Multi-Point Linearization (LINEAR)* menu on page 62 for details.

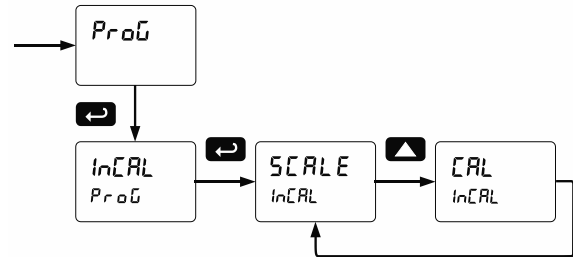


Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu; see *Advanced Setup & Programming* on page 59.

## Input Calibration Method (InCAL)

There are two methods of calibrating (or scaling) the display to show the correct engineering units.

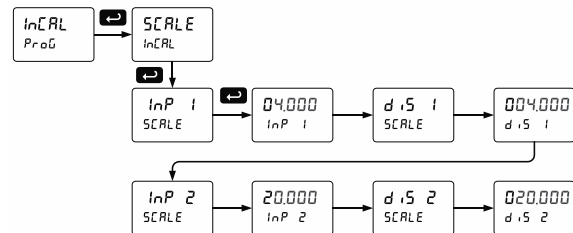
- Use the *Scale* menu to enter the scaling without a signal source.
- Use the *Calibrate* menu to apply a signal from a signal source.



**Note:** The Scale and Calibrate functions are exclusive of each other. The controller 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 controller. See *Multi-Point Linearization (LINEAR)* menu on page 62 for details.

## Scaling the Controller (SCALE)

The 4-20 mA and the  $\pm 10$  VDC inputs can be scaled to display the process variable in engineering units. A signal source is not needed to scale the controller; simply program the inputs and corresponding display values.



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

### IMPORTANT

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

### Error Message (Error)

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

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

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

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

### Minimum Input Span

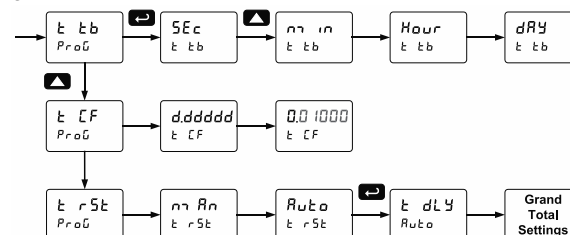
The minimum input span is the minimum difference between input 1 and 2 signals required to complete the calibration or scaling of the controller.

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

### 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<sup>3</sup>, 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 10,000 gallons per minute and the total conversion factor was 0.001, the total would increase by 10 every minute. This is useful, for instance, if you want to show rate in gallons and total in thousands of gallons.

## Batch Start Mode (הסדף)

### Manual Batch Control

The batch controller may operate in manual or automatic mode. In manual mode, the controller operates as described in *Manual Batch Control* on page 55.

### Automatic Batch Control

In automatic mode, the controller operates as described in *Automatic Batch Control* on page 56.

The batch process will start when the operator presses the START button and it will automatically restart after a completed batch. The time delay for the restart may be 0.1 to 999.9 seconds (הדלף).

Automatic batch start will only occur after a successful batch. A manually stopped batch will require a manual start to begin a new batch process.

### Grand Total Reset

The grand total can be programmed for manual or automatic reset. In the automatic reset mode, a programmable time delay is available to reset the 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.

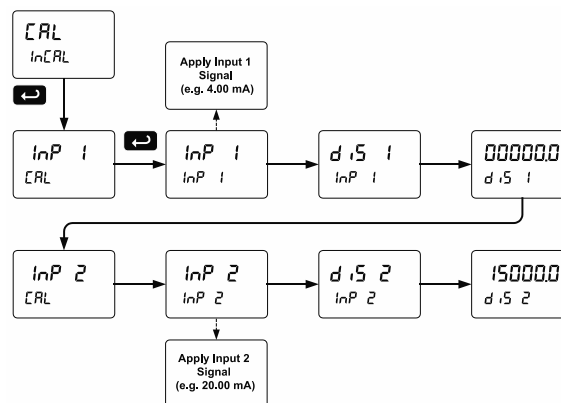
### Non-Resettable Totalizer

The grand total can be programmed as a non-resettable total, see *Grand Total Reset Password & Non-Resettable Total* on page 52 for details.

## Calibrating the Controller with External Source (ערל)

The controller can be calibrated to display the process variable in engineering units by applying the appropriate input signal and the corresponding display value.

The use of a calibrated signal source is strongly recommended to calibrate the controller.



**Note:** Inputs for the above example are:  
Input 1: 4.00 mA; Display 1: 0.0 Gallons  
Input 2: 20.00 mA; Display 2: 15000.0 Gallons

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



## Setting the Display Parameter & Intensity (dSPLY)

Display line 1 (LINE 1) can be programmed to display:

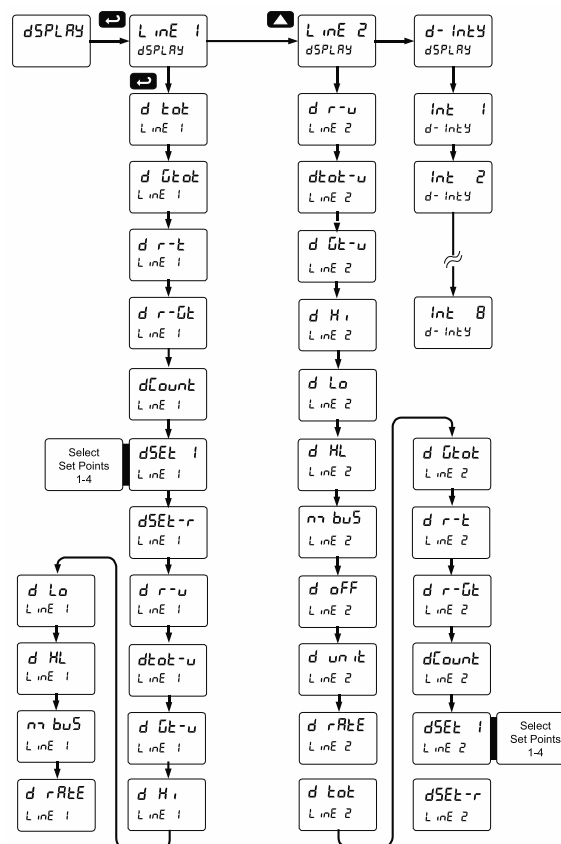
1. Display total
2. Display grand total
3. Toggle rate and total
4. Toggle rate and grand total
5. Display batch count
6. Relay set points
7. Toggle preset and rate
8. Toggle rate and units
9. Toggle total and units
10. Toggle grand total and units
11. Display max and min values
12. Display Modbus input
13. Display rate value

Display line 2 (LINE 2) can be programmed to display:

1. Toggle rate and units
2. Toggle total and units
3. Toggle grand total and units
4. Display max and min values
5. Display Modbus input
6. Off (no display)
7. Display rate units
8. Display rate
9. Display total
10. Display grand total
11. Toggle rate and total
12. Toggle rate and grand total
13. Display batch count
14. Relay set points
15. Toggle preset and rate

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 controller.

## Display Menu



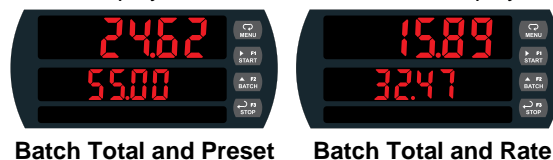
## Display Intensity (d- IntY)

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

## Display Configurations

The main and second displays may be assigned to rate, total, grand total, batch count, preset, set points, units (second display only), alternating R & T, R & GT, preset & rate, max & min, or a Modbus display register. Any rate/total/grand total display may be programmed to alternate with a custom unit or tag. The default display configuration consists of a main display of batch total and a second display of the batch preset.

The display can also be set up, so batch total is on the main display and rate is on the second display.



Batch Total and Preset

Batch Total and Rate

## Setting the Relay Operation (rELAY)

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

### ⚠ CAUTION

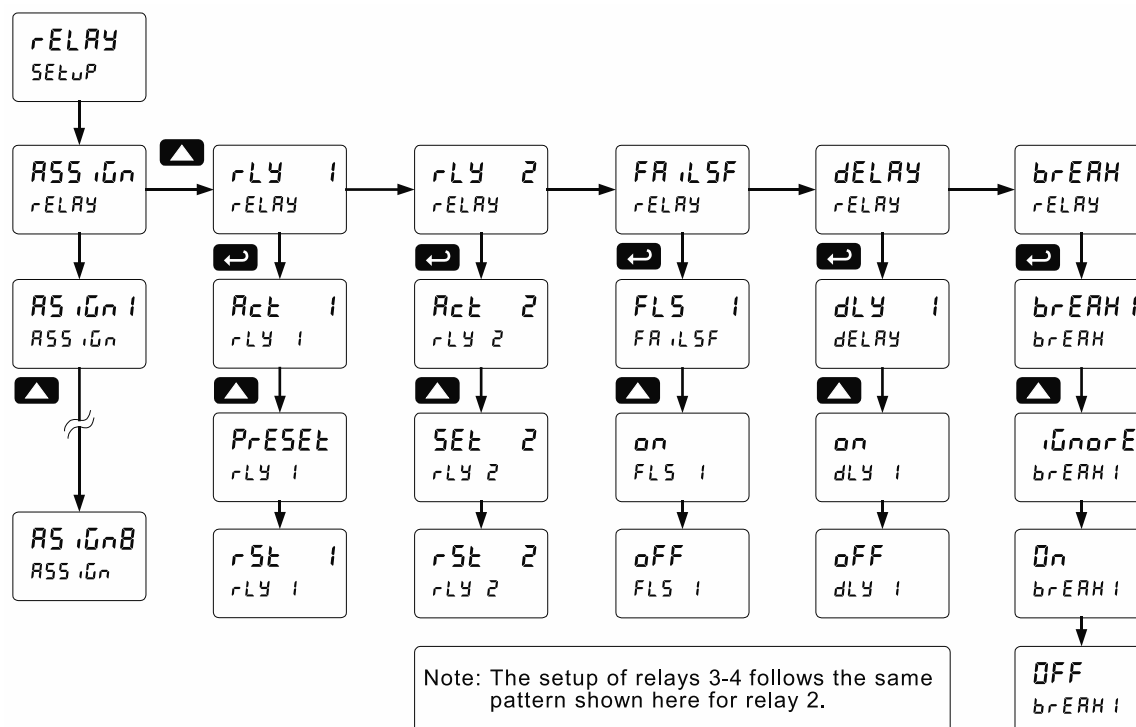
- During setup, the relays do not follow the input and they will remain in the state found prior to entering the Relay menu.

