

# ProtEX-MAX PD8-6080/PD8-6081 Modbus® Scanners

## Instruction Manual



- Fully Approved Explosion-Proof Modbus® Scanners
- Modbus® RS-485 RTU Scanner as Master, Slave, or Snooper
- Dual Analog Inputs (0-20 mA, 4-20 mA, 0-5 V, 1-5 V, and  $\pm 10$  V)
- On-Board USB & RS-485 Serial Communication Standard
- Decimal or Feet & Inches (with Eighths & Sixteenths) Display Options
- Poll and Display up to 16 Process Variables
- Add, Diff, Avg, Multi, Div, Min, Max, Weighted Avg, Ratio, Concentration, & More
- 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°
- 4 Relays with Interlocking Capability + Isolated 4-20 mA Output Option
- Password Protection
- Free PC-Based, On-Board, ScanView USB Programming Software
- SunBright Display Standard Feature; Great for Outdoor Applications
- Operating Temperature Range: -55 to 65°C (-67 to 149°F)
- CSA Certified as Explosion-Proof / Dust-Ignition-Proof / Flame-Proof
- ATEX and IECEx Certified as Flame-Proof
- Input Power Options: 85-265 VAC / 90-265 VDC or 12-24 VDC / 12-24 VAC
- Multi-Pump Alternation Control
- 32-Point, Square Root, or Exponential Linearization
- Flanges for Wall or Pipe Mounting
- Explosion-Proof Aluminum or Stainless Steel NEMA 4X / IP68 Enclosures
- Four 3/4" NPT Threaded Conduit Openings
- Stainless Steel Pipe Mounting Kit
- Stainless Steel Tag Available
- 3-Year Warranty

### PRECISION DIGITAL CORPORATION

233 South Street • Hopkinton MA 01748 USA

Tel (800) 343-1001 • (508) 655-7300

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

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- 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.
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## FREE ScanView Programming Software



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

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

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

**For more information on ScanView visit**  
[www.predig.com/ScanView](http://www.predig.com/ScanView)

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

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

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

**WARNING**

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

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## Introduction

The ProtEX-MAX PD8-6080 and PD8-6081 Explosion-Proof Modbus Scanners can be programmed as a Master, Slave, or Snooper. Their primary use is to scan and display up to 16 Modbus registers or two 4-20 mA inputs in place of two Modbus registers.

In Master mode, the ProtEX-MAX reads up to 16 slave devices. In Snooper mode, the scanner listens to the Modbus traffic and picks up a specific register or registers being polled by a master device from a specific slave device and process the data being read. In Slave mode, the scanner is controlled by a master device. In all modes, the data sent to the scanner is displayed, and used to operate the relays and 4-20 mA output.

The scanners are capable of polling up to 16 process variables (PVs) and displaying them in sequence at a user programmable scan rate.

A fully loaded ProtEX-MAX scanner comes with four SPDT relays, a 4-20 mA output, five digital inputs and four digital outputs, and RS-485 serial communications.

Free ScanView software allows the ProtEX-MAX Modbus Scanner to be accessed via a computer. It can be used to configure multiple scanners, conveniently monitor critical information, and data log right from a PC.

## CapTouch Buttons

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



## Ordering Information

### Aluminum Enclosure 85-265 VAC Models

Model	Standard Features	Options Installed
<b>Decimal Display</b>		
<a href="#">PD8-6080-6H0</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6080-6H7</a>		
<b>Feet &amp; Inches Display</b>		
<a href="#">PD8-6081-6H0</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6081-6H7</a>		

### 12-24 VDC Models

Model	Standard Features	Options Installed
<b>Decimal Display</b>		
<a href="#">PD8-6080-7H0</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6080-7H7</a>		
<b>Feet &amp; Inches Display</b>		
<a href="#">PD8-6081-7H0</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6081-7H7</a>		

### Stainless Steel Enclosure 85-265 VAC Models

Model	Standard Features	Options Installed
<b>Decimal Display</b>		
<a href="#">PD8-6080-6H0-SS</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6080-6H7-SS</a>		
<b>Feet &amp; Inches Display</b>		
<a href="#">PD8-6081-6H0-SS</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6081-6H7-SS</a>		

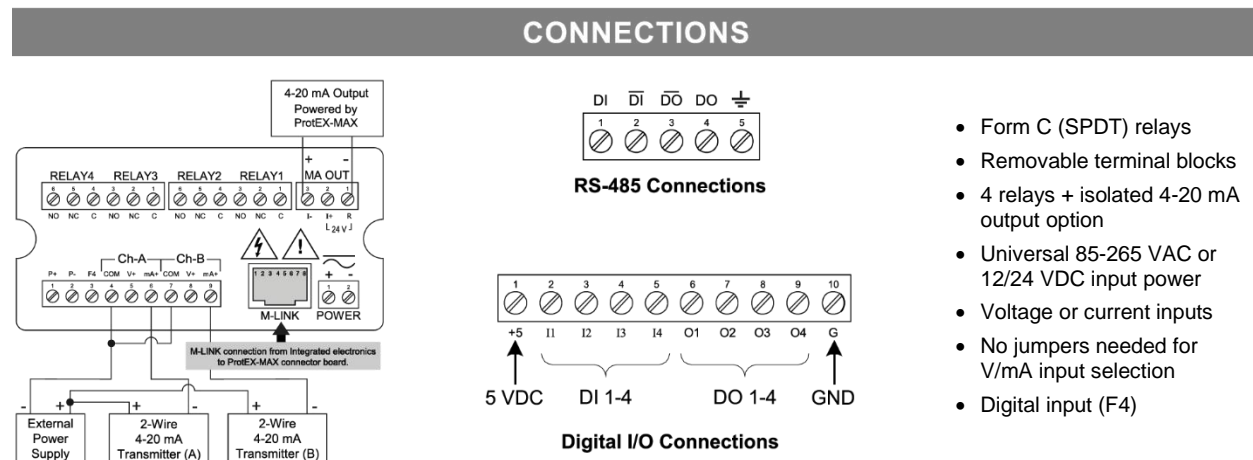
### 12-24 VDC Models

Model	Standard Features	Options Installed
<b>Decimal Display</b>		
<a href="#">PD8-6080-7H0-SS</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6080-7H7-SS</a>		
<b>Feet &amp; Inches Display</b>		
<a href="#">PD8-6081-7H0-SS</a>	5 Digital Inputs, 4 Digital Outputs, Dual Analog Inputs	No options 4 relays 4-20 mA output
<a href="#">PD8-6081-7H7-SS</a>		

## 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

## Key Features



Connections for PD8-6080-6H7, PD8-6081-6H7, PD8-6080-7H7 & PD8-6081-7H7

## The Only Explosion-Proof Modbus Scanner You Will Ever Need

Front, back and in between, the PD8-6080 and PD8-6081 ProtEX-MAX Explosion-proof Modbus scanners boast specifications, features and functionality that make them the only hazardous area Modbus scanners you will ever need. They can scan up to 16 process variables made up of Modbus registers or two analog signals such as 4-20 mA. The PD8-6080 displays in decimal format, while the PD8-6081 has a feet & inches display.

These Modbus scanners can be operated in Master, Slave or Snooper modes. In Master mode, the ProtEX-MAX reads up to 16 slave devices, scales the data from each, displays the result, and operates the internal relays and 4-20 mA output. As a Snooper, the scanners listen to the Modbus traffic and pick up a specific register or registers being polled by a master device from a specific slave device and process the data being read. In Slave mode, the scanner is controlled by a master device. The data sent to the scanner by the master is scaled, displayed, and used to operate the relays and 4-20 mA output.

The first thing you notice about the PD8-6000 is its modern looking, rugged, explosion-proof housing with convenient mounting flanges, available in aluminum or stainless steel. Housed inside this enclosure is a dual-line, 6-digit display with high-intensity LEDs that can be read in direct sunlight. The main line can display numbers up to 999,999 and the second line can be used to indicate a tag or display the input in another scale. The front panel push-buttons can even be operated in a hazardous area without removing the cover by using the CapTouch through-glass feature.

Various math functions may be applied to the Modbus and analog inputs as well as signal conditioning functions such as square root extraction, programmable exponent, or round horizontal tank calculations. The displays, relays, and the analog outputs may be assigned to PVs or to math channels C1, C2, C3, or C4. All these features and capabilities can easily be programmed without removing the cover using CapTouch buttons in a hazardous area or with free ScanView PC-based software in a safe area.

## Modbus Capabilities

There are three operating modes for the Modbus scanners:

### Master

Processes data read from Modbus RTU slave devices. It polls up to 16 process variables from 1 to 16 slave devices. The Master is capable of scanning the selected PVs, scaling the data, triggering relays, performing math operations, and driving the analog outputs.

### Snooper

Listens to the Modbus traffic and picks up a specific register or registers being polled by a master device from a specific slave device and processes the data being read. The Snooper mode handles the data the same way as the Master.

### Slave

Processes data sent to it from a Modbus RTU master device.

Possible applications include:

- Use Master Mode to scan the top level, interface level, and temperature from Modbus multivariable level transmitters.
- Use Master Mode to display the flow rate, tag, and units, for multiple Modbus-enabled flow meters.
- Use Snooper Mode to add a tank side indicator at eye-level for a Modbus level transmitter being polled by a master in the control room.
- Use Snooper Mode to add additional remote displays to a network with a Modbus scanner acting as the master and display the data at all operator locations.
- Use Slave Mode to display data sent to the scanner by a Modbus master in the control room.

## Modbus Scanner Video

Learn more about the Modbus scanners in this short video.

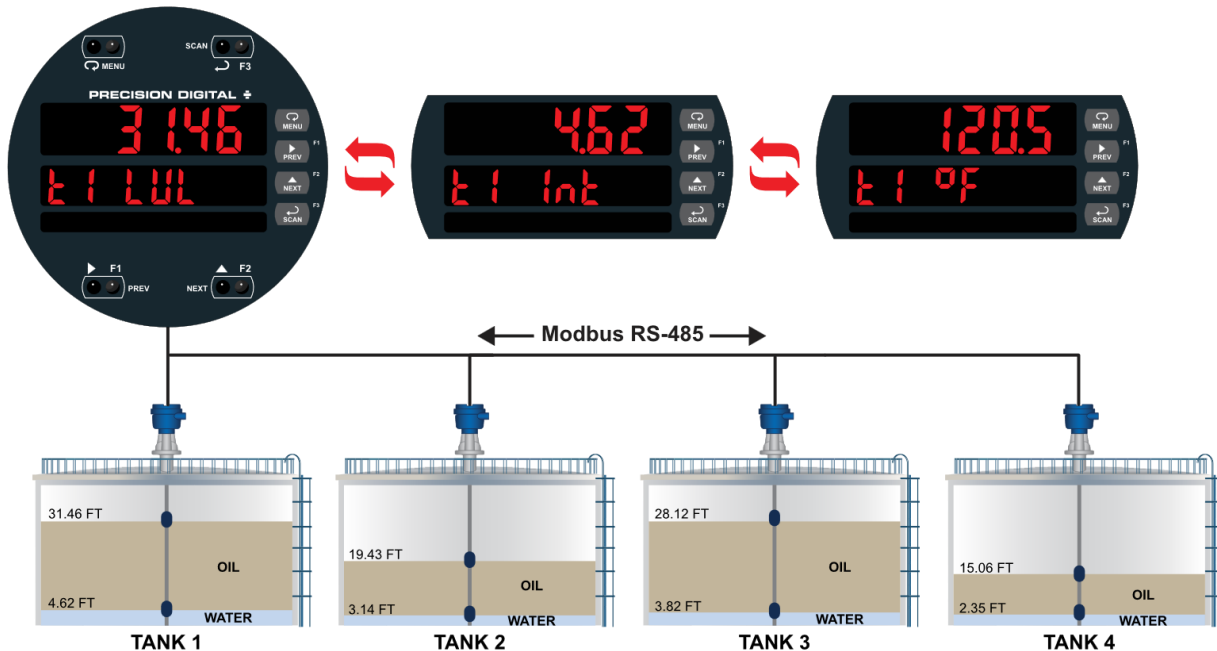


<https://www.prediq.com/videos/dD6BGcKUwuc>



## Multivariable Level Transmitters Application

In this application we have a system consisting of four multivariable tank level gauges connected to a PD8-6080-6H7 displaying product level, interface level, and average temperature. The PD8-6080 is setup for Master mode, and it is polling the Modbus transmitters.

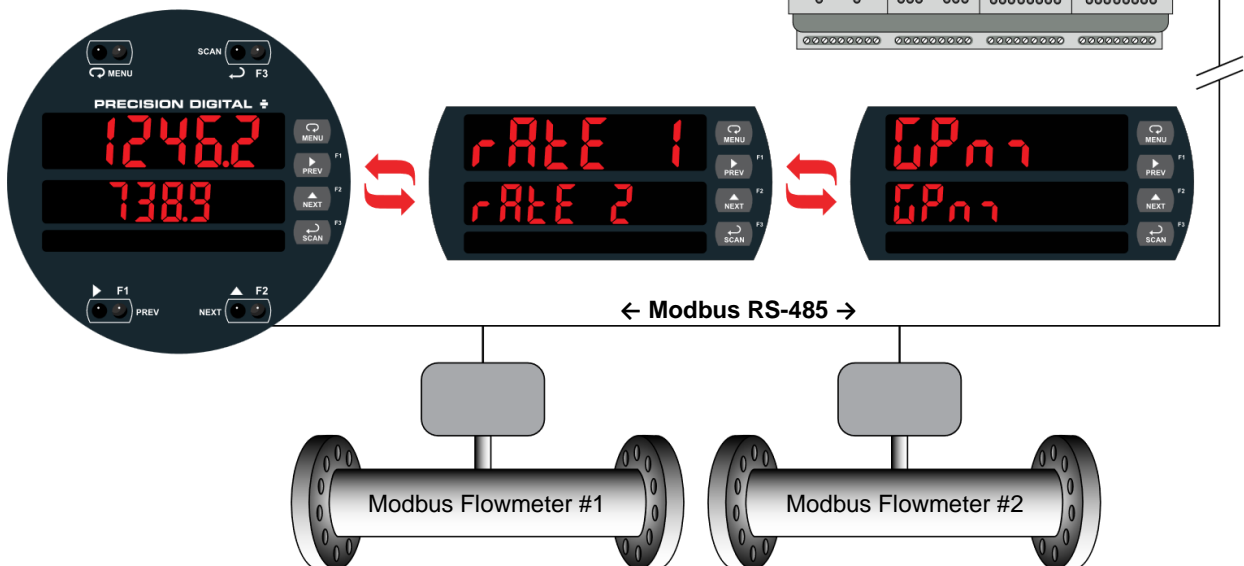


## Snooper Displaying Flow Rate from Modbus Flow Meters

In this application we have a system consisting of two Modbus enabled flowmeters connected to a SCADA system operated out of a control room. A Modbus PLC polls the data out of the flowmeters. A PD8-6080-6H7 has been added to the system as a Modbus Snooper, to provide the operators an easy-to-read field display near the flow lines. The scanner displays one flow rate on the main display, and one on the second display. Each has an alternating tag and units for clear identification.

Local Display with PD8-6080  
in Snooper Mode Displaying  
2 PVs Simultaneously

PLC Master in  
Control Room



## Powerful Math Functions

The PD8-6080 & PD8-6081 use up to 16 process variables in a variety of powerful math functions designed for process applications. Programmable Adder (P) and Factor (F) constants allow each formula to be customized as needed for a specific application. The Math Channels (C1-C4) may be displayed in many useful combinations. Most math functions may be applied to all PVs: for example, it is possible to add up to 16 PVs and calculate the total volume of all the tanks in a field. The Math2 function allows for further calculations on the results of other math channels (e.g. C4= C2/C1).

Name	Function	Setting
Addition	$C1=(PV1+PV2+P)*F$	5000
Difference	$C1=(PV1-PV2+P)*F$	0.1F
Absolute Difference	$C1=((Abs(PV1 - PV2)+P)*F$	0.1F0.5
Average	$C1=((PV1+PV2)/2)+P)*F$	0.5
Multiplication	$C1=((PV1*PV2)+P)*F$	0.0001
Division	$C1=((PV1/PV2)+P)*F$	0.0001
Maximum PV	Maximum value of all selected PVs	0.0001
Minimum PV	Minimum value of all selected PVs	0.0001
Draw	$C1=((PV1/PV2)-1)*F$	0.0001
Weighted Average	$C1=((PV2-PV1)*F)+PV1$	0.5
Ratio	$C1=(PV1/PV2)*F$	0.0001
Concentration	$C1=(PV1/(PV1+PV2))*F$	0.0001
Resultant Math Channel	Math on all other math channels	0.0001
Addition	$C3=(C1+C2+P)*F$	5000
Difference	$C4=(C1-C2+P)*F$	0.1F
Absolute Difference	$C3=((Abs(C1 - C2)+P)*F$	0.1F0.5
Average	$C4=((C1+C2)/2)+P)*F$	0.5
Multiplication	$C3=((C1*C2)+P)*F$	0.0001
Division	$C4=((C1/C2)+P)*F$	0.0001

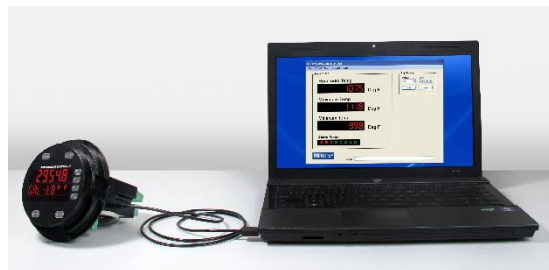
**Note:** The F constant can be any value from 0.00001 to 999999. If the value is less than 1, it will have the same effect as a divider. For example, the average could also be derived by using  $(A+B)*F$ , where  $F = 0.500$ .

## Automatic or Manual Scanning

The scanner may automatically or manually cycle through the PVs. The scanner can be programmed to display each PV for 1 to 99.9 seconds. The NEXT and PREV buttons can be used to manually scan to the next or previous PV display. The SCAN button will pause and resume automatic scanning.

## Easy Programming Methods

Given the nature of Modbus applications and the flexibility and feature-rich capabilities of the Modbus scanners, there is a considerable amount of programming required to get them going. Luckily, there is free PC-based software called ScanView that makes it very quick and easy to program the Modbus scanners. The scanners can also be programmed using the through-glass CapTouch buttons. This makes it easy to make small changes to the setup once the instrument is installed in the hazardous area. Once programming is completed, it can be locked with a password.



The ProtEX-MAX also comes preloaded with the free ScanView 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, ScanView is downloaded to your PC, the software automatically selects the model you are programming, and you're ready to start programming immediately. Further simplifying the programming process, the ProtEX-MAX can be powered from the USB port, so no need to apply external power while programming your meter. In addition to programming, the software will also allow you to monitor and datalog a ProtEX-MAX using your PC. You can also generate and save programming files for later use.

## 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, can have up to four relays and a 4-20 mA output, and features through-glass buttons for easy meter operation without the need to remove the cover. All of these features are backed by a 3-year warranty.

## Super-Bright LED Display

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



## CapTouch Through-Glass Buttons

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

## Rugged, Heavy-Duty Enclosure

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



## Wide Viewing Angle

Customers can't always look at the display from straight on, so the window and display module have been optimized to provide a wide viewing angle of approximately  $\pm 40^\circ$ ; 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 assemblies 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.

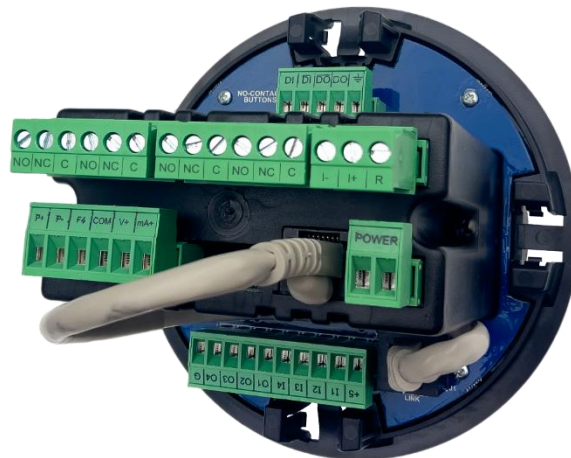
## Stainless Steel Tags

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.



**Note:** The above photograph is representative of the back of the PD8-6080 and PD8-6081 in every regard except for the signal input connector. See *Figure 5* on page 29 for actual input signal connections.

## USB Port ScanView



## 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.

## 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>Input/output</b>	Modbus RTU over RS-485 Two analog inputs (4-20 mA, ±10 V)
<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>Feet &amp; Inches Range (PD8-6081)</b>	-9 <sup>FT</sup> 11 <sup>IN</sup> ( <sup>15</sup> / <sub>16</sub> or <sup>7</sup> / <sub>8</sub> ) to 99 <sup>FT</sup> 11 <sup>IN</sup> ( <sup>15</sup> / <sub>16</sub> or <sup>7</sup> / <sub>8</sub> )
<b>Display Intensity</b>	Eight user selectable intensity levels. Default value is six.
<b>LED Status Indicators</b>	See <i>LED Status Indicators</i> on page 35 for details.
<b>Overrange</b>	Display flashes 999999
<b>Underrange</b>	Display flashes -99999
<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 ScanView programming software.
<b>Max/Min Display</b>	Max/min readings are stored until reset by the user or when power to the scanner is turned off. User can reset by front panel pushbuttons, digital input, or via Modbus registers.
<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. 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
<b>Non-Volatile Memory</b>	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
<b>Power Options</b>	85-265 VAC 50/60 Hz; 90-265 VDC, 20 W max; 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 scanners may share one 5 A fuse
<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 meter 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 25 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.

## Operating Modes

<b>Master</b>	Processes data read from Modbus RTU slave devices. It polls up to 16 process variables from 1 to 16 slave devices. The Master is capable of scanning the selected PVs, scaling the data, triggering relays, performing math operations, and driving the analog outputs.
<b>Snooper</b>	Listens to the Modbus traffic and picks up a specific register or registers being polled by a master device from a specific slave device and processes the data being read. The Snooper mode handles the data the same way as the Master.
<b>Slave</b>	Processes data sent to it from a Modbus RTU master device.
<b>Note:</b> The relays and the 4-20 mA outputs are functional in all modes.	



## Master & Snooper Settings

<b>PV Number</b>	PV1–PV16 Enable or disable the process variables to be polled by the Master.
<b>Slave Id</b>	Assign the slave ID or address (1-247, 256-259 for mA or volts inputs) containing the process variables to be displayed by the selected PV.
<b>Function Code</b>	Select which Modbus function code (03, 04, or 65) to use in reading the slave device.
<b>Register Number</b>	5 digit: 30001-39999, 40001-49999, or 1-65,536 6 digit: 300001-365536 or 400001-465536 (Function Code 65 N/A here) Specifies which register(s) to read in the slave device. Range is dependent on Function Code selection (65, 04, or 03) and digits selection (5 or 6).
<b>Data Type</b>	Select the data format that the slave device uses. Select between Short integer (2 byte), Long integer (4 byte), or floating point (4 byte), Signed or Unsigned (integer only) and byte order: 1234, 4321, 2143, or 3412 (big-endian vs. little-endian, or swapped).
<b>Poll Time</b>	1.0 to 99.9 sec. Time between read-commands (Master mode).
<b>Slave Response Timeout</b>	0.0 to 99.9 seconds: Time allowed for the slave to respond before the scanner generates a communication break condition. The master polls the slave 3 times before starting the response timeout timer. Slave/Snooper mode: Time the scanner will wait for new data before going into break condition. Slave mode: Programming 0 disables the timeout; the last value received will be displayed indefinitely.
<b>Communication Break</b>	Displays <b>ERR</b> after the Master has polled the slave device 3 times and the response timeout has elapsed. The Snooper and Slave modes go into break condition after no new data is received within the response timeout window. Relays can be programmed to go on, off, or ignore the break condition. The analog outputs can be setup to generate a fixed mA current when a break condition is detected.

## PV Settings

<b>Tag &amp; Units</b>	6-character, independent tag and units for each PV and math channel
<b>PV Format</b>	PD8-6080 default: Decimal format PD8-6081 default: FT & IN, 1/8 <sup>th</sup> or 1/16 <sup>th</sup> ; decimal format may be selected for line 2 indication.
<b>Display Decimal Point</b>	Up to five decimal places or none: d.ddddd, dd.dddd, ddd.ddd, dddd.dd, dddddd.d, or dddddd
<b>Float Decimal Point</b>	Select the number of decimals to use for the floating point data expected from the slave or master device (this is independent from the display decimal point selection).
<b>PV &amp; Math Scaling</b>	All PVs and math channels may be scaled to represent the input data in any engineering unit. Example: Level transmitter = 999.999 inches; to display in Ft-In-1/16 <sup>th</sup> scale input 2 to display 83 Ft – 4 In – 0/16 <sup>th</sup> .

## Display Settings

<b>Scan Mode</b>	Automatic: 1.0 to 99.9 sec Manual: Front panel or digital inputs Go on alarm: Continues scanning after an alarm is detected Stop on alarm: Goes to the alarmed PV and stops scanning; press Scan to resume scanning.
<b>Display Scan Rate</b>	Master/Snooper: 1 PV/second to 1 PV every 99.9 seconds Slave: Dependent on master device (e.g. PLC) <b>Note:</b> The display scan rate is independent of the poll time.
<b>Display Assignment</b>	Display line 1: PV, Ch-C (math channel), PV & units, tag & PV, tag-PV-units, Ch-C & units, tag-Ch-C-unit, set points, max/min PV, max/min Ch-C Display line 2: Same as Display Line 1; plus units, tag or turned off The tag and units are displayed alternately for 2 seconds max, when selected. Different tags & PVs may be selected to display on line 1 & 2 at the same time

## Math Functions

Name	Math Operation (Examples) (P = Adder, F = Factor)	Setting
Addition	$(PV1+PV2+P)*F$	5 0 0 0
Difference	$(PV1-PV2+P)*F$	d 0 F
Absolute difference	$((Abs(PV1 - PV2)+P)*F$	d 0 F Abs
Average	$((PV1+PV2)/2+P)*F$	8 0 0
Multiplication	$((PV1*PV2)+P)*F$	0 0 0 0 0
Division	$((PV1/PV2)+P)*F$	d 0 0 d E
Max PV	Max value of all selected PVs	4 0 - P 0
Min PV	Min value of all selected PVs	1 0 - P 0
Draw	$((PV1/PV2)-1)*F$	d r 8 0 0
Weighted average	$((PV2-PV1)*F)+PV1$	0 0 8 0 0
Ratio	$(PV1/PV2)*F$	r 8 0 0
Concentration	$(PV1/(PV1+PV2))*F$	1 0 0 0 E 0
Math 2	Math on other math channels	0 0 8 0 0 2
<b>Programmable Constants</b>	Constant P (Adder): -99.999 to 999.999, default: 0.000 Constant F (Factor): 0.001 to 999.999, default: 1.000	

## 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)
<b>Scanner ID</b>	1 – 247 (Scanner Modbus address)
<b>Baud Rate</b>	300 – 19,200 bps
<b>Transmit Time Delay</b>	Programmable 0 to 4999 ms This is the time the scanner will wait for a slave to respond before sending another request on the bus. This value should be greater than 100 ms to avoid collisions on the bus.
<b>Data</b>	8 bits (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)
<b>Note:</b> Refer to the ProtEX-MAX Scanner Modbus Register Tables located at <a href="http://www.predig.com">www.predig.com</a> for details.	

