Helios Large Display Modbus® Scanner
Instruction Manual   PD2-6080/1

HELIOS

Modbus

Modbus Scanner

- Large 1.80" Digits
- Dual-Line 6-Digit Display
- Readable from up to 100 Feet (30 Meters) Away
- Superluminous Sunlight Readable Display
- NEMA 4X, IP65 Rated Field Mountable Enclosure
- Operating Temperature Range of -40 to 65°C (-40 to 150°F)
- Modbus® RTU Master, Slave, or Snooper Mode
- Poll and Display up to 16 Process Variables
- Addition, Difference, Average, Multiplication, Division, Min, Max, Weighted Average, Ratio, Concentration, & More
- Input Power Options Include 85-265 VAC or 12-24 VDC
- 2 or 4 Relays + Isolated 4-20 mA Output Options
- Onboard USB & RS-485 Serial Communication Options
- Program the Meter from a PC with onboard USB and ScanView

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⚠ **Caution**: *Read complete instructions prior to installation and operation of the meter.*	⚡ **Warning**: ***Risk of electric shock or personal injury.***
⚡ **Warning!**	***This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at their own risk. Precision Digital Corporation shall not be held liable for damages resulting from such improper use.***

Limited Warranty

Precision Digital Corporation warrants this product against defects in material or workmanship for the specified period under "Specifications" from the date of shipment from the factory. Precision Digital's liability under this limited warranty shall not exceed the purchase value, repair, or replacement of the defective unit.

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Introduction

The Helios PD2-6080 Large-Display Modbus® Scanner is a multi-purpose, easy to use, digital scanner that can be programmed as a Modbus RTU Master, Slave, or Snooper. It features large 1.8 inch superluminous LED digits, which can be read from up to 100 feet away and is capable of scanning up to 16 variables generated by any Modbus device. The PD2-6080 displays in decimal format, while the PD2-6081 has a feet & inches display. It is housed in a water-resistant, field mountable NEMA 4X/IP65 rated enclosure for convenient indoor or outdoor installation.

In *master* mode, Helios reads up to 16 slave devices, scales the data from each, displays the result, and operates the internal relays and 4-20 mA output. The scanner is capable of polling up to 16 process variables (PVs); it displays all the enabled PVs in sequence, at a user programmable scan rate. It also allows other Helios Modbus Scanners in *snooper* mode to read any of the variables being polled by the *master*. As a *snooper*, 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 processes the data being read. In *slave* mode, it is controlled by a *master* device. The data sent to it by the *master* is scaled, displayed, and used to operate the relays and 4-20 mA output.

The Helios PD2-6080/1 comes equipped with dual analog input channels (4-20 mA and/or 0-10 VDC) for use in *Master* mode. These can be assigned to mA or volts by mapping a PV to the internal scanner addresses 256-259, depending on the desired function.

Various math functions may be applied to the Modbus and analog inputs including addition, difference, absolute difference, average, weighted average, multiplication, division, minimum, maximum, draw, ratio, and concentration. This is in addition to the signal input conditioning functions (linear, square root, 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. The digital inputs/outputs can be custom-programmed for specific operations.

A fully loaded Helios PD2-6080/1 meter comes with four (4) SPDT relays, a 4 20 mA output, two 24 VDC power supplies, five (5) digital inputs and four (4) digital outputs, and RS485 serial communications. Free ScanView software allows the Helios Modbus Scanner to be accessed via computer. Configure multiple scanners, conveniently monitor critical information, and datalog right from a PC with ease, further increasing plant efficiency.

Ordering Information

Standard Decimal Display Models

85-265 VAC Model	12-24 VDC Model	Options Installed
PD2-6080-6H0	PD2-6080-7H0	No Options
PD2-6080-6H7	PD2-6080-7H7	4 relays & 4-20 mA output

Feet & Inches Display Models

85-265 VAC Model	12-24 VDC Model	Options Installed
PD2-6081-6H0	PD2-6081-7H0	No Options
PD2-6081-6H7	PD2-6081-7H7	4 relays & 4-20 mA output

Accessories

Model	Description
PDA1011	Dual 4-20 mA output expansion module
PDA6260	Pipe Mounting Kit
PDA7485-I	RS-232 to RS-422/485 isolated converter
PDA7485-N	RS-232 to RS-422/485 non-isolated converter
PDA8485-I	USB to RS-422/485 isolated converter
PDA8485-N	USB to RS-422/485 non-isolated converter
PDAPLUG2	Plastic Conduit Plug
PDX6901	Suppressor (snubber): 0.01 µF/470 Ω, 250 VAC

Specifications

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

Operating Modes

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.
	Note: The relays and the 4-20 mA outputs are functional in all modes.

Master & Snooper Settings

PV Number	PV1–PV16 Enable or disable the process variables to be polled by the Master.
Slave Id	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.
Function Code	Select which Modbus function code (03, 04, or 65) to use in reading the slave device.
Register Number	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).
Data Type	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).
Poll Time	1.0 to 99.9 sec. Time between read-commands (Master mode).

Slave Response Timeout

Slave Response Timeout	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.
Communica-tion Break	Displays "$br E R H$" 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

Tag & Units	6-character, independent tag and units for each PV and math channel
PV Format	PD6080 default: Decimal format PD6081 default: FT & IN, 1/8th or 1/16th; decimal format may be selected for display line 2 indication.
Display Decimal Point	Up to five decimal places or none: *d.ddddd*, *dd.dddd*, *ddd.ddd*, *dddd.dd*, *ddddd.d*, or *dddddd*
Float Decimal Point	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).
PV & Math Scaling	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-1/16th scale input 2 to display 83 Ft – 4 In – 0/16th.

Display Settings

Scan Mode	**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.
Display Scan Rate	**Master/Snooper:** 1 PV/second to 1 PV every 99.9 seconds **Slave:** Dependent on master device (e.g. PLC) *Note: The display scan rate is independent of the poll time.*
Display Assignment	Display line 1 may be assigned to PV (process values), Ch-C (math channel), PV & units, tag & PV, tag-PV-units, C & units, tag-C-unit, Set point 1-8, max/min PV, max/min C. Display line 2 may be assigned to all of the above, tag, tag & units, or off. The tag and units are displayed alternately for 2 sec max, when selected. Different tags & PVs may be selected to display on line 1 and line 2 at the same time.

Math Functions

Name	Math Operation (Examples) (P = Adder, F = Factor)	Setting
Addition	(PV1+PV2+P)*F	5um
Difference	(PV1-PV2+P)*F	d iF
Absolute difference	((Abs(PV1- PV2)+P)*F	d iFAb5
Average	(((PV1+PV2)/2)+P)*F	AUG
Multiplication	((PV1*PV2)+P)*F	muLt i
Division	((PV1/PV2)+P)*F	d iU idE
Max PV	Max value of all selected PVs	H i-PU
Min PV	Min value of all selected PVs	Lo-PU
Draw	((PV1/PV2)-1)*F	drAu
Weighted average	((PV2-PV1)*F)+PV1	uLAUG
Ratio	(PV1/PV2)*F	rAt io
Concentration	(PV1/(PV1+PV2))*F	ConcEn
Math 2	Math on other math channels	mAth2
Programmable Constants	**Constant P (Adder):** -99.999 to 999.999, default: 0.000 **Constant F (Factor):** 0.001 to 999.999, default: 1.000	

Serial Communications

Compatibility	EIA-485
Connectors	Removable screw terminal connector
Max Distance	3,937' (1,200 m) max
Status Indication	Separate LEDs for Power (P), Transmit (TX), and Receive (RX)
Scanner Id	1 – 247 (Scanner Modbus address)
Baud Rate	300 – 19,200 bps
Transmit Time Delay	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.
Data	8 bits (1 start bit, 1 or 2 stop bits)
Parity	Even, Odd, or None with 1 or 2 stop bits
Byte-To-Byte Timeout	0.01 – 2.54 second
Turn Around Delay	Less than 2 ms (fixed)

Note: Refer to the Modbus® Scanner Modbus Register Tables.

General

Input / Output	Modbus RTU over RS-485, Two analog inputs (4-20 mA, ±10 V)
Display	Main display: 1.8" (46 mm) high, red LEDs 6 digits per line (-99999 to 999999), with lead zero blanking
Display Intensity	Eight user selectable intensity levels
Display Update Rate	5/second (200 ms)
Overrange	Display flashes 999999
Underrange	Display flashes -99999
Programming Methods	Four programming buttons, digital inputs, PC and ScanView software, or Modbus registers.
Max/Min Display	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
Password	Three programmable passwords restrict modification of programmed settings. Pass 1: Allows use of function keys and digital inputs Pass 2: Allows use of function keys, digital inputs and editing set/reset points Pass 3: Restricts all programming, function keys, and digital inputs.

Power Options	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max **or** 12-24 VDC ± 10%, 15 W max
Isolated Transmitter Power Supply	Terminals P+ & P-: 24 VDC ± 10%. 12-24 VDC powered models selectable for 24, 10, or 5 VDC supply (internal P+/P- switch). 85-265 VAC models rated @ 200 mA max, 12-24 VDC powered models rated @ 100 mA max, @ 50 mA max for 5 or 10 VDC supply.
Non-Volatile Memory	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
Fuse	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse
Isolation	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
Overvoltage Category	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
Environmental	Operating temperature range: -40 to 150°F (-40 to 65°C) Storage temperature range: -40 to 185°F (-40 to 85°C) Relative humidity: 0 to 90% non-condensing
Connections	Removable and integrated screw terminal blocks accept 12 to 22 AWG wire...
Enclosure	UL Type 4X, IP65 rated. Polycarbonate & glass blended plastic case, color: gray. Includes four PG11 through-hole conduit openings, with two factory installed PG11, IP68, black nylon threaded hole plugs with backing nuts.
Mounting	**Wall Mounting:** Four (4) mounting holes provided for screwing meter into wall. See Wall Mounting Instructions on page 12 for additional details. **Pipe Mounting:** Optional pipe mounting kit (PDA6260) allows for pipe mounting. Sold separately. See Pipe Mounting Instructions on page 13 for additional details.
Tightening Torque	**Removable Screw Terminals:** 5 lb-in (0.56 Nm) **Digital I/O and RS485 Terminals:** 2.2 lb-in (0.25 Nm)
Overall Dimensions	10.63" x 12.59" x 4.77" (270 mm x 319.7 mm x 121.2 mm) (W x H x D)
Weight	6.10 lbs (2.76 kg)
Warranty	3 years parts & labor

Relays

Rating	4 SPDT (Form C) internal rated 3 A @ 30 VDC and 125/250 VAC resistive load; 1/14 HP (≈ 50 W) @ 125/250 VAC for inductive loads
Noise Suppression	Noise suppression is recommended for each relay contact switching inductive loads; see page 19 for details.
Electrical Noise Suppression	A suppressor (snubber) should be connected to each relay contact switching inductive loads to prevent disruption to the microprocessor's operation. Recommended suppressor value: 0.01 µF/470 Ω, 250 VAC (PDX6901).
Deadband	0-100% of span, user programmable
High Or Low Alarm	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
Relay Operation	Automatic (non-latching) and/or manual reset Latching (requires manual acknowledge) with/without clear Pump alternation control (2 to 4 relays) Sampling (based on time) Off (disable unused relays and enable Interlock feature) Manual on/off control mode
Relay Reset	User selectable via front panel buttons or digital inputs 1. Automatic reset only (non-latching), when the input passes the reset point. 2. Automatic + manual reset at any time (non-latching) 3. Manual reset only, at any time (latching) 4. Manual reset only after alarm condition has cleared (latching) *Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.*
Time Delay	0 to 999.9 seconds, on & off relay time delays Programmable and independent for each relay
Fail-Safe Operation	Programmable and independent for each relay. *Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.*
Auto Initialization	When power is applied to the meter, relays will reflect the state of the input to the meter.

Isolated 4-20 mA Transmitter Output

Output Source	Input channels A or B, rate, total, or grand total; channel C; max or min for channel A or B; highest or lowest max or min of A and B; set points 1-4; Modbus input; or manual control mode
Scaling Range	1.000 to 23.000 mA for any display range
Calibration	Factory calibrated: 4.000 to 20.000 = 4-20 mA output
Analog Out Programming	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break
Communications Break	Programmable mA output when a slave device does not reply within the response timeout.
Accuracy	± 0.1% of span ± 0.004 mA
Temperature Drift	0.4 µA/°C max from 0 to 65°C ambient, 0.8 µA/°C max from -40 to 0°C ambient *Note: Analog output drift is separate from input drift.*
Isolated Transmitter Power Supply	Terminals I+ & R: 24 VDC ± 10%. May be used to power the 4-20 mA output or other devices. Refer to Figure 19 on page 20. All models rated @ 40 mA max.
External Loop Power Supply	35 VDC maximum

Output Loop Resistance	Power supply	Minimum	Maximum
	24 VDC	10 Ω	700 Ω
	35 VDC (external)	100 Ω	1200 Ω

Dual Process Input

Two Inputs	Two **non-isolated** inputs, each separately field selectable: 0-20, 4-20 mA, ±10 V (0-5, 1-5, 0-10 V)
PV Analog Channel Id	**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
Accuracy	±0.03% of calibrated span ±1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span
Temperature Drift	0.005% of calibrated span/°C max from 0 to 65°C ambient, 0.01% of calibrated span/°C max from -40 to 0°C ambient

Signal Input Conditioning	Linear, square root, programmable exponent, or round horizontal tank volume calculation
Multi-Point Linearization	2 to 32 points for PV1 and PV2
Programmable Exponent	1.0001 to 2.9999
Low-Flow Cutoff	0-999999 (0 disables cutoff function) for PV1 and PV2

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

Input Impedance	Voltage ranges: greater than 500 kΩ Current ranges: 50 - 100 Ω (depending on resettable fuse impedance)
Input Overload	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.

Digital Input & Output Terminal

Channels	4 digital inputs & 4 digital outputs
Digital Input Logic High	3 to 5 VDC
Digital Input Logic Low	0 to 1.25 VDC
Digital Output Logic High	3.1 to 3.3 VDC
Digital Output Logic Low	0 to 0.4 VDC
Source Current	10 mA maximum output current
Sink Current	1.5 mA minimum input current
+5 V Terminal	To be used as pull-up for digital inputs only. Connect normally open pushbuttons across +5 V & DI 1-4.

⚠ **WARNING!**	**DO NOT use +5 V terminal to power external devices.**

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Compliance Information

Safety

UL & C-UL Listed	USA & Canada UL 508 Industrial Control Equipment (United States), C22.2 No. 142 (Canadian National Standard)
UL File Number	E160849
Front Panel	UL Type 4X, NEMA 4X, IP65
Low Voltage Directive	EN 61010-1:2010 Safety requirements for measurement, control, and laboratory use

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Safety Information

Caution: *Read complete instructions prior to installation and operation of the meter.*	**Warning**: *Risk of electric shock or personal injury.*
Warning!	***Hazardous voltages exist within enclosure.*** *Installation and service should be performed only by trained service personnel.*
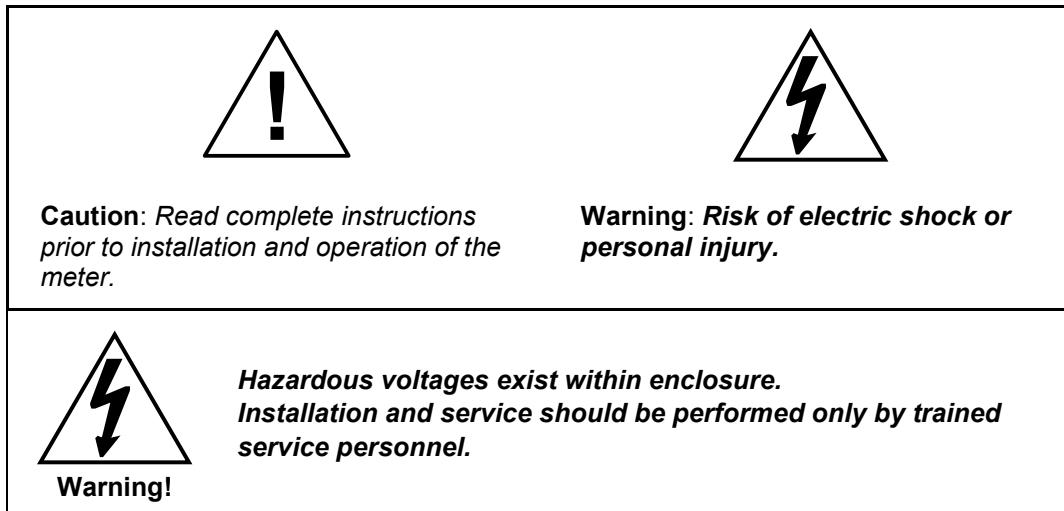
Installation

There is no need to open the clear plastic front cover in order to complete the installation, wiring, and setup of the meter. All programming is done through the buttons and switches located under the lower door panel and are accessible by removing the single securing screw. Wires should be run through the conduit entry holes located on the bottom of the meter.

There are a total of four pre-drilled conduit entry holes located at the bottom of the meter. If the need to drill additional holes arises, make sure you will have the clearance necessary for conduit mounting hardware.

Do not disconnect the RJ45 connector found on the right side of the meter wiring board. Doing so will disable the onboard digital I/O, RS-485 serial communications, and M-Link functionality.

Instructions are provided for changing the transmitter power supply to output 5 or 10 VDC instead of 24 VDC, see page 13.

Unpacking

Remove the meter from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier. If any part is missing or the meter malfunctions, please contact your supplier or the factory for assistance.

Wall Mounting Instructions

The meter can be mounted to any wall using the four provided mounting holes. Note that the bottom mounting holes are located underneath the front door panel. To mount the meter to a wall, follow these instructions.

1. Prepare a section of wall approximately 11" x 13" (280 mm x 330 mm) for meter mounting by marking with a pencil the mounting holes (shown in the image to the right) on the wall.

2. Using a drill bit slightly smaller than the girth of the mounting screws, pre-drill holes at the mounting locations previously marked.

3. Insert mounting screws into the four mounting holes and screw them into the pre-drilled holes. **Do not overtighten** the mounting screws as it is possible that the enclosure could crack and become damaged.
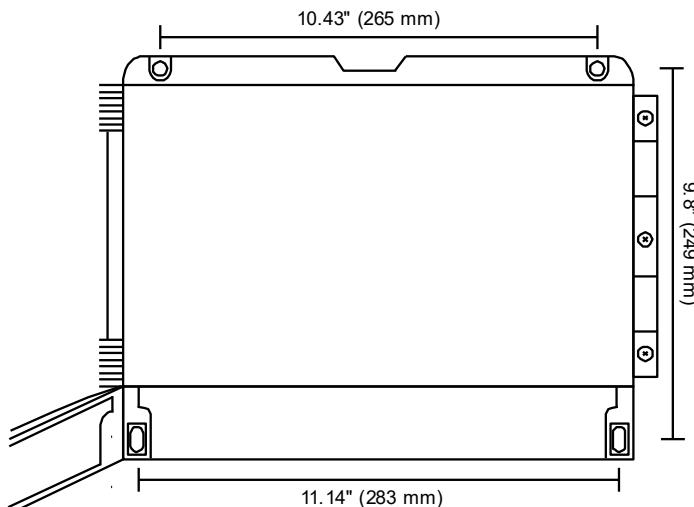
Figure 1. Meter Mounting Holes

Mounting Dimensions
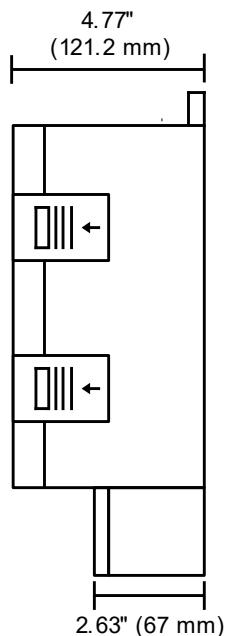
Figure 2. Meter Dimensions - Side View
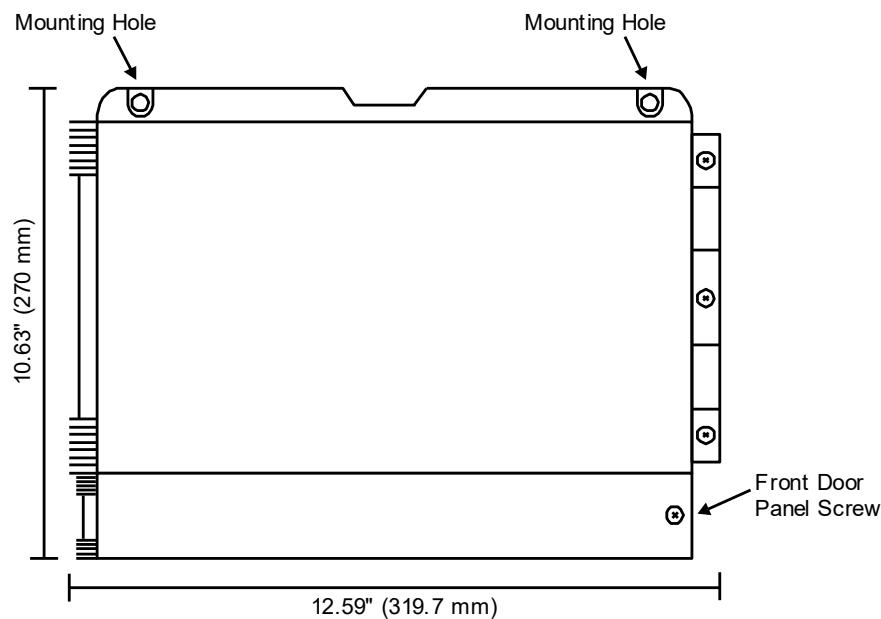
Figure 3. Meter Dimensions – Front View

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Pipe Mounting Instructions

The meter can also be mounted to a pipe using the optional pipe mounting kit (PDA6260). This kit includes two mounting plates, two U-bolts, and the necessary nuts and bolts. To mount the meter to a pipe using the pipe mounting kit accessory, follow these instructions.