- Relay assignment
  - Rate for low and high alarm
  - Total for batch control relays
  - Grand total for grand total alarms
- Relay action
  - Automatic reset only (non-latching)
  - Automatic + manual reset when not in a batch process (non-latching)
  - Latching (manual reset when not in a batch process only)
  - Latching with Clear (manual reset when not in a batch process only after alarm condition has cleared)
  - Pump alternation control (Not applicable to batch control)
  - Sampling (the relay is activated for a user-specified time and may be assigned to rate or grand total)
  - Off (relay state can be controlled by Interlock feature)
- Set and reset points; batch preset
- Fail-safe operation
  - On (enabled)
  - Off (disabled)
- Time delay
  - On delay (0-999.9 seconds)
  - Off delay (0-999.9 seconds)
- Relay action for loss (break) of 4-20 mA input (ignore, on, off)

**Note:** Fail-safe should not be used for relays assigned to batch control.

### ⚠ CAUTION

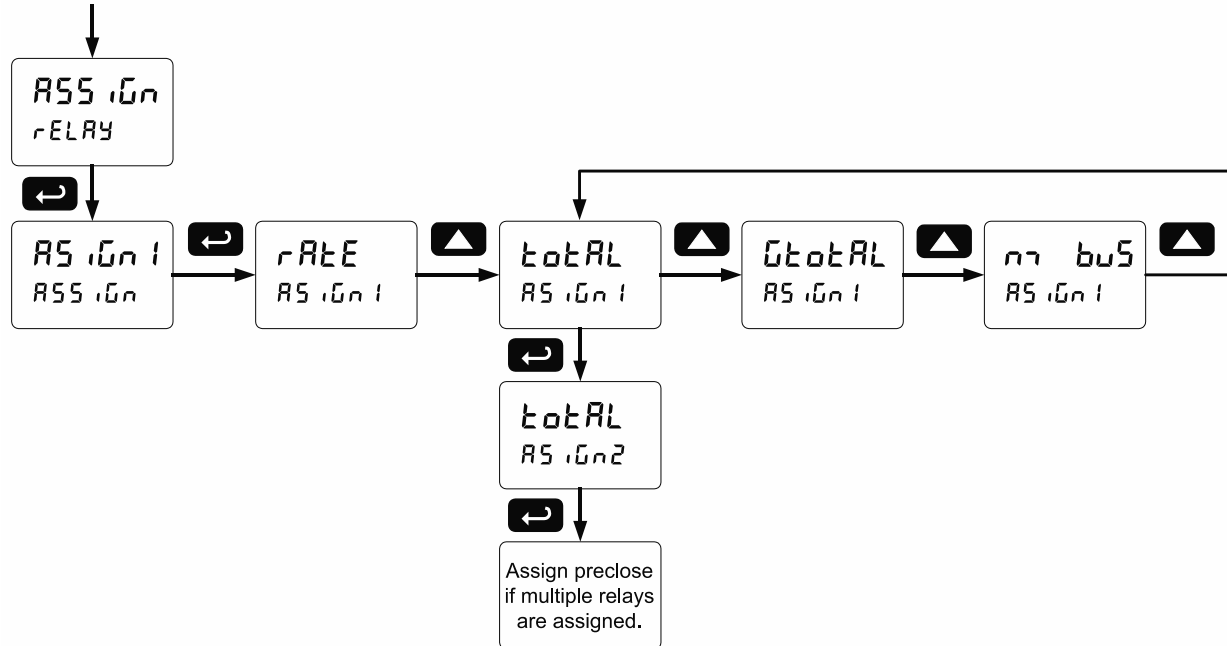
- The rate alarms are active only during a batch process. As a result, rate alarms should not be programmed with manual reset, as they cannot be manually reset during a batch process, the only time they are active.



## Relay Assignment (R55, iGn)

The relays can be assigned to any of the following parameters:

1. Rate for low or high alarm indication
2. Total for batch control relays
3. Grand total for alarm indication or sampling



### ⚠ IMPORTANT

- Relay 1 should always be assigned to "total" for batch control applications.

## Setting the Relay Action

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

1. Always set to Auto for Batch control operation. Also for automatic reset (non-latching) of alarms.
2. Sampling (the relay is activated for a user-specified time)
3. Off (relay state can be controlled by Interlock feature)

In addition, the following relay actions may be programmed. These actions are not appropriate for batch control applications but may be used when the controller is in other applications.

4. Automatic + manual reset when not in a batch process (non-latching)
5. Latching (manual reset only, when not in a batch process)
6. Latching with Clear (manual reset only when not in a batch process after alarm condition has cleared)
7. Pump alternation control (not applicable to batch control)

## Setting Batch Control Relays

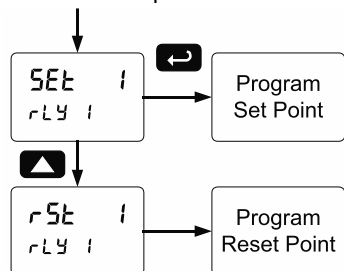
Operation of batch control relays are programmed in the *Assign* menu by selecting **Set RL** as the assignment. Relays set to **Set RL** beyond the first relay will include a pre-close parameter (**PreCL5**) option. Selecting **YES** for **PreCL5** will enable multi-stage batching with pre-close, and the valve will close prior to the end of the batch at volume equal to the preset value minus the pre-close amount entered. Selecting **no** for **PreCL5** will have the relay perform identically to the first batch control relay set to **Set RL**.

## Programming Alarm Set and Reset Points

High alarm: program set point above reset point.

Low alarm: 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. Failsafe mode should not be used on batch relays assigned to total.

## Programming Time Delay

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

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

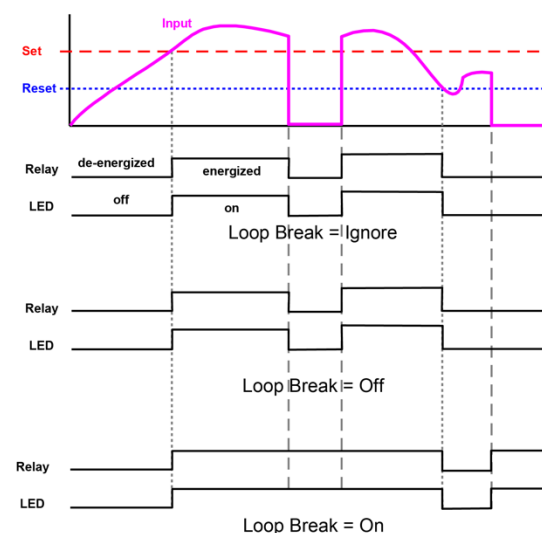
The *Off* time delay is associated with the reset point.

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

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

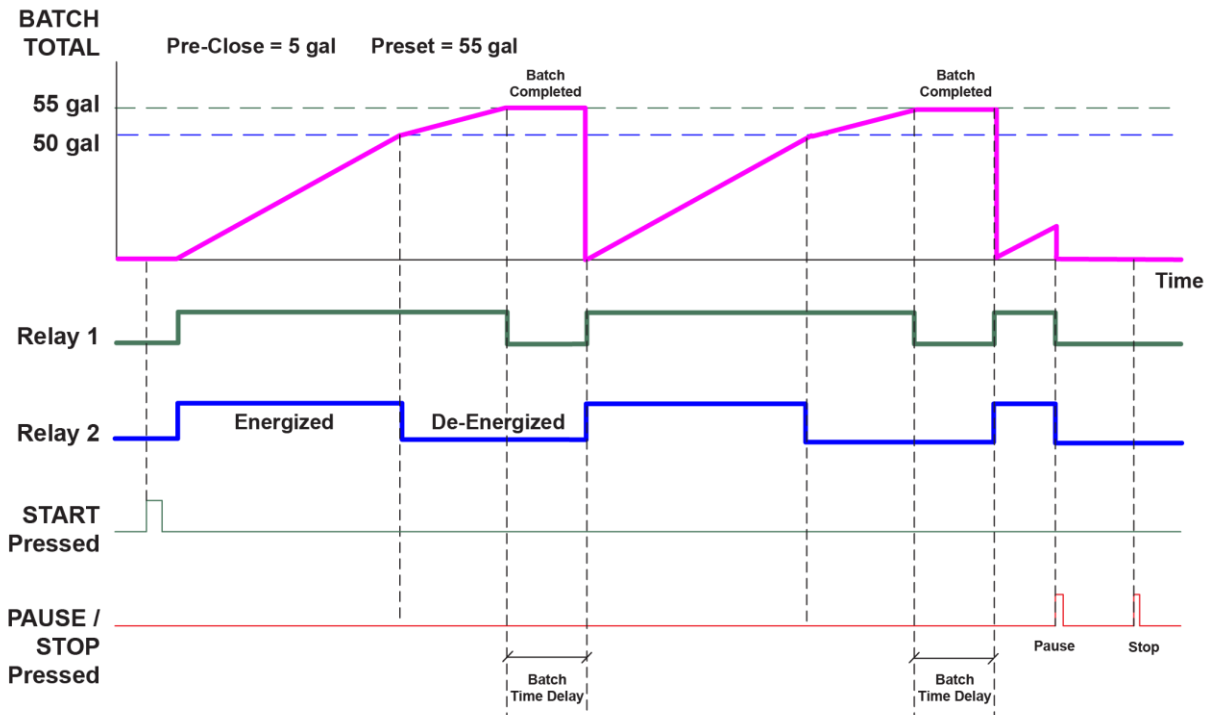
1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
3. Ignore (Process as a low signal condition)

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



## Automatic Batch Control Operation

The following graph shows automatic batch operation.