## Dual Process Inputs

<b>Two Inputs</b>	Two non-isolated analog inputs, independent field selectable: 0-20 mA, 4-20 mA; $\pm 10$ V (0-5, 1-5, 0-10 V)	
<b>Isolated Transmitter Power Supply</b>	Terminals P+ & P-: 24 VDC $\pm 10\%$ . 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.	
<b>PV Analog Channel ID</b>	Ch-A mA: Assign PV to ID 256 or Ch-A volt: 257; Ch-B mA: Assign PV to ID 258 or Ch-B volt: 259	
<b>Accuracy</b>	$\pm 0.03\%$ of calibrated span $\pm 1$ count, square root & programmable exponent accuracy range: 10-100% of calibrated span	
<b>Temperature Drift</b>	0.005% of calibrated span/ $^{\circ}$ C max from 0 to 65 $^{\circ}$ C ambient, 0.01% of calibrated span/ $^{\circ}$ C max from -40 to 0 $^{\circ}$ C ambient	
<b>Input Signal Conditioning</b>	Linear, square root, programmable exponent, or round horizontal tank volume calculation	
<b>Multi-Point Linearization</b>	2 to 32 points for PV1 and PV2	
<b>Programmable Exponent</b>	User selectable from 1.0001 to 2.9999 for open channel flow	
<b>Round Horizontal Tank</b>	Diameter & Length: 999.999 inch or cm calculates volume in gallons or liters respectively.	
<b>Low-value Cutoff</b>	0.1 to 999,999 (0 disables cutoff function) for PV1 and PV2. Point below at which display always shows zero.	
<b>Calibration Range</b>	Input Range	Minimum Span
	4-20 mA	0.15 mA
	$\pm 10$ V	0.10 V
An error message will appear if the input 1 & input 2 signals are too close together.		
<b>Input Impedance</b>	Voltage ranges: greater than 500 k $\Omega$ Current ranges: 50 - 100 $\Omega$ (depending on internal resettable fuse impedance)	
<b>Input Overload</b>	Current input protected by an internal resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.	
<b>HART Transparency</b>	The scanner can support ONLY one HART loop on either of the inputs. A signal isolator is required if two HART loops are being connected.  Under the described conditions, the scanner 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 scanner is not affected if a HART communicator is connected to the loop. The scanner 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 ( $\approx 50$ W) @ 125/250 VAC for inductive loads
<b>Noise Suppression</b>	Noise suppression is recommended for each relay contact switching inductive loads to prevent disruption to the microprocessor's operation. Recommended suppressor value: $0.01 \mu\text{F}/470 \Omega$ , 250 VAC (PDX6901). See <i>Switching Inductive Loads</i> on page 32 for details.
<b>Deadband</b>	0-100% of span, user programmable
<b>High or Low Alarm</b>	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
<b>Relay Operation</b>	<ul style="list-style-type: none"> <li>• Automatic (non-latching) and/or manual reset</li> <li>• Latching (requires manual acknowledge) with or without clear</li> <li>• Pump alternation control (2-4 relays)</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 front panel button, F4 digital input, external contact closure on digital inputs, or through serial communications.
<b>Time Delay</b>	0 to 999.9 seconds, on & off relay time delays. Programmable and independent for each relay
<b>Fail-Safe Operation</b>	Programmable and independent for each relay. <b>Note:</b> Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.
<b>Auto Initialization</b>	When power is applied to the scanner, relays will reflect the state of the input to the scanner.

## Isolated 4-20 mA Output

<b>Output Source</b>	PV1-16, math channels C1-4, set points 1-4, 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>Communications Break</b>	Programmable mA output when a slave device does not reply within the response timeout.		
<b>Accuracy</b>	$\pm 0.1\%$ of span $\pm 0.004$ mA		
<b>Temperature Drift</b>	0.4 $\mu\text{A}/^\circ\text{C}$ max from 0 to $65^\circ\text{C}$ ambient, 0.8 $\mu\text{A}/^\circ\text{C}$ max from $-40$ to $0^\circ\text{C}$ ambient. <b>Note:</b> Analog output drift is separate from input drift.		
<b>Isolated Transmitter Power Supply</b>	Terminals I+ & R: 24 VDC $\pm 10\%$ . 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 $\Omega$

## USB Connection

<b>Function</b>	Programming only
<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 scanner. <b><i>DO NOT</i></b> apply AC or DC power to the scanner while the USB port is in use.

## Digital Input (F4)

<b>Function</b>	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 80 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 80 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.

## ScanView Software

<b>Availability</b>	Download directly from scanner or from <a href="http://www.prediq.com/download_software">www.prediq.com/download_software</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, and data logging)
<b>Configuration</b>	Configure scanners one at a time
<b>Power</b>	USB port provides power to the scanner. <b><i>DO NOT</i></b> apply AC or DC power to the scanner while the USB port is in use.



## 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>	Aluminum: 14.7 lbs (6.7 kg) Stainless Steel: 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

Emissions	EN 55022 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
Immunity	EN 61326-1 Measurement, control, and laboratory equipment EN 61000-6-2 EMC heavy industrial generic immunity standard
RFI - Amplitude Modulated	80 -1000 MHz 10 V/m 80% AM (1 kHz) 1.4 - 2.0 GHz 3 V/m 80% AM (1 kHz) 2.0 - 2.7 GHz 1 V/m 80% AM (1 kHz)
Electrical Fast Transients	±2kV AC mains, ±1kV other
Electrostatic Discharge	±4kV contact, ±8kV air
RFI - Conducted	10V, 0.15-80 MHz, 1kHz 80% AM
AC Surge	±2kV Common, ±1kV Differential
Surge	1KV (CM)
Power-Frequency Magnetic Field	30 A/m 70%V for 0.5 period
Voltage Dips	40%V for 5 & 50 periods 70%V for 25 periods
Voltage Interruptions	<5%V for 250 periods

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

## Product Ratings and Approvals

<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 scanner.

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

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

## Cover Jam Screw



The cover jam screw should be properly installed once the scanner has been wired and tested in a safe environment. The cover jam screw is intended to prevent the removal of the scanner cover in a hazardous environment without the use of tools. Using a M2 hex wrench, turn the screw clockwise until the screw contacts the scanner. 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 scanner is in service.

## Mounting Dimensions

All units: inches (mm)

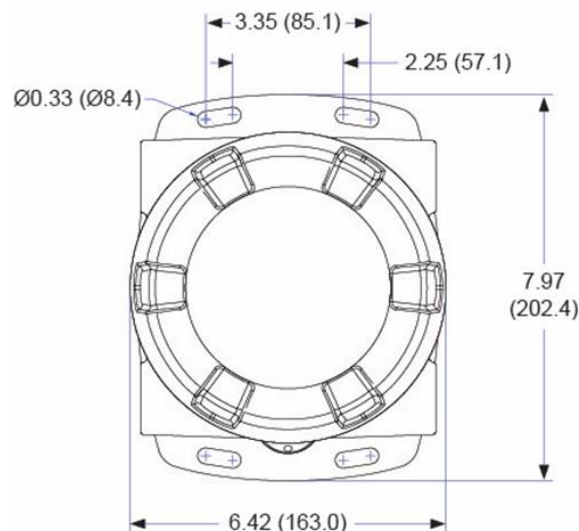


Figure 1. Enclosure Dimensions – Front View

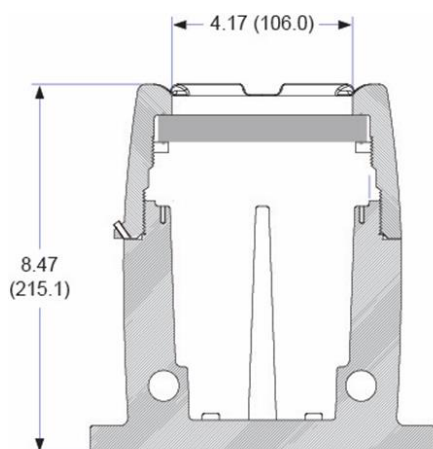


Figure 2. Enclosure Dimensions – Side Cross Section View

## Wall Mounting Instructions

The scanner 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 scanner to a wall, follow these instructions:

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

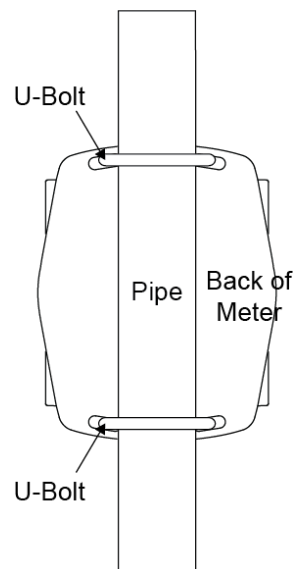


To mount the scanner using a U-Bolt kit, follow these instructions:

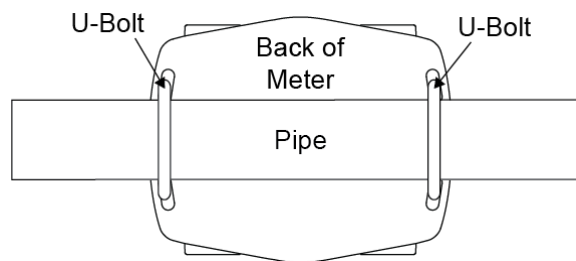
- Orient the groove on the back of the instrument with the pipe and secure it to the pipe with the two U-bolts and hardware provided.



### Vertical Pipe Mounting



### Horizontal Pipe Mounting



## Installation Overview

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

1. **DO NOT** apply AC or DC power to the scanner.
2. Connect the scanner to the PC with the USB cable provided. **DO NOT** use a different USB cable.
3. If ScanView (SV) 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 SV icon.
4. If SV is not installed, follow the instructions provided below.
5. Use SV to configure the scanner for your application.
6. Disconnect the USB cable from the scanner.
7. Apply power and signal and check operation of the scanner.
8. Install the scanner and put into service.
9. Make any programming adjustments using the programming buttons.

## ScanView Software

The easiest and quickest way to program your ProtEX-MAX scanner is to use the FREE ScanView programming software. This software is loaded into the scanner 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 scanner 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 scanner while your PC is connected to the scanner as it will disrupt the USB connection. It is not necessary to apply an input signal.

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

For more information on ScanView visit  
[www.prediq.com/ScanView](http://www.prediq.com/ScanView)

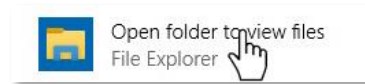
## ScanView Installation

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

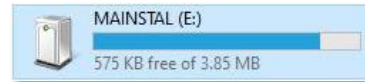
### ⚠ WARNINGS

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

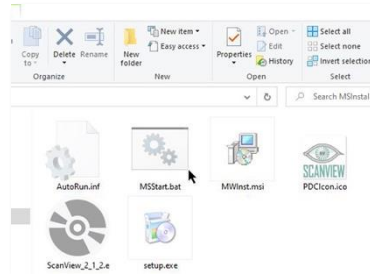
2. Once the driver is installed, an AutoPlay dialog should appear for the drive "MAINSTAL." Click "Open folder to view files."



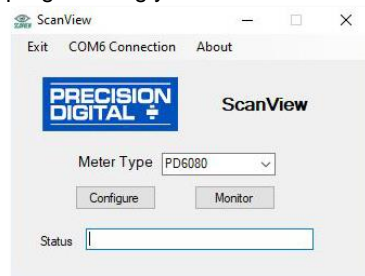
If the computer does not display an AutoPlay dialog for the drive "MAINSTAL," you should open My Computer and double-click on the drive labeled "MAINSTAL."



3. Double-click on the file named "MSStart." 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 scanner.



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

### ⚠ WARNINGS

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

## ScanView Monitoring



Once the scanner has been configured, the user chooses Monitor from the top menu bar. The Monitor window will appear; the enabled PVs and all associated values will take a few seconds to display. The PVs will display as configured - either in Decimal or Feet & Inches format. Data Logging, Scanning, and Alarm Status can all be viewed at the bottom of the Monitor window.

## ScanView Data Logging

ScanView software allows the user to log data and generate reports.

1. Select Monitor - Stop Scan from the top menu bar.
2. Select the Data Log drop-down menu from the top menu bar. Parameters for Data Logging are: Interval, Units, Log File Name, and Start/Pause. For Interval the choices are: 1-60, and for Unit choices for logging data are: Seconds, Minutes, and Hours.
3. Save the Data Log File. It is recommended to name the file using a unique name and the date, such as:  
**"ScanView\_1.00\_Log\_X\_100813".**
4. Select Monitor - Start Scan from the top menu bar, then select Data Log - Start from the top menu bar. The log file can be retrieved at any time by following the path:  
**(C:) - Program Files (x86) - PDC - ScanView 1.00 - Data Log.**

### IMPORTANT

- Once Data Logging has begun, the Configure, Customize, and Connection screens cannot be accessed until the user has paused Data Logging.

Data Log files are saved in the Data Log folder as ".CSV" files. To view Data Log files, the user must first pause both Scanning and Data Logging. Data Logging & Scan Status can be seen at the bottom of the Monitor window.

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

All scanners, including models equipped with the 12-24 VDC power option, are shipped from the factory configured to provide 24 VDC @ 25 mA power for the transmitter or sensor.

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

To access the voltage selection jumper:

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

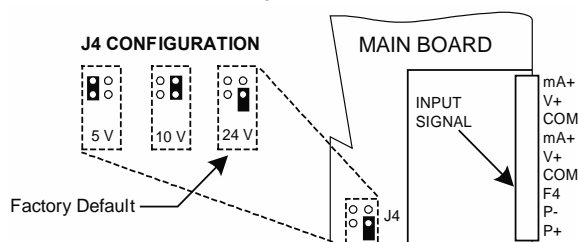


Figure 3. Transmitter Supply Voltage Selection

## Connections

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

### CAUTION

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

### WARNINGS

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

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

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

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

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

## Required & Factory Wired Connection

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

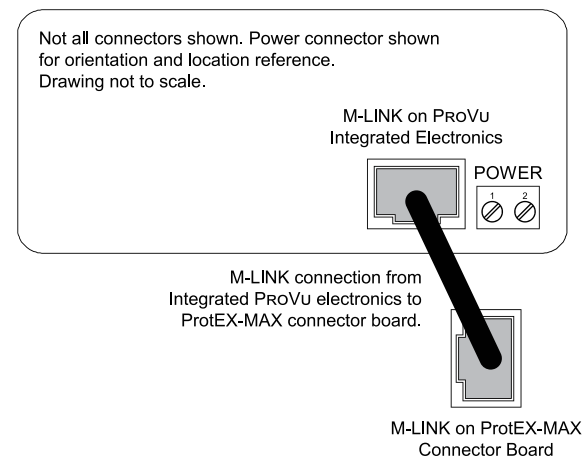
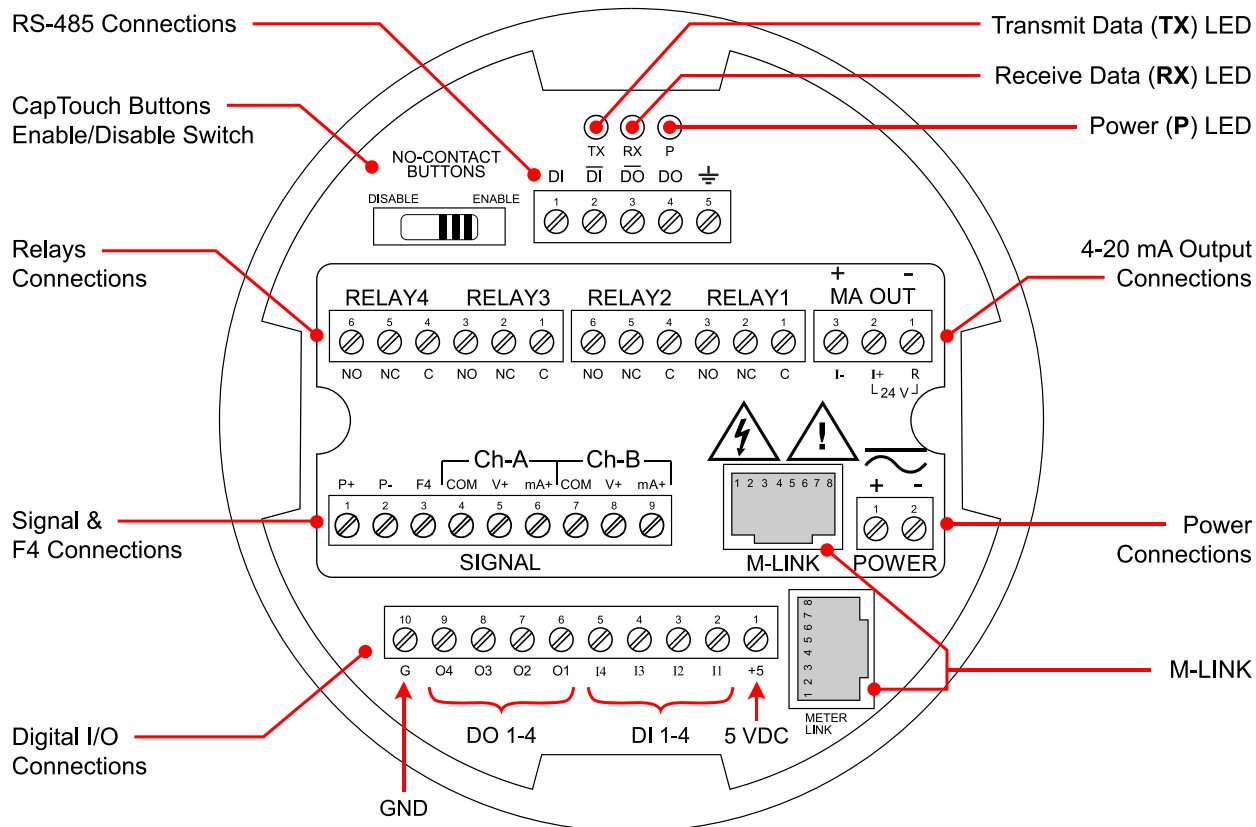


Figure 4. Integrated ProVu Required Connections



### ProVu Electronics Module Layout for PD8-6080/81-6H7 and PD8-6080/81-7H7\*



\* For models PD8-6080/81-6H0 and PD8-6080/81-7H0 the upper set of connectors (RELAYS & MA OUT) are not present

Figure 5. ProVu Electronics Module Layout

### USB Connection

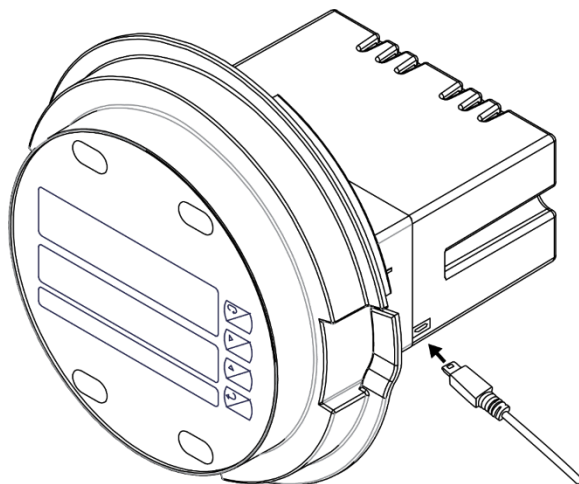


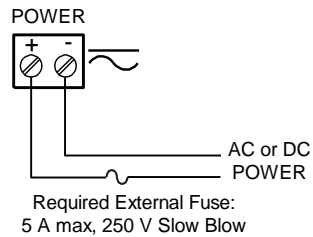
Figure 6. USB Connection

#### ⚠ WARNINGS

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

## Power Connections

Power connections are made to a two-terminal connector labeled POWER on the back of the scanner. The scanner 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 8 for details.



**Figure 7. Power Connections**

## 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 *Serial Communications (SER, RL)* on page 42 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 8. RS-485 Diagnostic LEDs

## RS-485 Multi-Drop Connection

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

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

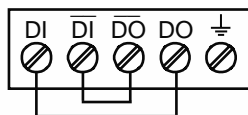


Figure 9. Three-Wire RS-485 Connection

## Digital I/O Connections



Digital inputs and outputs are provided in order to expand the functionality of the scanner. 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.

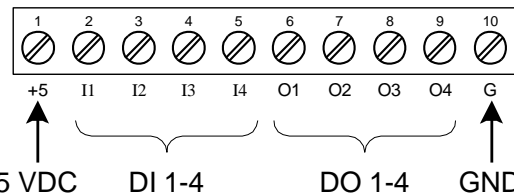


Figure 10. Digital Input and Output Connections

### 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 scanner. This digital input connected with a normally open contact across F4 and COM, or with an active low signal applied to F4. It can be used for remote operation of front-panel buttons, to acknowledge/reset relays, or to reset max/min values. See *Function Keys & Digital I/O Available Settings* on page 80 for a complete list of capabilities.

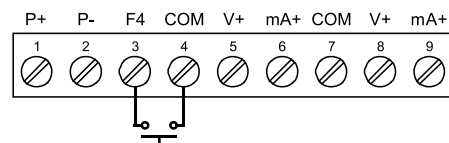


Figure 11. F4 Digital Input Connections

## Relay Connections

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

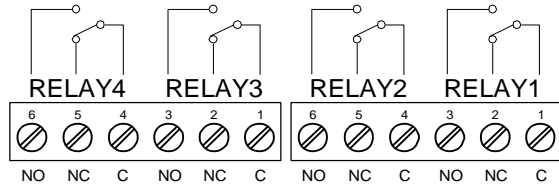


Figure 12. Relay Connections

## 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 trigger 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 64.

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.

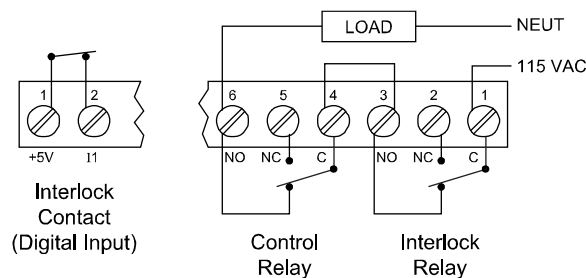


Figure 13. Interlock Connections

## Switching Inductive Loads

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

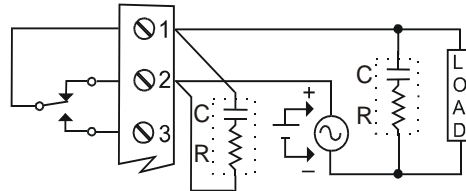


Figure 14. AC and DC Loads Protection

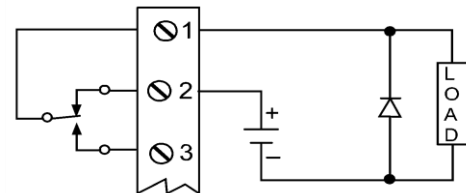
Choose R and C as follows:

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:

- Use capacitors rated for 250 VAC.
- RC networks may affect load release time of solenoid loads. Check to confirm proper operation.
- Install the RC network at the scanner'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 15. Low Voltage DC Loads Protection

## RC Networks (Snubbers) Available from Precision Digital

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

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



### 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.

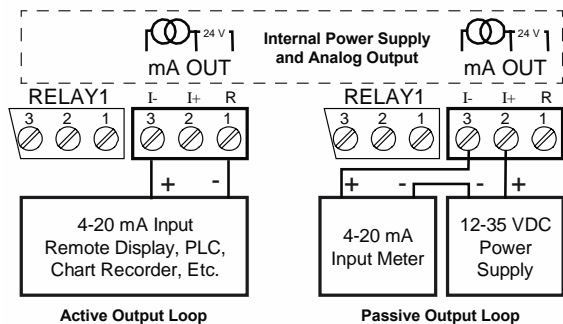


Figure 16. 4-20 mA Output Connections

### Remote Programming

The scanner 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.

### Analog Output Power Supply

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

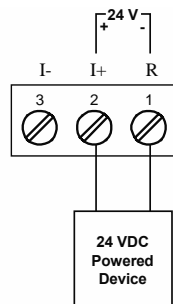


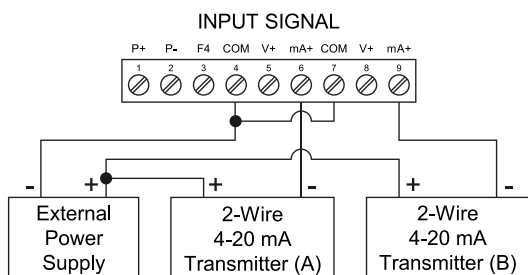
Figure 17. Analog Output Supply Powering Other Devices

## Analog Input Signal Connections

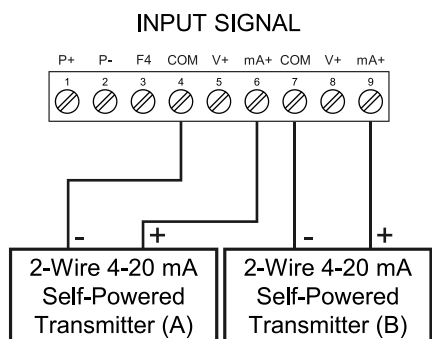
Analog input signal connections are made to a nine-terminal connector labeled SIGNAL. The COM (common) terminals are the return for the 4-20 mA and the  $\pm 10$  V input signals. The two COM terminals connect to the same common return and are not isolated.

### Current (mA) Connections

The following figures show examples of current connections. There are no switches or jumpers to set up for current inputs. Setup and programming is performed through the programming buttons or using ScanView software.



**Figure 18. Transmitter Powered by External Power Supply**



**Figure 19. Self-Powered Transmitters**

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.

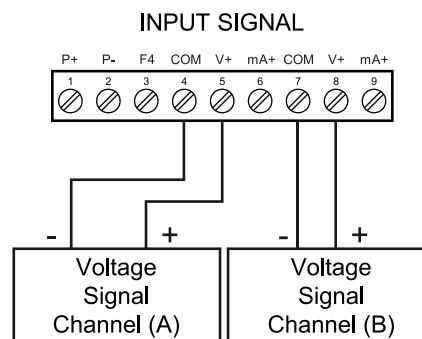
The fuse limits the current to a safe level when it detects a fault condition, and automatically resets itself when the fault condition is removed.