1. Secure the mounting plates to the top and bottom (for vertical pipes) or left and right (for horizontal pipes) of the reverse side of the meter enclosure using the provided fasteners. **Do not overtighten** the fasteners as it could cause damage to the enclosure.
2. Using the provided nuts and U-bolts, secure the mounting plates to the pipe enough torque such that the meter cannot be moved up or down (or side to side).
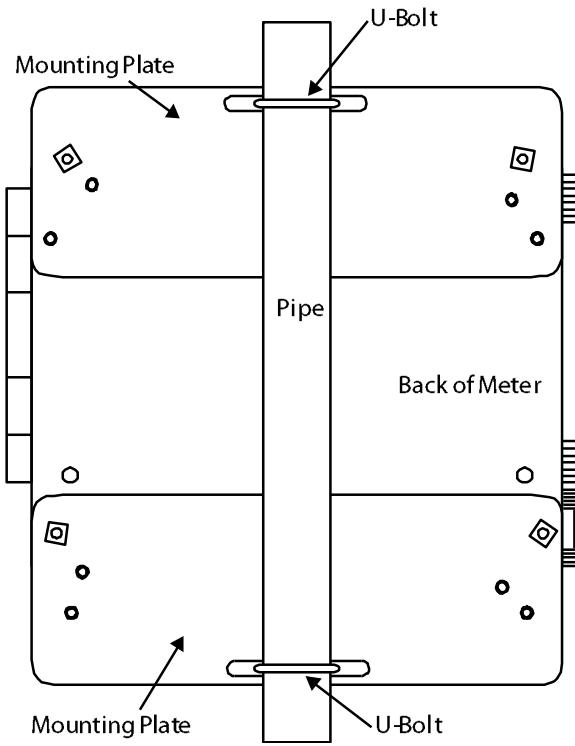
Figure 4. Vertical Pipe Mount Assembly
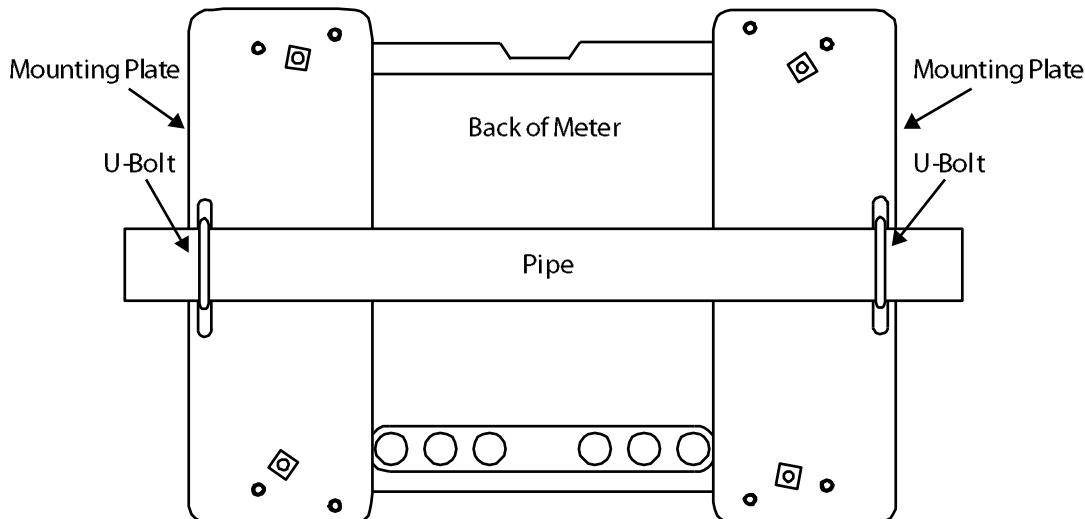
Figure 5. Horizontal Pipe Mount Assembly

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Transmitter Supply Voltage Selection (P+, P-)

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

If the transmitter requires 5 or 10 VDC excitation, the switch labeled P+/P- must be configured accordingly.

To access the voltage selection jumper:

1. Unplug the meter power.
2. Unscrew and open the front door panel.
3. Locate the P+/P- switch located in the center of the connections board (see diagram below).
4. Flip this switch into the appropriate position for the required transmitter excitation.
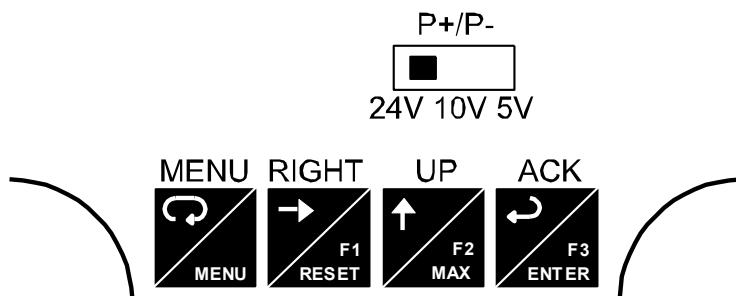
Figure 6. Transmitter Supply Voltage Selection

Connections

All connections are made to screw terminal connectors located under the front door panel. Remove the single securing screw in order to access the wiring terminals.

⚠️ **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.*
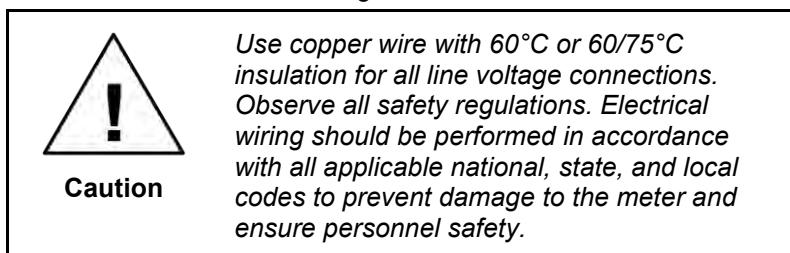
Connectors Labeling

The connectors' label, affixed to the inside of the lower door panel, shows the location of all connectors available with requested configuration.

⚠ **Warning!**	*Do not connect any equipment other than Precision Digital's expansion modules, cables, or meters 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 onboard digital I/O, RS-485 serial communications, and M-Link functionality.*

Figure 7. Connector Labeling for Fully Loaded PD2-6080/1

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 7 on page 15. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.

POWER

AC or DC
POWER

Required External Fuse:
5 A max, 250 V Slow Blow
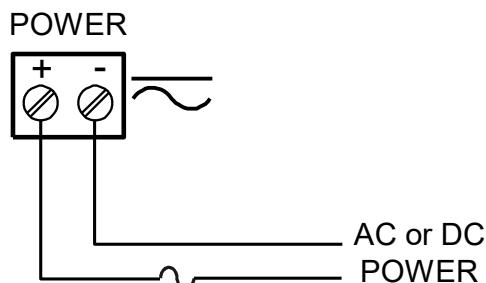
Figure 8. Power Connections

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Serial Communications Connection

An RS-485 connector is provided for the use of Modbus® serial communications. This connector is used to interface the Modbus scanner with other Modbus devices. It has a removable screw terminal connector for the RS-485 terminals which includes Transmit Data (DO) and (/DO), Receive Data (DI) and (/DI), and Signal Ground. Baud rates are adjustable and handled by the meter (see Serial Communications (𝚂𝙴𝚛 𝙸𝙰𝙻) on page 30 for more information).

Figure 9. RS485 Connection

The RS-485 connector has three diagnostic LEDs: a Power (PWR) LED to show when the adapter is powered properly, a Transmit Data (TX) LED to show when the adapter is sending data out from the PC side, and a Receive Data (RX) LED to show when the adapter is receiving data from the meter.

Installation

Figure 10 shows the connection of a meter to a PC using the RS485 output connector and a PDA7485 RS-232 to RS-422/485 converter in an RS-422 network. Figure 11 shows the connection of several meters to a PC using a PDA7485 RS-232 to RS-422/485 converter in an RS-485 network.

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.

To change the meter address:

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

Figure 10. RS-422 or RS-485 Wiring

Notes:
1. Termination resistors are optional and values depend on the cable length and characteristic impedance. Consult the cable manufacturer for recommendations.
2. Refer to RS-232 to RS-422/485 Converter documentation for further details.
3. Use shielded cable, twisted-pairs plus ground. Connect ground shield only at one location.
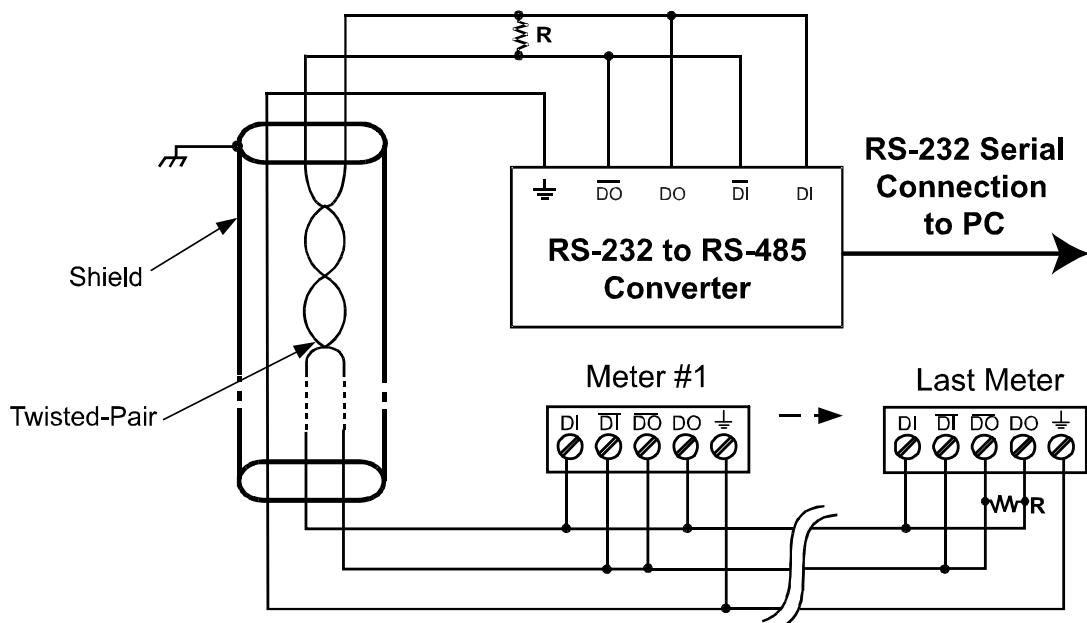
Figure 11. RS-485 Two-Wire Multi-Drop Wiring

Notes:
1. Termination resistors are optional and values depend on the cable length and characteristic impedance. Consult the cable manufacturer for recommendations.
2. Refer to RS-232 to RS-485 Converter documentation for further details.
3. Use shielded cable, twisted-pair plus ground. Connect ground shield only at one location.

Connections

Figure 12 details the wiring connections from the RS-485 connector to an RS-422/485 serial converter (such as the PDA7485 or PDA8485) for a four-wire network.

RS485 Connector to RS-422/485 Serial Converter Connections	
RS-422/485 Serial Converter	PDA1485 RS-485 Adapter
⏚	⏚
$\overline{DO}$	$\overline{DI}$
DO	DI
$\overline{DI}$	$\overline{DO}$
DI	DO

Figure 12. Connections for RS485 Connector to Serial Converter

Three Wire Connection

In order to wire the 5 pins for use as a 3-wire half-duplex RS-485 connection, it is necessary to create a jumper connection between DI – DO and DI- – DO- as shown below.
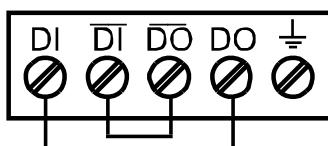
Figure 13. Three-Wire RS485 Connection

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Digital I/O Connections

Digital inputs and outputs are provides in order to expand the functionality of the meter. Digital inputs are made via a push button or switch connection to the appropriate digital input connector block and the +5 VDC block. Digital output connections are made by wiring from the appropriate digital output block to the grounding terminal block.
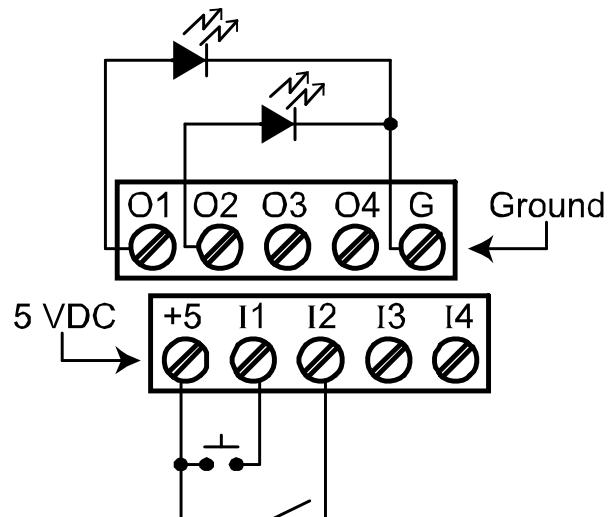
Figure 14. Digital Input and Output Connections

F4 Digital Input Connections

Digital input F4 is also available on the meter. This digital input is connected with a normally open contact across F4 and COM, or with an active low signal applied to F4.
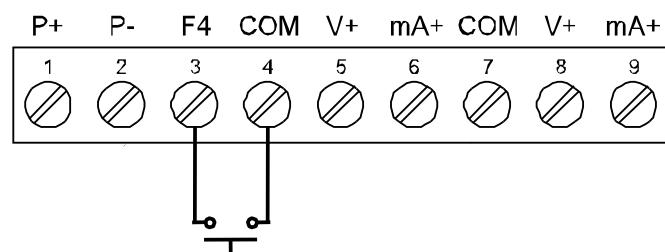
Figure 15. F4 Digital Input Connections

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Relay Connections

Relay connections are made to two six-terminal connectors labeled RELAY1 – RELAY4 on Figure 7. 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.
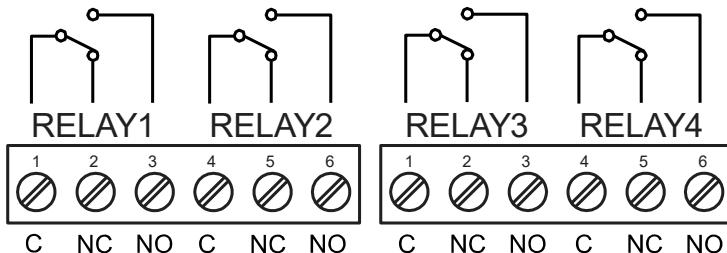
Figure 16. Relay Connections

Switching Inductive Loads

The use of suppressors (snubbers) is strongly recommended when switching inductive loads to prevent disrupting the microprocessor's operation. The suppressors also prolong the life of the relay contacts. Suppression can be obtained with resistor-capacitor (RC) networks assembled by the user or purchased as complete assemblies. Refer to the following circuits for RC network assembly and installation:
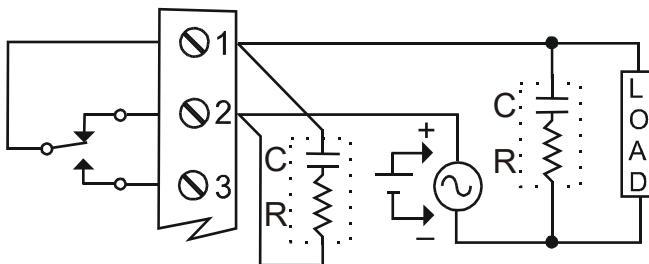
Figure 17. AC and DC Loads Protection

Choose R and C as follows:

R: 0.5 to 1 Ω for each volt across the contacts

C: 0.5 to 1 µF for each amp through closed contacts

Notes:

1. *Use capacitors rated for 250 VAC.*
2. *RC networks may affect load release time of solenoid loads. Check to confirm proper operation.*
3. *Install the RC network at the meter's relay screw terminals. An RC network may also be installed across the load. Experiment for best results.*
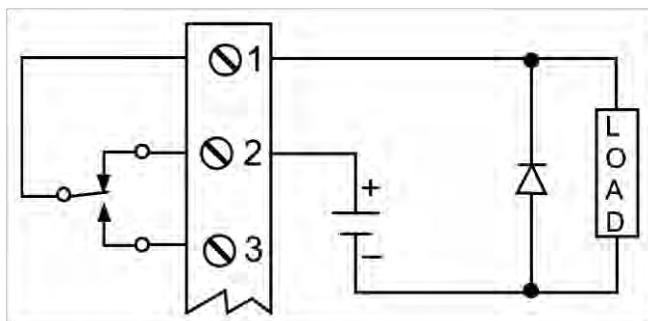
Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

Figure 18. Low Voltage DC Loads Protection

RC Networks Available from Precision Digital

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

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

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4-20 mA Output Connections

Connections for the 4-20 mA transmitter output are made to the connector terminals labeled MA OUT. The 4-20 mA output may be powered internally or from an external power supply.
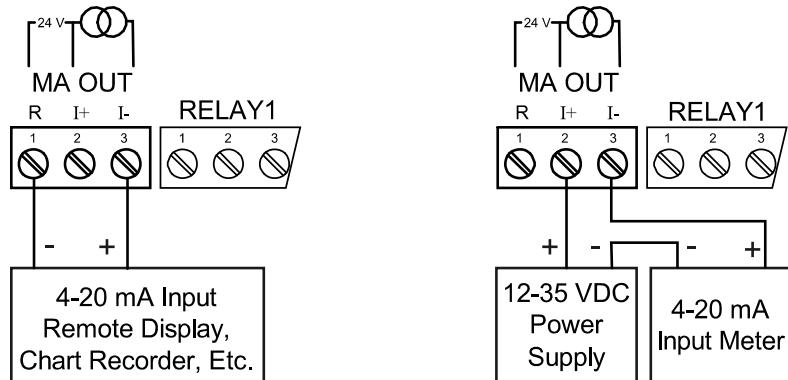
Figure 19. 4-20 mA Output Connections

Analog Output Transmitter Power Supply

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

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 relative digital input(s) (see page 52). In one example, dry interlock contacts are connected in series to one digital input which will be used to force on (energize) the assigned interlock power relay when all interlock contacts are closed (safe). The interlock relay front panel LED flashes when locked out. The interlock relay would be wired in-series with the load (N/O contact). See below.
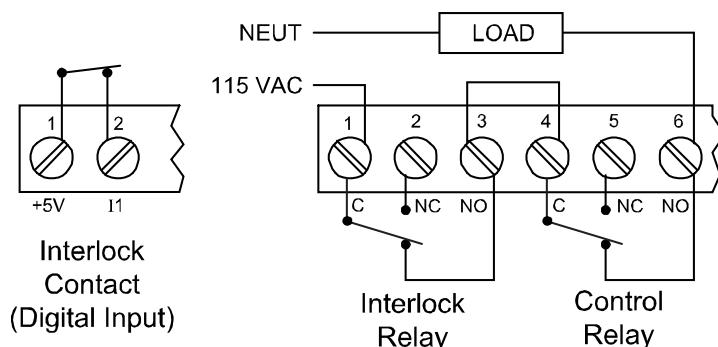
Figure 20. Interlock Connections

External Analog Output Connection

The analog out expansion module PDA1011 is connected to the scanner using a CAT5 cable provided with the module. The two RJ45 connectors on the I/O expansion module are identical and interchangeable; they are used to connect additional modules to the system. See LIM1044, Expansion Module Instruction Manual, for details.