When START is pressed, a short delay occurs before the low flow alarm sensing is activated. Each relay can be programmed with additional ON delay to satisfy various conditions and applications.

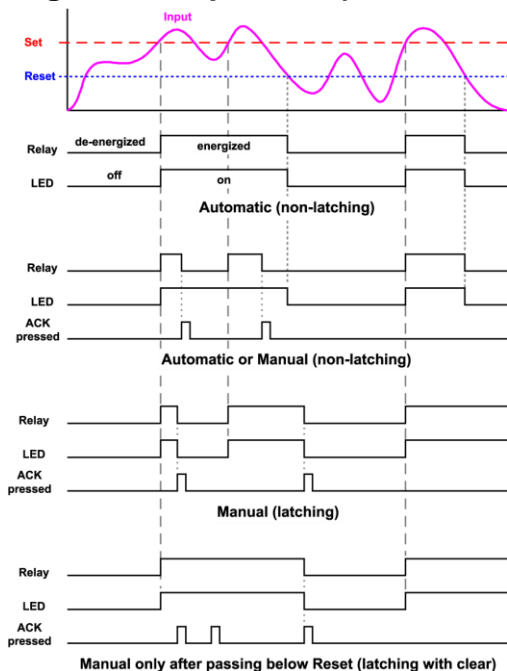
1. START button is pressed
2. Both relays are energized opening both valves controlling the flow
3. At 50 gallons (pre-close = 5 gal), relay 2 closes the main valve
4. At 55 gallons (preset = 55 gal), relay 1 closes the dribble valve
5. After the Batch Time Delay elapses, a new batch starts automatically without the operator's intervention.



## Relay and Alarm Operation Diagrams

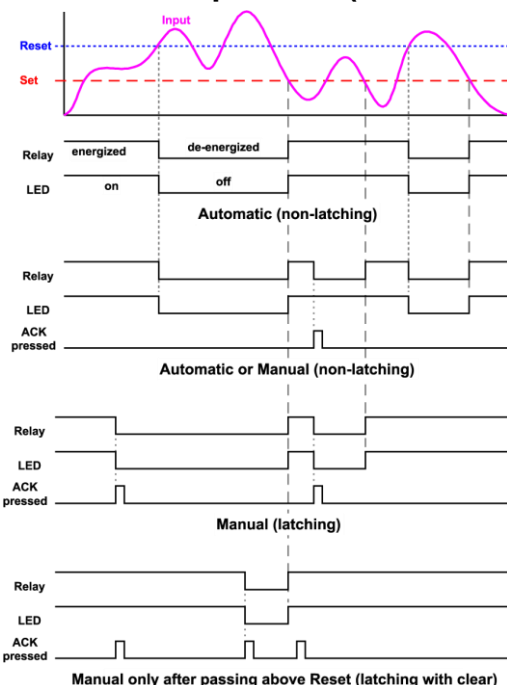
The following graphs illustrate the operation of the relays, status LEDs, and ACK button.

### High Alarm Operation (Set > Reset)



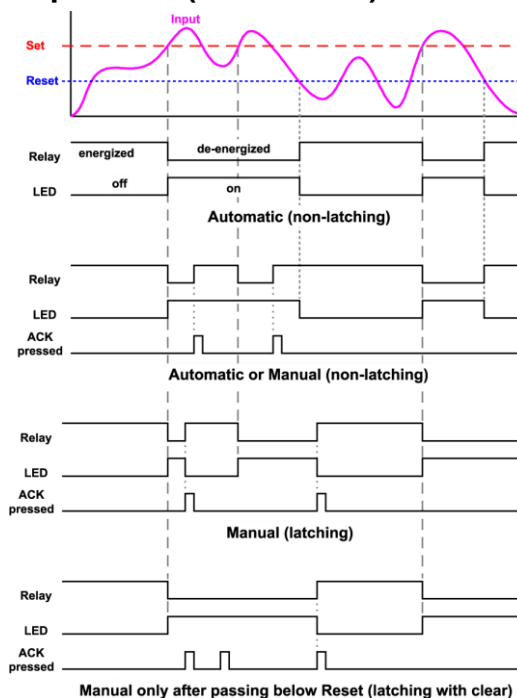
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

### Low Alarm Operation (Set < Reset)



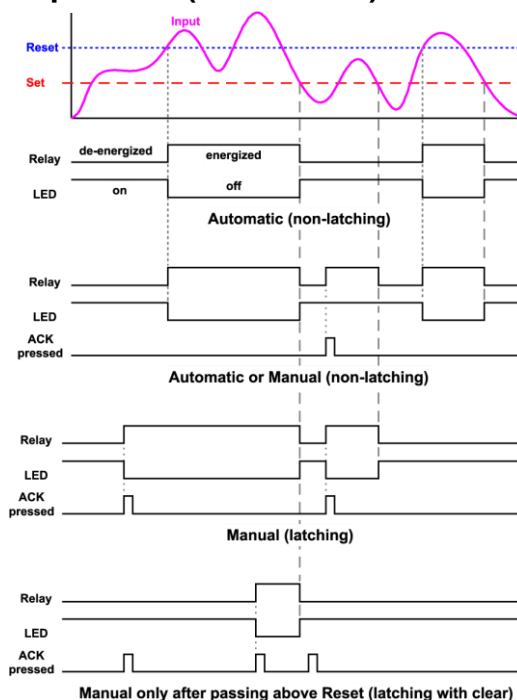
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

### 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.

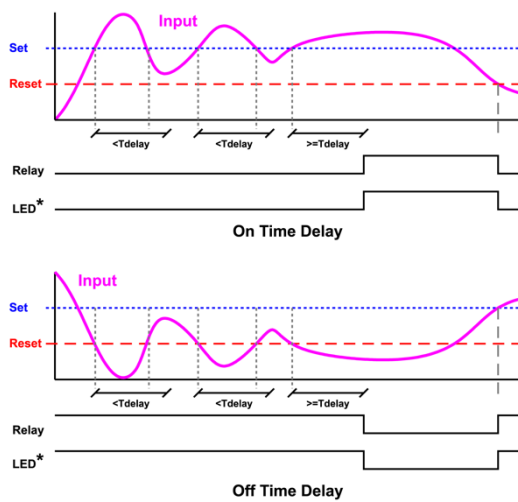
### Low Alarm with Fail-Safe Operation (Set < Reset)



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

## Time Delay Operation

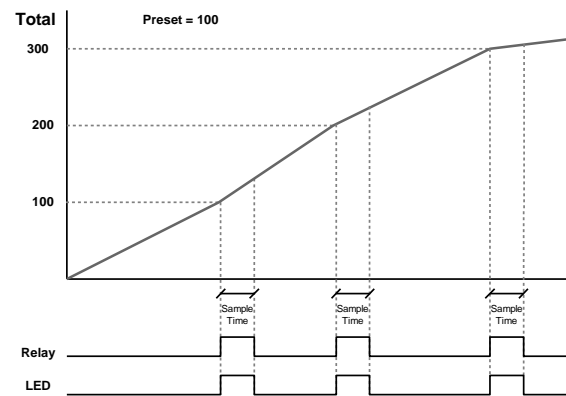
The following graphs show the operation of the time delay function.



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 (R-n Rn)" 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 relays of the controller can serve three roles, as batch control relays for single or multi-stage batching, as rate or grand total alarm, or as a sampling relay based on grand total or rate alarm.

These capabilities include front panel alarm status LEDs and 4 relays.

The relays used for batch control (total) are activated when the batching process starts and deactivate when the batch total is reached. The relays assigned as pre-close are deactivated when the batch reaches the preset value minus the pre-close value.

For an example of batch control operation, see *Batch Control Operation Example* on page 54.

Typical applications for alarms are low flow and high flow alarms or grand total limit alarms. Note that rate alarms are only activated during a batch process and deactivated when the process is stopped.

The relays can also be set for sampling, where the relay will activate for a specific amount of time after a certain grand total has been reached (e.g. 10 seconds sample relay activation every 100 gallons batched).

There are three basic ways the relays can be used:

1. Batch Control (Total)
2. High or Low Alarms for Rate or Grand Total
3. Sampling (Based on Grand Total and Sample Time)

### Relays Initialization

Batch control (total) relays will activate when the start function is enabled, such as when the START button is pressed. Rate alarm relays will enable and initialize to their programmed states when the batch process is started. Grand total alarm relays will initialize to their programmed state at controller power-up.

### Fail-Safe Operation

The following table indicates how alarm 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 in de-energized state
On	Closed	Open	Open	Closed	Relays in energized state

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

### Front Panel LEDs

The alarm status LEDs on the front panel are available on all controllers and provide status indication for the following:

LED	Status
1	Batch Relay 1
2	Batch Relay 2
3	Low Flow Alarm
4	High Flow Alarm

The controller is supplied with 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. Note that rate alarms are only activated during a batch process, and they are deactivated when the process is stopped.