## Voltage (V) Connections

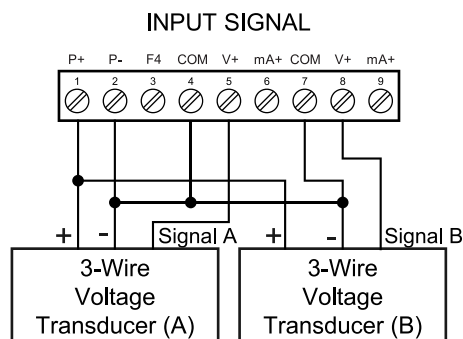
The following figures show examples of voltage connections.

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

The total current required to drive the two voltage-output transducers cannot exceed 25 mA if the internal transducer power supply is used.



**Figure 20. 2-Wire Voltage Input Connections**



**Figure 21. 3-Wire Voltage Input Connections**

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

## Setup and Programming

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

### Overview

There are no jumpers involved in the scanner setup procedure.

Setup and programming is done using ScanView software or through the programming buttons.

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

### LED Status Indicators

#### PD8-6080



LED	State	Indication
1-4	Steady	Alarm condition based on set and reset points, independent of relay status in certain configurations. (Available on all meter configurations, including those without relays installed)
1-4	Flashing	Relay interlock switch open
1-4 & M	Flashing	Relay in manual control mode
F	Flashing	Communications fault condition
	Flashing	Press SCAN to pause scanning
▶	Steady	Press SCAN to resume scanning
■	Flashing	Stop scan on alarm
M	Flashing	Analog output in manual control mode





## PD8-6081







LED	State	Indication
1-4	Steady	Alarm condition based on set and reset points, independent of relay status in certain configurations. (Available on all meter configurations, including those without relays installed)
1-4	Flashing	Relay interlock switch open
1-4 & M	Flashing	Relay in manual control mode
8	Steady	Eighths of an inch
16	Steady	Sixteenths of an inch
F	Flashing	Communications fault condition
II	Flashing	Press SCAN to pause scanning
▶	Steady	Press SCAN to resume scanning
■	Flashing	Stop scan on alarm
M	Flashing	Analog output in manual control mode

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

## Programming Buttons

Button	Description
 	Press to enter, exit Programming Mode, or exit max/min readings
 	Press to move to the previous PV or math channel

Button	Description
 	Press to move to the next PV or math channel
 	Press once to pause scanning, press again to resume scanning

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

## CapTouch Buttons

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

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

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

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

### CapTouch Button Tips:

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





## Display Functions & Messages

The following table shows the main menu functions and messages in the order they appear in the menu.

Display Functions & Messages		
Display	Parameter	Action/Setting Description
Mode	Mode	Enter <i>Mode</i> menu
Master	Master	Enter <i>Master</i> Mode
PV Number	PV Number	Select PV
PV 1	PV	Select PV 1-16
Enable	Enable	Enable PV
Disable	Disable	Disable PV
Slave ID	Slave ID	Enter the unique Slave ID for each PV
Function Code	Function Code	Enter the Function Code for each PV
Function Code 03	Function Code 03	Use Function Code 03 to read slave device
Function Code 04	Function Code 04	Use Function Code 04 to read slave device
Function Code 65	Function Code 65	Use Function Code 65 to read slave device
Register Number	Register Number	Enter the Register Number for each PV
5 digits 6 digits	Register Number Digits	Select either 5 (x0001-x9999) or 6 (x00001-x65536) digits
Data Type	Data Type	Enter the Data Type for each PV
Floating Point Data Type	Floating Point Data Type	Floating Point Data Type. Select <i>Floating Point</i> as the data type to be read from the slave device.
Short Integer Data Type	Short Integer Data Type	Short Integer Data Type. Select <i>Short Integer</i> as the data type to be read from the slave device.
Long Integer Data Type	Long Integer Data Type	Long Integer Data Type. Select <i>Long Integer</i> as the data type to be read from the slave device.
Binary	Binary	Binary Data format. Select <i>Binary</i> format for Short or Long integers.
BCD	BCD	BCD Data format. Select <i>BCD</i> format for Short or Long integers.
Signed	Signed	Signed Data. Select <i>Signed</i> Binary format for Short or Long integers.
Unsigned	Unsigned	Unsigned Data. Select <i>Unsigned</i> Binary format for Short or Long integers.
Byte Order	Byte Order	Select big-endian byte order.
Byte Order	Byte Order	Select little-endian byte order.
Byte Order	Byte Order	Select byte-swapped big-endian byte order. Not available for Short integer.

Display Functions & Messages		
Display	Parameter	Action/Setting Description
Byte Order	Byte Order	Select byte-swapped little-endian byte order. Not available for Short integer.
Polling Time	Polling Time	Enter Polling Time (the time between read commands). In other words, how often the display is updated in Master mode.
Response Time	Response Time	Enter the time allowed for a slave device to respond to a command.
Snooper	Snooper	Enter <i>Snooper</i> Mode
PV Number	PV Number	Select PV
PV 1	PV	Select PV 1-16
Enable	Enable	Enable PV
Disable	Disable	Disable PV
Slave ID	Slave ID	Enter the unique Slave ID of the device to be polled by Master
Function Code	Function Code	Enter the Function Code for each PV
Function Code 03	Function Code 03	Use Function Code 03 to read slave device
Function Code 04	Function Code 04	Use Function Code 04 to read slave device
Function Code 65	Function Code 65	Use Function Code 65 to read slave device
Register Number	Register Number	Enter the Register Number for each PV
5 digits 6 digits	Register Number Digits	Select either 5 (x0001-x9999) or 6 (x00001-x65536) digits
Data Type	Data Type	Enter the Data Type for each PV
Floating Point Data Type	Floating Point Data Type	Floating Point Data Type. Select <i>Floating Point</i> as the data type to be read from the slave device.
Short Integer Data Type	Short Integer Data Type	Short Integer Data Type. Select <i>Short Integer</i> as the data type to be read from the slave device.
Long Integer Data Type	Long Integer Data Type	Long Integer Data Type. Select <i>Long Integer</i> as the data type to be read from the slave device.
Binary	Binary	Binary Data. Select <i>Binary</i> format for Short or Long integers.
BCD	BCD	BCD Data. Select <i>BCD</i> format for Short or Long integers.
Signed	Signed	Signed Data. Select <i>Signed</i> Binary format for Short or Long integers.
Unsigned	Unsigned	Unsigned Data. Select <i>Unsigned</i> Binary format for Short or Long integers.

Display Functions & Messages		
Display	Parameter	Action/Setting Description
1234	Byte Order	Select big-endian byte order.
4321	Byte Order	Select little-endian byte order.
2143	Byte Order	Select byte-swapped big-endian byte order. Not available for Short.
3412	Byte Order	Select byte-swapped little-endian byte order. Not available for Short.
Time	Response Time	Enter the time allowed for a slave device to respond to a command.
SLAVE	Slave	Enter Slave Mode
DATA	Data Type	Enter the Data Type for each PV
Float	Floating Point Data Type	Floating Point Data Type. Select <i>Floating Point</i> as the data type to be read from the slave device.
Short	Short Integer Data Type	Short Integer Data Type. Select <i>Short Integer</i> as the data type to be read from the slave device.
Long	Long Integer Data Type	Long Integer Data Type. Select <i>Long Integer</i> as the data type to be read from the slave device.
Binary	Binary	Binary Data. Select <i>Binary</i> format for Short or Long integers.
BCD	BCD	BCD Data. Select <i>BCD</i> format for Short or Long integers.
Signed	Signed	Signed Data. Select <i>Signed</i> Binary format for Short or Long integers.
Unsigned	Unsigned	Unsigned Data. Select <i>Unsigned</i> Binary format for Short or Long integers.
1234	Byte Order	Select big-endian byte order.
4321	Byte Order	Select little-endian byte order.
2143	Byte Order	Select byte-swapped big-endian byte order. Not available for Short integer.
3412	Byte Order	Select byte-swapped little-endian byte order. Not available for Short integer.
Time	Response Time	Enter the time allowed for a slave device to respond to a command.
Setup	Setup	Enter Setup menu
PV	Process Variable	Enter PV Setup menu
PV 1	PV	Select PV 1-16
Tag	Tag	Tag

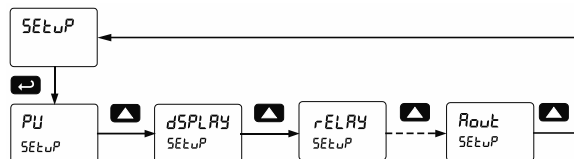
Display Functions & Messages		
Display	Parameter	Action/Setting Description
Units	Units	Units
Format	Format	Format (Decimal, Eighths, or Sixteenths of an Inch)
Decimal	Decimal	Decimal Format
Eighth	Eighths	Eighth Inch Format
Sixteenth	Sixteenths	Sixteenth Inch Format
Decimal Point	Decimal Point	Decimal Point menu
Display Decimal Point	Display Decimal Point	Set the decimal point position for the display. This is independent from float decimal point.
Floating Decimal Point	Floating Decimal Point	Floating Decimal Point. Select the decimal point for the expected floating point data.
Scale PV	Scale PV	Scale PV
Input 1	Input 1	Scale input 1 signal or program input 1 value
Display 1	Display 1	Program display 1 value
Input 2	Input 2	Scale input 2 signal or program input 2 value (up to 32 points)
Display 2	Display 2	Program display 2 value (up to 32 points)
Display Setup	Display	Enter Display Setup menu
Display Line 1	Display Line 1	Top Display
Display PV	Display PV	Display PVs 1-16
Display C Channel	Display C Channel	Display Math Channels C1-C4
Display PV & Units	Display PV & Units	Display PV & Units
Display Tag, PV Number	Display Tag, PV Number	Display Tag & PV Number selected
Display Tag, PV# & Units	Display Tag, PV# & Units	Display Tag, PV Number selected, & Units
Display C & Units	Display C & Units	Display C1-C4 & Units
Display Tag, C, & Units	Display Tag, C, & Units	Display Tag, C1-C4 & Units
Display Set Points 1-4	Display Set Points 1-4	Display Set Points 1-4
Display Max PV 1-16	Display Max PV 1-16	Display Maximum value for each enabled PV1-16
Display Min PV 1-16	Display Min PV 1-16	Display Minimum value for each enabled PV1-16
Display Max Ch C1-C4	Display Max Ch C1-C4	Display Maximum for math channels C1-C4
Display Min Ch C1-C4	Display Min Ch C1-C4	Display Minimum for math channels C1-C4
Display Line 2	Display Line 2	Bottom Display
Display Tag	Display Tag	Display Tag
Display Tag & Units	Display Tag & Units	Display Tag & Units

Display Functions & Messages		
Display	Parameter	Action/Setting Description
<b>d OFF</b>	<i>Display off</i>	Display Off
<b>d- IntY</b>	<i>Display Intensity</i>	Display Intensity
<b>rELRY</b>	<i>Relay Setup</i>	Enter <i>Relay Setup</i> menu
<b>R55 1n</b>	<i>Assign Relay</i>	Assign Relay menu
<b>rELRY 1</b>	<i>Relay 1-4</i>	Assign Relay 1-4
<b>PV 1</b>	<i>PV 1-16</i>	Map Relay to PV 1-16
<b>n-PV</b>	<i>Multiple PVs</i>	Map Relay to Multiple PVs
<b>rLY 1</b>	<i>Relay 1-4</i>	Relay 1-4
<b>Rct 1</b>	<i>Relay Action 1-4</i>	Assign Relay Action for relays 1-4
<b>Ruto</b>	<i>Automatic</i>	Set relay for automatic reset
<b>R-nRn</b>	<i>Auto-manual</i>	Set relay for auto or manual reset any time
<b>LRtCH</b>	<i>Latching</i>	Set relay for latching operation
<b>Lt-CLr</b>	<i>Latching-cleared</i>	Set relay for latching operation with manual reset only after alarm condition has cleared
<b>RLtErn</b>	<i>Alternate</i>	Set relay for pump alternation control
<b>SRnPL</b>	<i>Sample</i>	Set relay for sample time trigger control
<b>OFF</b>	<i>Off</i>	Turn relay off
<b>FR LSF</b>	<i>Fail-safe</i>	Enter <i>Fail-safe</i> menu
<b>FLS 1</b>	<i>Fail-safe 1</i>	Set relay 1-4 fail-safe operation
<b>on</b>	<i>On</i>	Enable fail-safe operation
<b>oFF</b>	<i>Off</i>	Disable fail-safe operation
<b>dELRY</b>	<i>Delay</i>	Enter relay <i>Time Delay</i> menu
<b>dLY 1</b>	<i>Delay 1*</i>	*Enter relay 1-4 time delay setup
<b>On 1</b>	<i>On 1</i>	Set relay 1 On time delay
<b>OFF 1</b>	<i>Off 1</i>	Set relay 1 Off time delay
<b>brERH</b>	<i>Break</i>	Set relay condition if communication break detected
<b>no Rct</b>	<i>No action</i>	Ignore break condition. No change in relay state when Communications Break detected.
<b>On</b>	<i>On</i>	Relay goes to alarm condition when break detected. Relay turns on when Communications Break detected.
<b>OFF</b>	<i>Off</i>	Relay goes to non-alarm condition when break detected. Relay turns off when Communications Break detected.

Display Functions & Messages		
Display	Parameter	Action/Setting Description
<b>Rout</b>	<i>Analog output</i>	Enter the <i>Analog Output</i> scaling menu
<b>Rout 1</b>	<i>Aout channel</i>	Analog Output source channel
<b>d 1 1</b>	<i>Display 1</i>	Program the first <i>Display</i> value for the Analog Output.
<b>Out 1</b>	<i>Output 1</i>	Program the first <i>Output</i> value that corresponds to the <i>Display 1</i> value for the Analog Output. (e.g. 4.000 mA).
<b>d 1 2</b>	<i>Display 2</i>	Program the second <i>Display</i> value for the Analog Output.
<b>Out 2</b>	<i>Output 2</i>	Program the second <i>Output</i> value that corresponds to the <i>Display 2</i> value for the Analog Output. (e.g. 4.000 mA). (e.g. 20.000 mA)
<b>SEr RL</b>	<i>Serial</i>	Enter <i>Serial</i> menu
<b>ScRn Id</b>	<i>Scan ID</i>	Enter <i>Scan ID</i> of the meter being polled (1-247)
<b>bRud</b>	<i>Baud Rate</i>	Select <i>Baud Rate</i> (Choices: 300/600/1200/2400/4800/9600/19,200) (Must match that of other devices)
<b>tr dLY</b>	<i>Transmit Delay</i>	Enter <i>Transmit Delay</i> (Master's delay must be greater than Snooper or slave devices)
<b>PRr LY</b>	<i>Parity</i>	Select <i>Parity</i> (Even, Odd, None 1-Stop, or None 2-Stop) (Must match that of other devices)
<b>t-bYt</b>	<i>Byte-to-byte Timeout</i>	Enter the timeout value allowed between received bytes. (This is used to fix communication problems with slow devices).
<b>PR55</b>	<i>Password</i>	Enter the <i>Password</i> menu
<b>PR55 1</b>	<i>Password 1</i>	Set or enter Password 1
<b>PR55 2</b>	<i>Password 2</i>	Set or enter Password 2
<b>PR55 3</b>	<i>Password 3</i>	Set or enter Password 3
<b>unLoc</b>	<i>Unlocked</i>	Program password to lock scanner
<b>Locd</b>	<i>Locked</i>	Enter password to unlock scanner
<b>999999 -999999</b>	<i>Flashing</i>	Over/under range condition

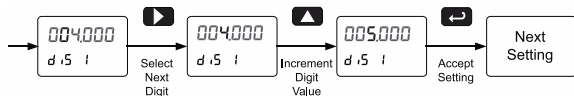
## Menu Navigation Tip

- The Up arrow scrolls through the sub-menus within a menu, after the last item it returns to the top menu. Press Enter to step into the menu again or press Up arrow to move to the next menu. Note: There are some exceptions (e.g. PV - Enable - - Data type ▲ Next PV).
- Press Menu to exit programming at any time.



## Setting Numeric Values

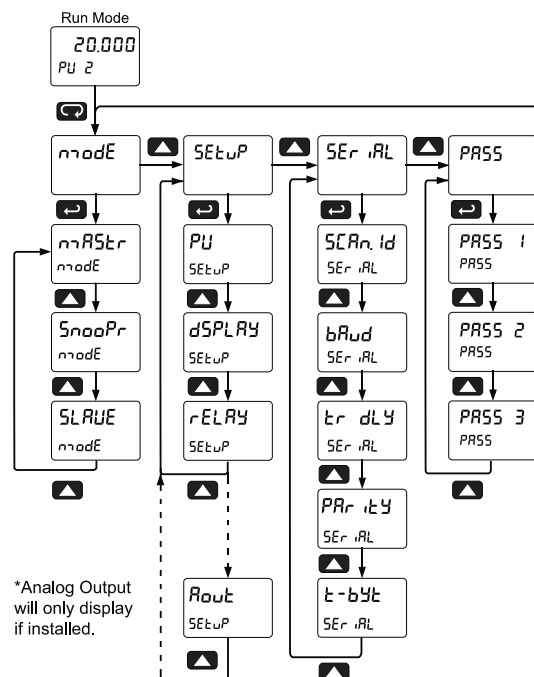
The numeric values are set using the Right and Up arrow buttons. Press the Right arrow to select the next digit and the Up arrow to increment the digit's value. The digit being changed is displayed brighter than the rest. Press and hold the Up arrow to auto-increment the display value. Press the Enter button, at any time, to accept a setting or the Menu button to exit without saving changes.



## Main Menu

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

- Press Menu button to enter Scanner Programming
- Press Up arrow button to scroll through the menus
- Press Menu, at any time, to exit and return to Run Mode
- 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



## Serial Communications (SEr iAL)

The scanner is equipped with RS-485 Modbus RTU serial communications.

The *Serial* menu is used for programming the Scanner ID, Baud Rate, Transmit Delay, Parity, and Byte-to-Byte Timeout parameters.

The scanner 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 8 for details.

### WARNING

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

When using more than one scanner in a multi-drop mode, each scanner must be provided with its own unique address. The scanner address (Scan ID) may be programmed between 1 and 247.

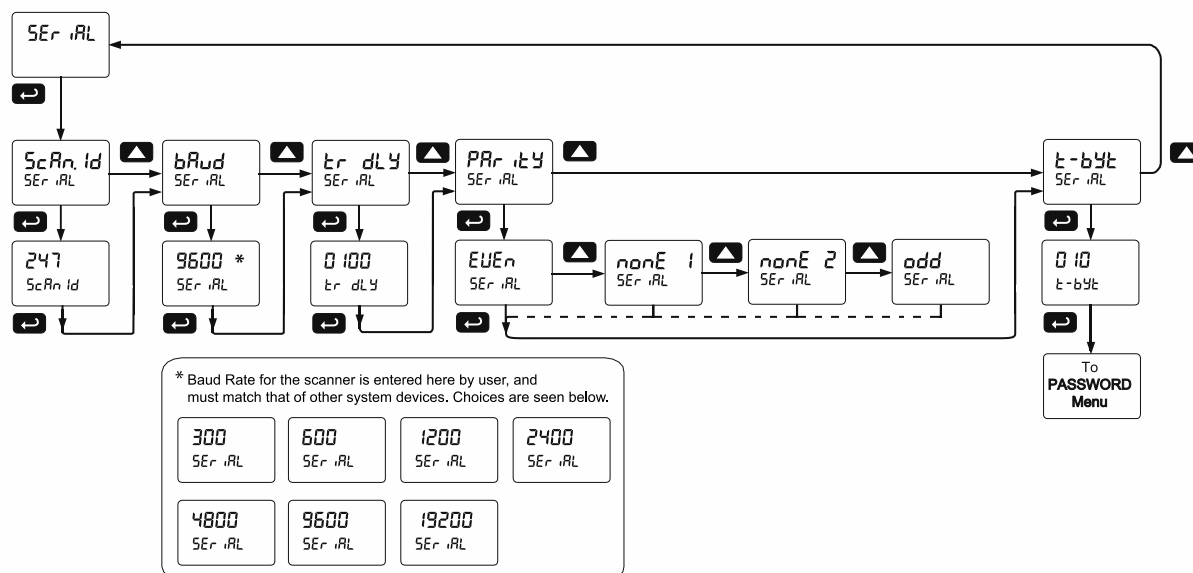
The transmit delay may be set between 0 and 4999 ms; this value must be less than (Poll Time/# of PVs).

The parity can be set to even, odd, or none with 1 or 2 stop bits.

When setting up the scanner to run on a Modbus system, the devices must be programmed with matching Baud Rate and Parity. Failure to match up the network devices' parameters may result in communication breaks.

### Notes:

1. The byte-to-byte timeout setting may be adjusted to fix communication errors with slow devices.
2. The Transmit Delay of the Master must be greater than the Snooper or the slave devices being polled.





## Scanner Mode Selection

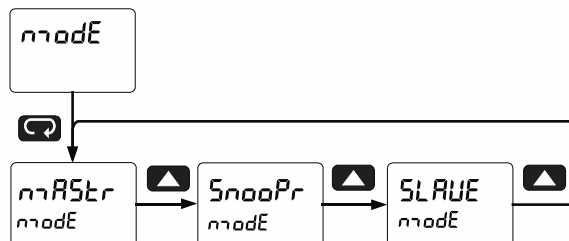
### Operating Modes (הרדע)

The *Mode* menu is used to select how the scanner is to function:

1. **Master:** Reads a slave device, scales the data from it, displays the result, and operates the relays and 4-20 mA output. The Master polls from 1 to 16 process variables from 1 to 16 slave devices. The Master processes and displays PV1 through PV16 and alternately displays the variables being polled.
2. **Snooper:** Listens to the Modbus traffic and picks up a specific register or registers being polled by a Master device from a specific slave device and processes the data being read.
3. **Slave:** Read and controlled by a master device (PLC, DCS, etc). The data sent to it by the master is scaled, displayed, and used to operate the relays and 4-20 mA output.

The Master mode requires additional parameter selection to specify how the slave device is to be read and how to interpret the data.

Press **Menu** to enter Scanner Programming. 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 and return to Run mode.



## How to Enable Process Variables (PVs)

In Master or Snooper Mode, navigate to the *PV Number* menu and press ENTER. From there, the user can scroll through all of the sixteen available PVs. In order to enable a specific PV, simply press ENTER to access the desired PV, then scroll to ENABLE and press ENTER (Follow the same course of action for disabling PVs).

Enter the Slave ID of the device being polled by the Master, followed by the Function Code, Register Number, Data Type, and Byte Order. Analog input channels must be assigned a Slave ID corresponding to the input to be read as indicated here:

- Ch A = 256 (mA) or 257 (V)
- Ch B = 258 (mA) or 259 (V)

Once the desired PVs are enabled, navigate to the *Setup* menu and enter the PV Setup in order to select the PV tag, units, format, and decimal point parameters, as well as to scale the PVs.

Once the user has scaled the final PV, the scanner automatically goes to the *Display Setup* menu to access line 1 and 2 display assignments.

By default, display line 1 is assigned to *Display PV* (הרדע הרדע) and line 2 to display the *Tag* (הרדע הרדע) for the corresponding PV.

It is possible to display PVs & Tags on line 1 and 2 simultaneously by selecting *Tag & PV Number* (הרדע הרדע). Display line 1 is setup by default to display PV & tag for PV1, 3, 5, 7; while line 2 is setup by default to display PV & tag 2, 4, 6, 8. These can be changed by the user to display any or all PVs. Program either display line 1 or 2 to show the desired parameters and press ENTER. See *Setting Up the Displays* (הרדע הרדע הרדע) on page 50 for details.

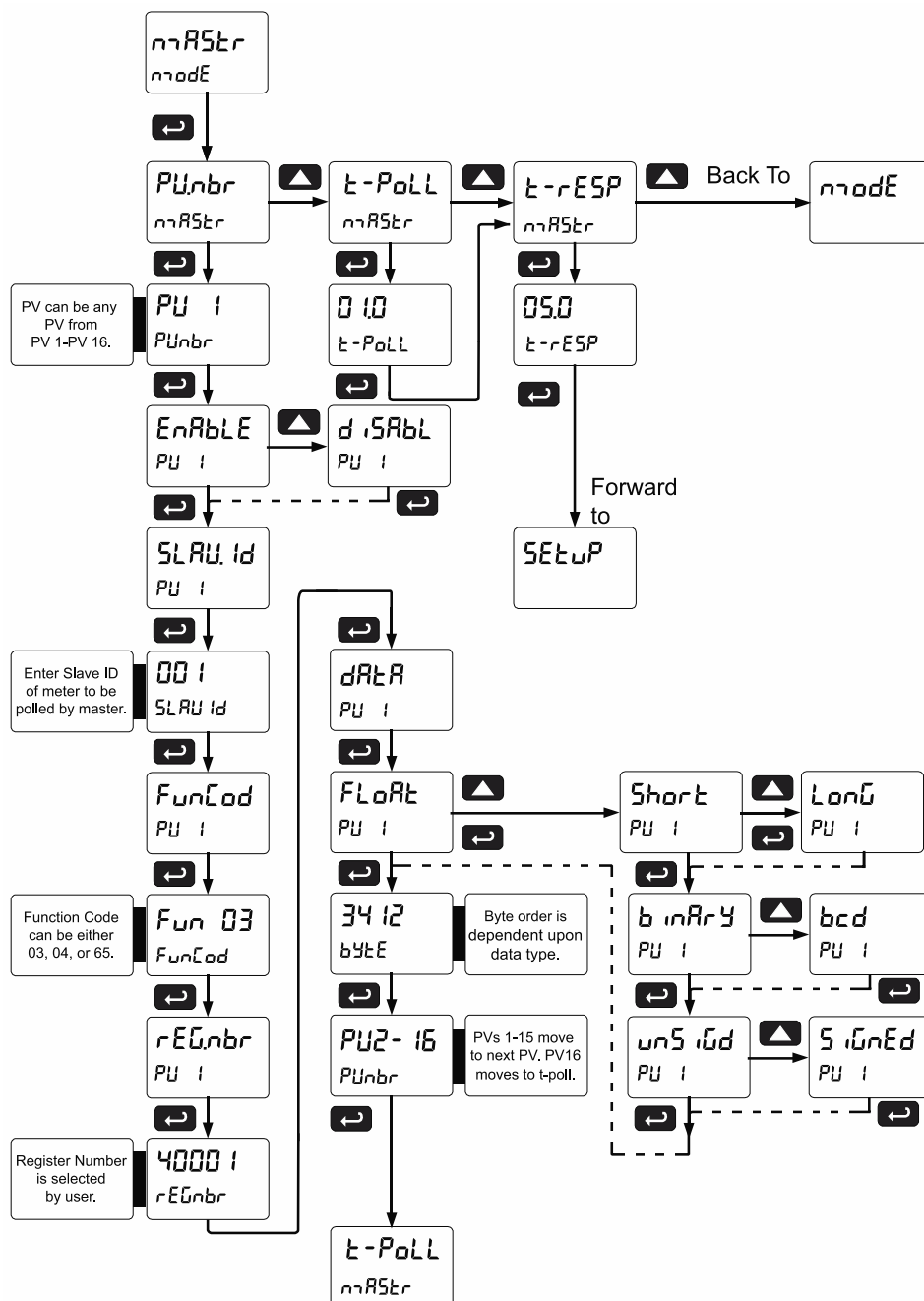
## Master Mode (מאסטר)

The Master mode contains the *PV Number*, *Poll Time*, and *Response Timeout* menus.