⚠️ **Warning!**   *Do not connect or disconnect the expansion modules with the power on!*
More detailed instructions are provided with each optional expansion module.

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Analog Input Signal Connections

Signal connections are made to a nine-terminal connector labeled SIGNAL on Figure 7. The COM (common) terminals are the return for the 4-20 mA and the ±10 V input signals. The two COM terminals connect to the same common return and are not isolated.

Current and Voltage Connections

The following figures show examples of current and voltage connections.

There are no switches or jumpers to set up for current and voltage inputs. Setup and programming is performed through the front panel buttons.
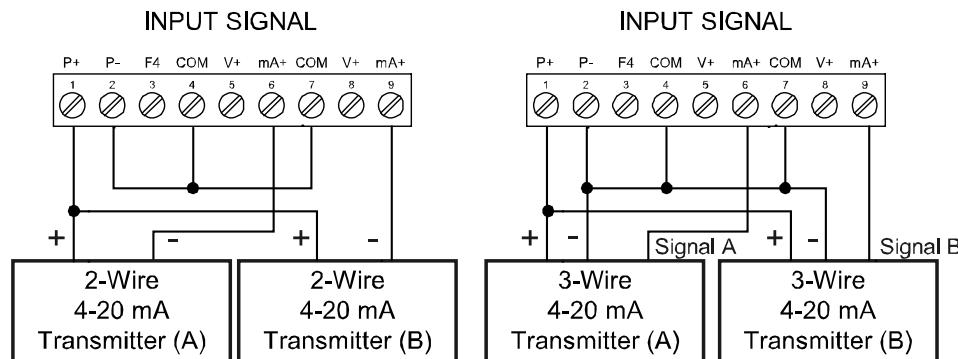
Figure 21. Transmitters Powered by Internal Supply
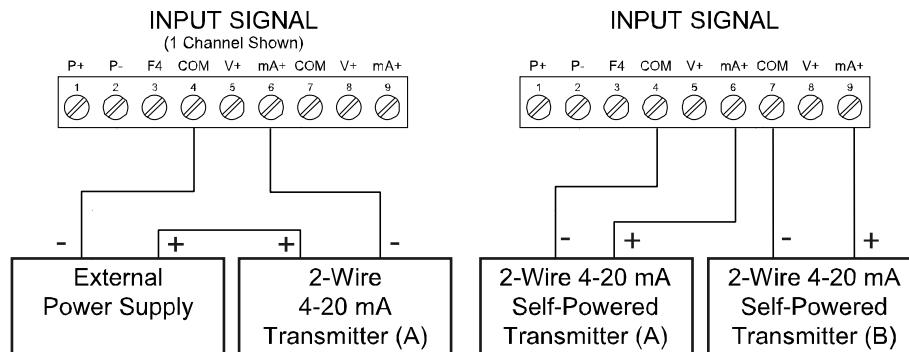
Figure 22. Transmitter Powered by Ext. Supply or Self-Powered

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

The fuse limits the current to a safe level when it detects a fault condition, and automatically resets itself when the fault condition is removed.
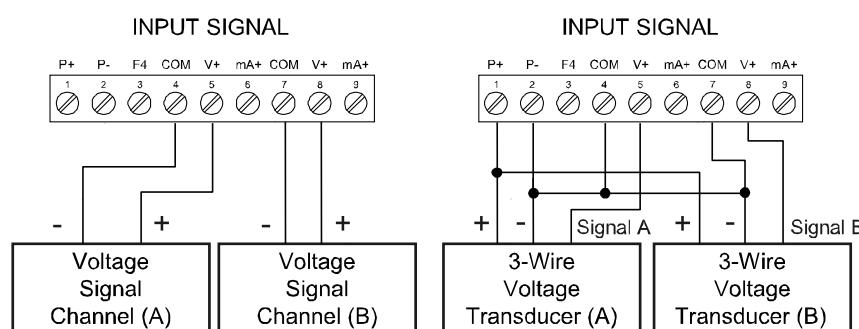
Figure 23. Voltage Input Connections

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

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Setup and Programming

> **The analog inputs of the scanner are factory calibrated prior to shipment to read in milliamps and volts, depending on the input selection. The calibration equipment is certified to NIST standards.**

Overview

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

Setup and programming are done through the programming buttons located under the front door panel.

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

PD2-6080 Decimal Display   PD2-6081 Feet & Inches Display

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Programming Buttons and Status LED Indicators

The meter can be programmed using the buttons located behind the front door panel. Use the *Menu* button to enter or exit *Programming Mode*, the *Up Arrow* button to cycle through menu options, and the *Enter* button to select the menu item or option you want. The *Right Arrow* button is used during numeric and decimal point programming.

Front Door Panel
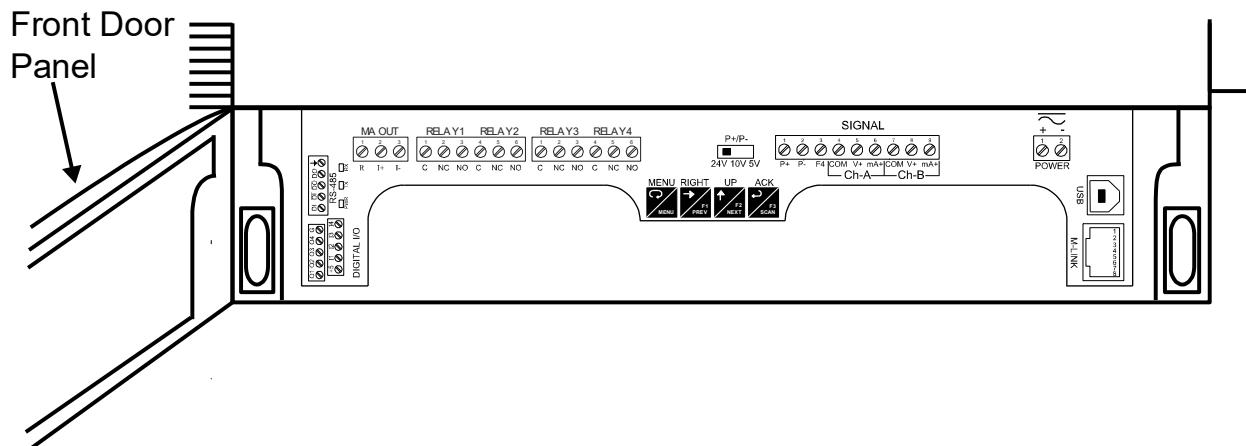
Button Symbol	Description
MENU	**Menu**
RIGHT / F1 RESET	**Previous** **Right arrow/F1**
UP / F2 NEXT	**Next** **Up arrow/F2**
ACK / F3 SCAN	**Scan** **Acknowledge (Enter)/F3**

Note:
F4 – F8 are digital inputs.

Note:
LEDs for relays in manual mode flash with the "M" LED every 10 seconds. "M" flashing by itself indicates Aout – manual control is used.

LED	Status
1-4	Alarm 1-4 indicator
1-4 M	Flashing: Relay in manual control mode
$\overline{8}$ $\overline{16}$	Fractions of an inch indicator (eighths or sixteenths)
1-4	Flashing: Relay interlock switch open
F	Communications Fault Condition
‖	**Pause** Press SCAN to pause scanning
■	**Stop** Stop scan on alarm
▶	**Play** Press SCAN to resume scanning

- Press the **Menu** button to enter or exit the Programming Mode at any time.
- Press the **Right** button to move to the next digit during digit or decimal point programming.
- Press the **Up** button to scroll through the menus, decimal point, or to increment 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.
- Press the **SCAN** button once to pause scanning (Pause LED flashes), then press the **SCAN** button again to resume scanning (Play LED turns on).
- Press **NEXT** to go to the next PV; auto scan resumes after 10 seconds of inactivity.
- Press **PREV** to go to the previous PV; auto scan resumes after 10 seconds of inactivity.

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ScanView Software

The meter can also be programmed using the PC-based MeterView Pro software included with the meter. This software is can be installed on any Microsoft® Windows® (2000/XP/Vista/7/8/10) computer by connecting the meter's onboard USB. The meter is powered by the USB connection, so there is no need to wire anything prior to programming the meter, though USB is intended only for meter configuration.

ScanView Installation

1. Connect one end of the provided USB cable to the meter and the other end to the computer. The computer will automatically install the driver software it needs to talk to the meter.
    Only one meter may be connected at a time. Attaching multiple meters will cause a conflict with the meter software. Disconnect other meters before performing these steps.
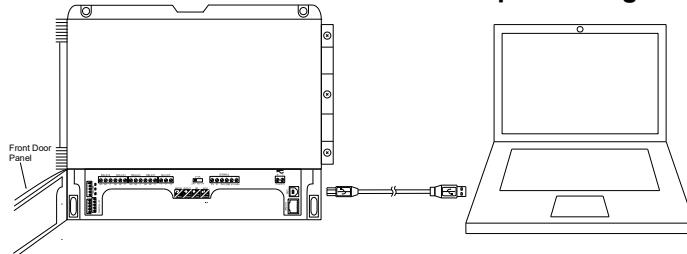
2. Once the driver is installed, an AutoPlay dialog should appear for the drive "MSINSTAL." Click "Open folder to view files."
    If the computer does not display an AutoPlay dialog for the drive "MSINSTAL," you should open *My Computer* and double-click on the drive labeled "MSINSTAL."
3. Double-click on the file named "MSStart." The program will open a few windows and install two programs on your computer. Simply follow the onscreen instructions until you see one of the dialogs below. If you receive a "User Account Control" warning, click "Yes."
4. If there is an update available, click the "Update" button to install the new version. Otherwise, click "Configure" to begin programming your meter.

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

⚠ **Warning!**	***Do not unplug the meter while the new installation files are being written to it. The meter will display ⊔⌐ ⌐⊏Ε during the process and you will receive an onscreen notification once the process is complete.***

Monitoring and data logging for one scanner (Master mode) is available with ScanView software. All the enabled PVs and math channels may be logged to a single .csv file. The ScanView software synchronizes with the scanner in *master* mode one second after the scanner has completed a polling cycle. Additional information regarding configuration and monitoring of the meter using ScanView software is available online.

Note: The poll time of the scanner must be greater than 5 seconds to prevent collisions on the bus.

Display Functions & Messages

The meter displays various functions and messages during setup, programming, and operation. The following table shows the main menu functions and messages in the order they appear in the menu.

Display	Parameter	Action/Setting Description
ɱ odE	Mode	Enter Mode menu
ɱ AStEr	Master	Enter Master Mode
PUnbr	PV Number	Select PV
PU 1	PV	Select PV 1-16
EnAbLE	Enable	Enable PV
d iSAbL	Disable	Disable PV
SLAU.Id	Slave ID	Enter the unique Slave ID for each PV
FunCod	Function Code	Enter the Function Code for each PV
rEGnbr	Register Number	Enter the Register Number for each PV
dAtA	Data Type	Enter the Data Type for each PV
FLoAt	Floating Point Data Type	Floating Point Data Type. Select Floating Point as the data type to be read from the slave device.
Short	Short Integer Data Type	Short Integer Data Type. Select Short Integer as the data type to be read from the slave device.
LonG	Long Integer Data Type	Long Integer Data Type. Select Long Integer as the data type to be read from the slave device.
b inArY	Binary	Binary Data format. Select Binary format for Short or Long integers.
bcd	BCD	BCD Data format. Select BCD format for Short or Long integers.
S iGnEd	Signed	Signed Data. Select Signed Binary format for Short or Long integers.
unS iGd	Unsigned	Unsigned Data. Select Unsigned Binary format for Short or Long integers.
1234	Byte Order	Select big-endian byte order.
4321	Byte Order	Select little-endian byte order.
2413	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.
t-PoLL	Polling Time	Enter Polling Time (the time between read commands). In other words, how often the display is updated in Master mode.
t-rESP	Response Time	Enter the time allowed for a slave device to respond to a command.
SnooPEr	Snooper	Enter Snooper Mode
PUnbr	PV Number	Select PV
PU 1	PV	Select PV 1-16
EnAbLE	Enable	Enable PV
d iSAbL	Disable	Disable PV
SLAU.Id	Slave ID	Enter the unique Slave ID of the device to be polled by Master
FunCod	Function Code	Enter the Function Code for each PV
Fun 03	Function Code 03	Use Function Code 03 to read slave device
Fun 04	Function Code 04	Use Function Code 04 to read slave device

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Display	Parameter	Action/Setting Description
Fun 65	Function Code 65	Use Function Code 65 to read slave device
rEG.nbr	Register Number	Enter the Register Number for each PV
5 d iG 6 d iG	Register Number Digits	Select either 5 (x0001-x9999) or 6 (x00001-x65536) digits for the Register Number by pressing the Right Arrow in Register Number menu.
dAtA	Data Type	Enter the Data Type for each PV
FLoAt	Floating Point Data Type	Floating Point Data Type. Select *Floating Point* as the data type to be read from the slave device.
Short	Short Integer Data Type	Short Integer Data Type. Select *Short Integer* as the data type to be read from the slave device.
LonG	Long Integer Data Type	Long Integer Data Type. Select *Long Integer* as the data type to be read from the slave device.
b inArY	Binary	Binary Data. Select *Binary* format for Short or Long integers.
bcd	BCD	BCD Data. Select *BCD* format for Short or Long integers.
5 iGnEd	Signed	Signed Data. Select *Signed* Binary format for Short or Long integers.
unS iGd	Unsigned	Unsigned Data. Select *Unsigned* Binary format for Short or Long integers.
1234	Byte Order	Select big-endian byte order.
4321	Byte Order	Select little-endian byte order.
2413	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.
t-rESP	Response Time	Enter the time allowed for a slave device to respond to a command.
SEtuP	Setup	Enter *Setup* menu
PU	Process Variable	Enter *PV Setup* menu
PU 1	PV	Select PV 1-16
tAG	Tag	Tag
un it5	Units	Units
Forn t	Format	Format (Decimal, Eighths, or Sixteenths of an Inch)
dEc	Decimal	Decimal Format
Ft in 8	Eighths	Eighth Inch Format
Ft in 16	Sixteenths	Sixteenth Inch Format
dEc.Pt	Decimal Point	Decimal Point menu
d iSP.dP	Display Decimal Point	Set the decimal point position for the display. This is independent from float decimal point.
FLot.dP	Floating Decimal Point	Floating Decimal Point. Select the decimal point for the expected floating point data.
SCALE	Scale PV	Scale PV
InP 1	Input 1	Calibrate input 1 signal or program input 1 value
d iS 1	Display 1	Program display 1 value
InP 2	Input 2	Calibrate input 2 signal or program input 2 value (up to 32 points)
d iS 2	Display 2	Program display 2 value (up to 32 points)
dSPLAY	Display	Enter *Display Setup* menu

Display	Parameter	Action/Setting Description
L inE 1	*Display Line 1*	Display Line 1
d PU	*Display PV*	Display PVs 1-16
d Ch-C	*Display C Channel*	Display Math Channels C1-C4
PUun it	*Display PV & Units*	Display PV & Units
tGPUn	*Display Tag, PV Number*	Display Tag & PV Number selected
tGPUnw	*Display Tag, PV# & Units*	Display Tag, PV Number selected, & Units
Cun it	*Display C & Units*	Display C1-C4 & Units
tG. C. u	*Display Tag, C, & Units*	Display Tag, C1-C4 & Units
dSEt 1	*Display Set Points 1-8*	Display Set Points 1-8
H i-PU	*Display Max PV 1-16*	Display Maximum value for each enabled PV1-16
Lo-PU	*Display Min PV 1-16*	Display Minimum value for each enabled PV1-16
H i-C	*Display Max Ch C1-C4*	Display Maximum for math channels C1-C4
Lo-C	*Display Min Ch C1-C4*	Display Minimum for math channels C1-C4
L inE 2	*Display Line 2*	Display Line 2
d tAG	*Display Tag*	Display Tag
d tAGw	*Display Tag & Units*	Display Tag & Units
d oFF	*Display off*	Display Off
d- IntY	*Display Intensity*	Display Intensity
rELAY	*Relay Setup*	Enter *Relay Setup* menu
ASS iGn	*Assign Relay*	Assign Relay menu
rELAY 1	*Relay 1-8*	Assign Relay 1-8
PU 1	*PV 1-16*	Map Relay to PV 1-16
nn -PU	*Multiple PVs*	Map Relay to Multiple PVs
rLY 1	*Relay 1-8*	Relay 1-8
Act 1	*Relay Action 1-8*	Assign Relay Action for relays 1-8
Auto	*Automatic*	Set relay for automatic reset
A-nnAn	*Auto-manual*	Set relay for auto or manual reset any time
LAtCH	*Latching*	Set relay for latching operation
Lt-CLr	*Latching-cleared*	Set relay for latching operation with manual reset only after alarm condition has cleared
ALtErn	*Alternate*	Set relay for pump alternation control
SAnn PL	*Sample*	Set relay for sample time trigger control
OFF	*Off*	Turn relay off

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Display	Parameter	Action/Setting Description
FAILSF	Fail-safe	Enter *Fail-safe* menu
FLS 1	Fail-safe 1	Set relay 1-8 fail-safe operation
on	On	Enable fail-safe operation
oFF	Off	Disable fail-safe operation
dELAY	Delay	Enter relay *Time Delay* menu
dLY 1*	Delay 1*	*Enter relay 1-8 time delay setup
On 1	On 1	Set relay 1 On time delay
OFF 1	Off 1	Set relay 1 Off time delay
brEAH	Break	Set relay condition if communication break detected
no Act	No action	Ignore break condition. *No* change in relay state when Communications Break detected.
On	On	Relay goes to alarm condition when break detected. Relay turns *on* when Communications Break detected.
OFF	Off	Relay goes to non-alarm condition when break detected. Relay turns *off* when Communications Break detected.
Aout	Analog output	Enter the *Analog Output* scaling menu
AOut 1*	Aout channel	Analog Output source channel (*1-3)
diS 1	Display 1	Program the first *Display* value for the Analog Output.
Out 1	Output 1	Program the first *Output* value that corresponds to the Display *1* value for the Analog Output. (e.g. 4.000 mA).
diS 2	Display 2	Program the second *Display* value for the Analog Output.
Out 2	Output 2	Program the second *Output* value that corresponds to the Display *2* value for the Analog Output. (e.g. 4.000 mA). (e.g. 20.000 mA)
SErIAL	Serial	Enter *Serial* menu
SCAn.Id	Scan ID	Enter *Scan ID* of the meter being polled (1-247)
bAud	Baud Rate	Select *Baud Rate (Choices: 300/600/1200/2400/4800/9600/19,200)* *(Must match that of other devices)*
tr dLY	Transmit Delay	Enter *Transmit Delay* *(Master's delay must be greater than Snooper or slave devices)*
PArItY	Parity	Select *Parity (Even, Odd, None 1-Stop, or None 2-Stop)* *(Must match that of other devices)*
t-bYt	Byte-to-byte Timeout	Enter the timeout value allowed between received *bytes*. *(This is used to fix communication problems with slow devices).*
PASS	Password	Enter the *Password* menu
PASS 1	Password 1	Set or enter Password 1
PASS 2	Password 2	Set or enter Password 2
PASS 3	Password 3	Set or enter Password 3
unLoc	Unlocked	Program password to lock scanner
Locd	Locked	Enter password to unlock scanner
999999 -99999	Flashing	Over/under range condition

Main Menu

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

- Press Menu button to enter Scanner Programming then press the Up arrow button to scroll main menu.
- Press Menu, at any time, to exit and return to *Run Mode*. Changes made to settings prior to pressing Enter are not saved.
- Changes to the settings are saved to memory only after pressing Enter/F3.
- The display moves to the next menu every time a setting is accepted by pressing Enter/F3.
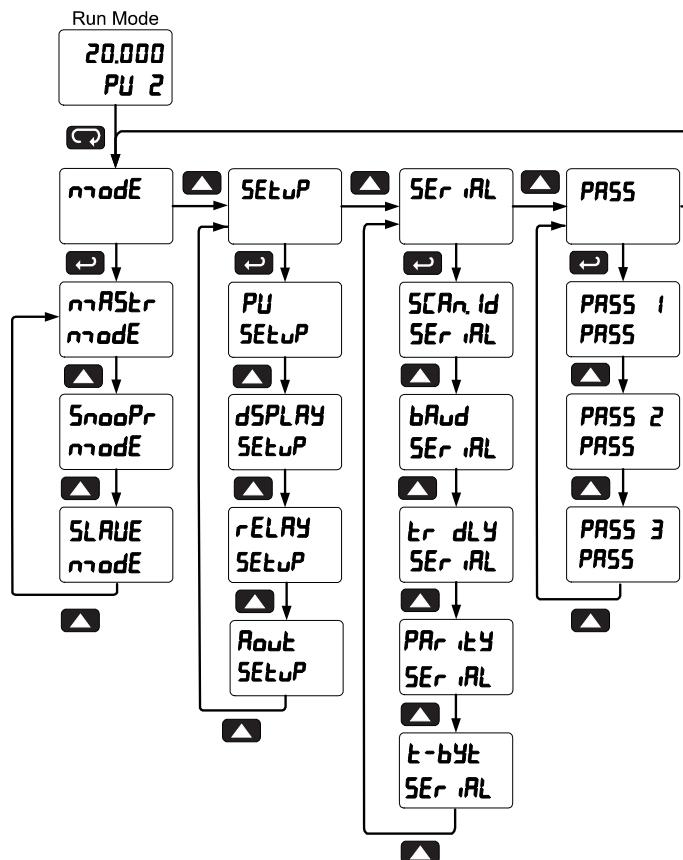
Menu Navigation Tip

- 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.
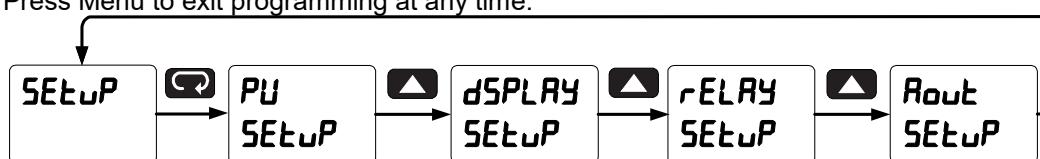
Setting Numeric Values

The numeric values are set using the Right and Up arrow buttons. Press Right arrow to select next digit and Up arrow to increment digit value.