Latching relays, or relays with manual reset, are not recommended when using this controller for batch control, as the manual reset will not be acknowledged during a batch process, when the rate alarms are active. For information on latching and manual reset alarms, see the [PD8-6200](#) instruction manual.

### Automatic Reset (Reset)

In this application, the controller 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

### Pump Alternation Control

Pump alternation control is not recommended when using this controller for batch control, as it is used only in level applications, and not with rate, total, or batching applications.

## Sample Relay Operation

The sampling function allows the operator to set a set point for a “sampling” relay. This can be done for the rate, total, or grand total. Each time the relay reaches the set point, it will close that relay’s contacts for a programmed period set by the user.

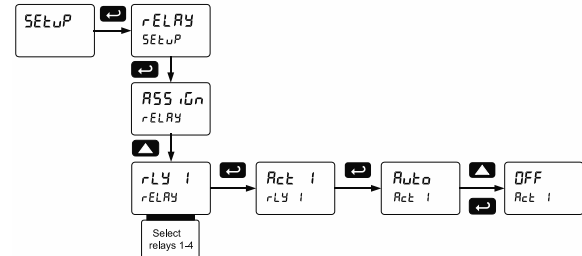
A rate sampling relay will activate for the sample time (SRNT), every time the set point rate is reached.

A total sampling relay will activate for the sample time (SRNT), every time the process has batched the amount programmed for the set point (See the diagrams on page 48 more details). The utility of this function can, of course, be expanded beyond sampling and be used whenever a timed relay output closure is required after the batch total interval reaches a certain set point.

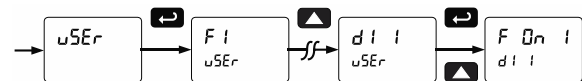
## Setting Up the Interlock Relay (Force On) Feature

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

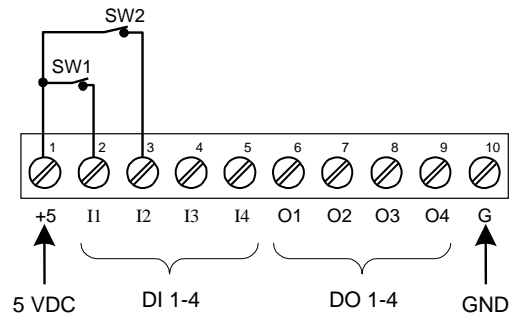
1. Access the *Setup – Relay – Action* menu and set the action to off.



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 +5 V terminal and the corresponding digital input (DI-1 to DI-4) terminal.



## Interlock Relay Operation Example

Relays 3 & 4 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 controller remotely.

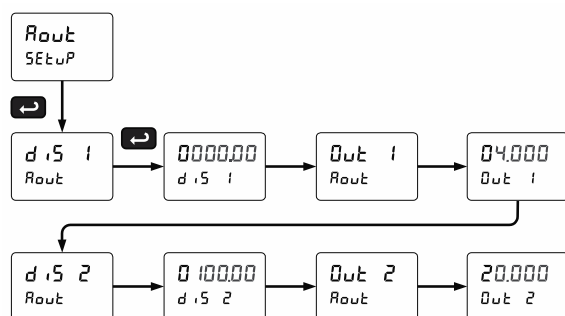
## Scaling the 4-20 mA Analog Output (Rout)

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

For further details, see *Setting Numeric Values* on page 37, *Analog Output Value for Loss of 4-20 mA Input (Loop Break)* on page 63.

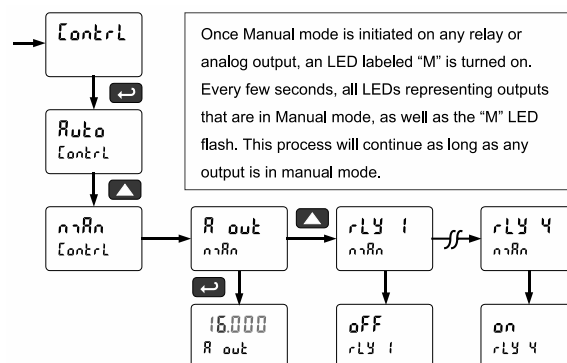


## Reset Menu (rESEt)

The *Reset* menu is used to reset the total, grand totals, batch count, maximum, or minimum reading (peak or valley) reached by the process; both maximum and minimum may be reset at the same time by selecting “reset high & low” (r5t HL).

## Manual Control Menu (Control)

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





## Setting Up the Password (PR55)

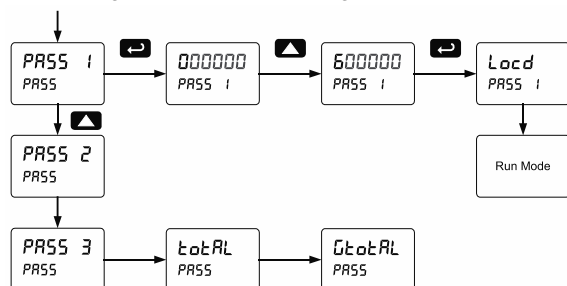
The *Password* menu is used for programming three levels of security to prevent unauthorized changes to the programmed parameter settings and to program the non-resettable totalizer.

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 Password: Prevents resetting the total manually  
 Gtotal Password: Prevents resetting the grand total manually

### Protecting or Locking the Controller

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

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



### Grand Total Reset Password & Non-Resettable Total

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

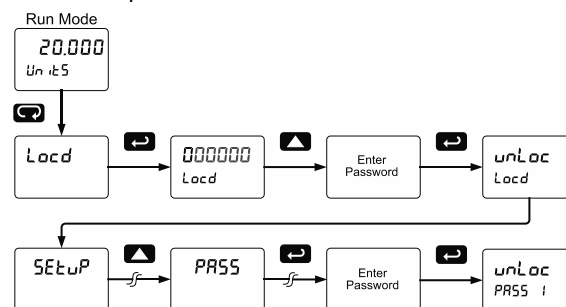
- Once the Grand Total has been programmed as "non-resettable" the feature **CANNOT** be disabled.

## Making Changes to a Password Protected Controller

If the controller is password protected, the controller 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 controller 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 controller is now unprotected until a new password is entered.



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

If the password entered is incorrect, the controller 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 controller.

## Controller Operation

When installed, the primary way to operate the controller 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 controller by connecting a hazardous area-approved control station or switch to one of the digital inputs. These can be used to perform various operations on the controller based on the Programmable Function Keys. Finally, certain operations can be performed on the controller with MeterView Pro software or through Modbus commands.

The three default operations that can be performed with the controller's CapTouch buttons are:





1. Set the batch size
2. Start the batch
3. Pause/Stop the batch

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 64.

Watch Batch Control Video at  
[www.prediq.com/videos/KN6Y6R0I1OE](http://www.prediq.com/videos/KN6Y6R0I1OE)

## Button Operation

The following table shows the default operations for the F1, F2, and F3 CapTouch Buttons: setting the batch size, starting the batch, and stopping the batch.

Button Symbol	Description
	Press to enter or exit Programming Mode or view settings
	Press to start the batch or other function assigned through the <i>User</i> menu
	Press to set the batch size or other function assigned through the <i>User</i> menu
	Press to pause/stop the batch or other function assigned through the <i>User</i> 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.

## Default Batch Control Operation

The following describes the operation of the three front panel operating keys as programmed with default settings.

### START Button

Press the START button to begin a new batch process. Press the START button to resume a batch that has been stopped.

### BATCH Button

Press the Batch button to access the Preset (batch amount) menu. Program the batch with the arrow keys, and confirm with the Enter key.

### STOP Button

Press the STOP key once during a batch to pause. Press the STOP key while paused to stop and cancel the batch. Press the STOP key while in stop/ready mode to cycle the second display parameters: preset, grand total, and batch count (or other parameter assigned to the second display).

### WARNING

- **Only STOP Button Enabled if a Batch is Running.** During a batch process, only the pause/stop functions are operational, other buttons are deactivated.

## Batch Control Operation Example

The following example shows how two-stage batch control functions with a PD8-6210. This setup will establish a 55 gallon preset for the batch, with a main valve (high flow) that will close at 50 gallons, and a trickle valve (low or restricted flow) that will close at 55 gallons. After the batch, the next container will hold 80 gallons, so the preset will be changed to 80.

### Two-Stage Batch Control Setup Using Relays 1 & 2

The following table shows the parameters as they appear within the **SETUP** menu entry **RELAY**.

Parameter	Setting	Function
RELAY	R55 :On	Press Enter to enter the relay assignment parameters.
R5 :On1	to RL	Assign relay 1 to batch total control.
R5 :On2	to RL	Assign relay 2 to batch total control.
PRECL5 to RL		Press Enter to access pre-close selection for multi-stage control.
PRECL5	YES	Yes, to enable a pre-close value for relay 2.
YES	000050	Set the pre-close value to 5 for closing the valve controlling relay 2 five gallons before reaching the preset.
...		Assignment for relays 3-4.
RLY 1 RELAY		Select relay 1 setup.
RLY 1 Rct 1		Configure activation of relay 1.
Rct 1	Auto	Always set to Auto for batch control function.
RLY 1 PRESET		Set the preset value for batch control.
PRESET	000550	Set 55 gallons as the preset.
...		Setup for relays 3-4.

The operation of relay 2 has already been assigned for multi-stage control pre-close and will not appear as a selection in the **RELAY** menu.

If only single stage batch control with one relay for control is desired, set the assignment of relay 2, **R55 :On2**, to off, rate, or grand total.

The following pages show an illustration of how the above settings control the batch operation. The display assignment shown is the default.