*PV Number*: Enable/disable PVs, select slave ID, function code, register number, data type & byte order.

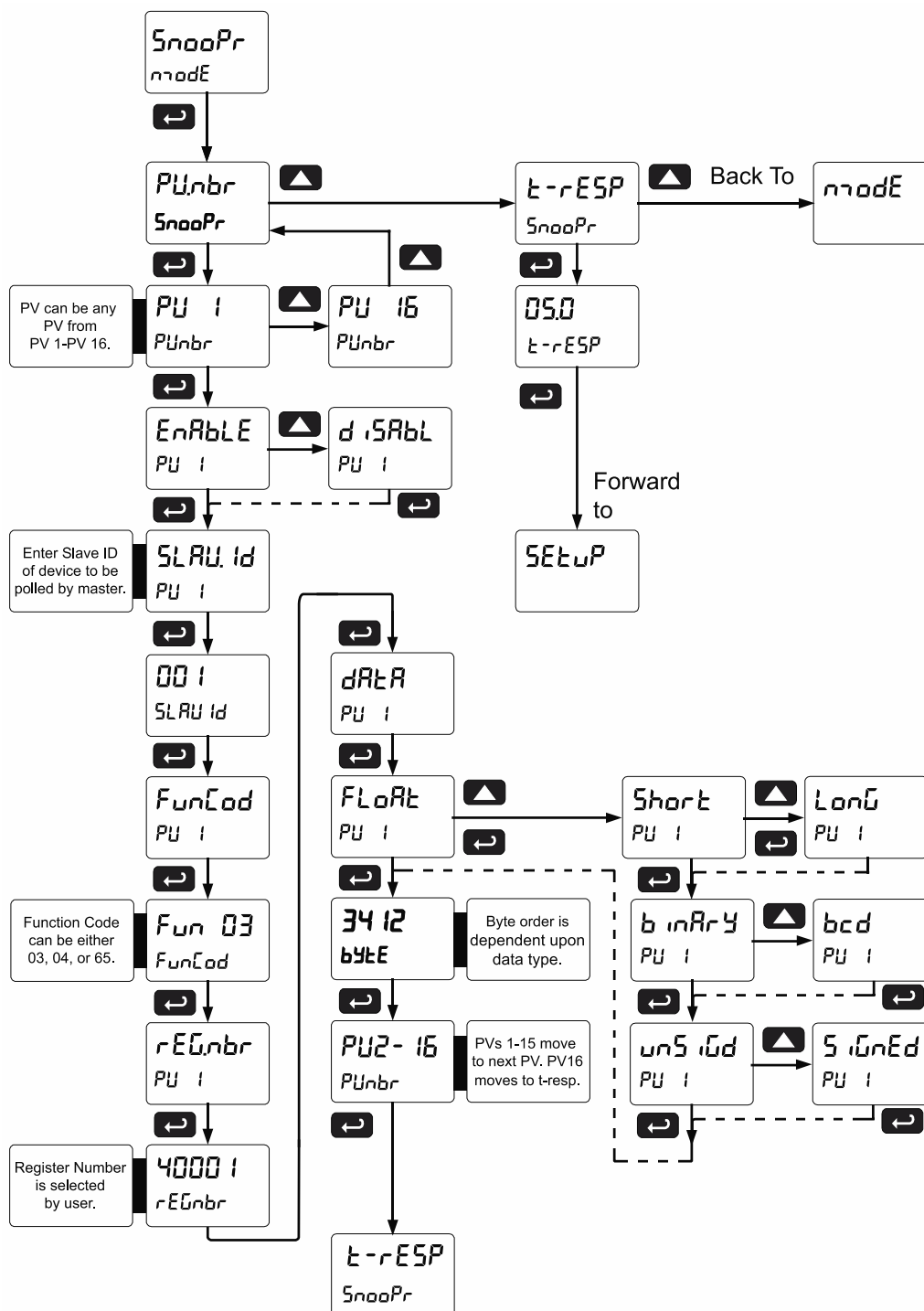
*Poll Time*: Enter the time interval to poll the slave devices selected.

*Response timeout*: Enter the time interval to wait after three polls before reporting it as a Communications Break.



## Snooper Mode (SnooPr)

The Snooper mode is used to listen to data being transmitted on the bus. Multiple Snoopers can be connected to the RS-485 bus and display any process variable. The same process variable can be displayed in multiple locations. Use the menu below to configure Snooper Mode parameters.

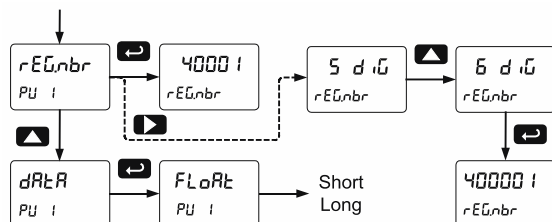


## How to Select 5 or 6-Digit Registers

In Master or Snooper Mode, it is possible to select either a five-digit or a six-digit Register Number. Once the operator has enabled a PV, entered a Slave ID, and chosen a Function Code, the scanner will arrive at the Register Number menu (*rEGnbr*). Press the Right arrow to display the number of digits being used and then the Up arrow to change the setting for the number of digits to be used for that register (5 *d iG* or 6 *d iG*), then press ENTER.

### Notes:

1. If Function Code 03 is selected, the Register Number defaults to 40001; if Function Code 04 is selected, the Register Number defaults to 30001.
2. Default Data Type is Float
3. Default Slave ID for PV1=001, for PV2=002, for PV3=003, etc.



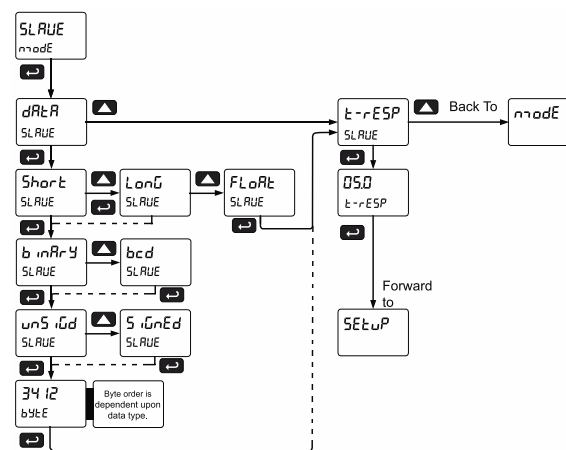
The Master ignores the decimal point setting for slave devices that specify a Short or Long integer. For example, a slave that is displaying 12.34 is read as 1,234. Floating point data may or may not utilize the decimal point. Refer to the slave's operating manual to make sure.

The Register Number range is based on the Function Code and the number of digits selected. See the following table:

Function Code	5 Digit	6 Digit
03	40001 – 49999	400001 – 465536
04	30001 – 39999	300001 – 365536
65	65001-65999	N/A

## Slave Mode (SLAVE)

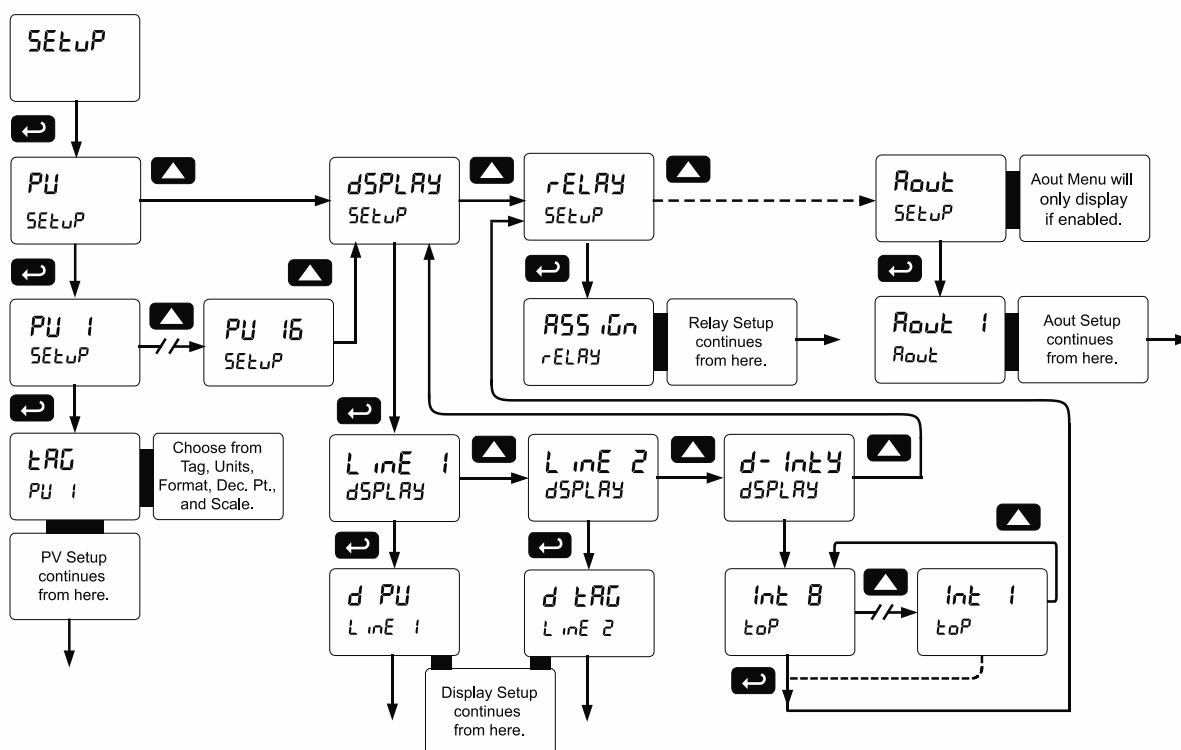
The Slave mode is capable of accepting Short, Long, and Float data types. Refer to the Modbus Register Tables at [www.predig.com](http://www.predig.com) for details of all the predefined parameters. Follow the menu below to navigate and set all parameters for Slave Mode.



The *Setup* menu is used to select:

1. PV Setup
  - a. PV Tags
  - b. PV Units
  - c. Format: Decimal point or Feet & Inches
  - d. Decimal Point
  - e. Scale input data
2. Display assignment & Intensity
3. Relay assignment and operation
4. 4-20 mA analog output scaling

Press the Menu button to exit at any time.

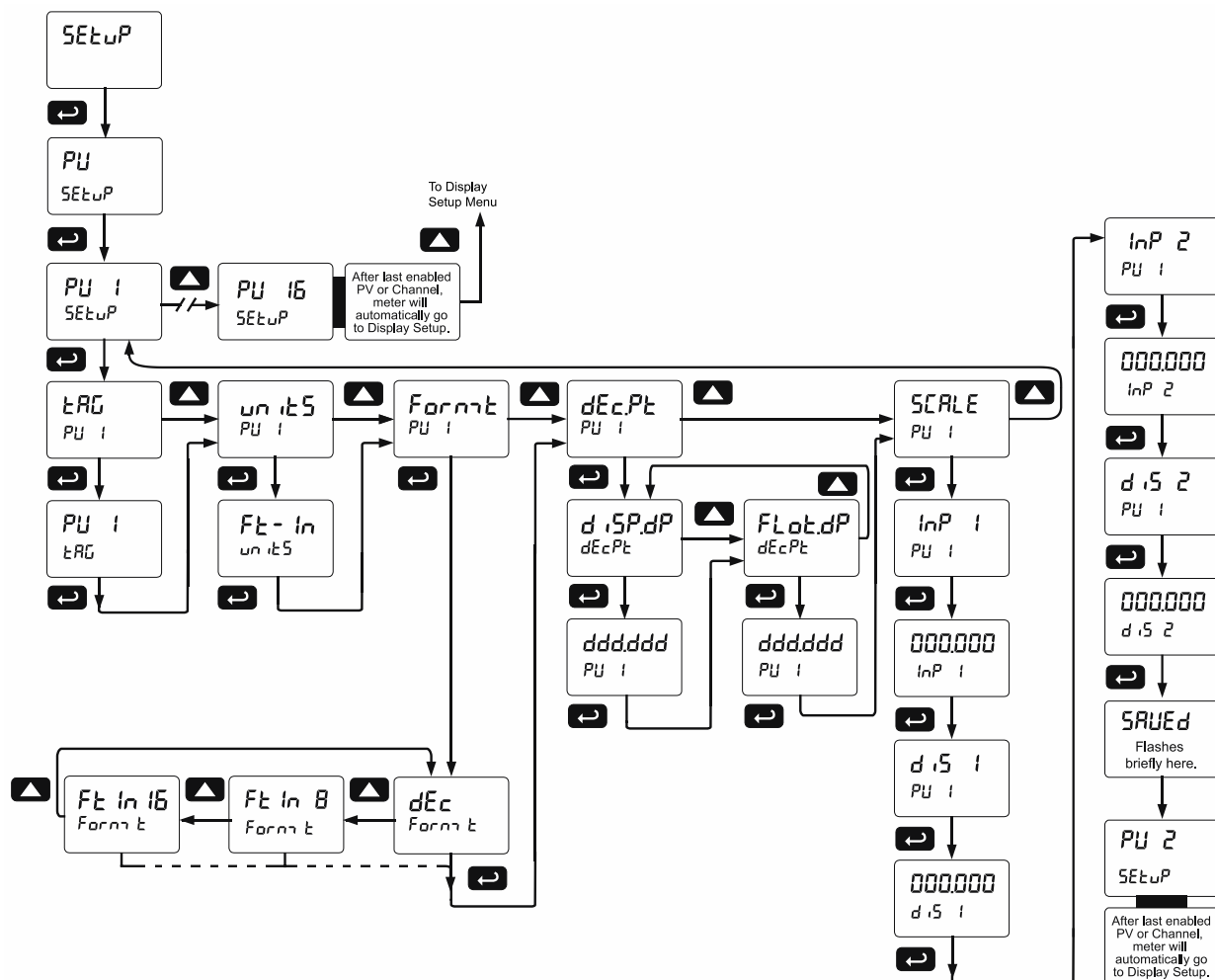




## Setting Up the Process Variables (PVs) (PU SEtUP)

Enter the *PV Setup* menu to set up all the criteria associated with each enabled PV. Once you have selected the desired PV, you can select parameters for each. These include tag, units, format, display decimal point, float decimal point (resolution), and scaling of the input data.

**Note:** PV1 and PV2 can have multiple points for linearization. Only two points are available for all other PVs and for either the Square Root or Programmable Exponent functions.



### Setting the Display Decimal Point (d,SPdP)

Decimal point may be set one to five decimal places or with no decimal point at all. Pressing the **Up** arrow moves the decimal point one place to the right until no decimal point is displayed, and then it moves to the leftmost position. The decimal point is programmable only for the Display Value.

### Setting the Float Decimal Point (FLoatdP)

If floating point data type is selected, select the number of decimals to correspond to the expected floating point data; the numbers to right of the LSD will be ignored by the scanner.

#### Example:

If you have a number such as 12.3456, you have to tell the scanner how many digits to the right are of interest to you. In this case selecting 4 places will make use of all the digits. For most applications the display decimal point will be set accordingly (*i.e.* 4 places).

If 2 decimal places are selected, the number 12.3456 is displayed as 12.35; notice that the number is rounded up.

### Scaling the PV Display Values (SCALE)

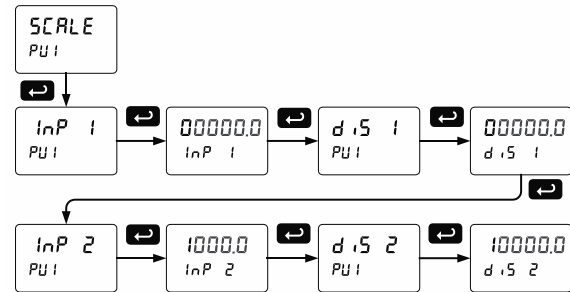
The data that the scanner receives can be scaled to display in engineering units. Input 1 must be less than Input 2, Input 2 must be less than Input 3, etc. (known as monotonic values). Press **Enter** to save the changes or **Menu** to exit without saving. When the Linear function is selected for PV1 & PV2, up to 32 points may be programmed to handle non-linear data. Only two points are available for all other PVs and for either the Square Root or Programmable Exponent functions. Round Horizontal Tanks are scaled using the length and diameter of the tank.

#### ⚠ IMPORTANT

##### • Reverse Scaling

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

### Scale Menu



The display will show **Error** if the scaling or calibration process is unsuccessful. Undesired operation may occur if the error is not corrected. Correct the error by either changing one of the inputs in question or changing the number of points to exclude an erroneous input point.

#### Notes:

- For Feet & Inches Display format, the display values will be in the format 99<sup>FT</sup> 11<sup>IN</sup> 15<sup>/16th</sup> or 8<sup>th</sup>. Make the left digit for inches and 16<sup>th</sup> blank if the value is less than 10. Example: 50 Feet, 9 Inches, and 8/16 will be displayed as 50<sup>FT</sup> \_9<sup>IN</sup> \_8<sup>16th</sup> instead of 50<sup>FT</sup> 09<sup>IN</sup> 08<sup>/16th</sup>.
- Scaling Short and Long input values (input 1, input 2, etc.) should be done without the decimal point.

### Multi-Point Linearization (L inErr)

The scanner is set up at the factory for 2-point linear scaling. Up to 32 linearization points may be selected for PV1 and PV2. All other PVs have two linearization points available. See *Linear Function Menu (L inErr)* on page 71 for details.

## Setting Up the Displays (ᐃᑭᑭᑭ ᑭᑭᑭᑭ)

### Display Line 1 Parameters (ᑭ ᑭᑭ ᑭᑭᑭᑭ)

The top display (ᑭ ᑭᑭ ᑭᑭ) can be programmed to display any of the following:

Display	Parameter	Setting Description
ᐃ ᑭᑭ	<i>Display PV</i>	Display PVs 1-16
ᐃ ᑭᑭ-ᑭ	<i>Display C Channel</i>	Display Math Channels C1-C4
ᑭᑭᑭᑭ ᑭᑭ	<i>Display PV &amp; Units</i>	Display PV & Units
ᑭᑭᑭᑭᑭ	<i>Display Tag, PV Number</i>	Display Tag & PV Number selected
ᑭᑭᑭᑭᑭᑭ	<i>Display Tag, PV# &amp; Units</i>	Display Tag, PV Number selected, & Units
ᑭᑭᑭ ᑭᑭ	<i>Display C &amp; Units</i>	Display C1-C4 & Units
ᑭᑭ ᑭᑭ ᑭᑭ	<i>Display Tag, C, &amp; Units</i>	Display Tag, C1-C4 & Units
ᐃᑭᑭᑭ ᑭᑭ	<i>Display Set Points 1-4</i>	Display Set Points 1-4
ᑭ ᑭᑭ-ᑭᑭ	<i>Display Max PV 1-16</i>	Display Maximum value for each enabled PV1-16
ᑭ ᑭᑭ-ᑭᑭ	<i>Display Min PV 1-16</i>	Display Minimum value for each enabled PV1-16
ᑭ ᑭᑭ-ᑭ	<i>Display Max Ch C1-C4</i>	Display Maximum for math channels C1-C4
ᑭ ᑭᑭ-ᑭ	<i>Display Min Ch C1-C4</i>	Display Minimum for math channels C1-C4

### Display Line 2 Parameters (ᑭ ᑭᑭ ᑭᑭᑭᑭ)

The bottom display (ᑭ ᑭᑭ ᑭᑭ) can be programmed to display any of the following:

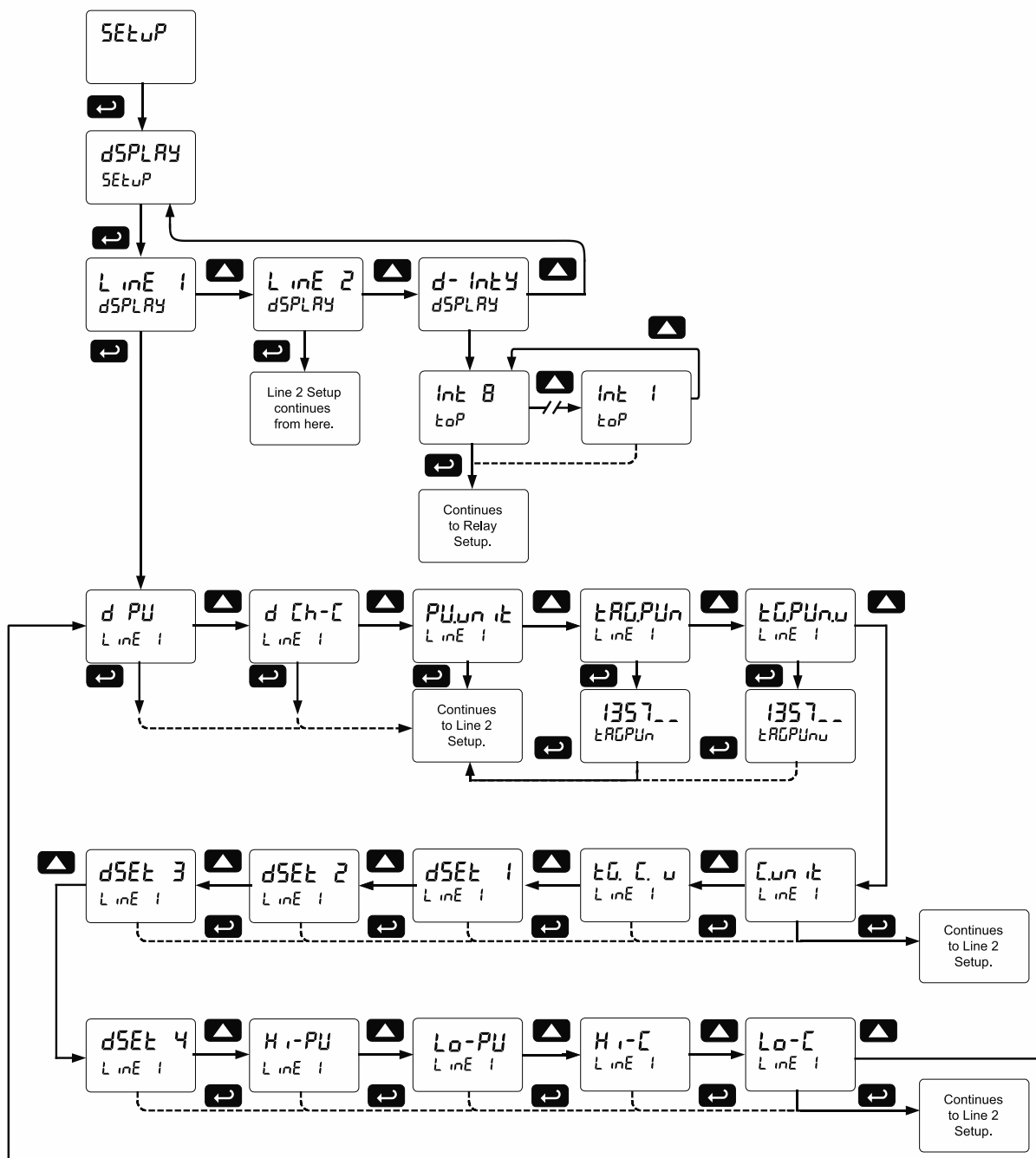
Display	Parameter	Setting Description
ᐃ ᑭᑭ	<i>Display PV</i>	Display PVs 1-16
ᐃ ᑭᑭ-ᑭ	<i>Display C Channel</i>	Display Math Channels C1-C4
ᑭᑭᑭᑭ ᑭᑭ	<i>Display PV &amp; Units</i>	Display PV & Units
ᑭᑭᑭᑭᑭ	<i>Display Tag, PV Number</i>	Display Tag & PV Number selected
ᑭᑭᑭᑭᑭᑭ	<i>Display Tag, PV# &amp; Units</i>	Display Tag, PV Number selected, & Units
ᑭᑭᑭ ᑭᑭ	<i>Display C &amp; Units</i>	Display C1-C4 & Units
ᑭᑭ ᑭᑭ ᑭᑭ	<i>Display Tag, C, &amp; Units</i>	Display Tag, C1-C4 & Units
ᐃᑭᑭᑭ ᑭᑭ	<i>Display Set Points 1-4</i>	Display Set Points 1-4
ᑭ ᑭᑭ-ᑭᑭ	<i>Display Max PV 1-16</i>	Display Maximum value for each enabled PV1-16
ᑭ ᑭᑭ-ᑭᑭ	<i>Display Min PV 1-16</i>	Display Minimum value for each enabled PV1-16
ᑭ ᑭᑭ-ᑭ	<i>Display Max Ch C1-C4</i>	Display Maximum for math channels C1-C4
ᑭ ᑭᑭ-ᑭ	<i>Display Min Ch C1-C4</i>	Display Minimum for math channels C1-C4
ᐃ ᑭᑭᑭ	<i>Display Tag</i>	Display Tag (Line 2 only)
ᐃ ᑭᑭᑭᑭ	<i>Display Tag &amp; Units</i>	Display Tag & Units (Line 2 only)
ᐃ ᑭᑭᑭ	<i>Display off</i>	Display Off (Line 2 only)

**Note:** Toggling displays use the Scan Time for the value and 2 seconds for Tag and Units.

### Display Intensity (ᐃᑭᑭ ᑭᑭᑭᑭ)

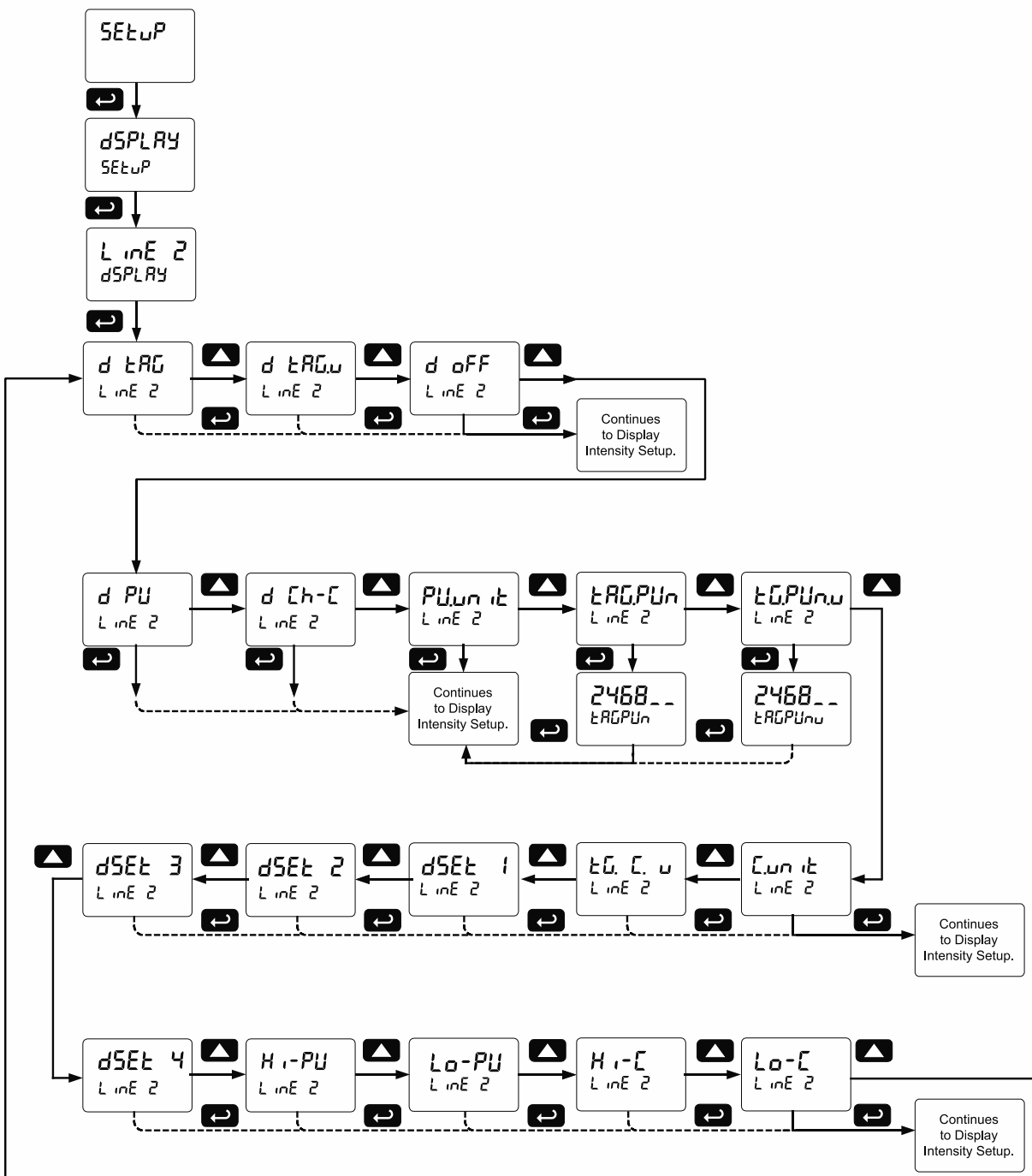
The scanner has eight display intensity levels to give the best performance under various lighting conditions. Select intensity 8 for outdoor applications. The default intensity setting is 6.