The digit being changed is displayed brighter than the rest.

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

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

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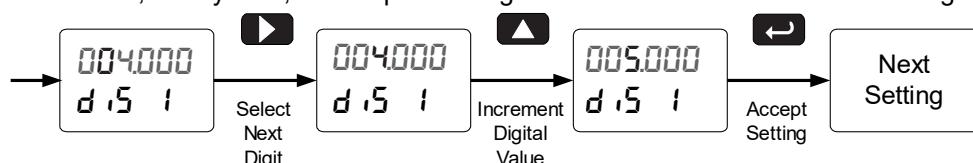
Serial Communications (𝖲𝖾𝗋𝗂𝖠𝖫)

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.

To communicate with a computer or other data terminal equipment, an RS-485 to USB or RS-485 to RS-232 converter is required; see *Ordering Information* on page 5 for details.

⚠ **Warning!**	***Do not connect any equipment other than Precision Digital's expansion modules, cables, or scanners to the RJ45 M-LINK connector. Otherwise damage will occur to the equipment and the scanner.***

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.

Changes made to the Serial menu are initialized after exiting the Serial menu.

* Baud Rate for the PD2-6080/PD2-6081 is entered here by user, and must match that of other system devices. Choices are seen below.
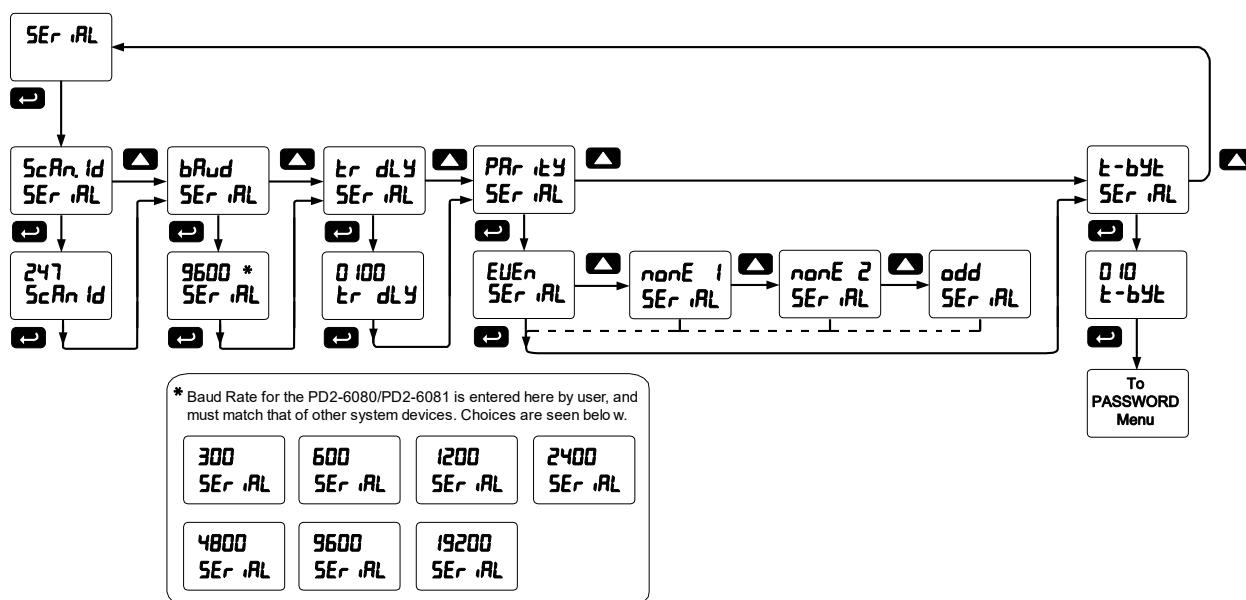
When setting up the scanner to run on a Modbus system, the devices must be programmed with matching Baud Rate and Parity. Failure to match up the network devices' parameters may result in communication breaks.

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 (ɱodE)

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*.
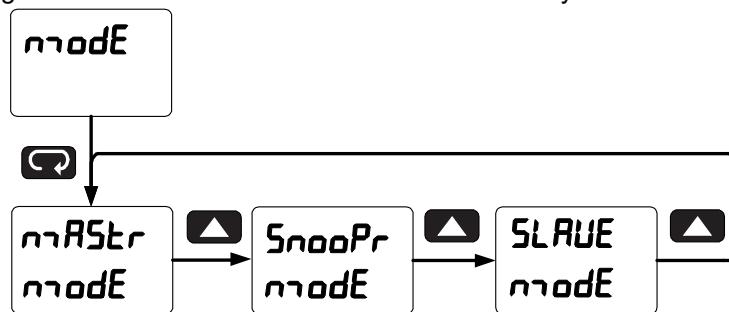
How to Enable Process Variables (PVs)

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 the line 1 and line 2 display assignments.

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

It is possible to display PVs & Tags on line 1 and line 2 simultaneously by selecting *Tag & PV Number* (tAGPUn). 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 line 1 or line 2 to show the desired parameters and press ENTER. See page 37 for details.

Master Mode (ㄲAStr)

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.

PV can be any PV from PV 1-PV 16.

Enter Slave ID of meter to be polled by master.

Function Code can be either 03, 04, or 65.

Register Number is selected by user.

Byte order is dependent upon data type.

PVs 1-15 move to next PV. PV16 moves to t-poll.

Back To

Forward to
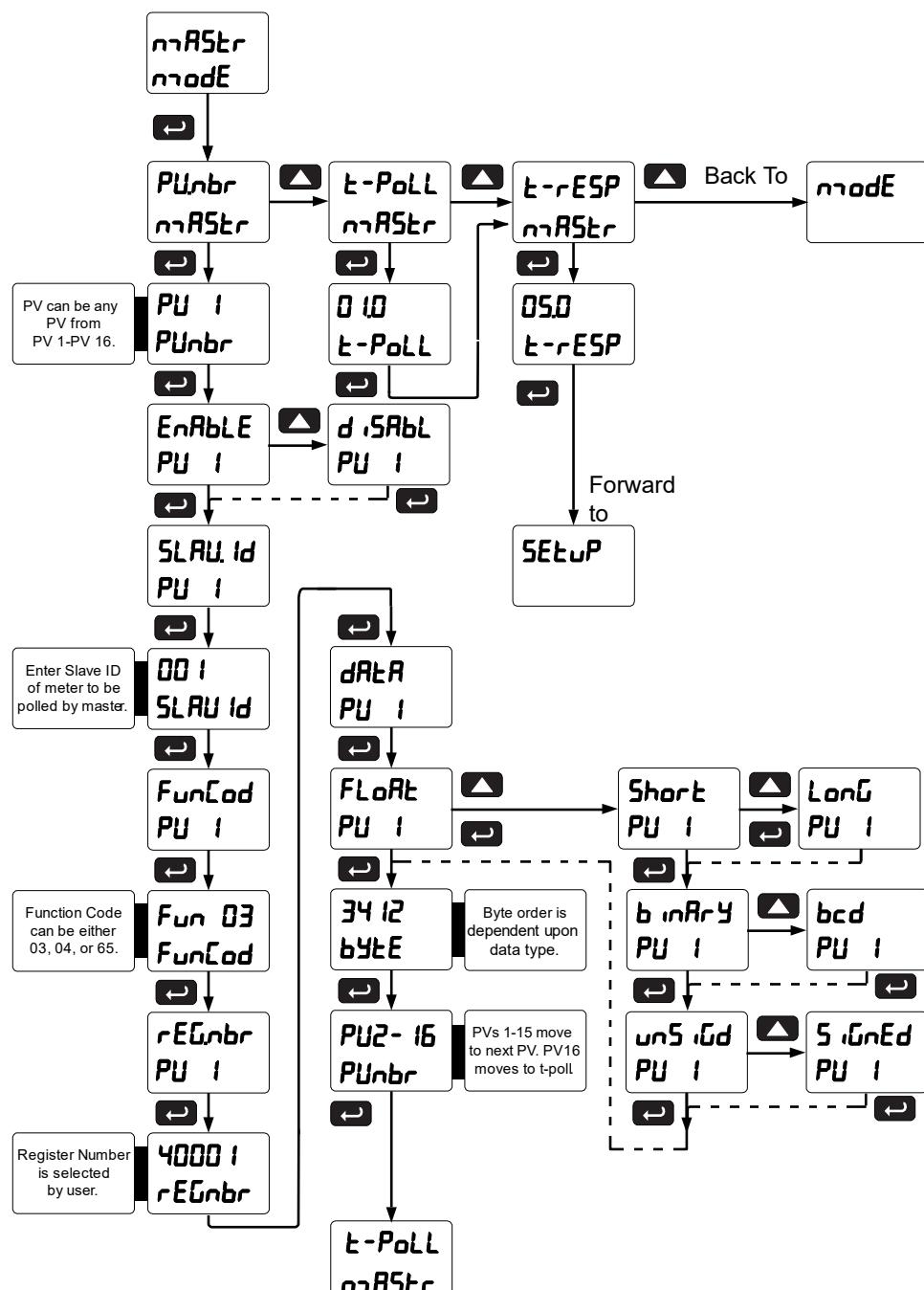
Snooper Mode (SnooPr)

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.

Notes:
1. *To minimize the possibility of communication errors and communication break conditions, use a poll time of 5 seconds or more with slow baud rates (e.g. 4800 bps or less).*
2. *The response time for scanners set up for Snooper mode must be greater than the Master's poll time. This setting corresponds to the time window during which the Snooper listens to the bus for a reply by the slave device being polled by the master device. As soon as the Snooper detects a new reply on the bus, the display is updated. If there is no reply within the response time setting, the Snooper goes into communications break condition.*

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 and then the Up arrow to change the setting for the number of digits used for the Register Number (5 diG or 6 diG), 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.*
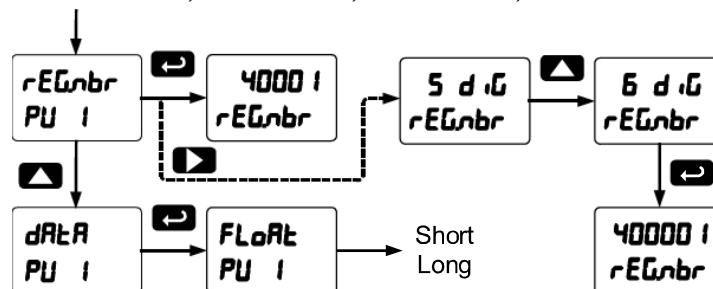
The Master ignores the decimal point setting for slave devices that specify a Short or Long integer. For example, a slave that is displaying 12.34 is read as 1,234. Floating point data may or may not utilize the decimal point. Refer to the slave's operating manual to make sure.

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

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

Slave Mode (SLAUE)

The Slave mode is capable of accepting Short, Long, and Float data types. Refer to the Modbus Register Tables for details of all the predefined parameters. Follow the menu below to navigate and set all parameters for Slave Mode.

34
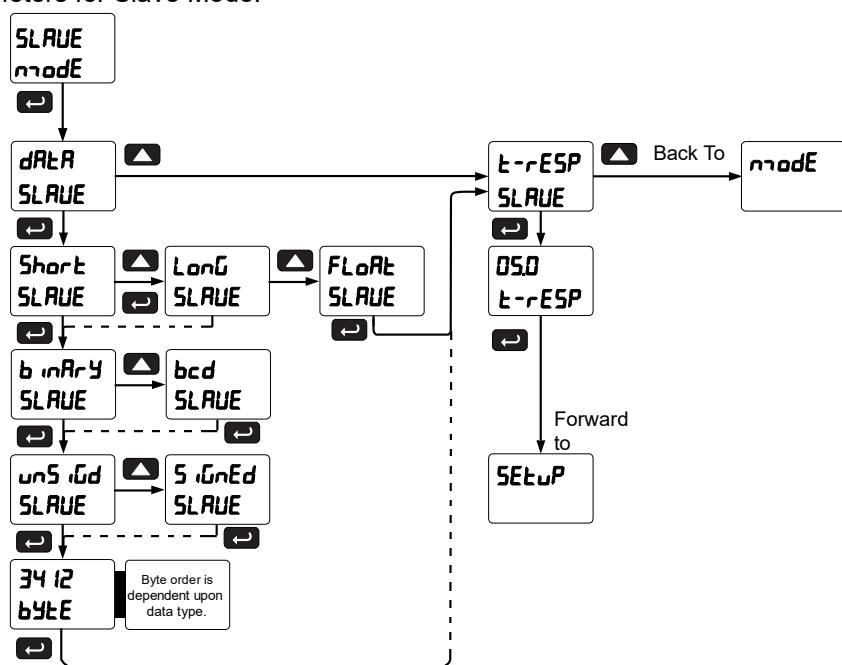
Setting up the Scanner (SEtuP)

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.
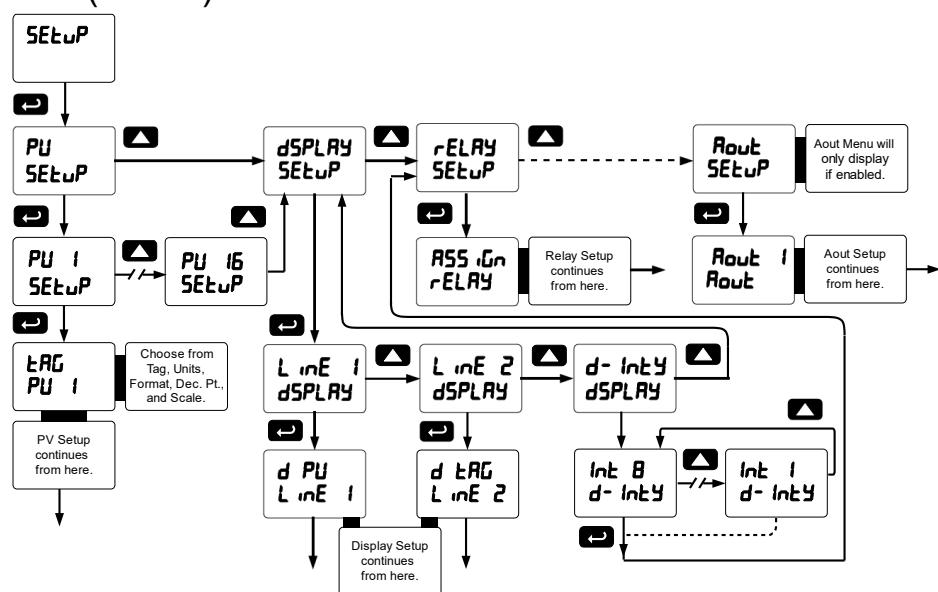
Setting up the Process Variables (PVs) (PU SEtuP)

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.

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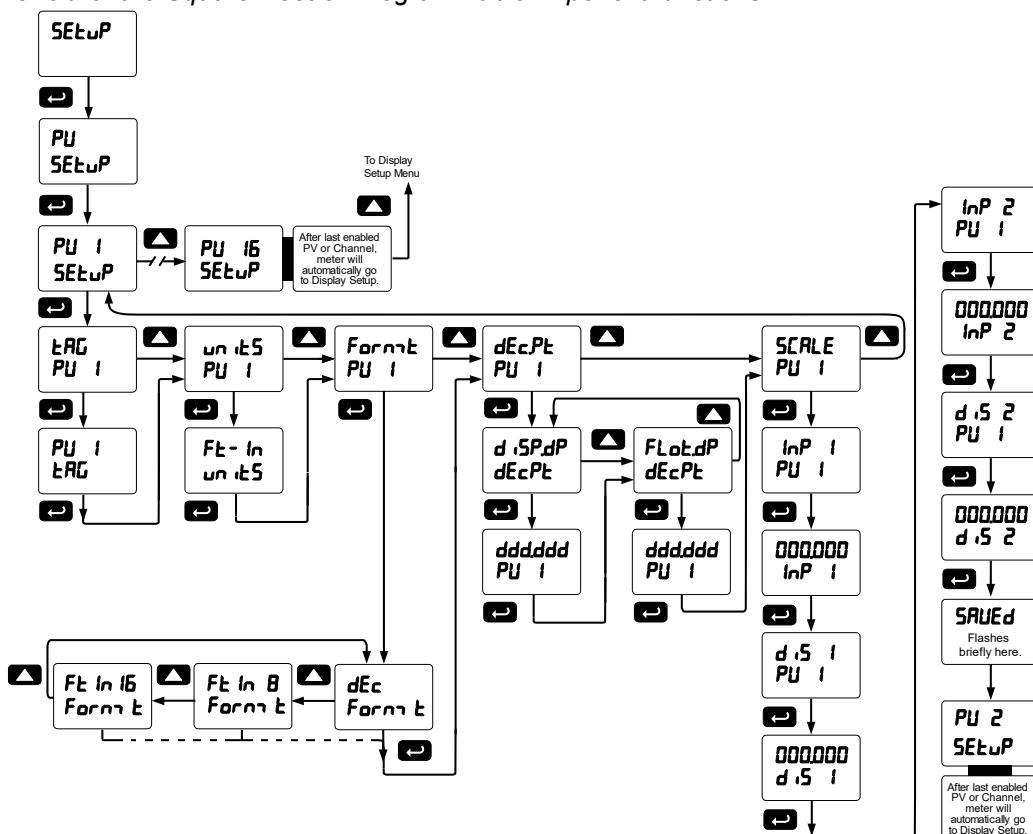
Setting the Display Decimal Point (d ᵢSP.dP)

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 (FLoŁ.dP)

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.