## Manual Batch Control

The manual batch control feature is used for batch processes where each batch must be started by the operator. The following diagrams demonstrate a typical manual batch operation with an optional hazardous area-approved remote control station. The batch could also be controlled using the through-glass buttons on the controller.

### Manual Batch Control Operation

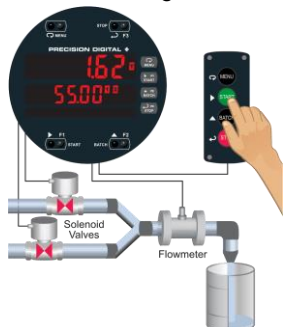
#### 1. System Setup

Both valves are closed with an empty barrel in place. The batched total is displayed in the main display, the preset is selected for the second display.



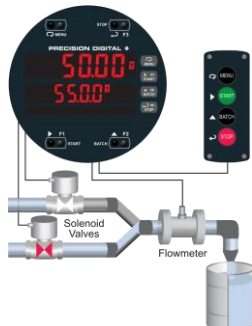
#### 2. Batch Start

The START button is pressed. Both valves open. The barrel begins to fill.



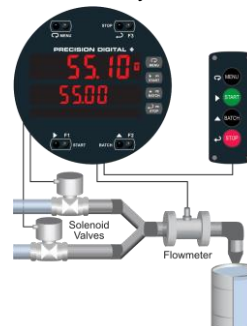
#### 3. Preclose Valve

When the batch total reaches a value of 50.00 (Preset [55.00] – Pre-close [5.00]) the full-flow valve closes. The fill rate of the tank slows as a result.



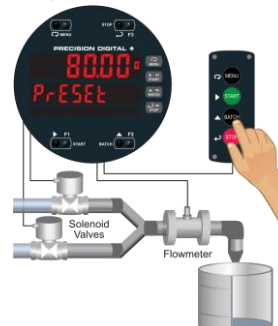
#### 4. Completed Batch

When the batch is complete, the restricted-flow valve closes. If overrun occurs, then the next batch will adjust for this offset amount to maintain accuracy.



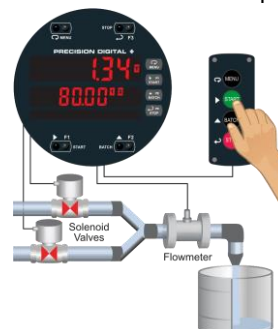
#### 5. Change Preset

After placing a new, empty barrel, a new preset fill amount may be selected with the Batch key, while the process is stopped.



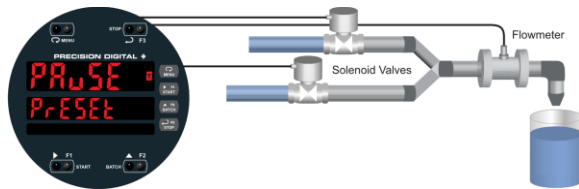
#### 6. Begin New Batch

The new batch begins when the START button is pressed, causing both relays to activate and both valves to open.



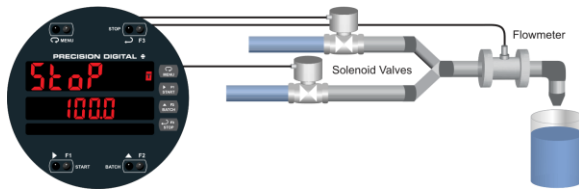
## Additional Features

### Pause Batch



At any time during the batch, the STOP button may be pressed to pause the process.

### Stop Batch



When paused, pressing the START button will continue the batch, and pressing the STOP button again will cancel the batch.

### STOP Mode



When in STOP mode, the STOP button may be pressed to cycle through alternative parameters to be displayed on the second display, including the grand total, batch count, and preset.

### Reset

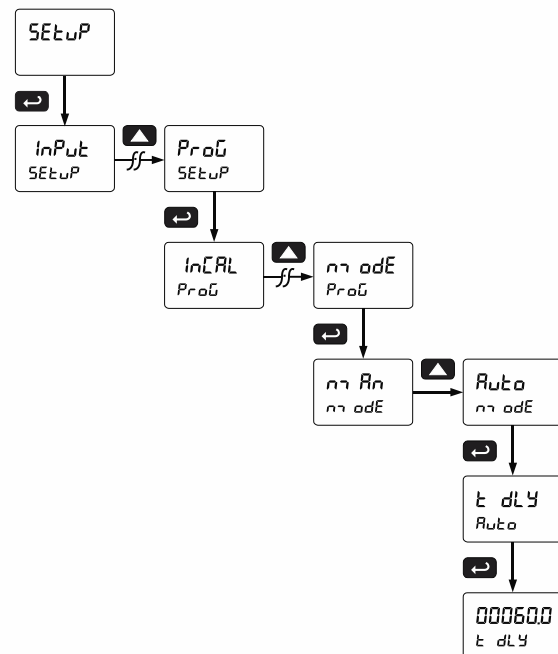
The grand total and batch count may be reset in the rESEt menu by pressing the MENU button and entering the reset menu. It may also be reset with digital inputs.

## Automatic Batch Control

The automatic batch control feature is used for batch processes where the batch size does not change, or the operator wants the next batch to start automatically after the previous batch is complete. The following diagrams demonstrate a typical automatic batch operation.

### Setup for Automatic Batch Control

The batch controller can be configured to automatically start a new batch after the selected time delay between batches has elapsed.



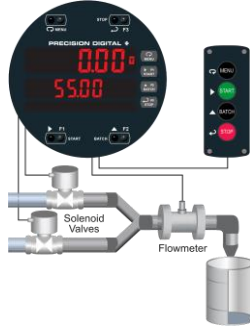
The time delay allows time for removing the full barrel and putting an empty barrel in place. Once the process starts, the operator does not have to press any buttons; except to pause or stop the batch process.



## Automatic Batch Control Operation

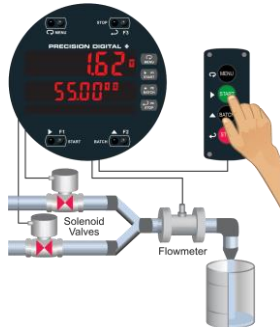
### 1. System Setup

Both valves are closed with an empty barrel in place. The batched total is displayed in the main display, the preset is selected for the second display. The batch could also be controlled using the through-glass buttons on the controller.



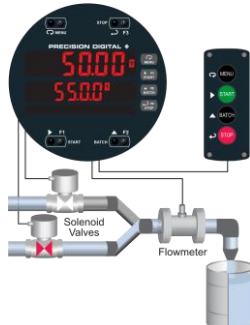
### 2. Batch Start

The START button is pressed. Both valves open. The barrel begins to fill.



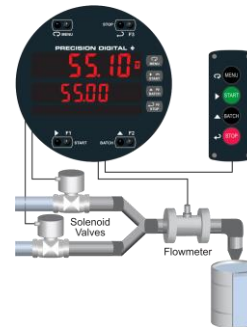
### 3. Preclose Valve

When the batch total reaches a value of 50.00 (Preset [55.00] – Pre-close [5.00]) the full-flow valve closes. The fill rate of the tank slows as a result.



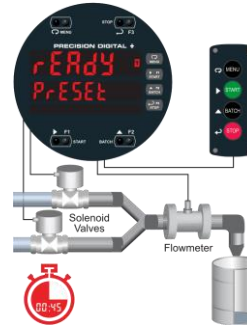
### 4. Completed Batch

When the batch is complete, the restricted-flow valve closes. If overrun occurs, then the next batch will adjust for this offset amount to maintain accuracy.



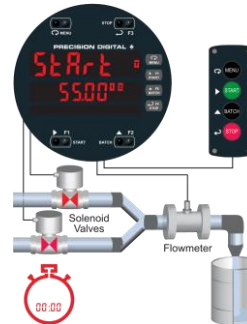
### 5. Replace Full Barrel with Empty Barrel

After the batch is completed, the operator removes the full barrel and places an empty barrel; the new batch starts automatically after a user-defined time delay of 60 seconds (Time Delay).



### 6. Begin New Batch

The new batch begins automatically after 60 seconds, both relays activate and both valves open.



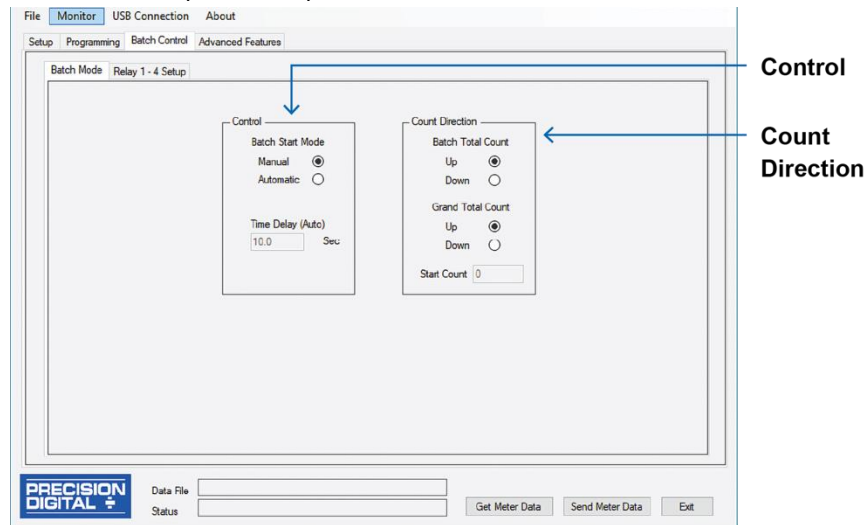
### 7. Stop Batch

At the end of the shift, press STOP twice to stop the batch process.



## Setup with MeterView Pro

Use MeterView Pro software to set up the batch controller for manual or automatic batch control, count up or count down operation, and set the batch preset and pre-close values.