## Display Line 1 Menu (LINE 1 dSPLY)



**Note:** For Tag-PVn and Tag-PVn-U, the default settings for PVs are 1,3,5, & 7, followed by two underscores, which represent empty PVs. These all can be changed to any enabled PVs.

## Display Line 2 Menu (LINE 2 DISPLAY)



**Note:** For Tag-PVn and Tag-PVn-U, the default settings for PVs are 2,4,6,& 8, followed by two underscores, which represent empty PVs. These all can be changed to any enabled PVs.



## Setting the Tags (LR) & Units (u) (5)

Each PV can be setup with its own tag and units. See the flow charts on the previous pages to access the display menu to show the tag or toggling tag & units. The engineering units and custom tags can be set using the following 7-segment character set:

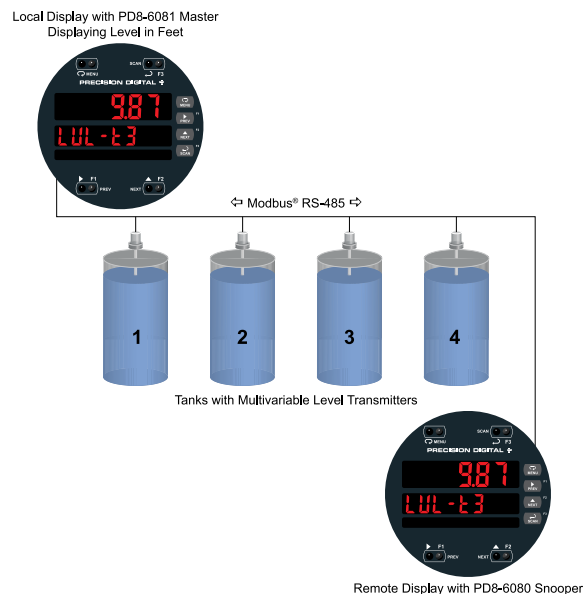
Display	Character	Display	Character
0	0	K	K
1	1	L	L
2	2	m	m
3	3	n	n
4	4	O	O
5	5	o	o
6	6	P	P
7	7	q	q
8	8	r	r
9	9	S	S
A	A	t	t
b	b	u	u
C	C	v	v
c	c	w	w
d	d	X	X
E	E	Y	Y
F	F	Z	Z
G	G	-	-
g	g	/	/
H	H	[	[
h	h	]	]
I	I	=	=
i	i	°	Degree(<)
J	J		Space

### Notes:

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

## Application Example 1

In this application we have a system consisting of (4) multivariable tank level gauges connected to (2) PD8-6080 Modbus scanners displaying Product Level, Interface Level, and Average Temperature. One of the Modbus Scanners is located next to the tanks and the other is located in the control room.



## Register Numbers & Process Variables

30001 - Product Level

30003 - Interface Level

30017 - Average Temperature

The following table shows the system setup for a typical multivariable level gauge, one PD8-6080 Master, and one PD8-6080 Snooper:

Parameter	PD8-6080 Master	PD8-6080 Snooper	Description/Comment
Mode	Master	Snooper	
PV1 Slave ID	1	1	
Function Code	04	04	
Register PV1	30001	30001	Tank 1 Product Level
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV2 Slave ID	1	1	
Function Code	04	04	
Register PV2	30003	30003	Tank 1 Interface

Parameter	PD8-6080 Master	PD8-6080 Snooper	Description/Comment
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV3 Slave ID	1	1	
Function Code	04	04	
Register PV3	30017	30017	Tank 1 Average Temperature
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV4 Slave ID	2	2	
Function Code	04	04	
Register PV4	30001	30001	Tank 2 Product Level
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV5 Slave ID	2	2	
Function Code	04	04	
Register PV5	30003	30003	Tank 2 Interface
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV6 Slave ID	2	2	
Function Code	04	04	
Register PV6	30017	30017	Tank 2 Average Temperature
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV7 Slave ID	3	3	
Function Code	04	04	

Parameter	PD8-6080 Master	PD8-6080 Snooper	Description/Comment
Register PV7	30001	30001	Tank 3 Product Level
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV8 Slave ID	3	3	
Function Code	04	04	
Register PV8	30003	30003	Tank 3 Interface
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV9 Slave ID	3	3	
Function Code	04	04	
Register PV9	30017	30017	Tank 3 Average Temperature
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV10 Slave ID	4	4	
Function Code	04	04	
Register PV10	30001	30001	Tank 4 Product Level
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV11 Slave ID	4	4	
Function Code	04	04	
Register PV11	30003	30003	Tank 4 Interface
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
PV12 Slave ID	4	4	

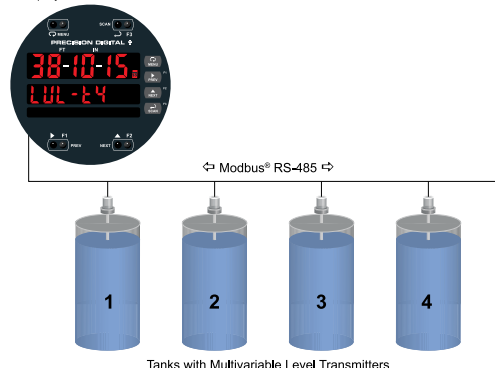
Parameter	PD8-6080 Master	PD8-6080 Snooper	Description/Comment
Function Code	04	04	
Register PV12	30017	30017	Tank 4 Average Temperature
Data Type	Long integer Binary, Signed	Long	
Byte Order	1234	1234	
Scanner ID	246	245	
Polling Time	5.0 sec	N/A	
Slave Response Timeout	10.0 sec	10.0 sec	
Baud	4800	4800	
Parity	None 1	None 1	1 stop bit
Byte-to-Byte Timeout	0.01 sec	0.01 sec	
Decimal point	3 places	3 places	
Input 1	000000	000000	Scaling for Level & Interface
Display 1	000000	000000	
Input 2	999999	999999	0.001 inch resolution
Display 2	83.333	83.333	Feet

## Application Example 2

In this application we have a system consisting of (4) multivariable tank level gauges connected to (2) PD8-6081s displaying Product Level, Interface Level, and Average Temperature.

One of the Modbus Scanners is located next to the tanks and the other is located in the control room. The display readout is shown in sixteenths of an inch.

Local Display with PD8-6081 Master



Remote Display with PD8-6081 Snooper

## Register Numbers & Process Variables

30001 - Product Level

30003 - Interface Level

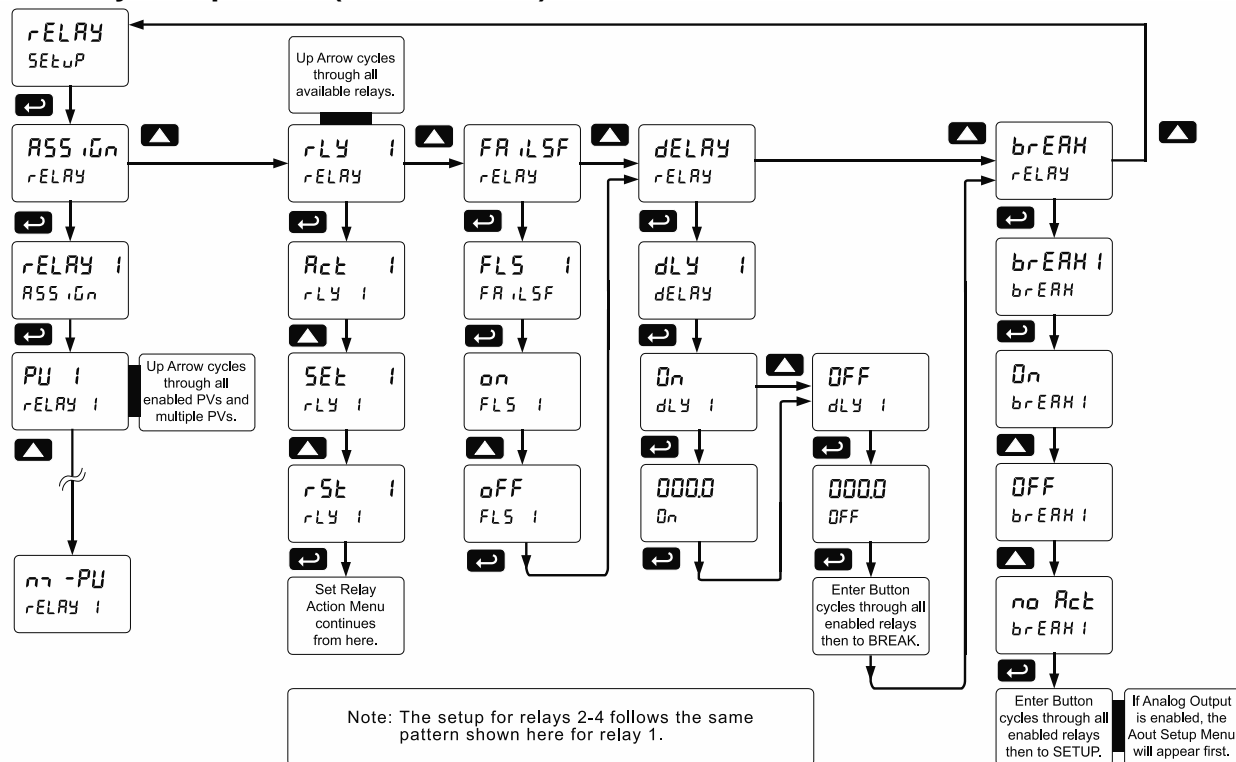
30017 - Average Temperature

**Note:** The example above shows the PD8-6081. The setup of the scanner is the same as the first example. The PD8-6081's Feet & Inches display is clearly visible.

## Setting the Relay Operation (rELAY)

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

### Relay Setup Menu (rELAY SEtUP)



Note: The setup for relays 2-4 follows the same pattern shown here for relay 1.

Enter Button cycles through all enabled relays then to SETUP. If Analog Output is enabled, the Aout Setup Menu will appear first.

### CAUTION

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

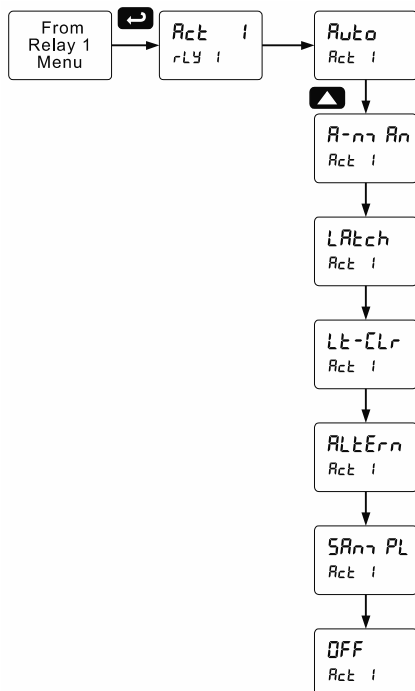
- ASSIGN Relay assignment**
  - Assign relay to PV
  - Assign relay to Math channel
  - Assign relay to multiple PVs (2 to 16 PVs)
- Act Relay action**
  - Automatic reset only (non-latching)
  - Automatic + manual reset at any time (non-latching)
  - Latching (manual reset only)
  - Latching with Clear (manual reset only after alarm condition has cleared)
  - Pump alternation control (automatic reset only)
  - Sampling (the relay is activated for a user-specified time)
  - Off (relay state controlled by Interlock feature)
- SEt Set point & rSt Reset point**
- FRILSF Fail-safe operation**
  - On (enabled)
  - Off (disabled)
- dELAY Time delay**
  - On delay (0-999.9 seconds)
  - Off delay (0-999.9 seconds)
- brERH Relay action for communications break or loss of 4-20 mA input**

## Setting the Relay Action (Rct i)

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

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

The following graphic shows relay 1 action setup; relay 2-4 are set up in a similar fashion.

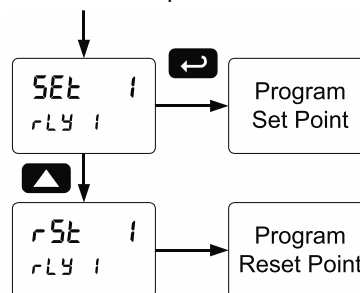


## Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

The deadband is defined as 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 (FR LSF)

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

## Programming Time Delay (dELRY)

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 Communications Break (brERRH)

The Scanner will poll the slave device three times before reporting a communications break condition. After the third failure, the Response Timeout timer starts and will determine the actual time to report a PV in break condition.

1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
3. No Action (The relays will maintain the last condition)

Refer to *Relay Operation After Communications Break* on page 60 for details.



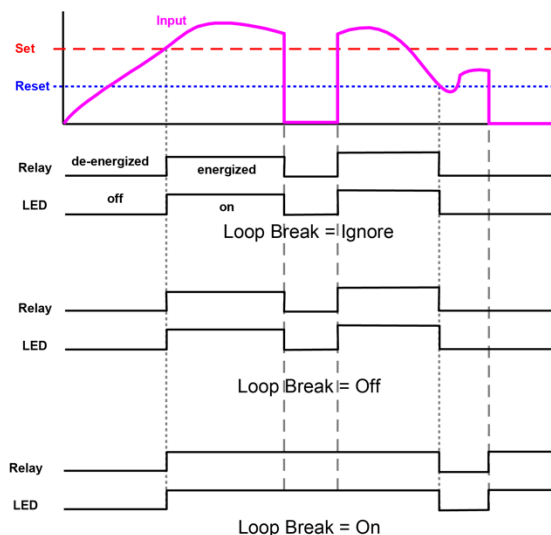
## Relay Action for Loss of 4-20 mA Input (Loop Break)

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

### Notes:

1. This is not dependent on the Communications Break or Response Timeout setting.
2. This is not a true loop break condition; if the signal drops below 0.005 mA, it is interpreted as a "loop break" condition.

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



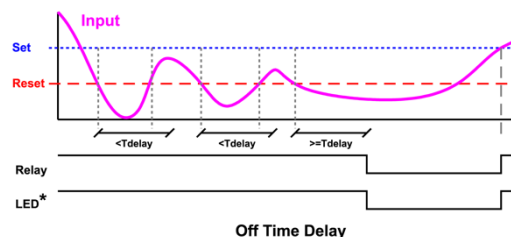
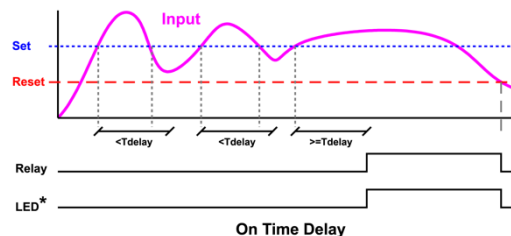
When the scanner detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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

**Note:** Select no Action

## Time Delay Operation

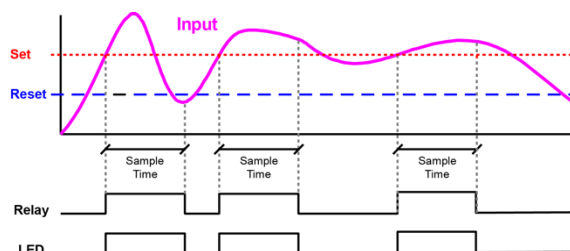
The following graphs show the operation of the time delay function.



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.

## Relay Sampling Operation



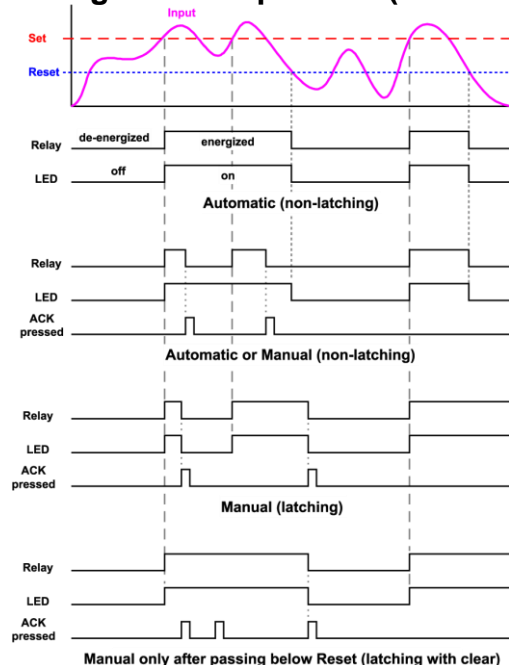
When the signal crosses the set point, the relay trips, and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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

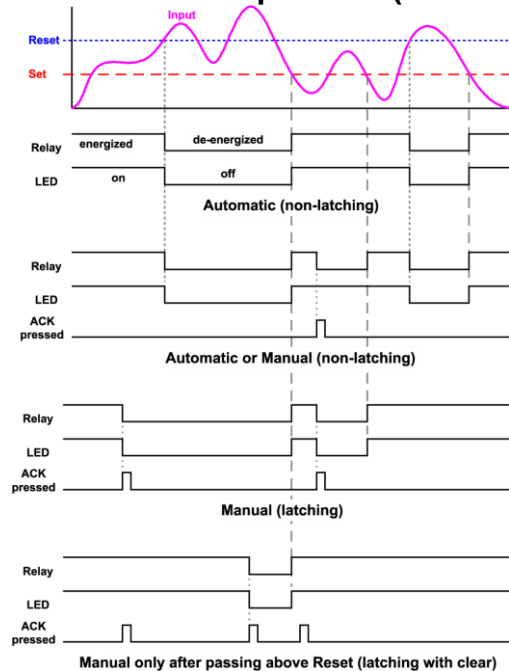
## Relay and Alarm Operation Diagrams

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

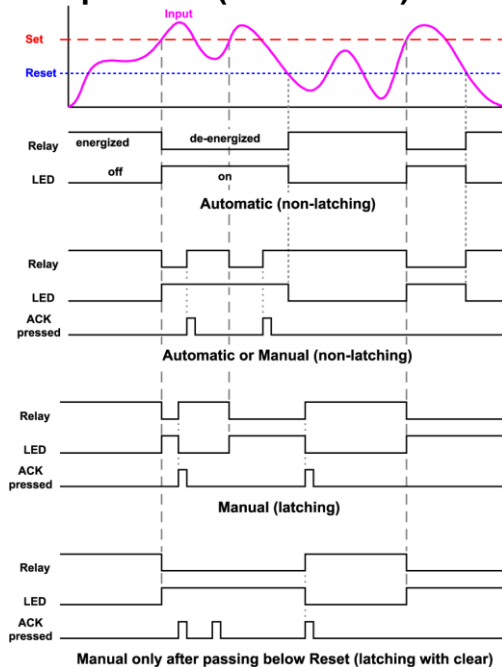
### High Alarm Operation (Set > Reset)



### Low Alarm Operation (Set < Reset)

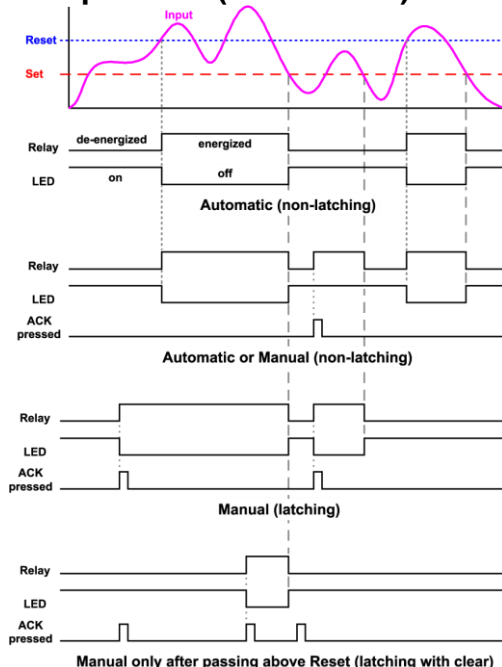


### High Alarm with Fail-Safe Operation (Set > Reset)



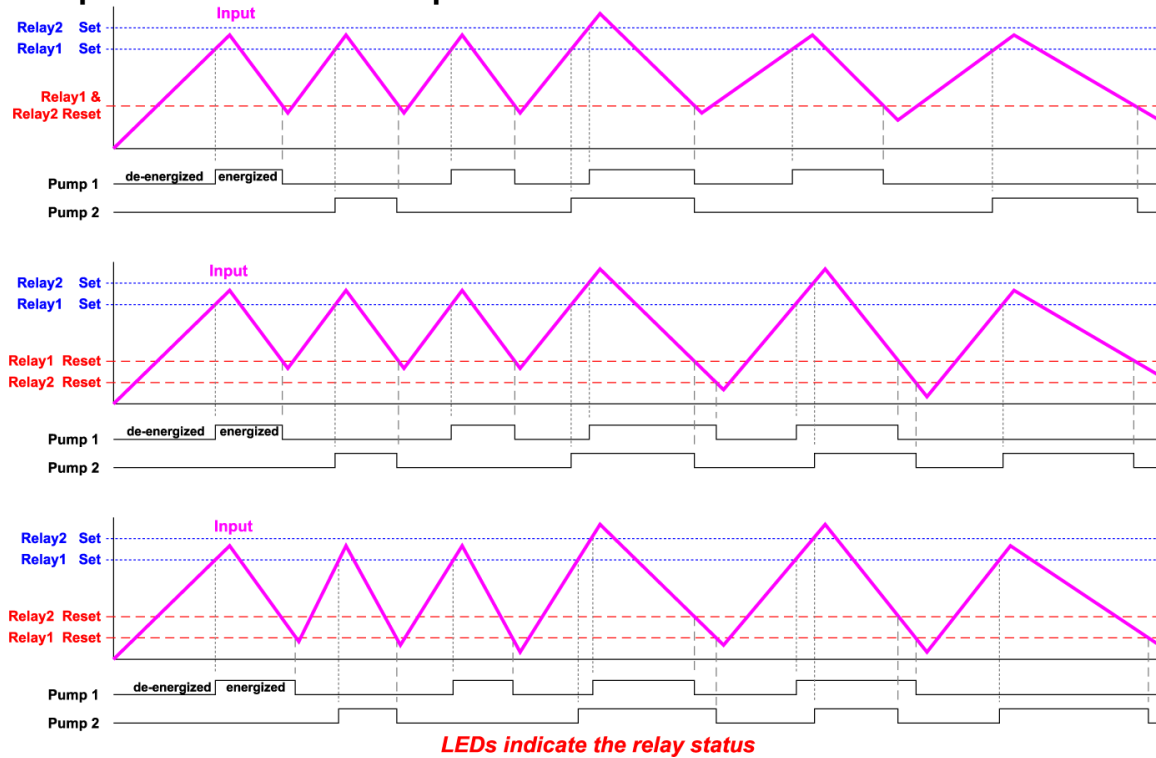
**Note:** Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

### 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.

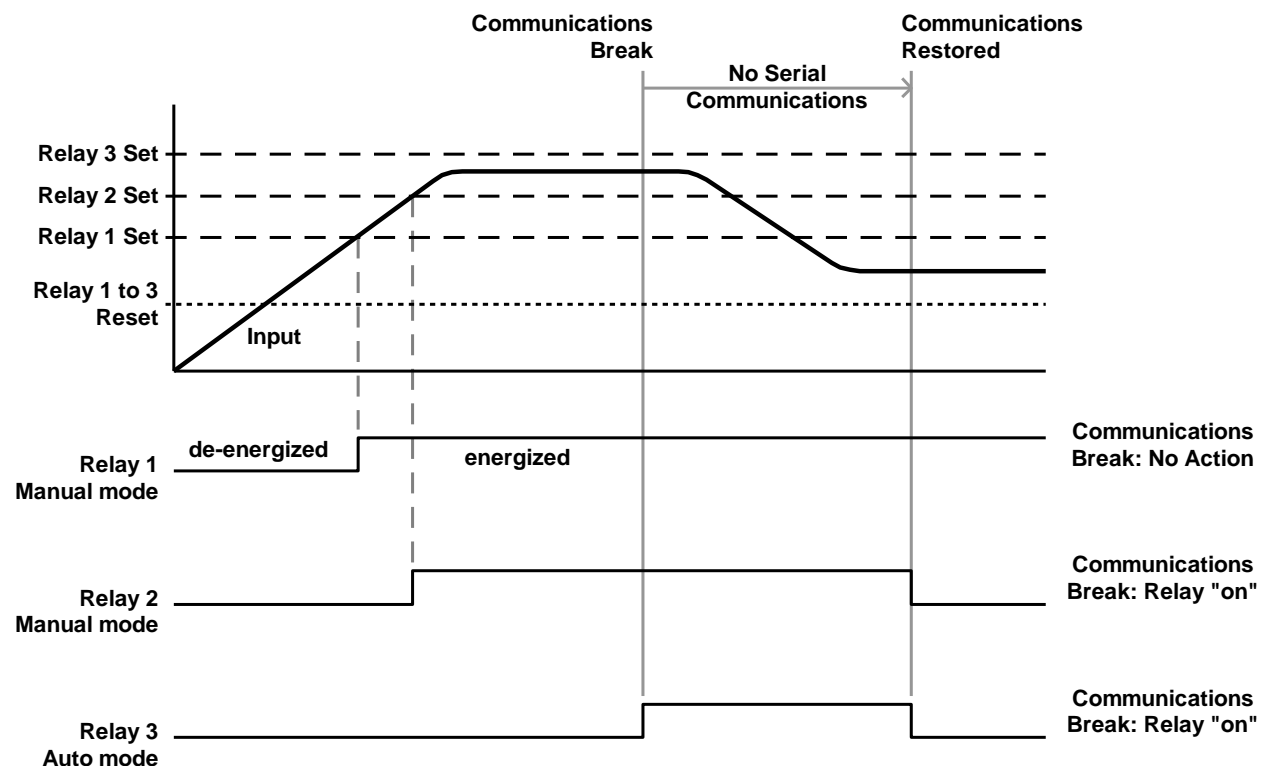
## Pump Alternation Control Operation



## Relay Operation After Communications Break

When a Master scanner fails to receive a reply from the slave it is called a Communications Break. The relays can be programmed to react to this event by going On, Off, or No Action. After communication is restored, the relays are turned off or on, based on their operating mode and their set and reset points, without regard to their prior state. This is similar to the auto initialization on power up.