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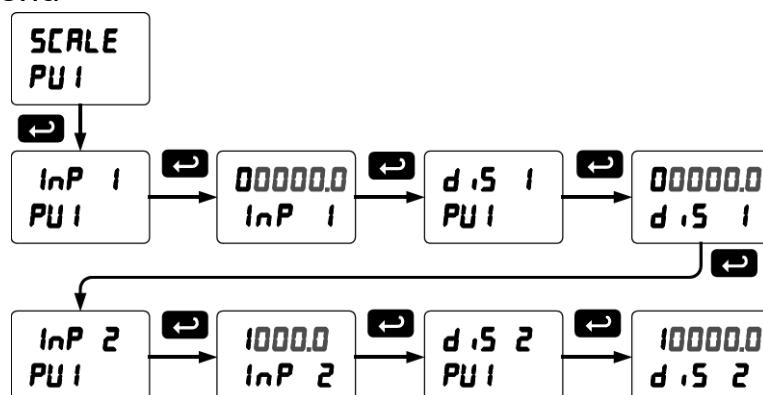
The display will show **Error** if the scaling or calibration process is unsuccessful. Undesired operation may occur if the error is not corrected. Correct the error by either changing one of the inputs in question or changing the number of points to exclude an erroneous input point.

Note 1: For Feet & Inches Display format, the display values will be in the format 99 FT 11 IN 15 /16th *or* 8th. *Make the left digit for inches and 16th blank if the value is less than 10. Example:* 50 Feet, 9 Inches, and 8/16 *will be displayed as* 50 FT _9 IN _8 16th *instead of* 50 FT 09 IN 08 /16th.

Note 2: Scaling Short and Long input values (input 1, input 2, etc.) should be done without the decimal point.

Multi-Point Linearization (L ᵢnEAr)

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 page 62 for details.

Setting up the Displays (dSPLAY SEtuP)

Display Line 1 Parameters (LinE 1 dSPLAY)

Display line 1 (LinE 1) can be programmed to display any of the following:

Display	Parameter	Setting Description
d PV	*Display PV*	Display PVs 1-16
d Ch-C	*Display C Channel*	Display Math Channels C1-C4
PV.unit	*Display PV & Units*	Display PV & Units
tG.PVn	*Display Tag, PV Number*	Display Tag & PV Number selected
tG.PVn.u	*Display Tag, PV# & Units*	Display Tag, PV Number selected, & Units
C.unit	*Display C & Units*	Display C1-C4 & Units
tG. C. u	*Display Tag, C, & Units*	Display Tag, C1-C4 & Units
dSEt 1	*Display Set Points 1-8*	Display Set Points 1-8
Hi-PV	*Display Max PV 1-16*	Display Maximum value for each enabled PV1-16
Lo-PV	*Display Min PV 1-16*	Display Minimum value for each enabled PV1-16
Hi-C	*Display Max Ch C1-C4*	Display Maximum for math channels C1-C4
Lo-C	*Display Min Ch C1-C4*	Display Minimum for math channels C1-C4

Display Line 2 Parameters (LinE 2 dSPLAY)

Display line 2 (LinE 2) can be programmed to display any of the following:

Display	Parameter	Setting Description
d PV	*Display PV*	Display PVs 1-16
d Ch-C	*Display C Channel*	Display Math Channels C1-C4
PV.unit	*Display PV & Units*	Display PV & Units
tG.PVn	*Display Tag, PV Number*	Display Tag & PV Number selected
tG.PVn.u	*Display Tag, PV# & Units*	Display Tag, PV Number selected, & Units
C.unit	*Display C & Units*	Display C1-C4 & Units
tG. C. u	*Display Tag, C, & Units*	Display Tag, C1-C4 & Units
dSEt 1	*Display Set Points 1-8*	Display Set Points 1-8
Hi-PV	*Display Max PV 1-16*	Display Maximum value for each enabled PV1-16
Lo-PV	*Display Min PV 1-16*	Display Minimum value for each enabled PV1-16
Hi-C	*Display Max Ch C1-C4*	Display Maximum for math channels C1-C4
Lo-C	*Display Min Ch C1-C4*	Display Minimum for math channels C1-C4
d tAG	*Display Tag*	Display Tag (Line 2 only)
d tAG.u	*Display Tag & Units*	Display Tag & Units (Line 2 only)
d oFF	*Display off*	Display Off (Line 2 only)

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

Display Intensity (d-IntY)

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 8.

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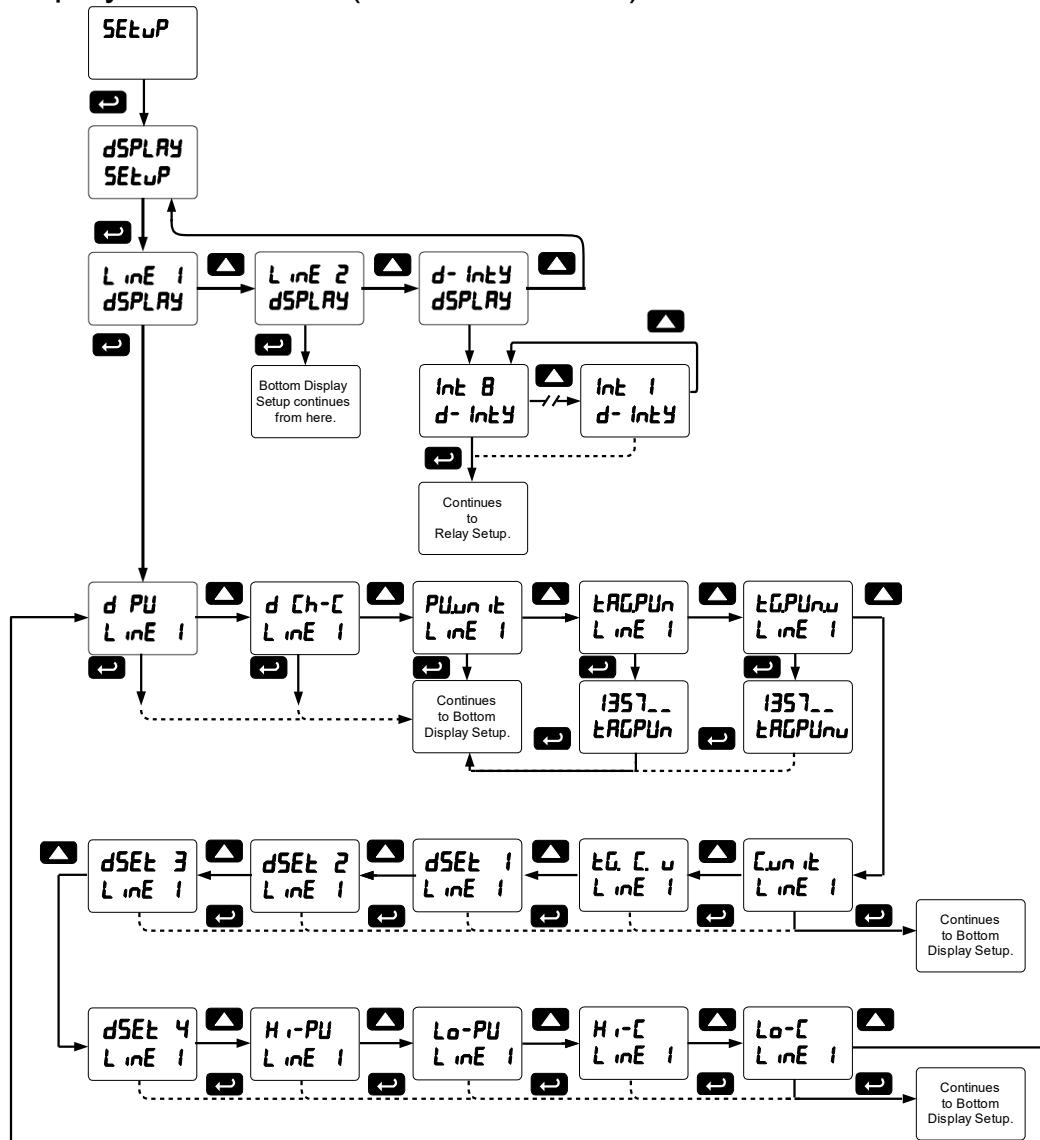
Note: For Tag-PVn and Tag-PVn-U, the default settings for PVs are 1,3,5,&7, followed by two
        underscores, which represent empty PVs. These all can be changed to any enabled PVs.

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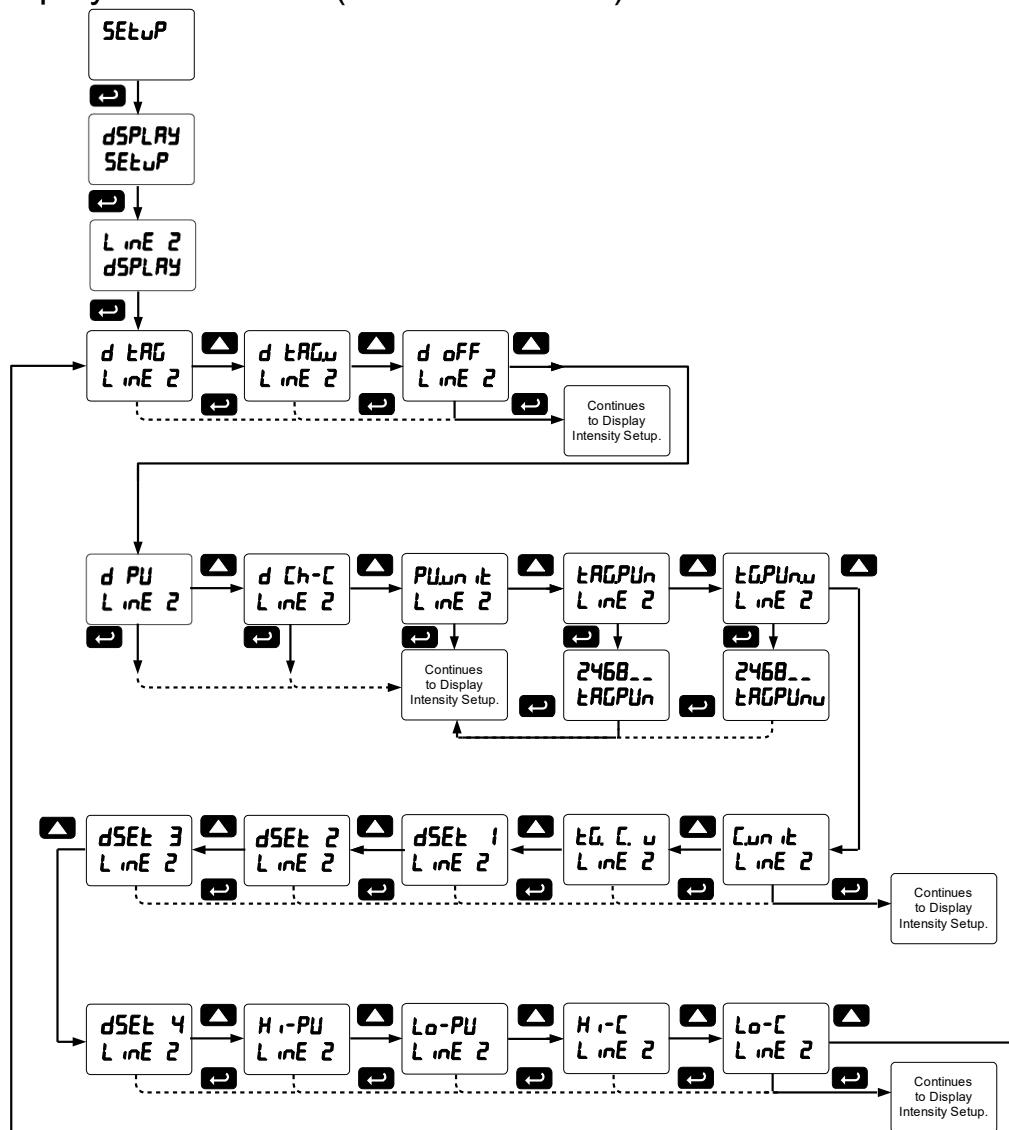
Note: For Tag-PVn and Tag-PVn-U, the default settings for PVs are 2,4,6,& 8, followed by two underscores, which represent empty PVs. These all can be changed to any enabled PVs.

Setting the Tags (ŁAG) & Units (un ıŁ5)

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	Display	Character	Display	Character
0	0	C	C	H	K	U	V
1	1	c	c	L	L	ப ப	w
2	2	d	d	ന	m	H	X
3	3	E	E	n	n	y	Y
4	4	F	F	0	O	Z	Z
5	5	G	G	o	o	-	-
6	6	g	g	P	P	ʼ	/
7	7	H	H	q	q	C	]
8	8	h	h	r	r	J	[
9	9	i	I	S	S	=	=
A	A	i	i	t	t	o	Degree(<)
b	b	J	J	u	u		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) MTS M-Series multivariable tank level gauges connected to (2) PD2-6080 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

Local Display with PD2-6080 Master
Displaying Level in Feet

⇦ Modbus RS-485 ⇨

Tanks with Mutivariable Level Transmitters

Remote Display with PD2-6080 Snooper

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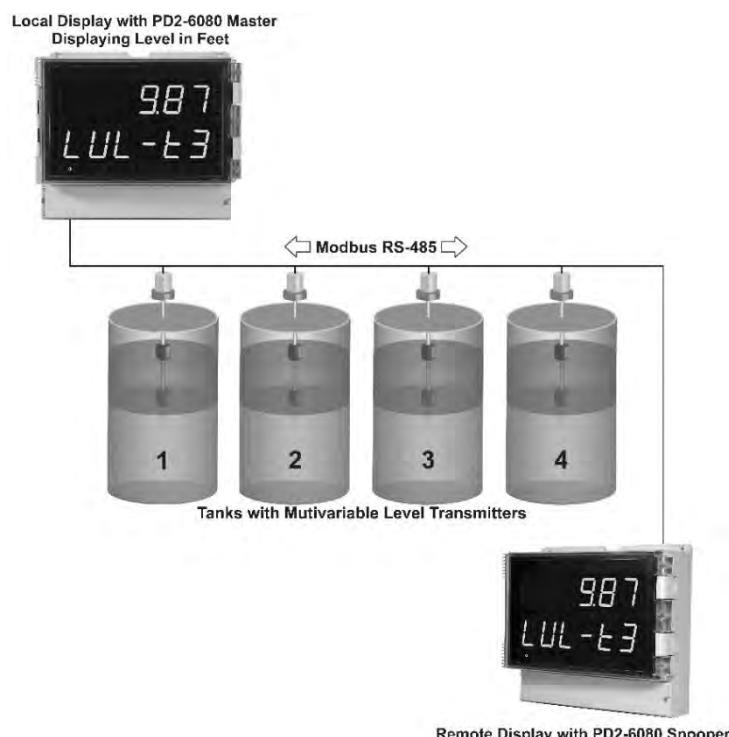
The following table shows the system setup for the MTS M-Series gauge, one PD2-6080 Master, and one PD2-6080 Snooper:

Parameter	PD2-6080 Master	PD2-6080 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
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	
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	

Parameter	PD2-6080 Master	PD2-6080 Snooper	Description / Comment
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	
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

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Application Example 2

In this application we have a system consisting of (4) MTS M-Series multivariable tank level gauges connected to (2) PD6081s 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.

Register Numbers & Process Variables

30001 - Product Level

30003 - Interface Level

30017 - Average Temperature

Note: The example above shows the PD6081. The setup of the scanner is the same as the first example. The PD6081's Feet & Inches display is clearly visible.

Local Display with PD2-6081 Master

Modbus RS-485

Tanks with Mutivariable Level Transmitters

Remote Display with PD2-6081 Snooper

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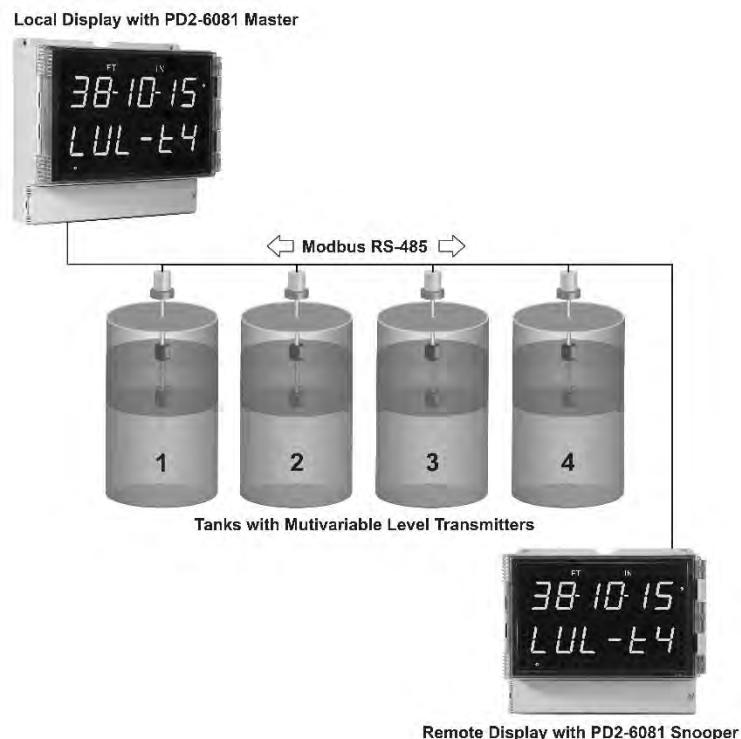
Setting the Relay Operation (rELAY)

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

> ⚠️ **Caution!**
>
> *During setup, the relays do not follow the input and they will remain in the state found prior to entering the Relay menu.*

1. Relay assignment
   a. Assign relay to PV
   b. Assign relay to Math channel
   c. Assign relay to multiple PVs (2 to 16 PVs)
2. Relay action
   a. Automatic reset only (non-latching)
   b. Automatic + manual reset at any time (non-latching)
   c. Latching (manual reset only)
   d. Latching with Clear (manual reset only after alarm condition has cleared)
   e. Pump alternation control (automatic reset only)
   f. Sampling (the relay is activated for a user-specified time)
   g. Off (relay state controlled by Interlock feature)
3. Set point & reset point
4. Fail-safe operation
   a. On (enabled)
   b. Off (disabled)
5. Time delay
   a. On delay (0-999.9 seconds)
   b. Off delay (0-999.9 seconds)
6. Relay action for loss (break) of 4-20 mA input (ignore, on, off)

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

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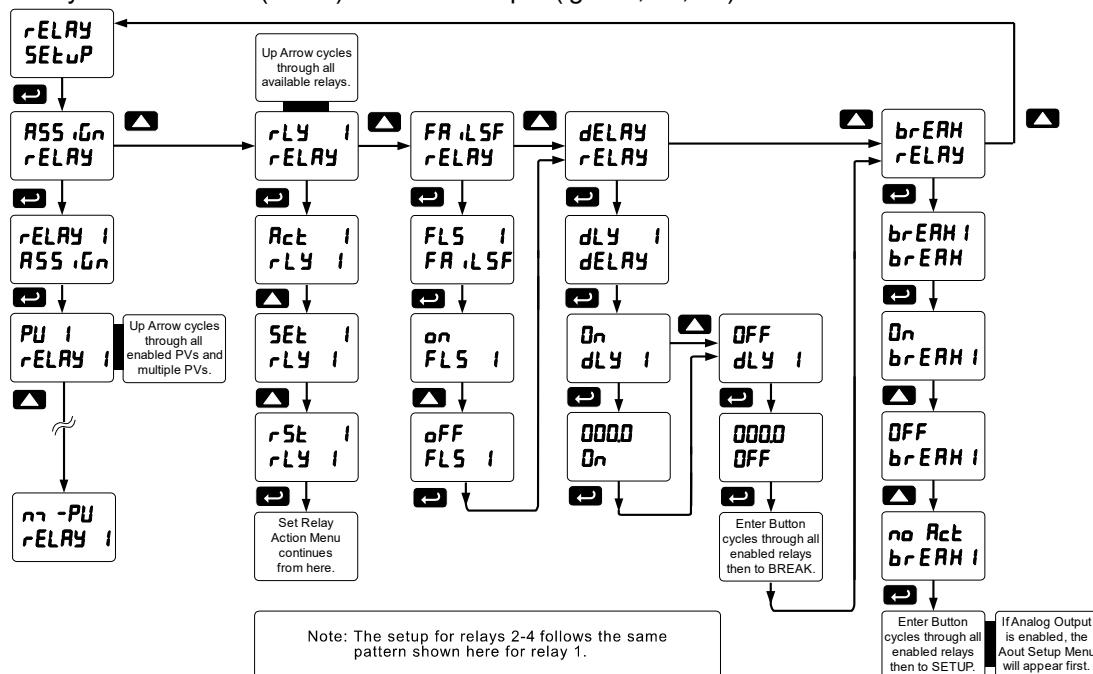
Setting the Relay Action

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

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

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

Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

The deadband is determined by the difference between set and reset points. Minimum deadband is one display count. If the set and reset points are programmed with the same value, the relay will reset one count below the set point.