### Control

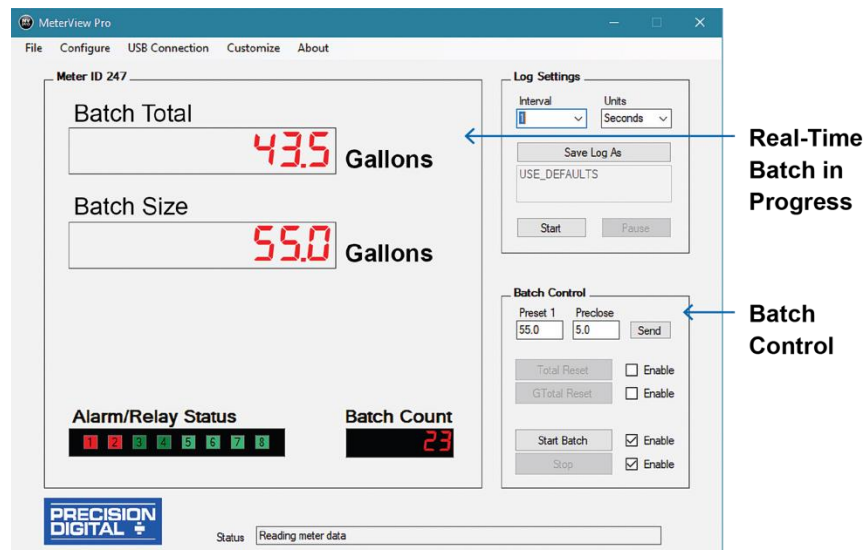
Program for automatic or manual batch operation and set time delay if automatic mode.

### Count Direction

Program the batch controller to count up or count down and set a starting count value if desired.

## Operate with MeterView Pro

MeterView Pro software also shows the Batch Size and Current Batch Total as well as allowing the user to start and stop the batch.



### Real-Time Batch in Progress

MeterView Pro software shows all the important batch-control information.

### Batch Control

MeterView Pro allows the user to set preset 1 and preclose values and start and stop the batch

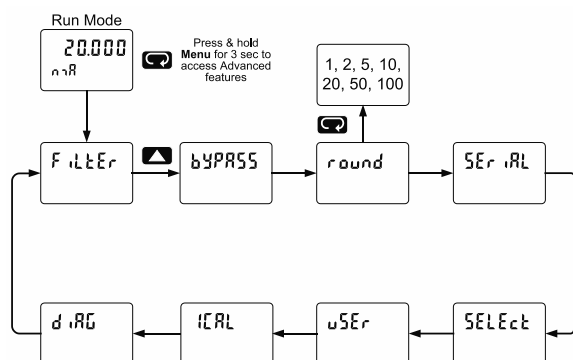
## Advanced Setup & Programming

In addition to the functions described in *Controller Operation* on page 53, the following advanced operation and display features may be programmed. Please note that configuring these features may disable some default batch controller features or it can make running a batch operation impossible. These functions should only be used by users who are sure of their need in their application.

### 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 controller. This cannot be done during a batch process as all functions other than STOP are disabled during a batch process, including the Menu button.



### Advanced Features Menu & Display Messages

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

Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
F ILT Er	Filter	Set noise filter value
bYPASS	Bypass	Set filter bypass value
r ound	Round	Set the rounding value for display variables
SEr iAL	Serial	Set serial communication parameters
SLAVE ID	Slave ID	Set slave ID or controller address
bAUD	Baud rate	Select baud rate
Tr dLY	Transmit delay	Set transmit delay for serial communication
PAR dLY	Parity	Select parity Even, Odd, or None with 1 or 2 stop bits
t -bYt	Time byte	Set byte-to-byte timeout

Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
SELEct	Select	Enter the Select menu (function, cutoff, out)
Functi on	Input Signal Conditioning	Select linear, square root, or programmable exponent
LINEAR	Linear	Set controller for linear function and select number of linearization points
no Pts	Number of points	Set controller for 2 to 32-point linearization
SQRtE	Square root	Set controller for square root extraction
ProG E	Programmable exponent	Set controller for programmable exponent and enter exponent value
CutoffF	Cutoff	Set low-flow cutoff
Count	Count	Set the totals to count up or down from a set value
to t C	Total count	Set the batch to count up to or down from the preset
uP	Up	Set the total to count up
dou n	Down	Set the total to count down
Gto t C	Grand total count	Set the grand total to count up or down from a defined value
C St r t	Count start	Set the starting grand total value when counting down
RoutePr	Analog output programming	Program analog output parameters
Source	Source	Select source for the 4-20 mA output
O -r RnG	Overrange	Program mA output for display overrange
u -r RnG	Underrange	Program mA output for display underrange
br ERK	Loop Break	Set analog output value if input loop break is detected
For cE	Force output	Force analog output value for loop break
IgnorE	Ignore	Ignore loop break condition
nR M	Maximum	Program maximum mA output allowed
nR m	Minimum	Program minimum mA output allowed
CL b	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 nR	4 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 nR	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

Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
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
ICAL	Internal source calibration	Enter internal source calibration (used for scaling the controller without a signal source)
CL	Current calibration	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
CLo	Current low	Calibrate low current input (e.g. 4 mA)
CHi	Current high	Calibrate high current input (e.g. 20 mA)
VL	Voltage calibration	Calibrate voltage input
VL0	Voltage low	Calibrate low voltage input (e.g. 0 V)
VHi	Voltage high	Calibrate high voltage input (e.g. 10 V)
diAG	Diagnostics	Display parameter settings
LED t	LED test	Test all LEDs
Info	Information	Display software number and version
ErASE	Erase	Erase MeterView Pro software stored in controller's memory

## 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 64 for details. The following table shows the default setting for each of the function keys.

Function Key/Button	Default Setting	Action
F1/START	StArT	Start batch
F2/BATCH	PrESet	Change preset
F3/STOP	StoP	Pause/stop batch
F4/Digital Input	StoP	Start/stop batch

## Digital Inputs Operation

Five (5) digital inputs, F4, DI-1 to DI-4, come standard on the controller. 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 64 for details.

### CAUTION

- **Only STOP Operation Enabled if a Batch is Running.** During a batch process, the only function that can be performed is the pause/stop functions of the STOP button; the default programming of the F3 key. No other functions, including min/max display, manual alarm reset, or total reset, will function while a batch is running.

## Advanced Setup and Calibration

### Multi-Point Calibration & Scaling

The controller 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 (LINE)* on page 62 for details.

### 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 digital inputs in the *User* menu.
2. Display continuously by assigning either display to max/min through the *Display* menu.

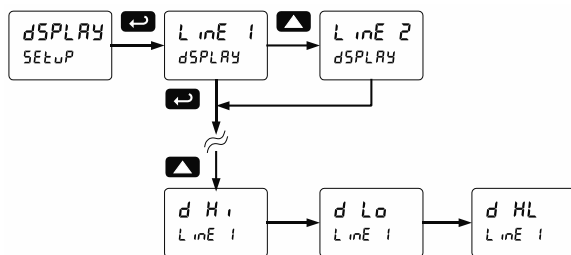
#### CAUTION

- Changing the programming of the F1-F3 function keys will disable the default batch operation of these keys, and is not recommended for batch control applications.

Any of the digital inputs can be programmed to reset the max & min readings.

#### To display max/min readings continuously:

Assign either display to Max (d H), Min (d L), or toggle between Max and Min (d HL) every 10 seconds.



#### CAUTION

- Note that changing the default programming of the main or second displays may affect viewing the batch total (main display) or preset (second display) of the batch process.

### Noise Filter (FILTER)

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

### Noise Filter Bypass (bYPASS)

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

### Rounding Feature (round)

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

Rounding causes the display to round to the nearest value according to the rounding selected.

### Modbus RTU Serial Communications (SERIAL)

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

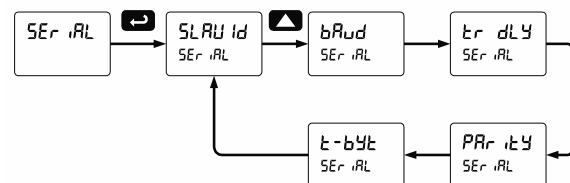
The controller may be connected to a PC for initial configuration via the on-board USB connection. For ongoing digital communications with a computer or other data terminal equipment, use the RS-485 connection with the appropriate serial converter; see *Ordering Information* on page 7 for details.

#### CAUTION

- DO NOT** connect any equipment to the RJ45 M-LINK connector. Otherwise damage will occur to the equipment and the controller.
- 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:** More detailed instructions are provided with each optional serial communications adapter.

Refer to the ProtEX-MAX Modbus Register Tables located at [www.prediq.com](http://www.prediq.com) for details.

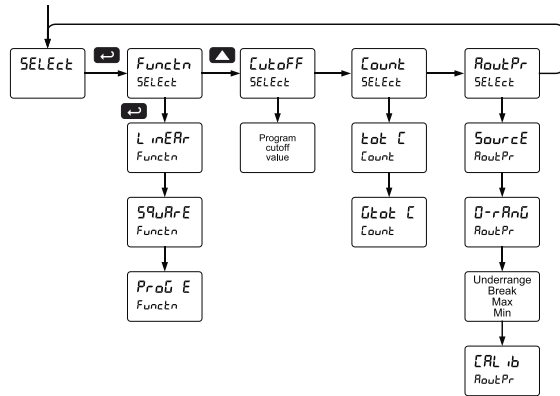


When using more than one controller in a multi-drop mode, each controller must be provided with its own unique address. The controller address (Slave ID) may be programmed between 1 and 247. The transmit delay may be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop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



## Select Menu (SELEct)

The *Select* menu is used to select the input signal conditioner applied to the input (linear, square root, or programmable exponent), 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, square root, or programmable exponent. The multi-point linearization is part of the linear function selection.