The same is true for a scanner set up to operate in Snooper mode.



## Relay Operation Details

### Overview

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

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

### Relays Auto Initialization

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

Alarm #	HI or LO Alarm	Set Point	Reset Point	Power-Up Reading	Relay & LED
1	HI	1000	500	499	Off
2	LO	700	900	499	On
3	LO	250	400	499	Off
4	HI	450	200	499	On

### Fail-Safe Operation (FR LSF)

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

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

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

### Front Panel LEDs

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

LED	Status
1	Alarm 1
2	Alarm 2
3	Alarm 3
4	Alarm 4

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

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

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

### Latching and Non-Latching Relay Operation

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

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

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

### WARNING

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

### Non-Latching Relay (ደህደዐ)

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

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

### Non-Latching Relay with Manual Reset (ደ-ገገደዐ)

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

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

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

### Latching Relay (ደደደዐ)

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

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

### Latching Relay with Clear (ደደ-ደደዐ)

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

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

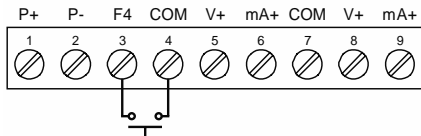
## Acknowledging Relays

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

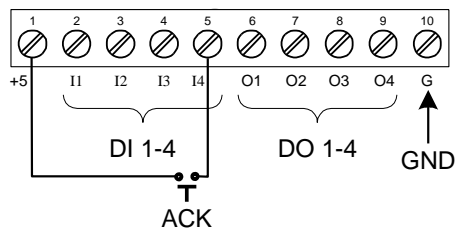
1. Via the programmable front panel function keys F1-F3 (Example: F3 assigned to ACK).



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



3. Remotely via a normally open push button wired to one of the digital inputs and the +5 V terminal on the digital I/O connections.



When the ACK button or the assigned digital input is closed, all relays programmed for manual reset are acknowledged.

## Pump Alternation Control Applications (RLLEn)

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

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

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

Set and Reset Point Programming			
Relay	Set Point	Reset Point	Function
1	30.000	10.000	Controls pump #1
2	35.000	5.000	Controls pump #2
3	4.000	9.000	Controls low alarm
4	40.000	29.000	Controls high alarm

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

## Pump Alternation Operation

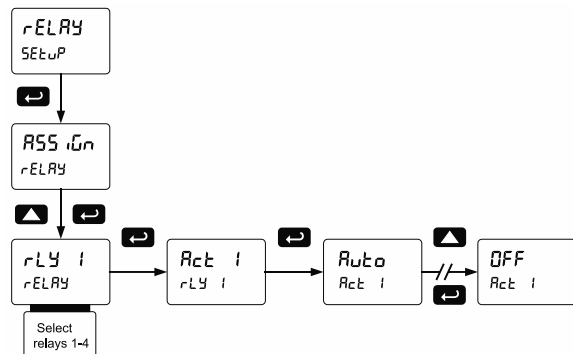
1. Pump #1 turns on when the level reaches 30.000, when level drops below 10.000 pump #1 turns off.
2. The next time the level reaches 30.000, pump #2 turns on, when the level drops below 10.000, pump #2 turns off.
3. If the level doesn't reach 35.000 pump #1 and pump #2 will be operating alternately.
4. If pump #1 cannot keep the level below 35.000 pump #2 will turn on at 35.000, then as the level drops to 10.000 pump #1 turns off, pump #2 is still running and shuts off below 5.000.
5. Notice that with the set and reset points of pump #2 outside the range of pump #1, the first pump on is the first pump to go off. This is true for up to 4 alternating pumps, if setup accordingly.
6. Relay #3 will go into alarm if the level drops below 4.000 and relay #4 will go into alarm if the level exceeds 40.000.



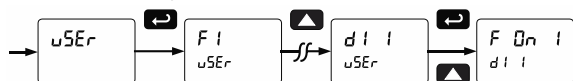
## Setting Up the Interlock Relay (Force On) Feature

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

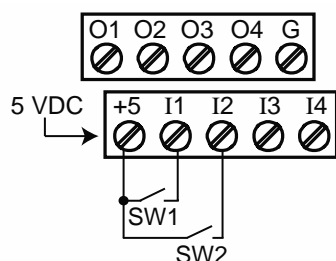
1. Access the *Setup – Relay – Action* menu and set the action to off.



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 (dl-1 to dl-4) terminal.



## Interlock Relay Operation Example

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

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

### IMPORTANT

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

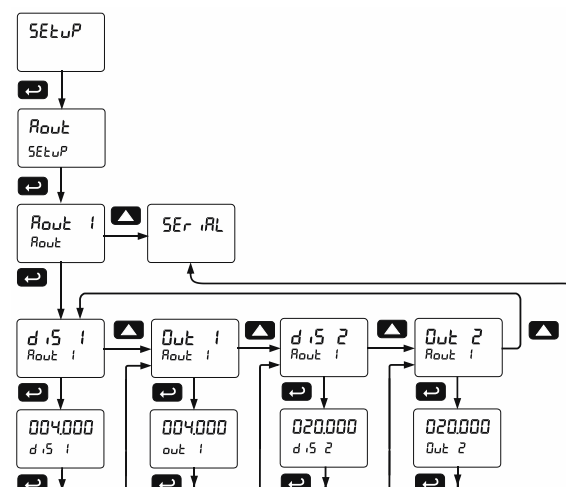
## Scaling the 4-20 mA Analog Output (Rout)

The 4-20 mA analog output can be scaled to provide a 4-20 mA signal for any display range selected. The Analog Output can be mapped to PVs or Math Channels. To select the channel and source assignments the analog output are assigned to, see *Analog Output Source Programming (RoutPr)* on page 78.

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

The *Analog Output* menu is used to program the 4-20 mA output based on display values.

For further details, see *Setting Numeric Values* on page 41, *Analog Output Value for Loss of 4-20 mA Input (Loop Break)* on page 78



**Notes:** Changes to the settings are saved to memory only after pressing **ENTER**. Changes made to settings prior to pressing **ENTER** are not saved. Once **ENTER** is pressed, the display moves to the next menu.

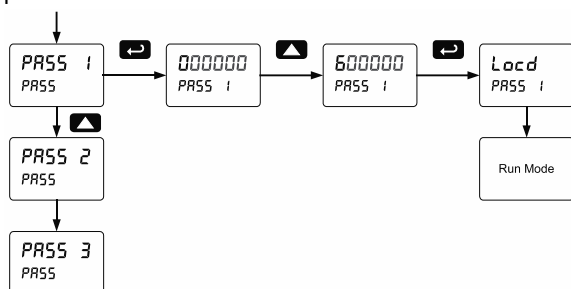
## Setting Up the Password (PR55)

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

Pass 1: Allows use of function keys and digital inputs  
 Pass 2: Allows use of function keys, digital inputs and editing set/reset points  
 Pass 3: Restricts all programming, function keys, and digital inputs

### Protecting or Locking the Scanner

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

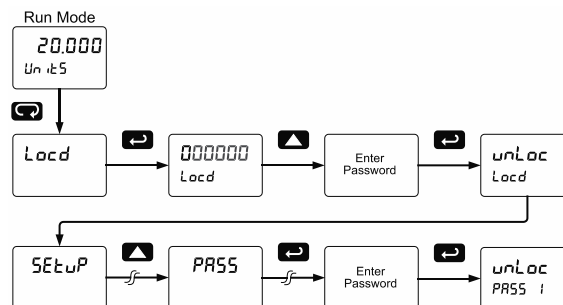


### Making Changes to a Password Protected Scanner

If the scanner is password protected, the scanner will display the message *Locd* (*Locked*) when the Menu button is pressed. Press the Enter button while the message is being displayed and enter the correct password to gain access to the menu. After exiting the programming mode, the scanner 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 scanner is now unprotected until a new password is entered.



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

If the password entered is incorrect, the scanner 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.

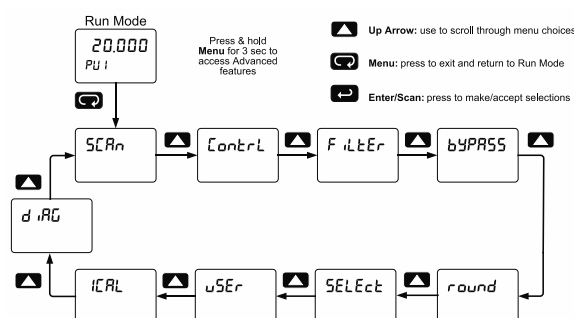
### Did you forget the password?

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 scanner.

## Advanced Features Menu

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

1. Scan Mode: Auto or manual; Go on alarm or stop on alarm
2. Control relays and analog output
3. Noise Filter
4. Noise Filter Bypass
5. Rounding Feature
6. Select Math, Linearization function, Cutoff
7. User Programming for function keys and digital I/O
8. Analog Channels Input Calibration
9. System Information



## Advanced Menu Navigation Tips

- Press and hold the **Menu** button for three seconds to access the Advanced Features Menu.
- Press the **Up** arrow button to scroll through the Advanced Features Menu.
- Press **Menu** at any time, to exit and return to Run mode.
- Changes made to settings prior to pressing **Enter/Scan** are not saved.
- Changes to the settings are saved to memory only after pressing **Enter/Scan**.
- The display automatically moves to the next menu every time a setting is accepted by pressing **Enter/Scan**.

## Advanced Features Menu & Display Messages

Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
Scan	Scan	Enter Scan menu
Scan Mode	Scan Mode	Select Auto or Manual Scan Mode
Automatic	Automatic	Select Automatic Scan Mode
Scan Time	Scan Time	Select Scanning Time
Manual	Manual	Select Manual Scan Mode
Alarm	Alarm	Select Go or Stop Alarm
Go	Go	Select Alarm Go
Stop	Stop	Select Alarm Stop
Manual Control	Manual Control	Enter Manual Control menu for relays and analog output 1
Automatic	Automatic	Select Automatic Control of Outputs and Relays
Manual	Manual	Select Manual Control of Outputs and Relays
Analog Output 1	Analog Output 1	Select Analog Output 1 for manual control
Relay 1	Relay 1	Select Relay 1-4 for manual control
On	On	Select On for Relay 1-4
Off	Off	Select Off for Relay 1-4
Filter	Filter	Enter Filter menu
PV 1	PV 1 Filter	Program Filter Value for PV 1
PV 2	PV 2 Filter	Program Filter Value for PV 2
Filter Bypass	Filter Bypass	Enter Filter Bypass menu
PV 1	PV 1 Filter Bypass	Program Filter Bypass Value for PV 1
PV 2	PV 2 Filter Bypass	Program Filter Bypass Value for PV 2
Rounding Feature	Rounding Feature	Enter Rounding Feature menu
1 Rounding Value	1 Rounding Value	Program Rounding Value for PV *(User-selectable & rounds to the nearest 1, 2, 5, 10, 20, 50, 100)
Select	Select	Enter Select menu
Function	Function	Enter data Linearization Function menu
PV 1*	PV 1 Function	*Enter Linearization Function menu for all enabled PVs
Ch C1*	Ch C1 Function	*Enter Linearization Function menu for all enabled math channels
Linear	Linear	Enter Linear menu
Number of Points	Number of Points	Enter Number of Linearization Points

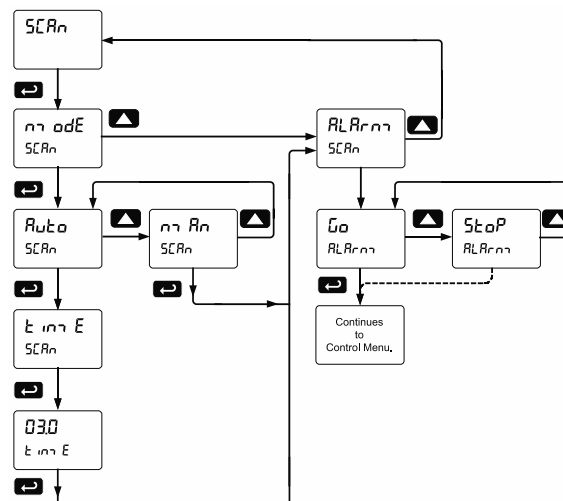
Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
Scale	Scale	Scale Number of Linearization Points
Input 1	Input 1	Scale input 1 signal or program input 1 value
Display 1	Display 1	Program display 1 value
Input 2	Input 2	Scale input 2 signal or program input 2 value (up to 32 points for PV1 & PV2)
Display 2	Display 2	Program display 2 value (up to 32 points for PV1 & PV2)
Square Root	Square Root	Enter Square Root menu
Programmable Exponent	Programmable Exponent	Enter Programmable Exponent menu
Programmable Exponent Value	Programmable Exponent Value	Enter the Programmable Exponent Value
Round Horizontal Tank	Round Horizontal Tank	Enter Round Horizontal Tank menu
Inch	Inch	Enter to calculate tank values in Inches
Centimeters	Centimeters	Enter to calculate tank values in Centimeters
Diameter	Diameter	Enter tank diameter
Length	Length	Enter tank length
Math	Math	Enter Math menu
Channel C1	Channel C1	*Enter Math Channel C1-C4 menu
Operation	Operation	Enter Math Operation menu
Constant	Constant	Enter Math Constant menu
Adder	Adder	Enter Adder Value
Factor	Factor	Enter Factor Value
Sum	Sum	Math Function Sum
Difference	Difference	Math Function Difference
Absolute Difference	Absolute Difference	Math Function Absolute Difference
Average	Average	Math Function Average
Multiply	Multiply	Math Function Multiply
Divide	Divide	Math Function Divide
Max	Max	Math Function Maximum of all selected PVs
Min	Min	Math Function Minimum of all selected PVs
Draw	Draw	Math Function Draw
Weighted Average	Weighted Average	Math Function Weighted Average
Ratio	Ratio	Math Function Ratio
Concentration	Concentration	Math Function Concentration
Math2	Math2	Resultant Math Channel Math operation applied to other math channels (e.g. C3 = C1/C2)

Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
Sum	Sum	Math2 Function Sum
Difference	Difference	Math2 Function Difference
Absolute Difference	Absolute Difference	Math2 Function Absolute Difference
Average	Average	Math2 Function Average
Multiply	Multiply	Math2 Function Multiply
Divide	Divide	Math2 Function Divide
Cutoff	Cutoff	Enter Low Flow Cutoff menu
PV 1 Cutoff	PV 1 Cutoff	Program Cutoff Value for PV 1
PV 2 Cutoff	PV 2 Cutoff	Program Cutoff Value for PV 2
Analog Output Program	Analog Output Program	Enter Analog Output Programmable parameters menu
Analog Output 1 (If Installed)	Analog Output 1	Analog Output 1 (If Installed)
Analog Output Data Source	Analog Output Data Source	Enter Analog Output Data Source menu
Source PV	Source PV	*Select PV for Analog Output Data Source
Source Math Channel	Source Math Channel	*Select C1-4 for Analog Output Data Source
Set Point 1-4	Set Point 1-4	*Select Set Points 1-4
Communications Break	Communications Break	Enter the Analog Output value when Communications Break is detected
Ignore Break	Ignore Break	Ignore Break
Force Break	Force Break	Force Break
Calibration	Calibration	Enter the Analog Output Calibration menu
Maximum	Maximum	Select Maximum value for all Analog Outputs
Minimum	Minimum	Select Minimum value for all Analog Outputs
Overrange	Overrange	Enter the Analog Output value for an Overrange condition
Underrange	Underrange	Enter the Analog Output value for an Underrange condition
User	User	Enter the User menu for assigning function keys and digital I/O
F1-F4 Function Keys	F1-F4	*F1-F4 Function Keys
Previous PV	Previous	Previous PV
Next PV	Next	Next PV
Scan or pause scan	Scan	Scan or pause scan
Acknowledge relays	Acknowledge	Acknowledge relays
Enter Reset menu	Reset	Enter Reset menu
Reset Maximum	Reset Max	Reset Maximum
Reset Minimum	Reset Min	Reset Minimum
Reset Maximum & Minimum	Reset Max-Min	Reset Maximum & Minimum
Relay menu	Relay	Relay menu

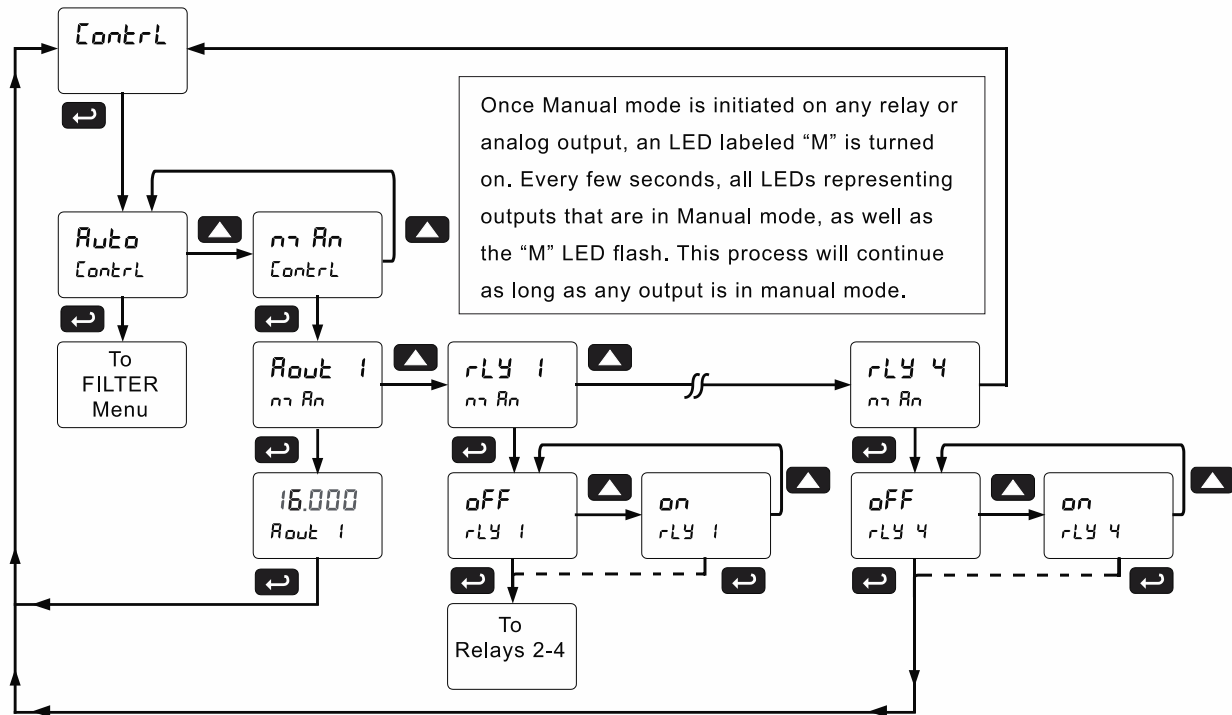
Advanced Features Menu & Display Messages		
Display	Parameter	Action/Setting
SEt I*	Set Points 1-4	Set Points 1-4
rLy d	Relay Disable	Relay Disable (all relays)
rLy E	Relay Enable	Relay Enable (all relays)
O HoLd	Output Hold	Output Hold (all relays)
d HoLd	Display Hold	Display Hold (while held low)
d,SRbL	Disable	Disable
[ontrL	Manual Control	Manual Control menu
dI I*	DI 1-4	*Digital Inputs 1-4
mEnu	Menu	Menu
rLyht	Right	Right
uP	Up	Up
EntEr	Enter	Enter
F on I*	Force On Relay 1	*Force On Relay 1-4
dO I*	DO 1-4	*Digital Outputs 1-4
RLAr I*	Alarm 1-4	*Alarm 1-4
RcH	Acknowledge	Acknowledge
rESEt	Reset	Enter Reset menu
rSEt H.	Reset Max	Reset Maximum
rSEt Lo	Reset Min	Reset Minimum
rSEt HL	Reset Max-Min	Reset Maximum & Minimum
d,SRbL	Disable	Disable
IcRL	Input Calibration	Enter analog channels Input Calibration menu
[h-A	Channel A	Enter Input Channel A
[h-B	Channel B	Enter Input Channel B
mAR	Milliamps	Enter Milliamps
[ [cRL	Milliamp Calibration	Enter Milliamp Calibration
[ Lo	Milliamp Low Signal	Enter Milliamp Low Signal
[ H.	Milliamp High Signal	Enter Milliamp High Signal
VolLt	Volts	Enter Volts
V [cRL	Voltage Calibration	Enter Voltage Calibration
V Lo	Voltage Low Signal	Enter Voltage Low Signal
V H.	Voltage High Signal	Enter Voltage High Signal
Error	Error	Error Message for Unsuccessful Calibration
d,RG	Diagnostic	Enter Diagnostics menu
rESEt	Reset	Reset to Factory Defaults
LEd t	LED Test	LEDs cycle through all digits, decimal points, and indicators
InfO	Info	Displays Scanner information
Sft	Software	Displays Software information
Ver	Software Version	Displays Software Version information

### Scan Function ( $\Sigma R_n$ )

The *Scan* menu is used to program the PV scan mode and the scanner's behavior on alarm condition. The operator is able to scan automatically based on a time parameter, or scan manually with front panel keys or digital inputs. The operator is also able to set the scanner to stop on alarm or continue scanning on alarm. To resume scanning the operator must press the Next or Previous button. Please follow the menu below for details. In the Stop on Alarm mode, the scanner will go to the alarmed PV and remain there until the operator manually advances to the next PV or returns to the previous PV. If a new alarm is detected the process is repeated. The scanner ignores old alarms.



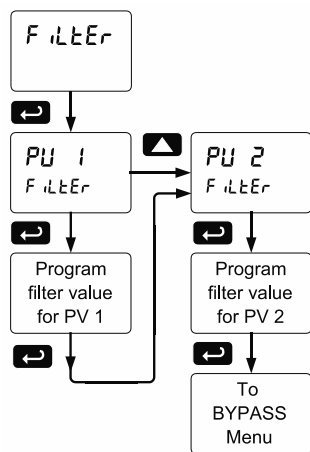
The *Manual Control* menu is used to control the 4-20 mA analog output and the relays manually, ignoring the input. Each relay and analog output can be programmed independently for manual control. Selecting automatic control sets all relays and analog output for automatic operation.





## Noise Filter (F i l t e r)

Most applications do not require changing this parameter. It is intended to help attain a steady display with unsteady (noisy) input data. The field selectable noise filter averages any minor or quick changes in the input data and displays the reading with greater stability. Increasing the filter value will help stabilize the display. However, this will reduce the display response to changes on the input data. The filter level may be set anywhere from 2 to 199. Setting the filter value to zero disables the filter function, and the bypass setting becomes irrelevant. This parameter is associated with the analog input channels, PV1, and PV2.



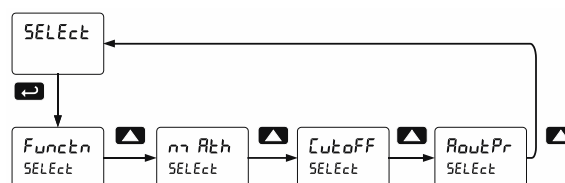
## Rounding Feature (r o u n d)

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 criteria selected.

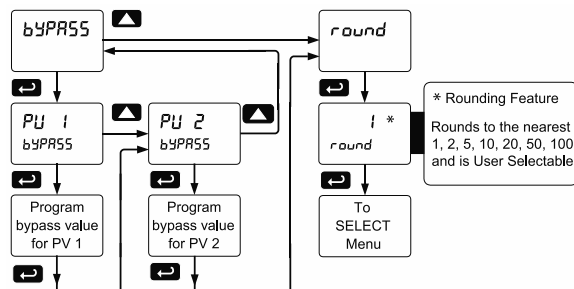
## Select Menu (S E L E c t)

The *Select* menu is used to select the input data linearization function (linear, square root, programmable exponent, or round horizontal tank), math functions, constants, low-value cutoff, and analog output programming. Multi-point linearization is part of the linear function selection.



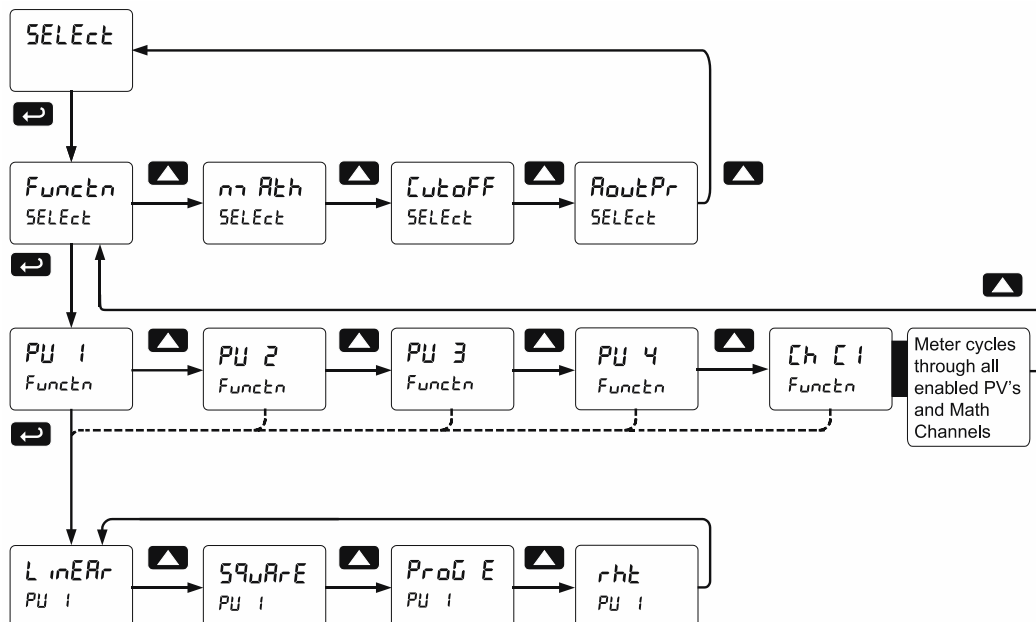
## Noise Filter Bypass (b y P A S S)

The scanner can be programmed to filter small input changes, but allow larger input changes to be displayed immediately, by setting the bypass value accordingly. If the input signal goes beyond the bypass value, it will be displayed immediately with no averaging done on it. The noise filter bypass value may be set anywhere from 0.2 to 99.9. Increasing the bypass value may slow down the display response to changes on the input signal.