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

Setting Fail-Safe Operation

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

Programming Time Delay

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

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

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

Relay Action for Communications Break (brEAK)

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)

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

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

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.

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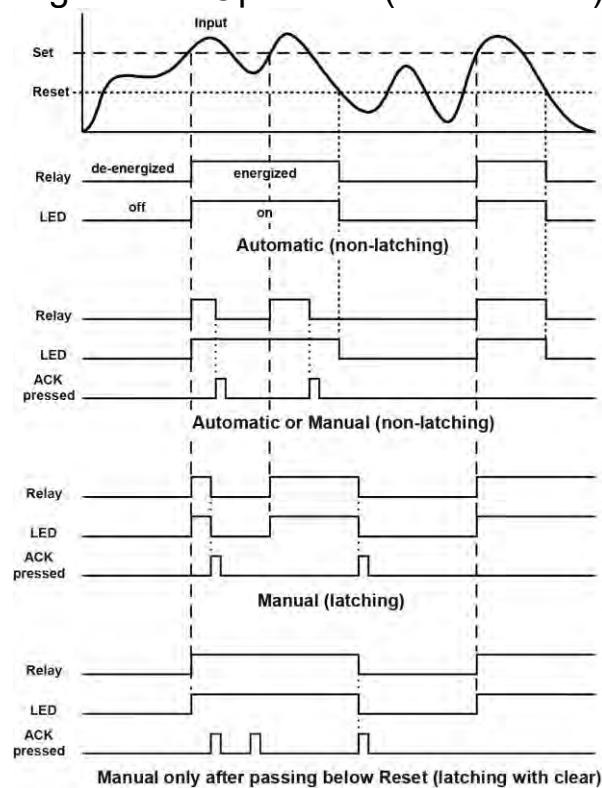
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.
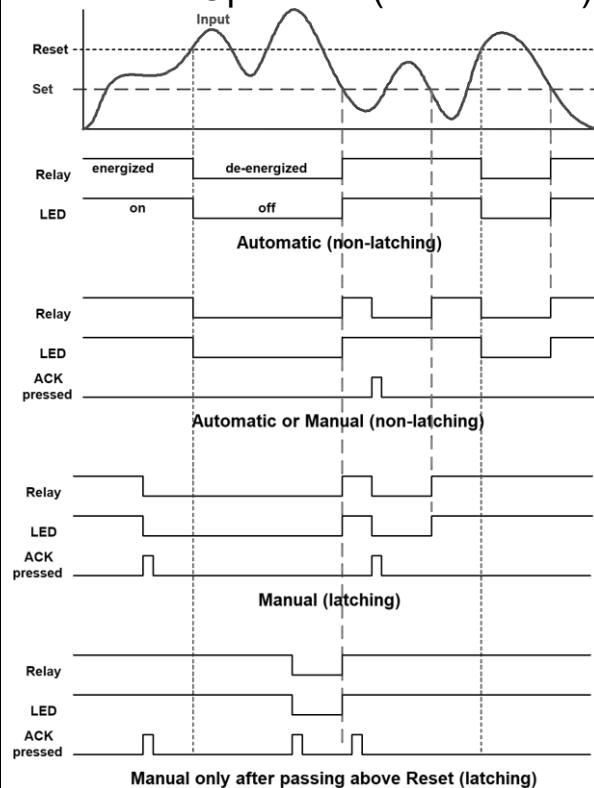
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point and then go below it.

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High Alarm with Fail-Safe Operation (Set > Reset)
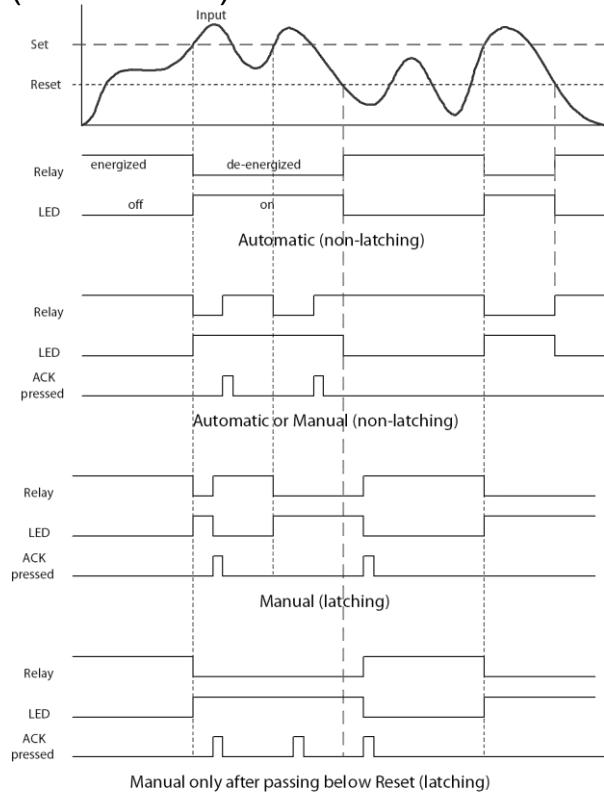
Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing below Reset (latching)

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)
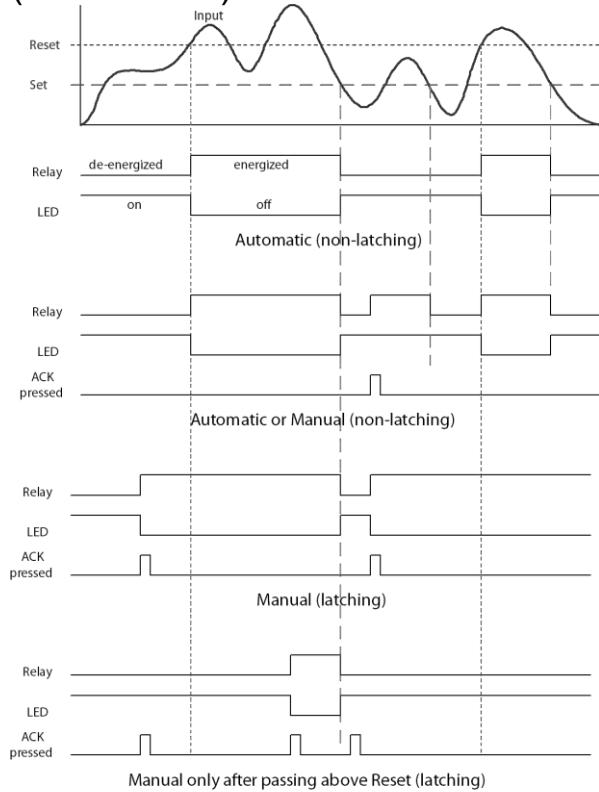
Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing above Reset (latching)

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

Pump Alternation Control Operation

LEDs indicate the relay status

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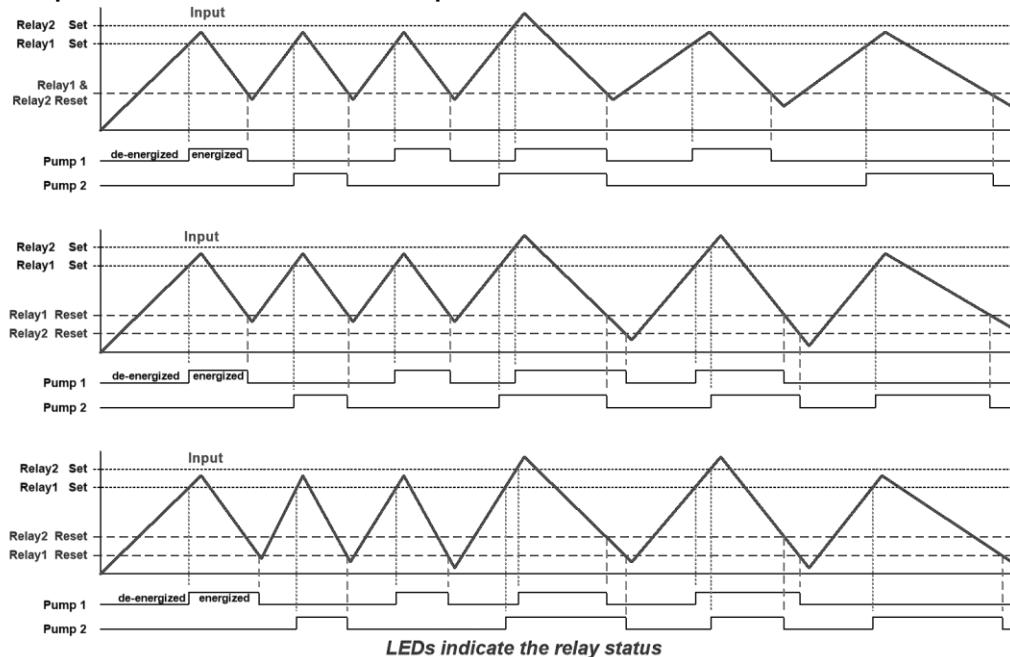
Relay Sampling Operation
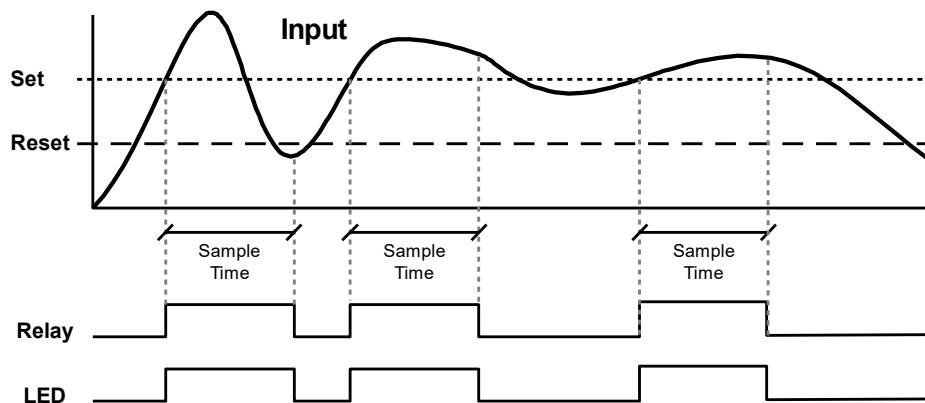
When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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

Signal Loss or Loop Break Relay Operation

The following graph shows the loop break relay operation for a high alarm relay.
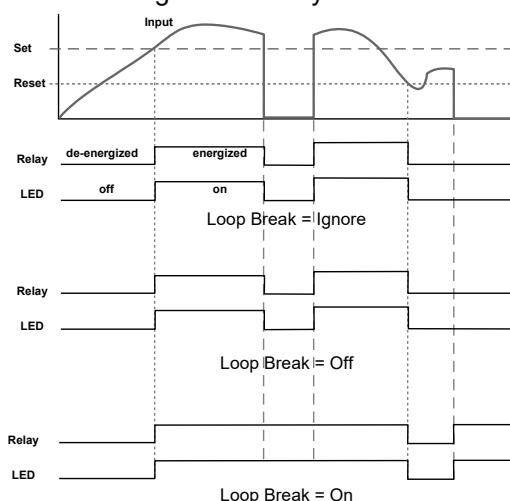
When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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

Time Delay Operation

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

On Time Delay
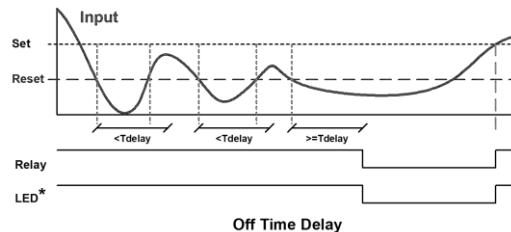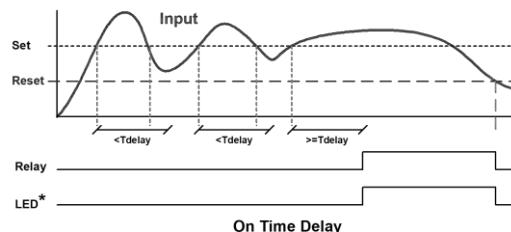
Off Time Delay

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

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

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Relay Operation Details

Overview

The relay capabilities of the meter expand its usefulness beyond simple indication to provide users with alarm and control functions. These capabilities include front panel alarm status LEDs as well as either 2 or 4 internal relays. Typical applications include high or low temperature, level, pressure or flow alarms, control applications such as simple on/off pump control, and pump alternation control for up to 8 pumps. There are four basic ways the relays can be used:

1. High or 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 8 Pumps**

Relays Auto Initialization

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

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

Fail-Safe Operation

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

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

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

Front Panel LEDs

The LEDs on the front panel provide status indication for the following:

The meter is supplied with four alarm points that include front panel LEDs to indicate alarm conditions. This standard feature is particularly useful for alarm applications that require visual-only indication. The LEDs are controlled by the set and reset points programmed by the user. When the

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

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.

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

Relay terminology for following tables

Terminology	Relay Condition
On	Alarm (Tripped)
Off	Normal (Reset)
Ack	Acknowledged

> ⚡ **Warning!** *In latching relay mode, latched relays will reset (unlatch) when power is cycled.*

Non-Latching Relay (Auto)

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

Automatic reset only

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

Non-Latching Relay (A-n₁ An)

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

The next time an alarm occurs, the operator acknowledges the alarm manually while the alarm condition still exists. This causes the relay to reset, but the LED stays on until the meter returns to the normal condition.

Automatic + manual reset at any time

Condition	LED	Relay
Normal	Off	Off
Alarm	On	On
Normal	Off	Off
Next Alarm	On	On
Ack	On	Off
Normal	Off	Off

Latching Relay (LAtcH)

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

Manual reset any time

Condition	LED	Relay
Normal	Off	Off
Alarm	On	On
Ack	Off	Off

Latching Relay (Lt-CLr)

In this application, the meter is set up for manual reset only after the signal passes the reset point (alarm condition has cleared). Acknowledging the alarm while it is still present has no effect on either the LED or the relay. When the alarm is acknowledged after it returns to the normal state,

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

the LED and the relay go off. Notice that the LED remains on, even after the meter returns to the normal condition. This is because, for latching relays, the alarm LED reflects the status of the relay, regardless of the alarm condition.

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Acknowledging Relays

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

1. Via the programmable F4 digital input assigned to ACK (Default) and connected to a normally open pushbutton wired across F4 and COM.
2. Remotely via a normally open pushbutton wired across one of the digital inputs and the +5 V terminals on the digital I/O terminal, or using the F4 digital input, which is triggered with a contact closure to COM, or with an active low signal (see page 18).

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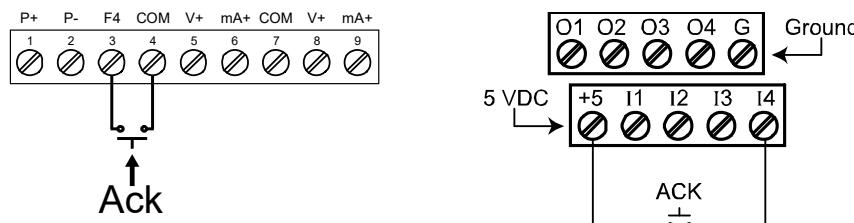

Figure 24. Acknowledge Relays w/Function Key or Digital Input

Pump Alternation Control Applications (ALtErn)

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

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

Application #1: Pump Alternation Using Relays 1 & 2

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

Pump Alternation Operation

1. Pump #1 turns on when level reaches 30.000, when level drops below 10.000, pump #1 turns off.

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

2. The next time level reaches 30.000, pump #2 turns on, when 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 8 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.
7. Adding the 4 external relays, expansion module allows using the 4 SPDT internal relays for pump alternation and the 4 SPST external relays for high, high-high, low, and low-low alarm indication.

Setting up the Interlock Relay (Force On) Feature

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

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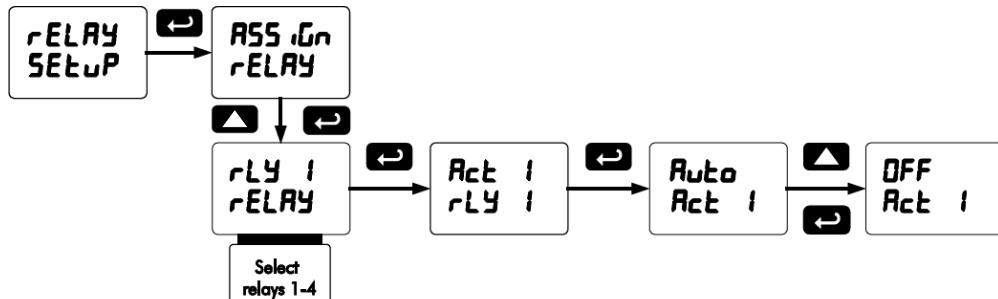
2. In the Advanced features – *User* menu program any of the digital inputs to *Force On* any of the internal relays (1-4).
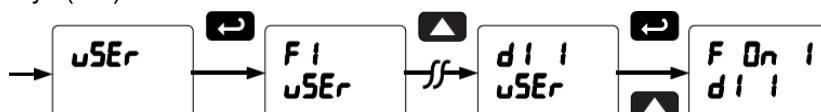
3. Connect a switch or dry contact between the +5V terminal and the corresponding digital input (dI-1 to dI-4) terminal.
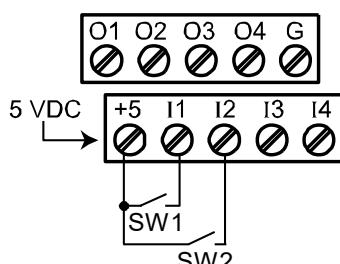
Interlock Relay Operation Example

Relays 1 & 2 are configured to energize (their front panel LEDs are off) 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.

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

The 4-20 mA analog outputs can be scaled to provide a 4-20 mA signal for any display range selected. To select the channel and source assignments the analog outputs are assigned to, see Analog Output Programming on page *69*.

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 outputs based on display values.
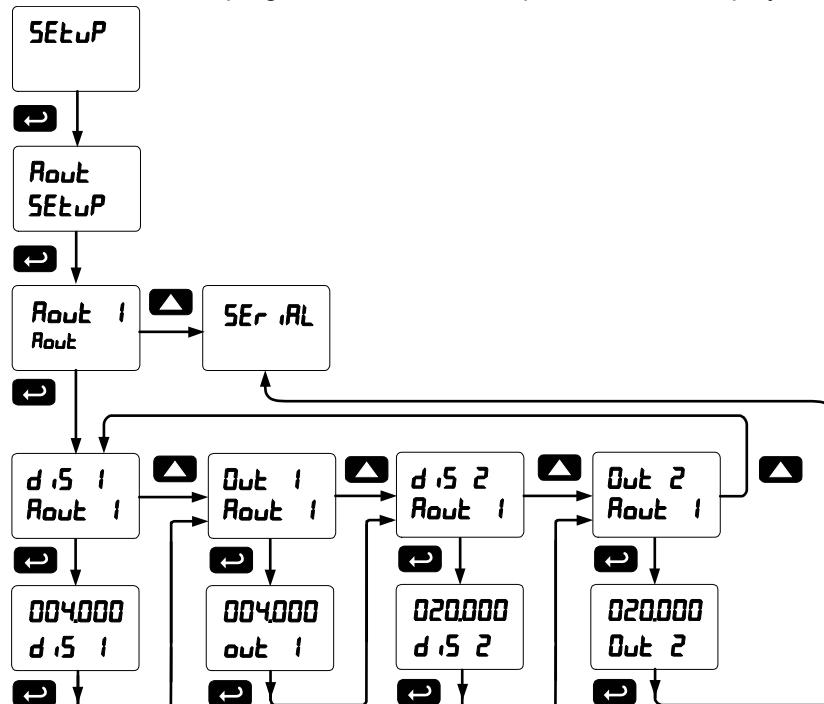
There are three analog outputs available. These only display when they are enabled. See graphic below.