Controllers 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.

## Square Root Linearization (SQurE)

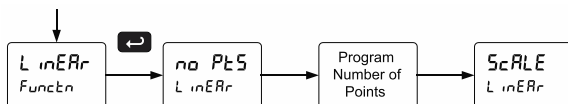
The square root function can be used to linearize the signal from a differential pressure transmitter and display flow rate in engineering units.

## Programmable Exponent Linearization (ProG E)

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

## Multi-Point Linearization (LinEAR)

Controllers 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 such as those from level transmitters used to measure volume in odd-shaped tanks or to convert level to flow using weirs and flumes with complex exponent.



## Low-Flow Cutoff (Cutoff)

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

The cutoff value may be programmed from 0.1 to 999999. The controller will display zero below the cutoff value. Programming the cutoff value to zero disables the cutoff feature. The cutoff can be disabled to display negative values.

## Total and Grand Total Count Direction (Count)

By default, the batch total and grand total count up during batch processes. *Count* parameter allows this to change. When set to count down, the batch total will count down from the preset to 0. When set to count down, the grand total will count down from a starting value to zero.

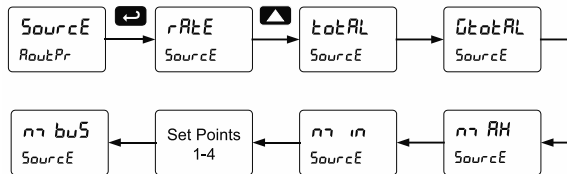
## Analog Output Programming (RoutPr)

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. Break: Analog output value when loop break is detected
5. Max: Maximum analog output value allowed regardless of input
6. Min: Minimum analog output value allowed regardless of input
7. Calibrate: Calibrate the internal 4-20 mA source reference used to scale the 4-20 mA output

### Analog Output Source

The source for generating the 4-20 mA output may be assigned to the 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 Value for Loss of 4-20 mA Input (Loop Break)

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

### Analog Output Calibration

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

### Analog Output Calibration Procedure

1. Wire the PD8-6210 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 19. 4-20 mA Output Connections* on page 31 for details.
2. Turn on all devices. Allow for a 15 to 30 minute warm-up.
3. Go to the Advanced Features menu, navigate to Select (SELE) and choose Analog Output Programming (ROutPr)/Calibration (CAL) menu and press **Enter**.
4. The display will show 4 mA. The PD8-6210 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 PD8-6210 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 controller will now calculate the calibration factors and store them.
7. Press **Menu** to exit and return to Run mode.

## Programmable Function Keys User Menu (u5Er)

### ⚠ CAUTION

- Changing the programming of the F1-F3 function keys will disable the default batch operation of these keys, and is not recommended for batch control applications.

The *User* menu allows the user to assign the front panel function keys F1, F2, and F3, the digital input F4 (located on the input signal connector), and four digital inputs (located on the digital I/O connector) to access most of the menus or to activate certain functions immediately (e.g. reset max & min, hold relay states, etc.). This allows the controller 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 controller (i.e. alarms, relay acknowledgement, reset max, min, or 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.

Display	Description
5tRrŁ	Starts the batch process
5tŁP	Stops the batch process
5rŁ5ŁP	Allows the same function key to both start and stop the batch process
rŁŸ d	Disable all relays until a button assigned to <i>enable relays</i> (rŁŸ E) is pressed
rŁŸ E	Enable all relays to function as they have been programmed
Ł HŁŁd	Hold current relay states and analog output as they are until a button assigned to <i>enable relays</i> (rŁŸ E) is pressed
d HŁŁd	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.
ŁnŁ HŁ	Display maximum display value on line 1
ŁnŁ ŁŁ	Display minimum display value on line 1
ŁnŁ HŁ	Display maximum & minimum display values on line 1
ŁnŁ HŁ	Display maximum display value on line 2
ŁnŁ ŁŁ	Display minimum display value on line 2
ŁnŁ HŁ	Display maximum & minimum display values on line 2
ŁnŁ ŁŁ	Display the grand total on line 2
ŁnŁ ŁŁ	Display the batch count on line 2

Display	Description
ŁŁŁŁŁŁ	Directly access the manual control menu
d ŁRŁŁŁ	Disable the selected function key or digital I/O
RŁH	Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching
rŁŁŁŁŁ	Directly access the reset menu
rŁŁ Ł	Reset the total
rŁŁ ŁŁ	Reset the grand total
rŁŁ ŁŁ	Reset the batch count
rŁŁ HŁ	Reset the maximum display value
rŁŁ ŁŁ	Reset the minimum display value
rŁŁ HŁ	Reset the maximum & minimum display values
rŁŁ RŁ	Directly access the relay menu
PŁŁŁŁŁ	Change the preset value
5ŁŁ Ł*	Directly access the set point menu for relay 2 (*through 4)
ŁŁŁŁŁ	Mimic the menu button functionality (digital inputs only)
r ŁŁŁŁ	Mimic the right arrow/F1 button functionality (digital inputs only)
ŁP	Mimic the up arrow/F2 button functionality (digital inputs only)
ŁŁŁŁŁ	Mimic the enter/F3 button functionality (digital inputs only)
F Łn Ł*	Force relay 1 (*through 4) into the on state. This function is used in conjunction with a digital input to achieve interlock functionality. See <i>Setting Up the Interlock Relay (Force On) Feature</i> on page 50 for details about interlock relays.
RŁŁŁ Ł*	Provide indication when alarm 1 (*through 4) has been triggered (digital outputs only)

## Internal Source Calibration ( $\text{I} \text{E} \text{R} \text{L}$ )

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

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

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

### Notes:

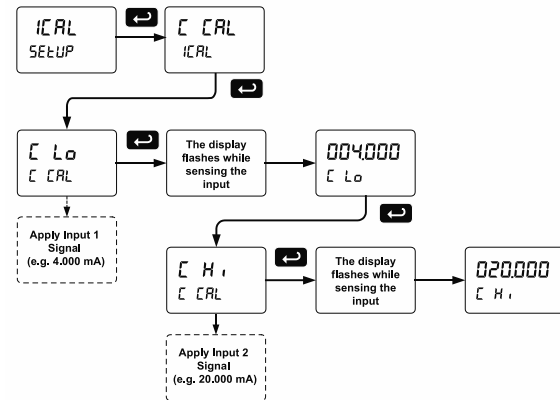
1. If controller is in operation and it is intended to accept only one input type (e.g. 4-20 mA), recalibration of other input is not necessary.
2. Allow the controller to warm up for at least 15 minutes before performing the internal source calibration procedure.

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

1. Press and hold the Menu button for three seconds to access the advanced features of the controller.
2. Press the Up arrow button to scroll to the *Internal calibration* menu (  $\text{I} \text{E} \text{R} \text{L}$  ) and press Enter.
3. The controller displays either current calibration (  $\text{I} \text{E} \text{R} \text{L}$  ) or voltage calibration (  $\text{V} \text{E} \text{R} \text{L}$  ), according to the input setup. Press Enter to start the calibration process.

### Example of Internal Calibration for current input:

4. The controller displays *low* input current message (  $\text{I} \text{L} \text{O}$  ). Apply the low input signal and press Enter. The display flashes for a moment while the controller is accepting the low input signal.
5. After the display stops flashing, a number is displayed with the leftmost digit brighter than the rest. The bright digit is the active digit that can be changed by pressing the Up arrow button. Press the Right arrow button to move to the next digit.
6. Set the display value to correspond to the input signal being calibrated, typically 4.000 mA.
7. The display moves to the *high* input calibration (  $\text{I} \text{H} \text{I}$  ). Apply the high input signal and press Enter.
8. Set the display for the high input calibration, in the same way as it was set for the low input calibration, typically 20.000 mA.



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

### Tips:

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

## Error Message ( $\text{E} \text{R} \text{R} \text{O} \text{R}$ )

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

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

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

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

\*Not relevant when scaling the controller.

## Minimum Input Span

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

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

## Troubleshooting

Due to the many features and functions of the controller, it's possible that the setup of the controller does not agree with what an operator expects to see.

If the controller is not working as expected, refer to the *Diagnostics* menu and recommendations below.

### Diagnostics Menu (d ,RÜ)

The *Diagnostics* menu is located in the *Advanced Features Menu*; to access the *Diagnostics* menu refer to page 59.

This menu allows the user to test the functionality of all the controller LEDs, check the controller's software and version information, and erase the MeterView Pro software installation files from the controller. Press the Enter button to view the settings and the Menu button to exit at any time.

For a description of the diagnostic messages, see *Advanced Features Menu & Display Messages*, page 59.

### Testing the Display LEDs

To test all LEDs on the display:

1. Go to the *Diagnostics* menu (d ,RÜ) and press Enter button.
2. Press Up arrow button and scroll to *LED Test* menu (L E d Ü)
3. Press the Enter button to activate the LED Test. The controller 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 (i n F a) or press the Menu button to return to Run Mode.

### Determining Software Version

To determine the software version of a controller:

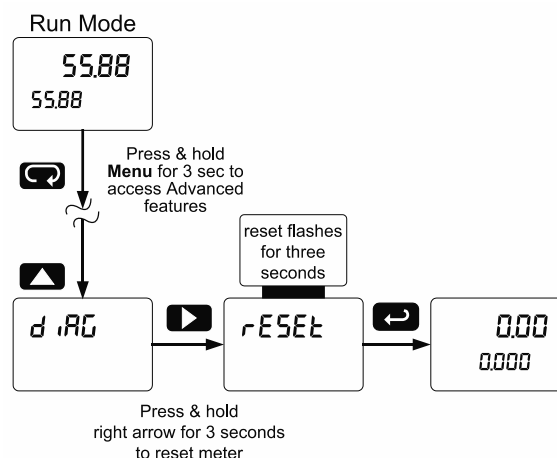
1. Go to the *Diagnostics* menu (d ,RÜ) and press Enter button.
2. Press Up arrow button and scroll to *Information* menu (i n F a).
3. Press Enter to access the software number (S F t) and version (V E r) information. Write down the information as it is displayed. Continue pressing Enter until all the information is displayed.
4. The controller returns to Run Mode after displaying all the settings.