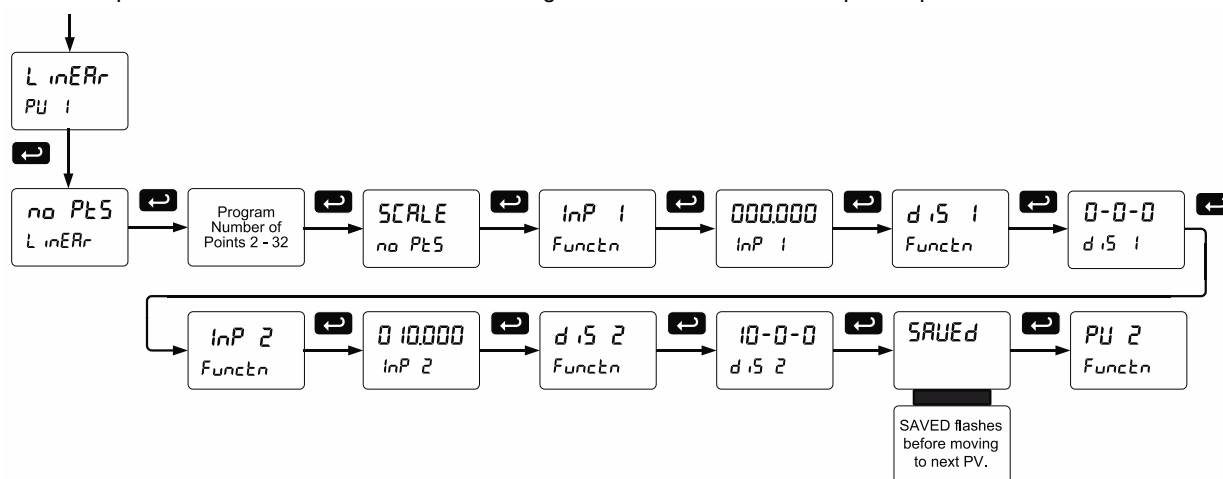
### Input Data Conditioning Function Menu (Function)

The *Function* menu is used to select the input-to-output transfer function applied to the input data: linear, square root, programmable exponent, or round horizontal tank volume calculation. Multi-point linearization (for PV1 and PV2) is part of the linear function selection. Scanners 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 data (e.g. 0.000 = 0.000, 10.000 = 10.000, and then 5.000 = 5.000).



### Linear Function Menu (L inERr)

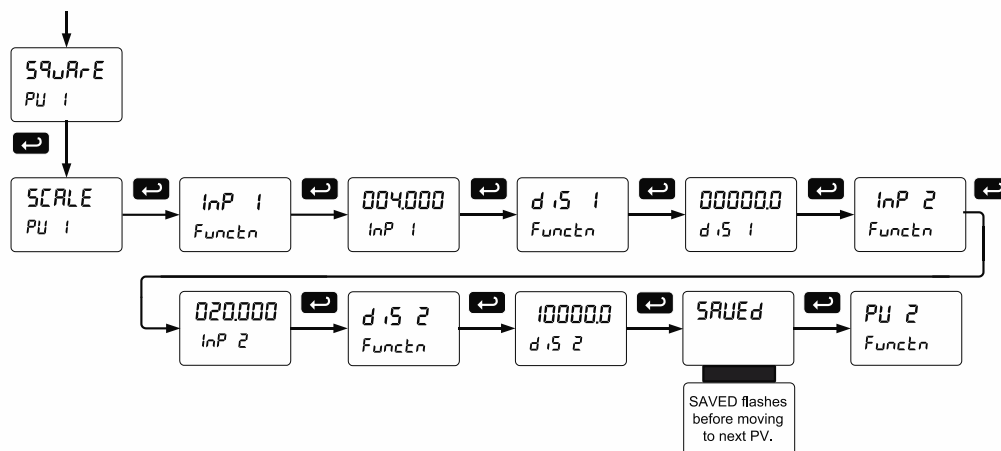
Scanners are set up at the factory for linear function with 2-point linearization. Up to 32 linearization points can be selected for PV1 and PV2 under the *Linear* function in the *Advanced Features* menu. The multi-point linearization can be used to linearize the display for non-linear signals such 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 exponents.



**Note:** Multi-point Linearization applies to PV1 and PV2 only. All other PVs use two linearization points.

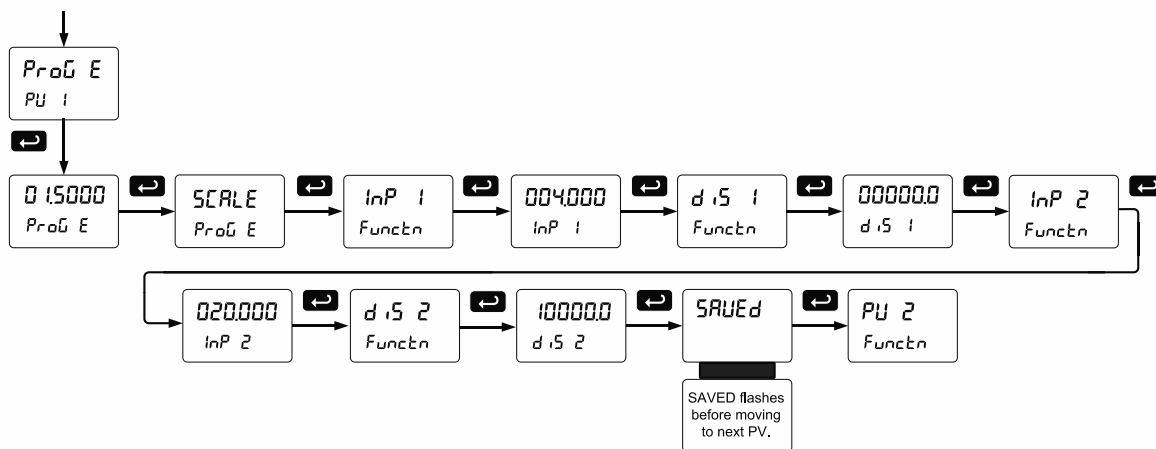
### Square Root Function Menu (S<sub>Q</sub>U<sub>R</sub>√E)

The square root function is used to calculate flow measured with a differential pressure transmitter. The flow rate is proportional to the square root of the differential pressure. Scale the scanner so that the low input signal (e.g. 4 mA) is equal to zero flow and the high input signal (e.g. 20 mA) is equal to the maximum flow.



### Programmable Exponent Function Menu (P<sub>ro</sub>√ E)

The programmable exponent function is used to calculate open-channel flow measured with a level transmitter in weirs and flumes. The flow rate is proportional to the head height. Scale the scanner so that the low input signal (e.g. 4 mA) is equal to zero flow and the high input signal (e.g. 20 mA) is equal to the maximum flow. This method works well for all weirs and flumes that have a simple exponent in the flow calculation formula. For weirs and flumes with complex exponents it is necessary to use a strapping table and the 32-point linearization of the scanner.



## Round Horizontal Tank Function Menu (rht)

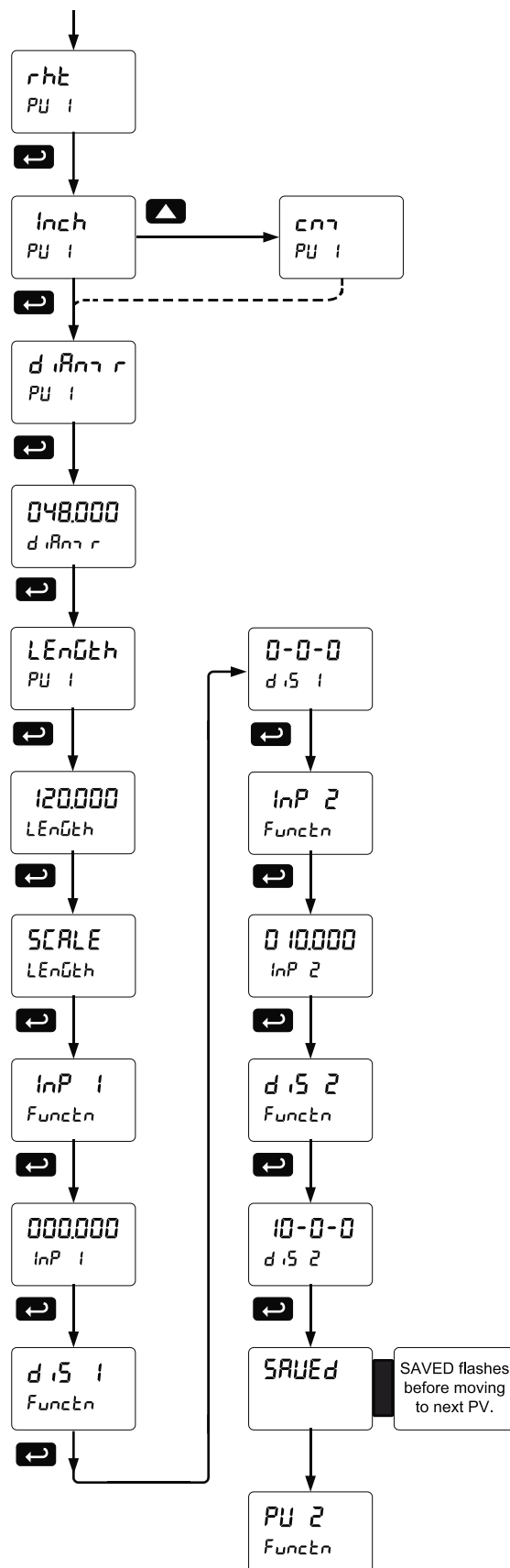
This function is used to calculate volume in a round horizontal tank with flat ends. The volume is calculated based on the diameter and length of the tank. The tank's dimensions can be entered in inches or centimeters; the scanner automatically calculates the volume in gallons or liters. After entering the dimensions, complete the scaling process with the display values calculated by the scanner. The scanner can be re-scaled to display the volume in any engineering unit without the need to re-enter the dimensions again.

### Changing the Volume from Gallons to Liters

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

1. Convert gallons to liters  
1 US gallon = 3.7854 L  
940.02 gal = 3558.4 L
2. Go to the *Setup - PV - Decimal Point* menu and change the decimal point to 1 decimal.
3. Go to the *Setup - PV - Scale* menu and press Enter until d.5 2 is shown on display line 1.
4. Press Enter and change the display 2 value to 3558.4.
5. The scanner is now displaying the volume in liters.

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



### Math Functions (ጠገደክ)

The *Math* menu is used to select the math function that will determine the channels' C1-C4 value. These math functions are applied to PVs and other math channels. The results are displayed by selecting Display Channel C (ፈ ሂ ኺ) in the *Display* menu. Most math functions may be applied to all PVs: For example, it is possible to add up to 16 PVs and calculate the total volume of all the tanks in a field. The Math2 function allows for further calculations on the results of other math channels (e.g. C4 = C2/C1). The following math functions are available:

Name	Math Operation (Examples) (P = Adder, F = Factor)	Setting
Addition	$(PV1+PV2+P)*F$	ፍጠገ
Difference	$(PV1-PV2+P)*F$	ፈ ያፍ
Absolute difference	$((Abs(PV1- PV2)+P)*F$	ፈ ያፍፅፍ
Average	$((PV1+PV2)/2)+P)*F$	ጸህፍ
Multiplication	$((PV1*PV2)+P)*F$	ጠገፅፅ ፡
Division	$((PV1/PV2)+P)*F$	ፈ ህ፡ፈፂ
Max PV	Max value of all selected PVs	ጠ፡-ፆህ
Min PV	Min value of all selected PVs	ፈ፡-ፆህ
Draw	$((PV1/PV2)-1)*F$	ፈ፡ፆህ፡፡
Weighted average	$((PV2-PV1)*F)+PV1$	ፅጋፆህፍ
Ratio	$(PV1/PV2)*F$	፡ፆፅ ህ፡
Concentration	$(PV1/(PV1+PV2))*F$	ፈ፡ፅፅፅፅ
Math 2	Math on other math channels	ጠገፅፅ ከፊ
Addition	$C3 = (C1+C2+P)*F$	ፍጠገ
Difference	$C4 = (C1-C2+P)*F$	ፈ ያፍ
Absolute difference	$C3 = ((Abs(C1- C2)+P)*F$	ፈ ያፍፅፍ
Average	$C4 = (((C1+C2)/2)+P)*F$	ጸህፍ
Multiplication	$C3 = ((C1*C2)+P)*F$	ጠገፅፅ ፡
Division	$C4 = ((C1/C2)+P)*F$	ፈ ህ፡ፈፂ

### Math Constants (ፈፅፅፅ)

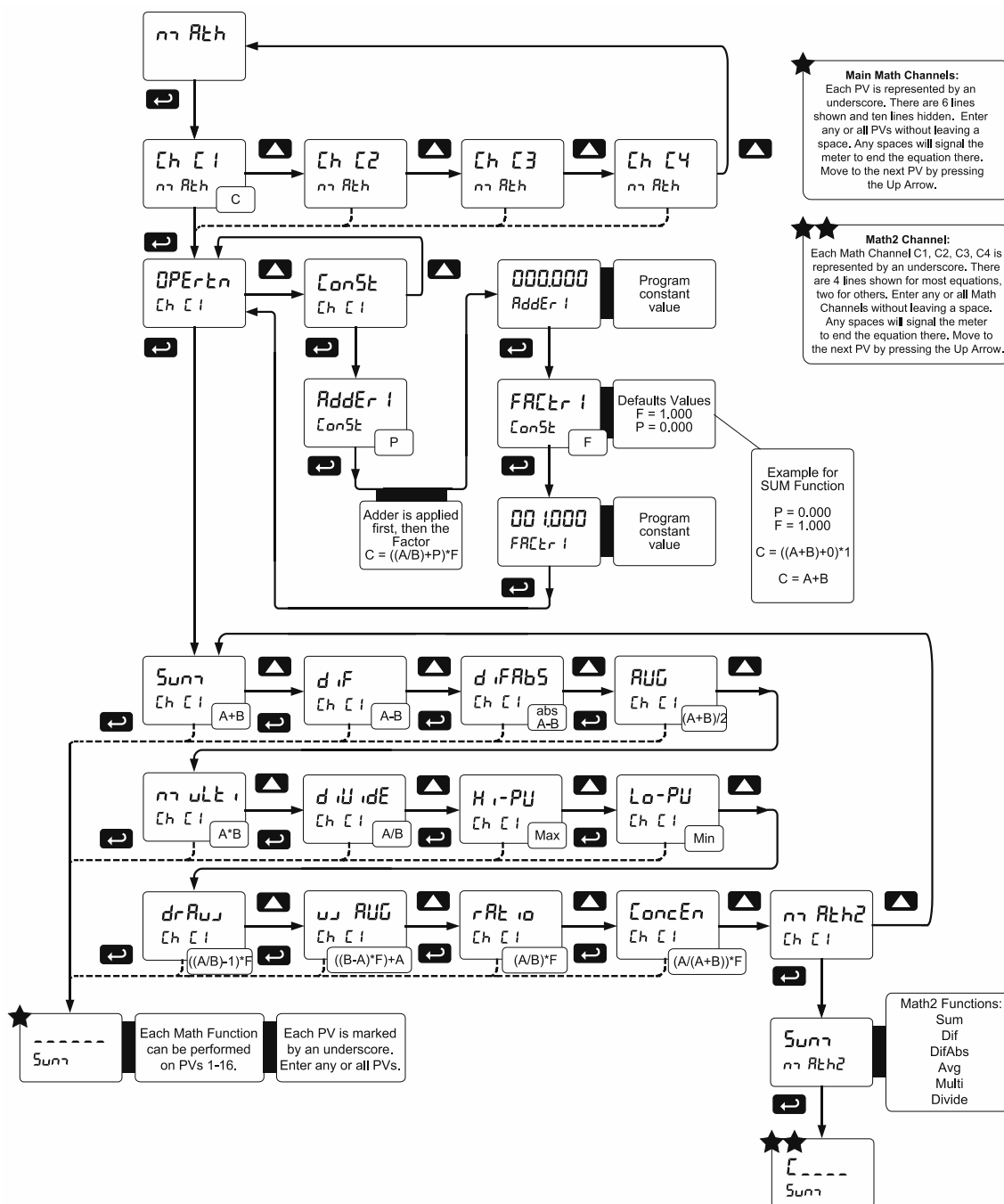
The *Math Constants* menu is used to set the constants used in the math channel. The math functions include the selected PVs, as well as the constants P (Adder) and the Factor F (Multiplier) as indicated in the above examples.

The *Adder* constant (P) may be set from -99.999 to 999.999.

The *Factor* constant (F) may be set from 0.001 to 999.999.

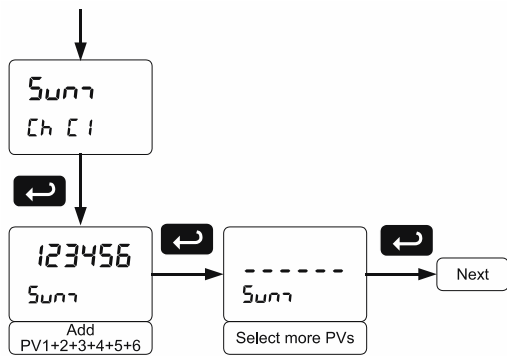
The above chart details the math functions that may be selected in the *Math Function* menu.

## Math Function Menu (ᐃᐃᐃ)

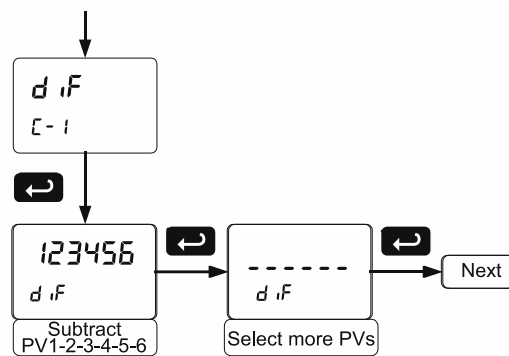




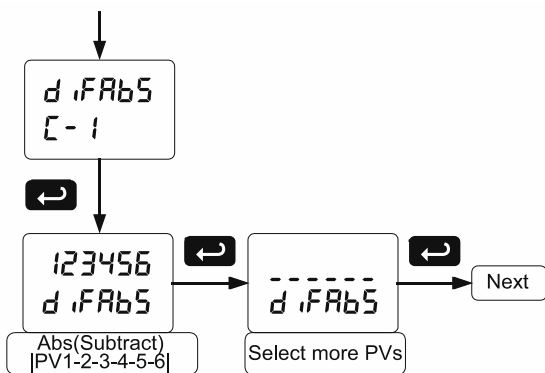
### Sum Menu (סכום)



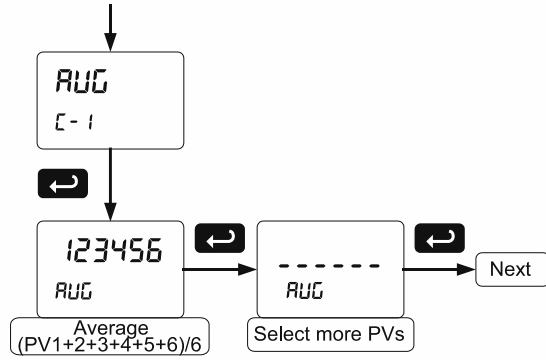
### Difference Menu (ד, פ)



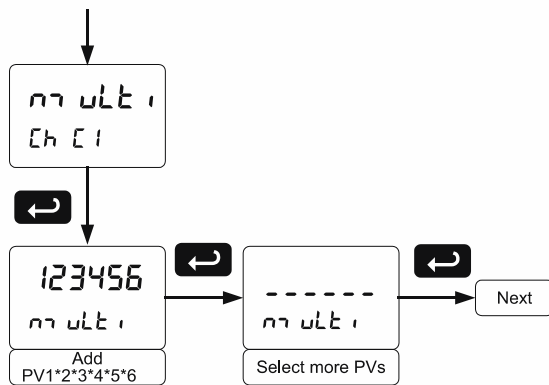
### Difference Absolute Menu (ד, פAbs)



### Average Menu (RUG)

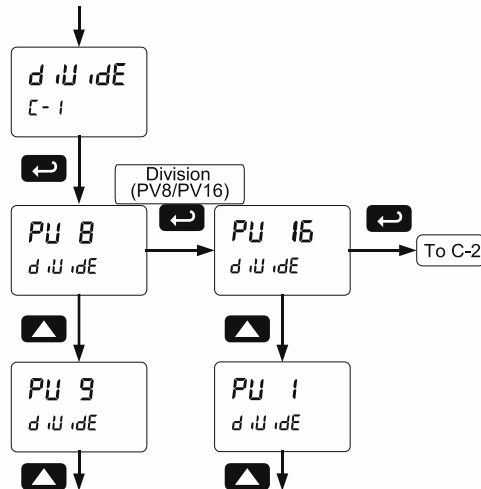


### Multiplication Menu (י, לטירה)



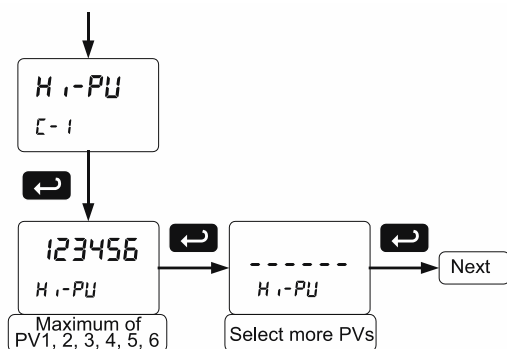
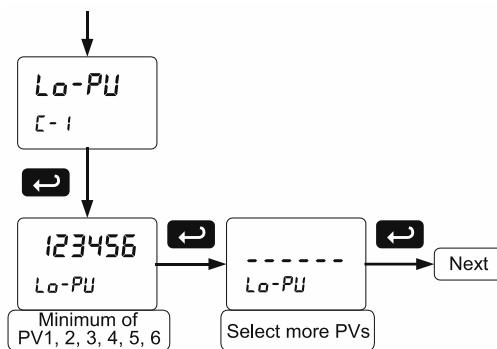
### Divide Menu (ד, ו, דE)

Only two PVs at a time will be used for this function.

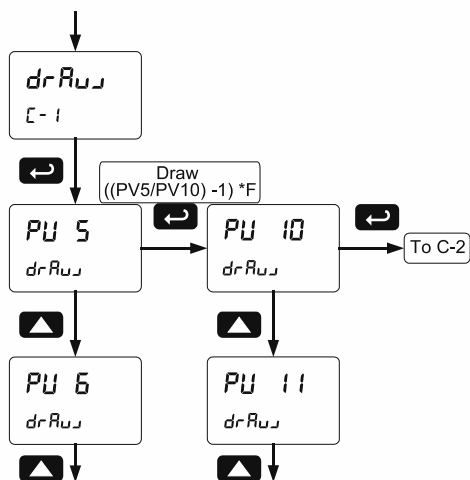


Notes:

1. Press Up arrow to scroll through PV1 - PV16
2. The first PV is the dividend and the second PV is the divisor.

**Maximum PV Menu (H I -PU)****Minimum PV Menu (Lo -PU)****Draw Menu (drPUU)**

Only two PVs at a time will be used for this function.