* If Installed

> *For instructions on how to program numeric values see Setting Numeric Values, page 29.*
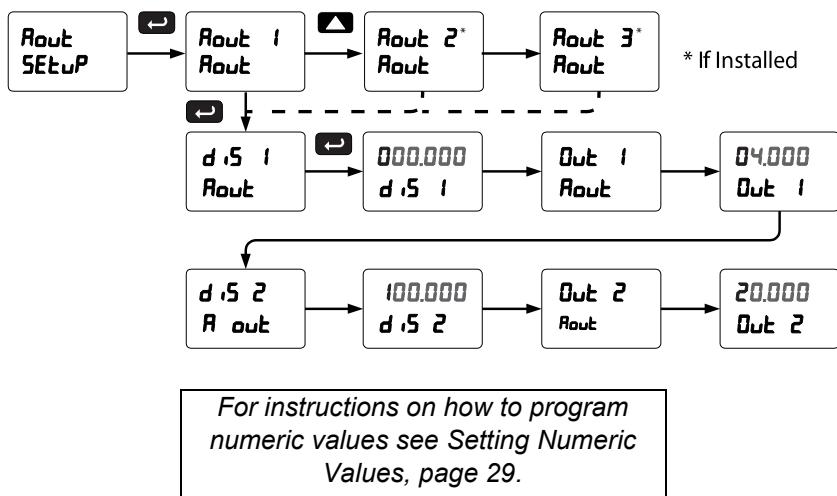
Notes: Changes to the settings are saved to memory only after pressing ENTER. Changes made to settings prior to pressing ENTER are not saved. Once ENTER is pressed, the display moves to the next menu.

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Setting up the Password (*PASS*)

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

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

Protecting or Locking the Meter

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

For instructions on how to program numeric values see *Setting Numeric Values*, page 29.

Record the password for future reference. If appropriate, it may be recorded in the space provided.

Model:	
Serial Number:	
Password 1:	__ __ __ __ __ __
Password 2:	__ __ __ __ __ __
Password 3:	__ __ __ __ __ __
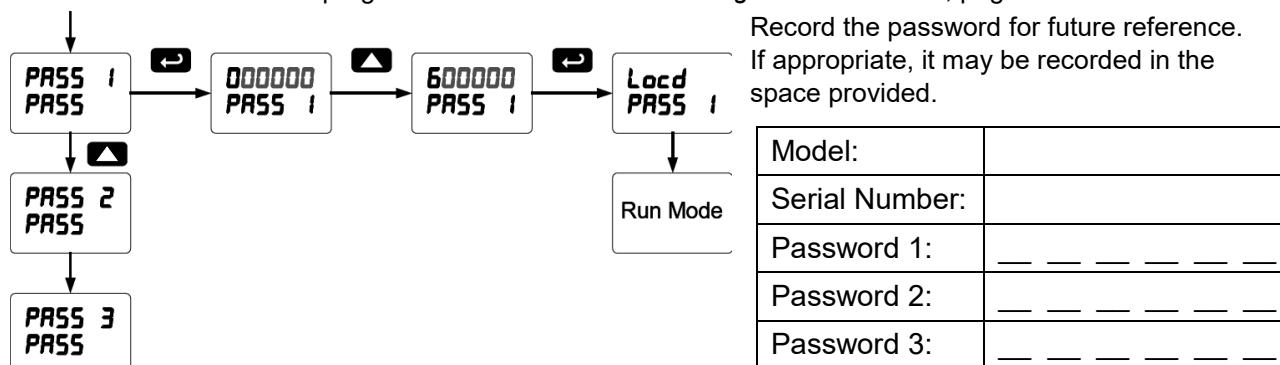
Making Changes to a Password Protected Meter

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

Disabling Password Protection

To disable the password protection, access the *Password* menu and enter the correct password twice, as shown below. The meter is now unprotected until a new password is entered.

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

If the password entered is incorrect, the meter displays the message *Locd* (Locked) for about two seconds, and then it returns to Run Mode. To try again, press Enter while the *Locked* message is displayed.
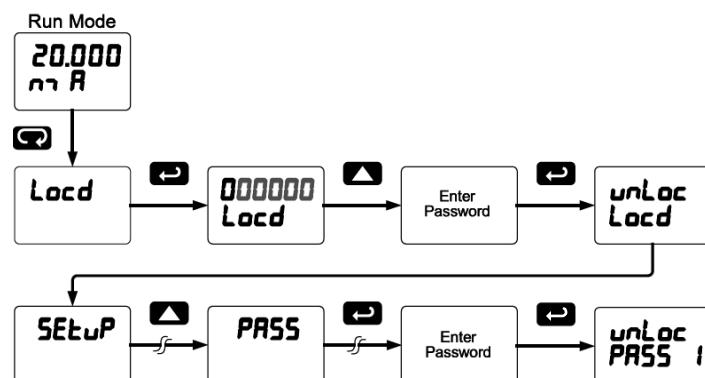
> Did you forget the password?
>
> The password may be disabled by entering a master password once. If you are authorized to make changes, enter the master password 508655 to unlock the meter.

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1.800.561.8187   www.itm.com   information@itm.com

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*
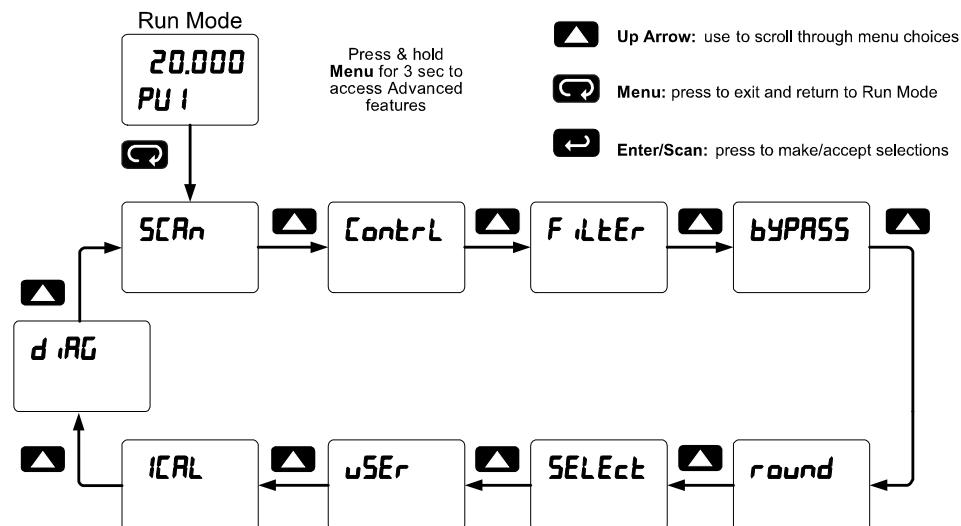
Advanced Menu Navigation Tips:

- 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

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

| Display	Parameter	Action/Setting
SCAn	Scan	Enter *Scan* menu
mode	Scan Mode	Select Auto or Manual Scan Mode
Auto	Automatic	Select Automatic Scan Mode
time	Scan Time	Select Scanning Time
mAn	Manual	Select Manual Scan Mode
ALArm	Alarm	Select Go or Stop Alarm
Go	Go	Select Alarm Go
StoP	Stop	Select Alarm Stop
ContrL	Control	Enter *Control* menu for relays and analog output 1
Auto	Automatic	Select Automatic Control of Outputs and Relays
mAn	Manual	Select Manual Control of Outputs and Relays
Aout 1	Analog Output 1	Select Analog Output 1 for manual control
rLY 1	Relay 1	Select Relay 1-8 for manual control
on	On	Select *On* for Relay 1-8
oFF	Off	Select *Off* for Relay 1-8
FiLtEr	Filter	Enter *Filter* menu
PU 1	PV 1 Filter	Program Filter Value for PV 1
PU 2	PV 2 Filter	Program Filter Value for PV 2
bYPASS	Filter Bypass	Enter *Filter Bypass* menu
PU 1	PV 1 Filter Bypass	Program Filter Bypass Value for PV 1
PU 2	PV 2 Filter Bypass	Program Filter Bypass Value for PV 2
round	Rounding Feature	Enter *Rounding Feature* menu
1*	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
Functn	Function	Enter data *Linearization Function* menu
PU 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
no PtS	Number of Points	Enter *Number of Linearization Points*
SCALE	Scale	Scale *Number of Linearization Points*
InP 1	Input 1	Calibrate input 1 signal or program input 1 value
diS 1	Display 1	Program display 1 value
InP 2	Input 2	Calibrate input 2 signal or program input 2 value (up to 32 points for PV1 & PV2)
diS 2	Display 2	Program display 2 value (up to 32 points for PV1 & PV2)
SquArE	Square Root	Enter *Square Root* menu
ProG E	Programmable Exponent	Enter *Programmable Exponent* menu
1.5000	Programmable Exponent Value	Enter the Programmable Exponent Value

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Display	Parameter	Action/Setting
rht	Round Horizontal Tank	Enter *Round Horizontal Tank* menu
Inch	Inch	Enter to calculate tank values in Inches
cm	Centimeters	Enter to calculate tank values in Centimeters
dIAmr	Diameter	Enter tank diameter
LEnGth	Length	Enter tank length
mAth	Math	Enter *Math* menu
Ch C1*	Channel C1	*Enter *Math Channel C1-C4* menu
OPErtn	Operation	Enter *Math Operation* menu
ConSt	Constant	Enter *Math Constant* menu
AddEr	Adder	Enter *Adder Value*
FACtr	Factor	Enter *Factor Value*
Sum	Sum	Math Function *Sum*
diF	Difference	Math Function *Difference*
diFAbS	Absolute Difference	Math Function *Absolute Difference*
AUG	Average	Math Function *Average*
multi	Multiply	Math Function *Multiply*
dIVIdE	Divide	Math Function *Divide*
Hi-PV	Max	Math Function *Maximum of all selected PVs*
Lo-PV	Min	Math Function *Minimum of all selected PVs*
drAw	Draw	Math Function *Draw*
wAUG	Weighted Average	Math Function *Weighted Average*
rAtio	Ratio	Math Function *Ratio*
ConcEn	Concentration	Math Function *Concentration*
mAth2	Math2	*Resultant Math* Channel Math operation applied to other math channels (e.g. C3 = C1/C2)
Sum	Sum	Math2 Function *Sum*
diF	Difference	Math2 Function *Difference*
diFAbS	Absolute Difference	Math2 Function *Absolute Difference*
AUG	Average	Math2 Function *Average*
multi	Multiply	Math2 Function *Multiply*
dIVIdE	Divide	Math2 Function *Divide*
CutoFF	Cutoff	Enter *Low Flow Cutoff* menu
PV 1	PV 1 Cutoff	Program Cutoff Value for PV 1
PV 2	PV 2 Cutoff	Program Cutoff Value for PV 2
AoutPr	Analog Output Program	Enter *Analog Output Programmable* parameters menu
Aout 1*	Analog Output 1-3	*Analog Output 1-3 (If Installed)
SourCE	Analog Output Data Source	Enter Analog Output Data *Source* menu
PV 1*	Source PV	*Select *PV* for Analog Output Data Source
Ch C1*	Source Math Channel	*Select *C1-4* for Analog Output Data Source
SEt 1*	Set Point 1-8	*Select Set Points 1-8
brEAH	Communications Break	Enter the Analog Output value when *Communications Break* is detected

Display	Parameter	Action/Setting
iGnorE	Ignore Break	Ignore Break
ForcE	Force Break	Force Break
CAL ib	Calibration	Enter the Analog Output *Calibration* menu
m AX	Maximum	Select *Maximum* value for all Analog Outputs
m in	Minimum	Select *Minimum* value for all Analog Outputs
O-rAnG	Overrange	Enter the Analog Output value for an *Overrange* condition
U-rAnG	Underrange	Enter the Analog Output value for an *Underrange* condition
uSEr	User	Enter the *User* menu for assigning function keys and digital I/O
F 1*	F1-4	*F1-F4 Function Keys
PrEU	Previous	Previous PV
nEHt	Next	Next PV
SCAn	Scan	Scan or pause scan
AcH	Acknowledge	Acknowledge relays
rESEt	Reset	Enter *Reset* menu
rSt Hi	Reset Max	Reset Maximum
rSt Lo	Reset Min	Reset Minimum
rSt HL	Reset Max-Min	Reset Maximum & Minimum
rELAY	Relay	Relay menu
SEt 1*	Set Points 1-8	Set Points 1-8
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 iSAbL	Disable	Disable
ContrL	Control	Control menu
d i 1*	DI 1-8	*Digital Inputs 1-8
m Enu	Menu	Menu
r iGht	Right	Right
uP	Up	Up
EntEr	Enter	Enter
F on 1*	Force On Relay 1	*Force On Relay 1-4
dO 1*	DO 1-8	*Digital Outputs 1-8
ALm 1*	Alarm 1-8	*Alarm 1-8
AcH	Acknowledge	Acknowledge
rESEt	Reset	Enter *Reset* menu
rSt Hi	Reset Max	Reset Maximum
rSt Lo	Reset Min	Reset Minimum
rSt HL	Reset Max-Min	Reset Maximum & Minimum
d iSAbL	Disable	Disable
iCAL	Input Calibration	Enter analog channels *Input Calibration* menu
Ch-A	Channel A	Enter *Input Channel A*
Ch-b	Channel B	Enter *Input Channel B*
m A	Milliamps	Enter *Milliamps*
C CAL	Milliamp Calibration	Enter *Milliamp Calibration*

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Display	Parameter	Action/Setting
C Lo	*Milliamp Low Signal*	Enter *Milliamp Low Signal*
C Hi	*Milliamp High Signal*	Enter *Milliamp High Signal*
UoLt	*Volts*	Enter *Volts*
U CAL	*Voltage Calibration*	Enter *Voltage Calibration*
U Lo	*Voltage Low Signal*	Enter *Voltage Low Signal*
U Hi	*Voltage High Signal*	Enter *Voltage High Signal*
Error	*Error*	Error Message for *Unsuccessful Calibration*
d iAG	*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
UEr	*Software Version*	Displays *Software Version* information
ErASE	*Erase*	Delete the ScanView installation files from the meter

Scan Function (SCAn)

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.
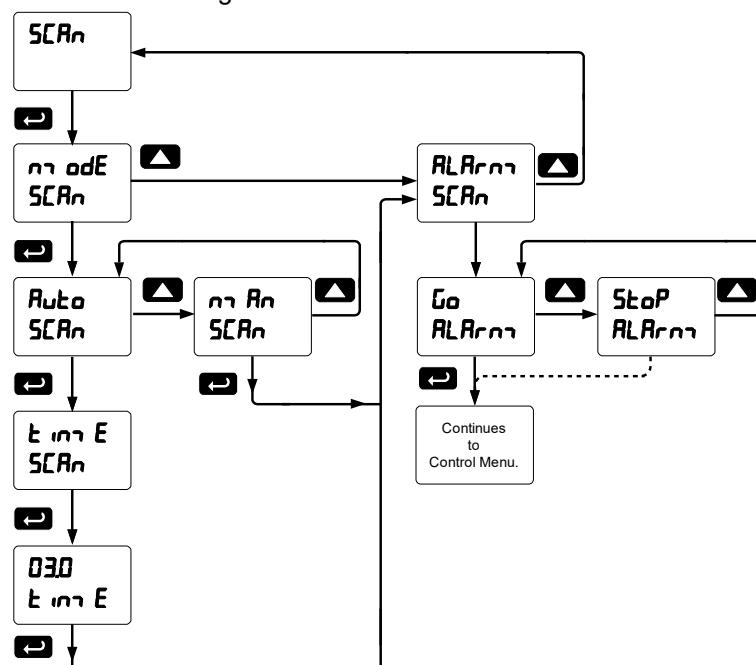
Control Menu (`ControL`)

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

Once Manual mode is initiated on any relay or analog output, an LED labeled "M" is turned on. Every few seconds, all LEDs representing outputs that are in Manual mode, as well as the "M" LED flash. This process will continue as long as any output is in manual mode.
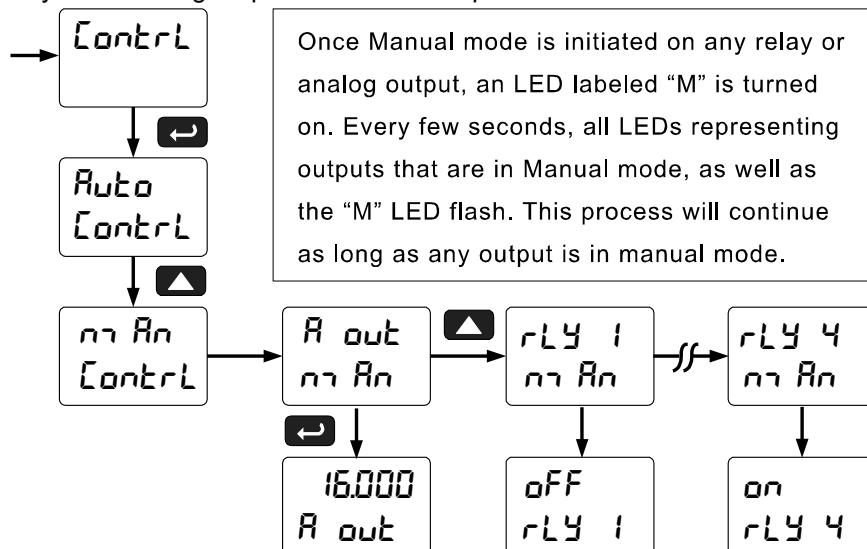
Noise Filter (`F iLtEr`)

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.
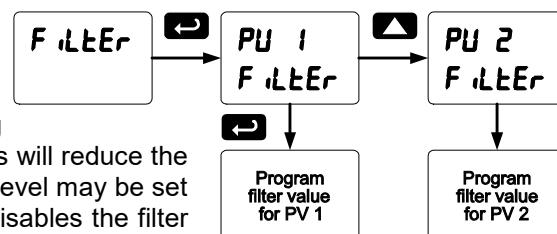
Noise Filter Bypass (`bYPASS`)

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. This parameter is associated with the analog input channels.
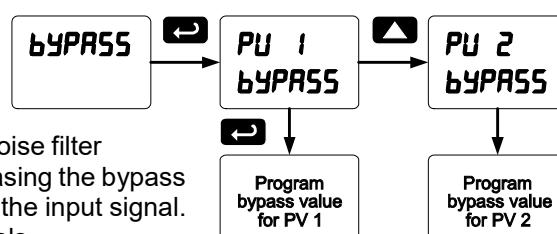
Rounding Feature (`round`)

The rounding feature is used to give the user a steadier display with fluctuating signals. Rounding is used in addition to the filter function. Rounding causes the display to round to the nearest value according to the rounding criteria selected by the user. This setting affects the last three digits, regardless of decimal point position.

Rounding Selection	Actual Value	Display Value	Actual Value	Display Value
1	12.022	12.022	12.023	12.023
5	12.022	12.020	12.023	12.025
10	12.024	12.020	12.025	12.030

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Select Menu (5ELEct)

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-flow cutoff, and analog output programming. Multi-point linearization is part of the linear function selection.
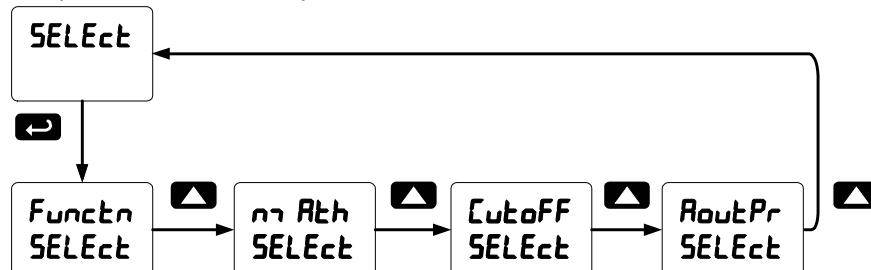
Input Data Conditioning Function Menu (Functn)

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).