## Reset Controller 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 Setup & Programming*, page 59.
2. Press Up arrow to go to *Diagnostics* (d ,RÜ) menu
3. Press and hold Right arrow for three seconds, press Enter when display flashes r E S E t .  
**Note:** If Enter is not pressed within three seconds, the display returns to the *Diagnostics* menu.
4. The controller 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 the major programmable parameters on the controller.

Factory Defaults & User Settings		
Parameter	Display	Default Setting
Input type	Input	4-20 mA
Total	YES	Total enabled
Units	unit	Rate / total / G total mA / mA / mA
Rate decimal point	0.00000	3 Places
Total decimal point	0.00000	1 Place
Grand Total decimal point	0.00000	0 Places
Function	Function	Linear
Number of points	no. Pts	2
Programming	Prog	Scale
Input 1	Input 1	4.000 mA
Display 1	0.00000	4.000
Input 2	Input 2	20.000 mA
Display 2	0.00000	20.000
Display line 1	Line 1	Display batch total
Display line 2	Line 2	Display preset
Display intensity	display	6
Total time base	time	Second
Total conversion factor	factor	1.000
Batch mode	mode	Manual
Grand total time base	time	Second
Grand total conversion factor	factor	1.000
Grand total reset	reset	Manual
Relay 1 assignment	Relay 1	Total
Relay 2 assignment	Relay 2	Total
Relay 2 pre-close	Pre-close	No
Relay 3 assignment	Relay 3	Rate
Relay 4 assignment	Relay 4	Rate
Relay 1 action	Action 1	Automatic
Batch preset	Preset	100.0
Relay 2 action	Action 2	Automatic
Relay 2 set point	Set point	200.0
Relay 3 action	Action 3	Automatic
Relay 3 set point	Set point	3.000
Relay 3 reset point	Reset point	2.500
Relay 4 action	Action 4	Automatic

## Factory Defaults & User Settings

Parameter	Display	Default Setting
Relay 4 set point	Set point	4.000
Relay 4 reset point	Reset point	3.500
Fail-safe relay 1	Fail-safe	Off
Fail-safe relay 2	Fail-safe	Off
Fail-safe relay 3	Fail-safe	Off
Fail-safe relay 4	Fail-safe	Off
On delay relay 1	On delay	0.0 sec
Off delay relay 1	Off delay	0.0 sec
On delay relay 2	On delay	0.0 sec
Off delay relay 2	Off delay	0.0 sec
On delay relay 3	On delay	0.0 sec
Off delay relay 3	Off delay	0.0 sec
On delay relay 4	On delay	0.0 sec
Off delay relay 4	Off delay	0.0 sec
Loop break relay 1	Loop break	Ignore
Loop break relay 2	Loop break	Ignore
Loop break relay 3	Loop break	Ignore
Loop break relay 4	Loop break	Ignore
Display 1 analog out	Display 1	4.000
Output 1 value	Output 1	4.000 mA
Display 2 analog out	Display 2	20.000
Output 2 value	Output 2	20.000 mA
Source analog output	Source	Rate/process
Overrange output	Overrange	21.000 mA
Underrange output	Underrange	3.000 mA
Loop break output	Loop break	1.000 mA
Filter	Filter	70
Bypass	Bypass	0.2
Cutoff value	Cutoff	0.0 (disabled)
Maximum output	Maximum	23.000 mA
Minimum output	Minimum	1.000 mA
Slave ID (Address)	Slave ID	247
Baud rate	Baud rate	9600
Transmit delay	Transmit	50 ms
Parity	Parity	Even
Byte-to-byte timeout	Byte-to-byte	010 (0.1 sec)
F1 function key	F1	Start
F2 function key	F2	Preset



Factory Defaults & User Settings		
Parameter	Display	Default Setting
F3 function key	F3	Stop
F4 function	F4	Start/Stop
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 1-4	d O 1	Alarm 1-4
Password 1	PR55 1	000000 (unlocked)
Password 2	PR55 2	000000 (unlocked)
Password 3	PR55 3	000000 (unlocked)
Total password	toLR	000000 (unlocked)
Grand total password	toLR	000000 (unlocked)

## Troubleshooting Tips

This controller is a highly sophisticated instrument with an extensive list of features and capabilities. If the programming buttons are used to program the controller, 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 controller for programming with MeterView Pro software.

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

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, <b>Lo</b> is displayed	Controller is password-protected; enter correct six-digit password to unlock or Master Password of 508655
Controller does not respond to input change	If a <i>Low-Flow Cutoff</i> Value has been programmed, the controller will display zero below that point, regardless of the input – which can appear like the controller 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.
Controller displays error message during calibration ( <b>Error</b> )	Check: 1. Signal connections 2. Input selected in <i>Setup</i> menu 3. Minimum input span requirements
Controller displays 1. <b>999999</b> 2. <b>-999999</b>	Check: 1. Input selected in <i>Setup</i> menu 2. Corresponding signal at Signal connector
Display is unstable	Check: 1. Input signal stability and value 2. Display scaling vs. input signal 3. Filter and bypass values (increase)
Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: 1. Input signal conditioner selected: Linear, square root, etc. 2. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check display assignment, it might be displaying max, min, or set point
Display alternates between 1. <b>H</b> and a number 2. <b>Lo</b> and a number	Press Menu to exit max/min display readings
Relay operation is reversed	Check: 1. Fail-safe in <i>Setup</i> menu 2. Wiring of relay contacts
Relay and status LED do not respond to signal	Check: 1. Relay action in <i>Setup</i> menu 2. Set and reset points
Flashing relay status LEDs	Relays in manual control mode or relay interlock switches opened
Controller not communicating with application programs	Check: 1. M-Link Connector installed between PROVU electronics and ProtEX-MAX connector board. See <i>Figure 4: Integrated PROVU Required Connections</i> on page 26 3. Serial settings 4. Controller address and baud rate
If the display locks up or the controller does not respond at all	Cycle the power to reboot the microprocessor

Symptom	Check/Action
Cannot access main menu	You cannot access the main menu when a batch is running. Make sure the batch has stopped before trying to access the main menu.
Batch is continuously overfilling	A multi-stage batch with a pre-close amount may be necessary. See <i>Two-Stage Batch Control Setup Using Relays 1 &amp; 2</i> on page 54.
Batch is not stopping when preset is reached	Check wiring. Relay 1 corresponds to the preset value.
CapTouch buttons do not respond	<ol style="list-style-type: none"> <li>1. Check if slide switch on connector board is in DISABLE position, switch to ENABLE.</li> <li>2. Be sure to hold the initial CapTouch button for 5 seconds to wake it up.</li> </ol>
Serial Communications Power (P) Indicator is off	Check: <ol style="list-style-type: none"> <li>1. Modular cable connection</li> <li>2. Power to the device</li> </ol>
If only the TX (or DATA IN) data status LED is flashing when serial communications attempted	Check: <ol style="list-style-type: none"> <li>1. Serial cable</li> <li>2. Instrument address &amp; baud rate</li> <li>3. Program address &amp; baud rate</li> </ol>
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	<ol style="list-style-type: none"> <li>1. Increase the TX delay time</li> <li>2. Decrease the baud rate</li> </ol>
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 controller to factory defaults, see *Reset Controller to Factory Defaults* on page 66. In addition, for best results, we recommend using the free MeterView Pro software for all programming needs.

# Complete Product Line of Displays and Controllers IN ALL SHAPES, SIZES & LOCATIONS



Big, Bright Displays  
For Indoor or Outdoor  
in Bright Sunlight



Large Dual-Line  
6-Digit Display



24 VDC  
Transmitter  
Power Supply



MeterView® Pro USB  
Programming Software



Universal 85-265  
VAC or 12-24 VDC  
Input Power  
Options



4-20 mA, 0-10 V,  
Thermocouple, RTD,  
Strain Gauge, High  
Voltage, & Modbus Inputs



Up To Four  
3 A Form C  
Relays (SPDT)



SP Ex IECEx CE



## LARGE DISPLAYS Helios Series

- 1.8" Digits Readable From 100 Feet
- NEMA 4X, IP65 Rated Enclosure
- Operating Temperature of -40 to 65°C
- Now UL and C-UL Approved!

## EXPLOSION-PROOF ProtEX-MAX Series

- NEMA 4X, IP68 Rated Enclosure
- CapTouch Through-Glass Buttons
- Operating Temperature of -55 to 65°C
- Worldwide Approvals



## PANEL METERS ProVu Series

- NEMA 4X, IP65 Rated Front
- Programmable Function Keys
- UL, C-UL, and CE Approvals
- 1/8 DIN Size

Go to [PREDIG.COM](http://PREDIG.COM) for details on ProVu, ProtEX-MAX and Helios Series Meters

## Contact Precision Digital

### Technical Support

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

Email: [support@predig.com](mailto:support@predig.com)

### Sales Support

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

Email: [sales@predig.com](mailto:sales@predig.com)

### Place Orders

Email: [orders@predig.com](mailto:orders@predig.com)

For the latest version of this manual please visit

[www.predig.com](http://www.predig.com)

### PRECISION DIGITAL CORPORATION

233 South Street • Hopkinton MA 01748 USA

Tel (800) 343-1001 • (508) 655-7300

[www.predig.com](http://www.predig.com)