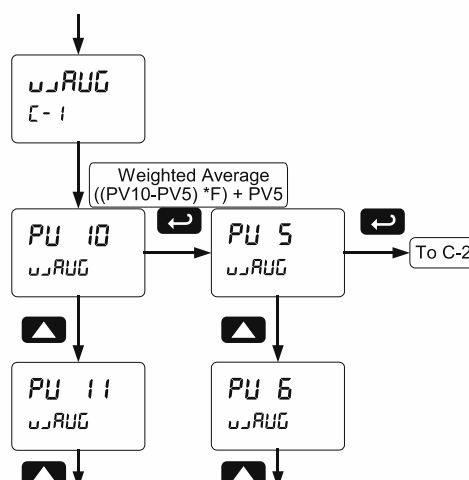


Notes:

1. Press Up arrow to scroll through PV1 - PV16
2. The first PV is the dividend and the second PV is the divisor.

**Weighted Average Menu (uJPUU)**

Only two PVs at a time will be used for this function

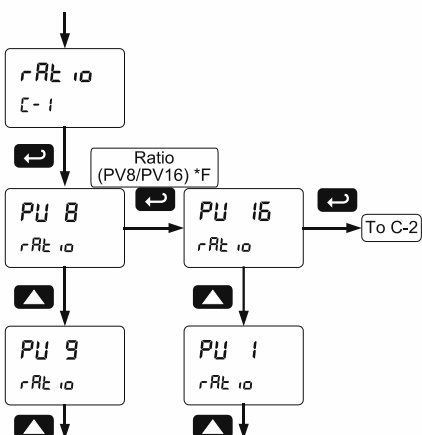


Notes:

1. Press Up arrow to scroll through PV1 - PV16
2. The first PV selected is the first PV in the equation.

**Ratio Menu (rRt io)**

Only two PVs at a time will be used for this function

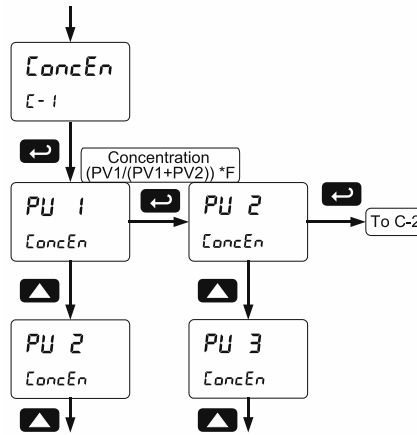


Notes:

1. Press Up arrow to scroll through PV1 - PV16
2. The first PV is the dividend and the second PV is the divisor.

**Concentration Menu (ConcEn)**

Only two PVs at a time will be used for this function

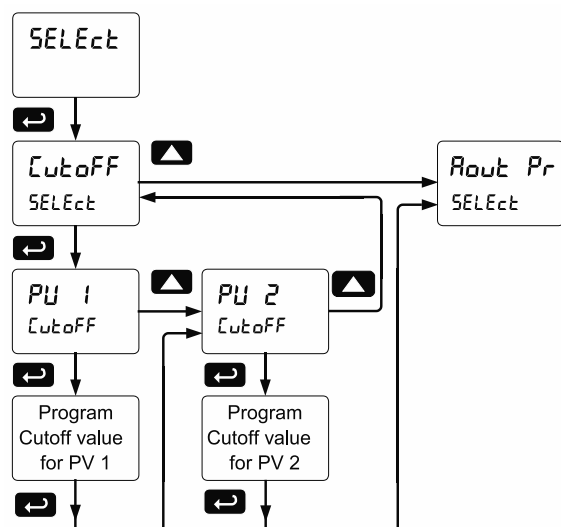


Notes:

1. Press Up arrow to scroll through PV1 - PV16
2. The first PV is the dividend and the Sum of the PVs is the divisor.

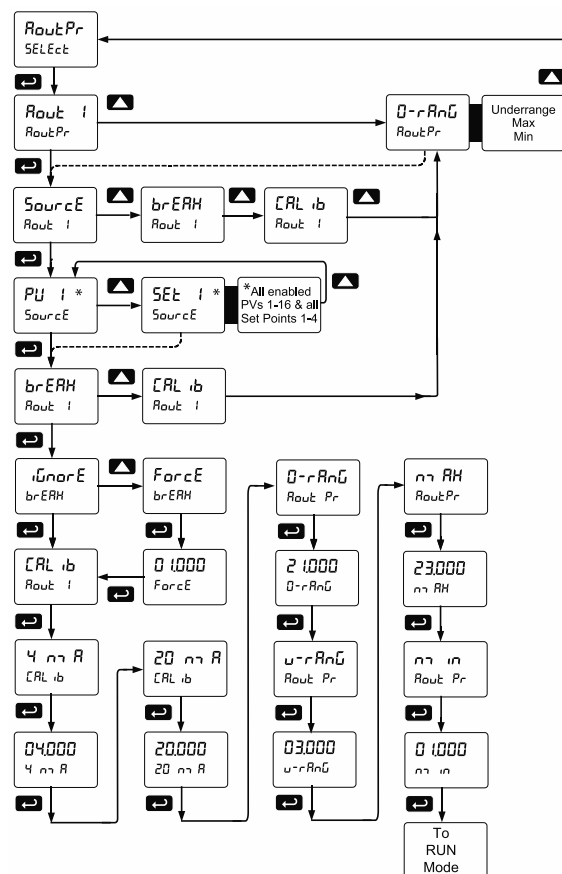
## Low-Value Cutoff (Cutoff)

The low-value cutoff feature allows the scanner to be programmed so that the often unsteady output from a differential pressure transmitter, at low flow rates, always displays zero on the scanner. The cutoff value may be programmed from 0.1 to 999999. When the input data is below the cutoff value, the scanner will display zero. Programming the cutoff value to zero disables the cutoff feature. The cutoff can be disabled to display negative values.



## Analog Output Source Programming (RoutPr)

The 4-20 mA analog outputs can be programmed for source of data, overrange and underrange, absolute maximum and minimum output, and communications break values. They can also be recalibrated.



- To calibrate the analog outputs, follow the graphic above.
- The overrange and underrange values are the values that will be output when the display shows an overrange or underrange condition. This setting is common to all analog outputs.
- The maximum and minimum values are the absolute limits for the 4-20 mA output. This setting is common to all analog outputs.
- The communications break value determines the mA output when a Slave fails to reply to a command within the Response time.

## 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

- There is **no need to recalibrate** the 4-20 mA output when first received from the factory.
- The 4-20 mA outputs is **factory calibrated** prior to shipment. The calibration equipment is certified to NIST standards.

The 4-20 mA output can be recalibrated in the field. A calibrated digital meter with an input range of at least 25 mA and a resolution of 1  $\mu$ A is recommended.

#### CAUTION

- If an uncalibrated meter or a meter with less resolution is used, the calibration of the 4-20 mA output could be adversely affected.

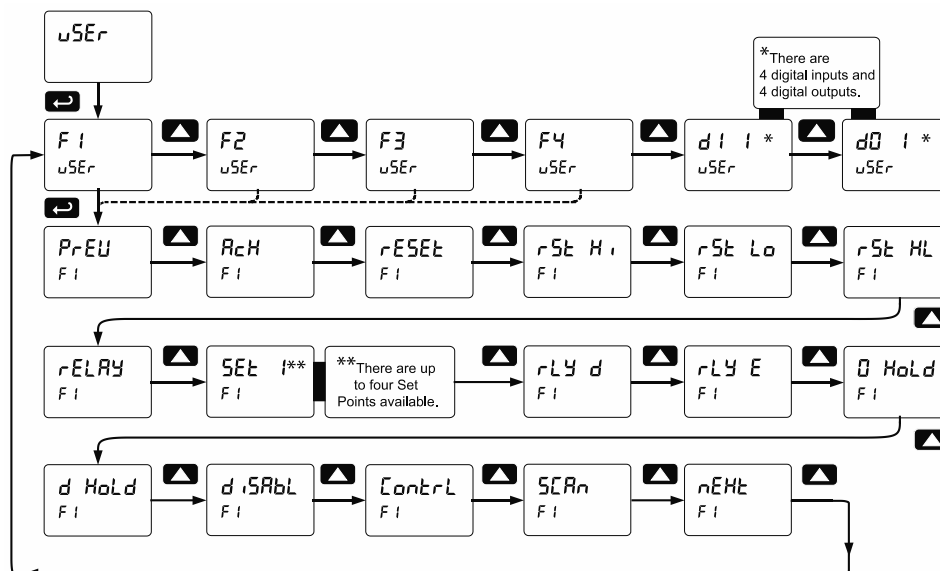
### Analog Output Calibration Procedure

1. Wire the scanner 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 16. 4-20 mA Output Connections* on page 33 for details.
2. Turn on all devices. Allow for a 15 to 30 minute warm-up.
3. Go to the Advanced Features menu and navigate to Select (SÉLÉCt) and choose Analog Output Programming (RoutPr) → Calibration (CALIB) menu and press **Enter**.
4. The display will show 4 mA. The scanner mA output should now be close to 4 mA. Press **Enter** and the display will show 04.0000. Enter the actual value read by the digital mA meter and press **Enter**.
5. The display will show 20 mA. The scanner mA output should now be close to 20 mA. Press **Enter** and the display will show 20.0000. Enter the actual value read by the digital mA meter and press **Enter**.
6. The scanner will now calculate the calibration factors and store them.
7. Press **Menu** to exit and return to Run mode.

## Programmable Function Keys User Menu (uSEr)

The *User* menu allows the user to assign the front 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 scanner 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 scanner (i.e. alarms, relay acknowledgement, reset max, min, or max & min, tare, and reset tare). The digital outputs can be used to trigger external alarms or lights to indicate these specific events.

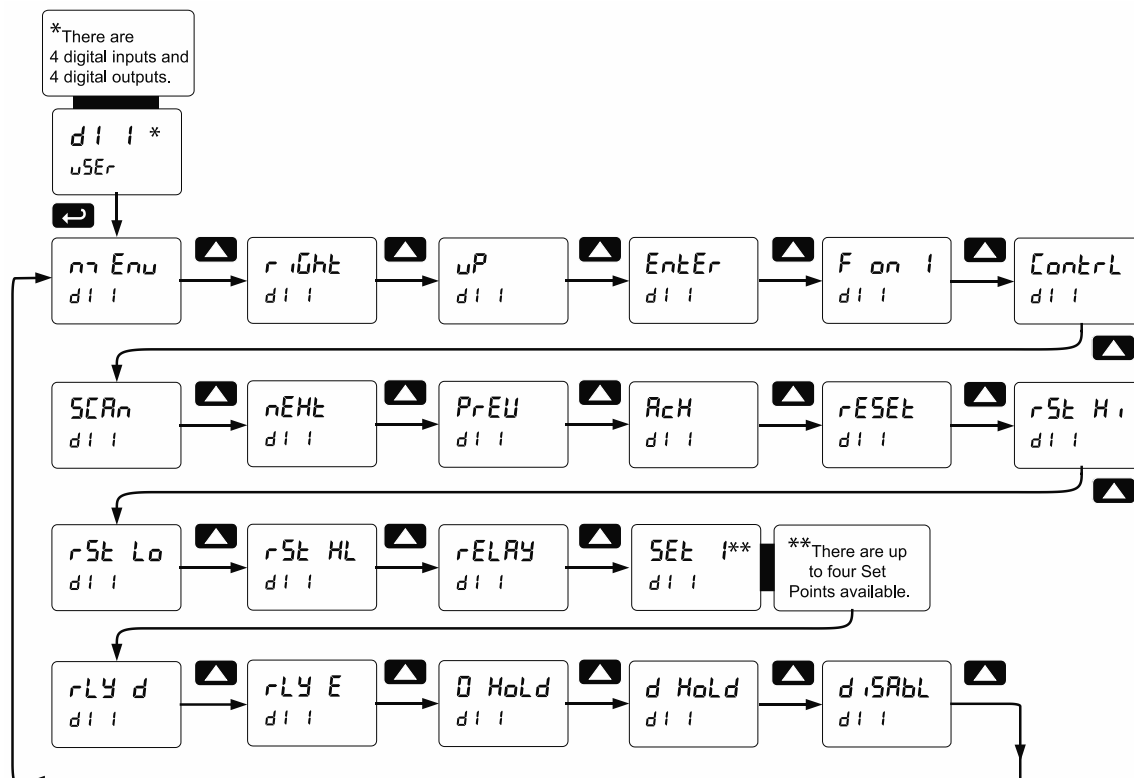


### Function Keys & Digital I/O Available Settings

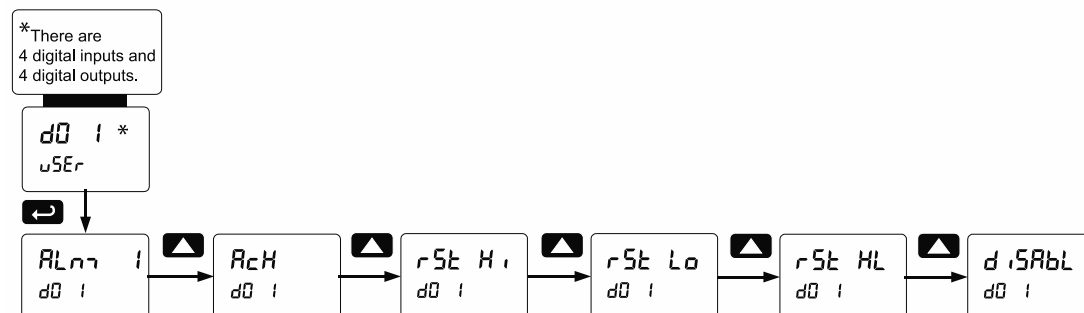
Display	Description
SCAn	Scan through all PVs
nEHt	Skip to the next PV
PrEU	Return to the previous PV
RcH	Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching
rESEt	Directly access the reset menu
rSt H.	Reset the stored maximum display values for all channels
rSt Lo	Reset the stored minimum display values for all channels
rSt Hl	Reset the stored maximum & minimum display values for all channels
rELRY	Directly access the relay menu
SEt i*	Directly access the set point menu for relay 1 (*through 4)
rLY d	Disable all relays until a button assigned to <i>enable relays</i> (rLY E) is pressed
rLY E	Enable all relays to function as they have been programmed
d HoLd	Hold current relay states and analog output as they are until a button assigned to <i>enable relays</i> (rLY E) is pressed

Display	Description
d HoLd	Hold the current display value, relay states, and analog output momentarily while the function key or digital input is active. The process value will continue to be calculated in the background.
d,SAbl	Disable the selected function key or digital I/O
ContrL	Directly access the manual control menu
nEHt	Mimic the menu button functionality (digital inputs only)
rLY E	Mimic the right arrow/F1 button functionality (digital inputs only)
uP	Mimic the up arrow/F2 button functionality (digital inputs only)
EnEHt	Mimic the enter/F3 button functionality (digital inputs only)
F on i*	Force relay 1 (*through 4) into the on state. This function is used in conjunction with a digital input to achieve interlock functionality. See page 63 for details about interlock relays.
RLn n i*	Provide indication when alarm 1 (*through 4) has been triggered (digital outputs only)

## Digital Input Menu (d I I)



## Digital Output Menu (d O I)



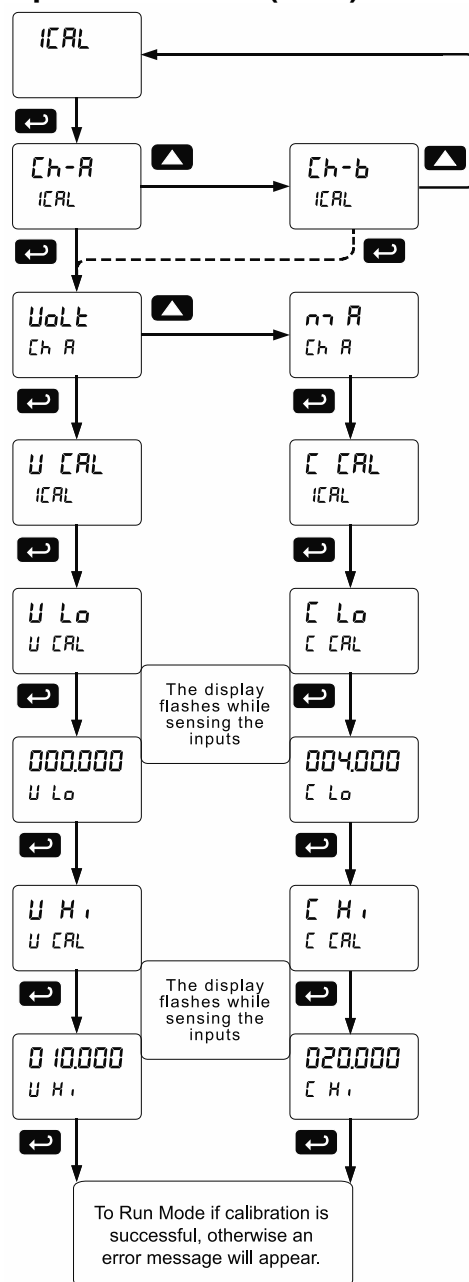
## Reset Menu (rESEt)

The *Reset* menu is used to reset the maximum or minimum reading (peak or valley) reached by the process; both may be reset at the same time by selecting “reset high & low” (rSt HL). This is applied to all PVs and math channels.

Resetting is possible by going into the USER menu, selecting a function key or digital input, pressing ENTER to take you to the next level, then pressing the Up arrow until you arrive at the RESET menu. Press ENTER to assign the RESET menu to the selected function key or digital input. Now, when the scanner is in Run Mode, pressing the selected function key will take you to the RESET menu, where you can scroll through Reset Hi (Max), Reset Lo (Min), and Reset HiLo (Reset Max and Min), choosing what value to reset. You can also select the specific reset function (e.g. Reset HiLo) to the selected digital input or function key.



## Input Calibration (ICAL)



## Recalibrating the Analog Input Channels (Ch-A & Ch-B)

The analog input channels are calibrated at the factory. If recalibration is needed, follow the flowchart menu above and the instructions below.

1. Enter the ICAL menu to calibrate channel A and channel B.
2. Select mA or Volt
3. Apply the low (4 mA or 0 V) and high (20 mA or 10 V) signals as requested.
4. Press Enter to accept the values entered or press Menu to exit calibration without saving the changes.

## Error Message (Error)

An error message indicates that the calibration or scaling process was not successful. After the error message is displayed, the scanner 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:

1. Input signal is not connected to the proper terminals, or it is connected backwards.
2. Minimum input span requirements not maintained.

Input Range	Input 1 & Input 2 Span
4-20 mA	0.15 mA
±10 VDC	0.10 VDC

## Scanner Operation

When installed, the primary way to operate the scanner 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 scanner by connecting a suitable control station or switch to one of the digital inputs that can be used to perform various operations on the scanner based on the Programmable Function Keys. Finally, certain operations can be performed on the scanner with ScanView software or through Modbus commands.








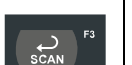
The default operations that can be performed with the scanner's CapTouch buttons are:

1. Display the maximum and minimum readings
2. Acknowledge the relays
3. Move to the next or previous PV or math channel
4. Pause / resume scanning

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 80.

## Button Operation

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

Button Symbol	Description
 	Press to enter, exit Programming Mode, or exit max/min readings
 	Press to move to the previous PV or math channel
 	Press to move to the next PV or math channel
 	Press once to pause scanning, press again to resume scanning

## CapTouch Buttons

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

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



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

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

### CapTouch Button Tips:

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

## Function Keys Operation

During operation, the programmable function keys operate according to the way they have been programmed in the *Advanced Features – User menu*. See *Programmable Function Keys User Menu (u5Er)* on page 80 for details.

The table in the *Button Operation* section shows the factory default settings for F1, F2, and F3.

## Digital Inputs Operation

Five (5) digital inputs, F4, DI-1 to DI-4, come standard on the scanner. 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 80 for details.

## Maximum/Minimum Readings

The max & min readings (peak & valley) reached by the PVs or math channels can be displayed by assigning the display to max/min through the *Display Setup* menu.

A digital input should be programmed to reset the max & min readings.

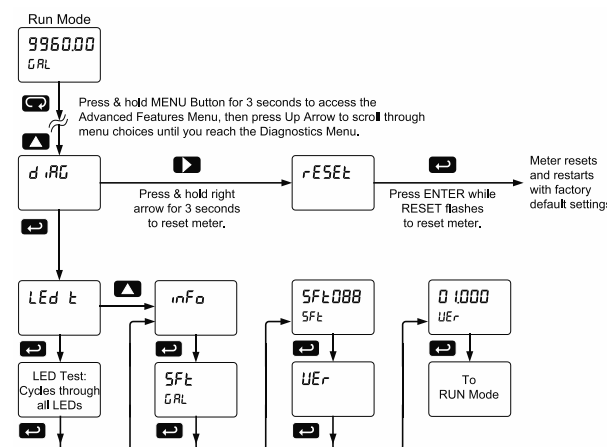
## Troubleshooting

The rugged design and the user-friendly interface of the scanner should make it unusual for the installer or operator to refer to this section of the manual.

However, due to the many features and functions of the scanner, it's possible that the setup of the scanner does not agree with what an operator expects to see. If the scanner is not working as expected, refer to the *Diagnostics* menu and recommendations below.

## Diagnostics Menu (d ,RG)

The *Diagnostics* menu is located in the *Advanced Features* menu, to access *Diagnostics* menu see *Advanced Features Menu* on page 66. This menu allows the user to test the functionality of all the scanner LEDs, check the scanner's software and version information, and erase the ScanView software installation files from the scanner. Press the Enter button to view the settings and the Menu button to exit at any time.



## Testing the Display LEDs

To test all LEDs on the display:

1. Go to the *Diagnostics* menu (d ,RG) and press Enter button.
2. Press Up arrow button and scroll to *LED Test* menu (LEd t)
3. Press the Enter button to activate the LED Test. The scanner 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 (inFa) or press the Menu button to return to Run Mode.

## Determining Software Version

To determine the software version of a scanner:

1. Go to the *Diagnostics* menu (d iRg) and press Enter button.
2. Press Up arrow button and scroll to Information menu ( i n F o).
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 scanner returns to Run Mode after displaying all the settings.

## Reset Scanner to Factory Defaults

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

### Instructions to load factory defaults:

1. Enter the *Advanced Features* menu, see *Advanced Features Menu* on page 66.
2. Press Up arrow to go to *Diagnostics* 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 Run Mode.
4. The scanner goes through an initialization sequence (similar as on power-up) and loads the factory default settings.

## Factory Defaults & User Settings

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

Factory Defaults & User Settings		
Parameter	Display	Default Setting
Mode	Mode	Master
Function Code	Function	03
PV Number	PV number	PV1-PV4 Enabled
Slave ID PV1-16	Slave ID	001 - 016
Register Number PV1-16	Register	40001
Data Type PV1-16	Data Type	Float
Byte Order	Byte Order	Big-endian
Polling Time	Polling Time	5.0 second
Slave Response Timeout	Slave Response Timeout	10.0 second
Serial	Serial	
Scanner ID	Scanner ID	246
Baud	Baud	9600
Parity	Parity	Even
Byte-to-byte timeout	Byte-to-byte timeout	0.01 second
Setup	Setup	
Tag PV1-16	Tag	PV 1 – PV 16
Units PV1-16	Units	FEET
Units C1-4	Units	UnitC1 – UnitC4
Display Format PV1-16	Display Format	Dec (PD8-6080) Ft-In-16 (PD8-6081)
Display Format C1-4	Display Format	Decimal
Display decimal point	Display decimal point	ddd.ddd
Float decimal point	Float decimal point	ddd.ddd
Number of points	Number of points	2 (all PVs and C channels)
Scaling	Scaling	All
Input 1	Input 1	0.000
Display 1	Display 1	0.000
Input 2	Input 2	10.000
Display 2	Display 2	10.000
Math, channel C1-4	Math	Sum
Adder (constant P)	Adder	0.000
Factor (constant F)	Factor	1.000
Filter	Filter	

Factory Defaults & User Settings		
Parameter	Display	Default Setting
Filter, PV 1	[h-R	70
Filter, PV 2	[h-b	70
Bypass, PV 1	bYPASS	0.2
Bypass, PV 2	bYPASS	0.2
Round	round	1
Cutoff	[utoff	
Cutoff value, PV 1	[h-R	0.0 (disabled)
Cutoff value, PV 2	[h-b	0.0 (disabled)
Display assignment	dSPLY	
Line 1	d P1	Display PV
Line 2	d tAG	Display tag
Display intensity	d-Int	6
Relay 1 assignment	P1	PV 1
Relay 1 action	Rct 1	Automatic
Relay 1 set point	SEt 1	1.000
Relay 1 reset point	rSt 1	0.500
Relay 2 assignment	P2	PV 2
Relay 2 action	Rct 2	Automatic
Relay 2 set point	SEt 2	2.000
Relay 2 reset point	rSt 2	1.500
Relay 3 assignment	P3	PV 3
Relay 3 action	Rct 3	Automatic
Relay 3 set point	SEt 3	3.000
Relay 3 reset point	rSt 3	2.500
Relay 4 assignment	P4	PV 4
Relay 4 action	Rct 4	Automatic
Relay 4 set point	SEt 4	4.000
Relay 4 reset point	rSt 4	3.500
Fail-safe relay 1	FLS 1	Off
Fail-safe relay 2	FLS 2	Off
Fail-safe relay 3	FLS 3	Off
Fail-safe relay 4	FLS 4	Off
On delay relay 1	On 1	0.0 sec
Off delay relay 1	OFF 1	0.0 sec
On delay relay 2	On 2	0.0 sec
Off delay relay 2	OFF 2	0.0 sec

Factory Defaults & User Settings		
Parameter	Display	Default Setting
On delay relay 3	On 3	0.0 sec
Off delay relay 3	OFF 3	0.0 sec
On delay relay 4	On 4	0.0 sec
Off delay relay 4	OFF 4	0.0 sec
Communications break relay 1	On	On
Communications break relay 2	On	On
Communications break relay 3	On	On
Communications break relay 4	On	On
Display 1 analog output	d 1	00.00.00
Output 1 value	Out 1	4.000 mA
Display 2 analog output	d 2	20.00.00
Output 2 value	Out 2	20.000 mA
Source analog output	Source	PV 1
Overrange output	Overrange	21.000 mA
Underrange output	Underrange	3.000 mA
Communications break output	brk	1.000 mA
Maximum output	max	23.000 mA
Minimum output	min	1.000 mA
F1 function key	F 1	Previous PV
F2 function key	F 2	Next PV
F3 function key	F 3	Scan/Pause
F4 function (digital input)	F 4	Acknowledge relays
Digital input 1	d i 1	Menu
Digital input 2	d i 2	Right arrow
Digital input 3	d i 3	Up arrow
Digital input 4	d i 4	Enter
Digital output 1	d o 1	Alarm 1
Digital output 2	d o 2	Alarm 2
Digital output 3	d o 3	Alarm 3
Digital output 4	d o 4	Alarm 4
Password 1	PRSS 1	000000 (unlocked)
Password 2	PRSS 2	000000 (unlocked)
Password 3	PRSS 3	000000 (unlocked)

## Troubleshooting Tips

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

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

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, <b>Lock</b> is displayed	Scanner is password-protected, enter correct six-digit password to unlock or Master Password of 508655.
Scanner does not respond to input change	If a <i>Low-Value Cutoff</i> value has been programmed, the scanner will display zero below that point, regardless of the input – which can appear like the scanner is not responding to an input change. Check to make sure the problem is not being caused by an undesired low-value cutoff value. To prevent the display from showing a negative value, set the low-value cutoff to a value greater than zero.
Scanner displays error message during scaling ( <b>Error</b> )	Check inputs: Input 2 must greater than Input 1, Input 3 must be greater than Input 2, etc.
Scanner displays 1. <b>999999</b> 2. <b>-999999</b>	Indicating overrange or underrange condition Check the input data value and scaling in <i>Setup</i> menu
Display stop scanning, ■ LED indicator flashing	Check: 1. Stop on alarm feature has been enabled 2. Press PREV or NEXT to resume scanning
Displays <b>ERR</b> message	Check: 1. RS-485 connection to slave devices 2. Slave Id, register number of slave devices 3. Baud rate and parity of all devices on the bus 4. Scanner Id must be different from other devices
Snooper mode not reading the PVs on the RS-485 bus	Check: 1. Increase Master's Transmit Delay (e.g. Snooper delay = 100ms, Master delay = 110ms) 2. Increase Snooper's byte-to-byte timeout 3. Decrease the slave device's transmit delay to <10ms 4. Snooper cannot read the same PV twice, check setup
Scanner experiencing faults and communication breaks	Check: 1. Increase response time ( <b>RESP</b> ) and/or transmit delay ( <b>TDLY</b> ). This may require some trial and error, as these are dependent upon the number of devices on the bus. 2. Internal Scan ID Modbus address. Addresses 256 (mA) or 257 (V) are used for Channel A, while Addresses 258 (mA) or 259 (V) are used for Channel B.
Scanner not communicating with ScanView software	Check: 1. Serial adapter and cable 2. Serial settings 3. Scanner address, baud rate, and transmit delay
Display does not respond to input data, reading a fixed number	Check display assignment, it might be displaying max/ min
Display reading is not accurate	Check: 1. PV Scaling 2. Check format selected: Dec or Ft&In
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.
If the display locks up or the scanner does not respond at all	Cycle the power to reboot the microprocessor.



## Troubleshooting Tips

Symptom	Check/Action
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 scanner to factory defaults, see *Reset Scanner to Factory Defaults* on page 85. In addition, for best results, we recommend using the free ScanView software for all programming needs.

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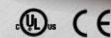


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233 South Street • Hopkinton MA 01748 USA

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