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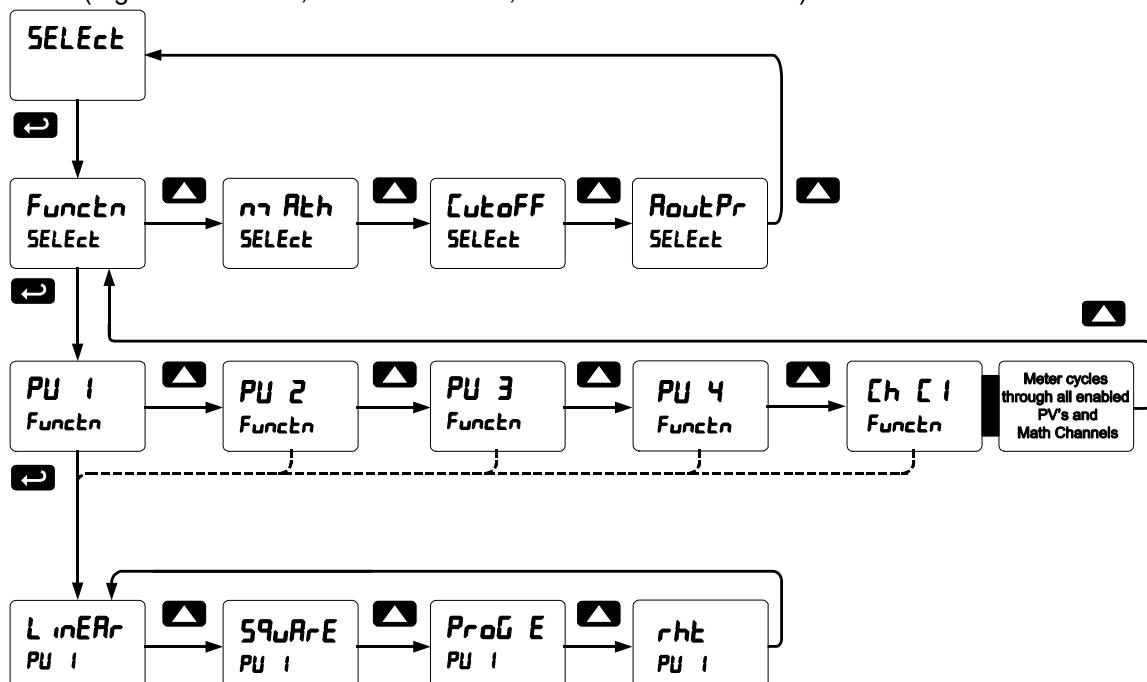
Linear Function Menu (L inEAr)

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.
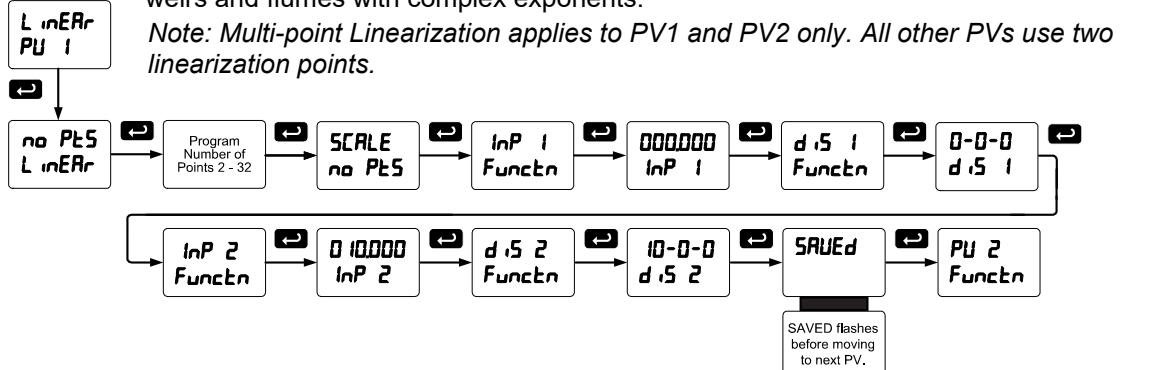
Square Root Function Menu (SquArE)

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.
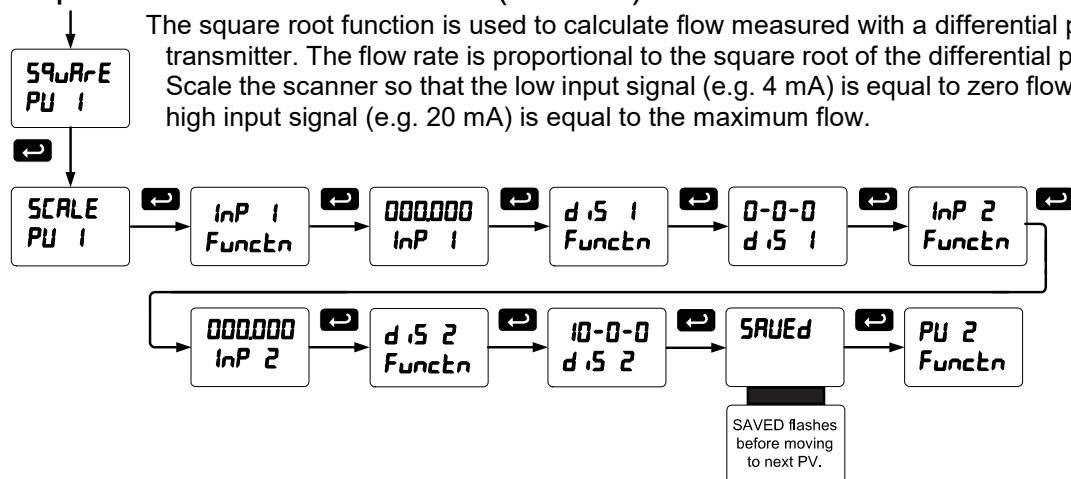
Programmable Exponent Function Menu (ProG E)

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.
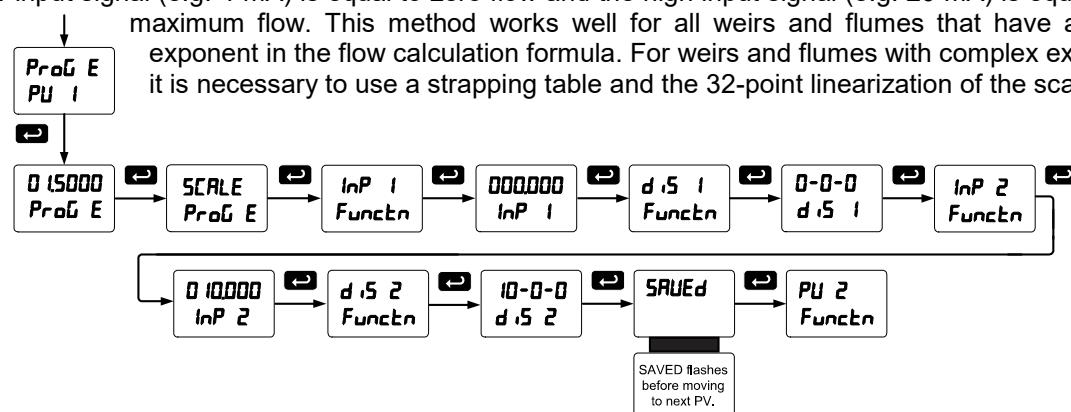
Round Horizontal Tank Function Menu (rht)

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.

SAVED flashes before moving to next PV.
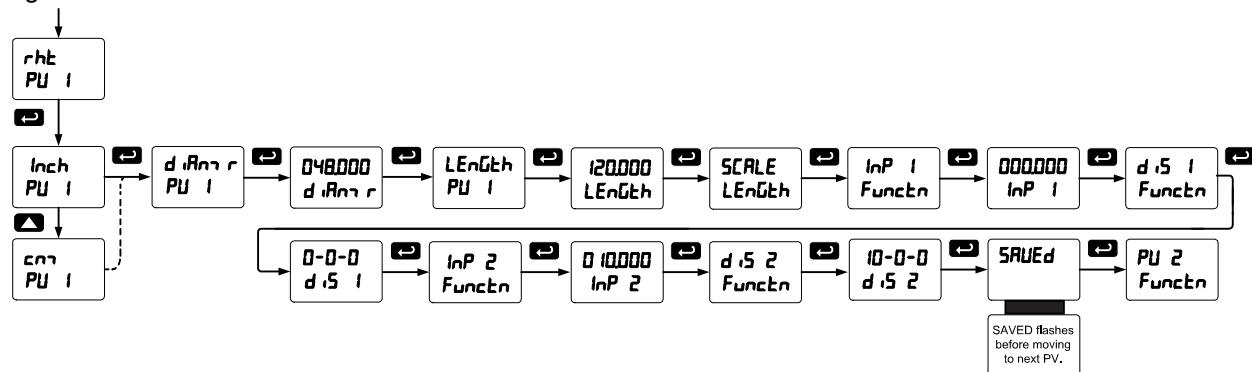
Changing the Volume from Gallons to Liters

In the above 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 **diS 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.

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Math Functions (ოი ᎡᏞᏂ)

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 (d Ch C) 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	Sum
Difference	(PV1-PV2+P)*F	d iF
Absolute difference	((Abs(PV1- PV2)+P)*F	d iFAbS
Average	(((PV1+PV2)/2)+P)*F	AUG
Multiplication	((PV1*PV2)+P)*F	muLt i
Division	((PV1/PV2)+P)*F	d iU idE
Max PV	Max value of all selected PVs	H i-PU
Min PV	Min value of all selected PVs	Lo-PU
Draw	((PV1/PV2)-1)*F	drAw
Weighted average	((PV2-PV1)*F)+PV1	wAUG
Ratio	(PV1/PV2)*F	rAt io
Concentration	(PV1/(PV1+PV2))*F	ConcEn
Math 2	Math on other math channels	mAth2
Addition	C3 = (C1+C2+P)*F	Sum
Difference	C4 = (C1-C2+P)*F	d iF
Absolute difference	C3 = ((Abs(C1- C2)+P)*F	d iFAbS
Average	C4 = (((C1+C2)/2)+P)*F	AUG
Multiplication	C3 = ((C1*C2)+P)*F	muLt i
Division	C4 = ((C1/C2)+P)*F	d iU idE

Math Constants (ConSt)

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 (ㄇㄱ R�ㄣㄱ)

Main Math Channels:
Each PV is represented by an underscore. There are 6 lines shown and ten lines hidden. Enter any or all PVs without leaving a space. Any spaces will signal the meter to end the equation there. Move to the next PV by pressing the Up Arrow.

Math2 Channel:
Each Math Channel C1, C2, C3, C4 is represented by an underscore. There are 4 lines shown for most equations, two for others. Enter any or all Math Channels without leaving a space. Any spaces will signal the meter to end the equation there. Move to the next PV by pressing the Up Arrow.

Program constant value

Defaults Values
F = 1.000
P = 0.000

Adder is applied first, then the Factor
C = ((A/B)+P)*F

Example for SUM Function

P = 0.000
F = 1.000

C = ((A+B)+0)*1

C = A+B

Program constant value

A+B   A-B   abs A-B   (A+B)/2

A*B   A/B   Max   Min

((A/B)-1)*F   ((B-A)*F)+A   (A/B)*F   (A/(A+B))*F

Each Math Function can be performed on PVs 1-16.   Each PV is marked by an underscore. Enter any or all PVs.

Math2 Functions:
Sum
Dif
DifAbs
Avg
Multi
Divide

Notes:
1. In the above menu, "A" & "B" in equations can represent any PVs (PV1-PV16). See table above.
2. Each digit represents one PV in hexadecimal format, except PV16 (G).
3. PV1 – PV9 = 1 - 9, PV10 – PV16 = A – G
4. No PV selected = "underscore symbol"
5. Digit range: 1-G, then "_"
6. If there is an empty digit, the scanner will end the equation at that point.
7. For Math2 Channel, "C" is fixed, indicating which Math Channels are being processed.
8. Please refer to the following graphics for details on various Math Functions:

Sum Menu (Sum)

Sum
Ch C1

123456
Sum
Add
PV1+2+3+4+5+6

Sum
Select more PVs

Next

Difference Menu (diF)

diF
C-1

123456
diF
Subtract
PV1-2-3-4-5-6

diF
Select more PVs

Next

Difference Absolute Menu (diFAbS)

diFAbS
C-1

123456
diFAbS
Abs(Subtract)
|PV1-2-3-4-5-6|

diFAbS
Select more PVs

Next

Average Menu (AUG)

AUG
C-1

123456
AUG
Average
(PV1+2+3+4+5+6)/6

AUG
Select more PVs

Next

Multiplication Menu (mulLt1)

mulLt1
Ch C1

123456
mulLt1
Add
PV1*2*3*4*5*6

mulLt1
Select more PVs

Next

Divide Menu (diUidE)
Only two PVs at a time are used for this function.

diUidE
C-1

Division
(PV8/PV16)

PU 8
diUidE

PU 16
diUidE

To C-2

PU 9
diUidE

PU 1
diUidE

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

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Maximum PV Menu (Hɪ-PU)

Maximum of PV1, 2, 3, 4, 5, 6

Select more PVs

Next

Minimum PV Menu (Lo-PU)

Minimum of PV1, 2, 3, 4, 5, 6

Select more PVs

Next

Draw Menu (drAw)
Only two PVs at a time will be used for this function.

Draw
((PV5/PV10) -1) *F

To C-2

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

Weighted Average
((PV10-PV5) *F) + PV5

To C-2

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

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Ratio Menu (rAt io)
Only two PVs at a time are used for this function
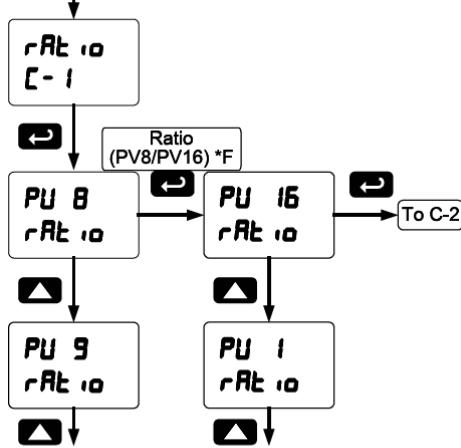
Notes:
1. Press Up arrow to scroll through PV1 - PV16
2. The first PV is the dividend and the second ☐ PV is the divisor.

Concentration Menu (ConcEn)
Only two PVs at a time are used for this function
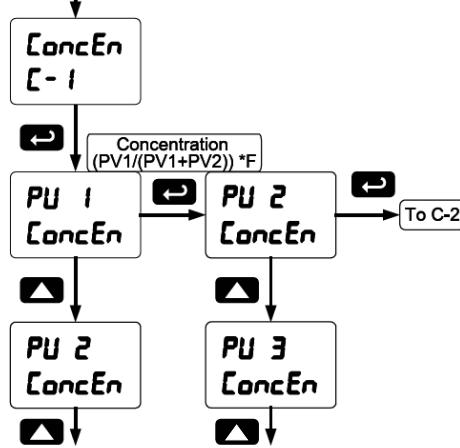
Notes:
1. Press Up arrow to scroll through PV1 - PV16
2. The first PV is the dividend and the Sum of ☐ the PVs is the divisor.

Low-Flow Cutoff (CutoFF)

The low-flow 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 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.

Analog Output 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.
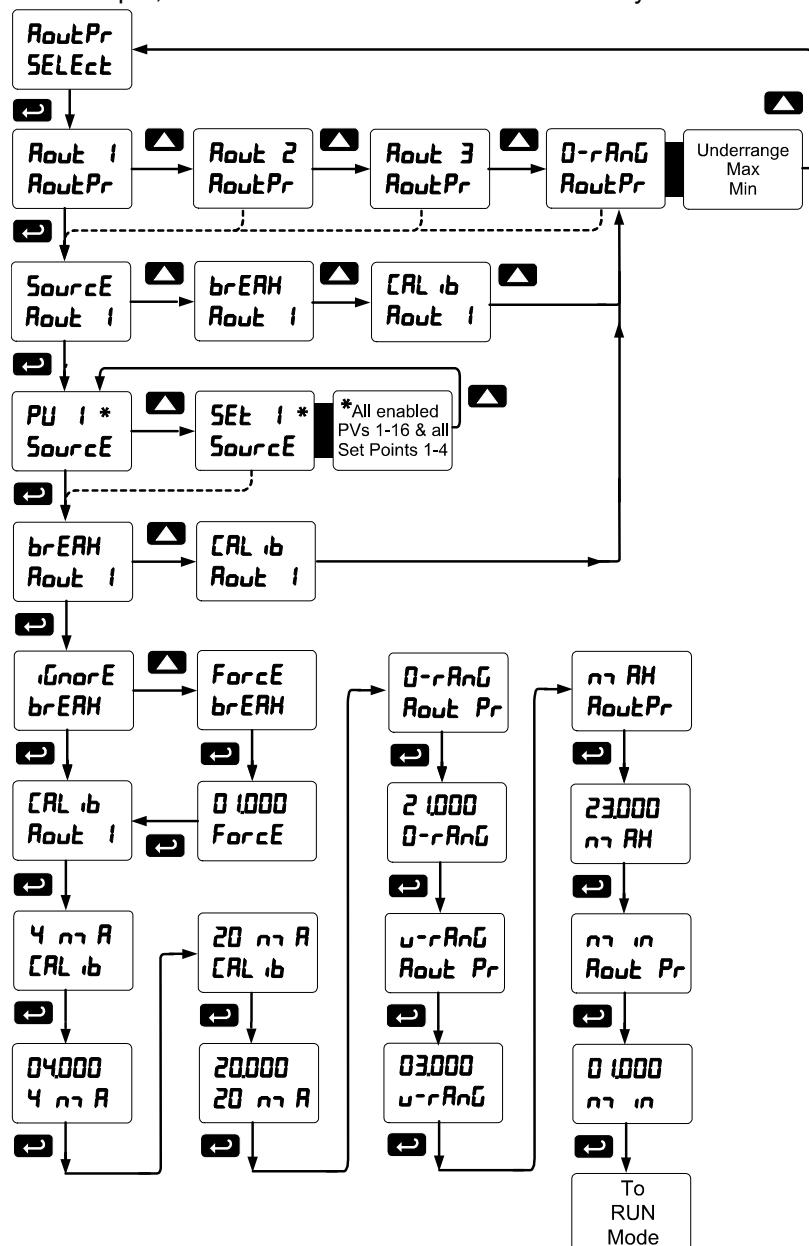
- To calibrate the analog outputs, follow the graphic above.
- The overrange and underrange values are the values that will be output when the display shows an overrange or underrange condition. This setting is common to all analog outputs.
- The maximum and minimum values are the absolute limits for 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.

User Menu (uSEr)

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

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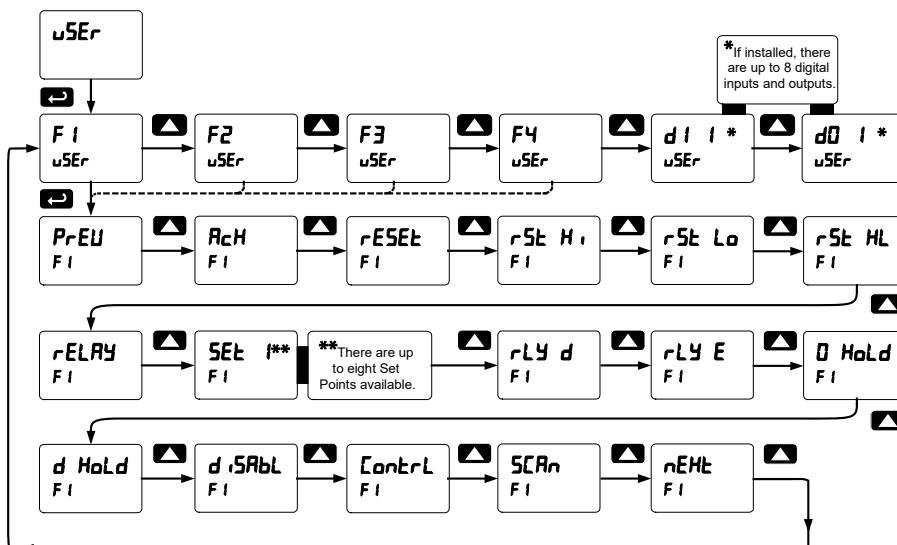
Function Keys & Digital I/O Available Settings

| Display	Description
SCAn	Scan through all PVs
nEHt	Skip to the next PV
PrEu	Return to the previous PV
AcH	Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching
rESEt	Directly access the reset menu
rSt Hi	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
rELAY	Directly access the relay menu
SEt 1*	Directly access the set point menu for relay 1 (*through 8)
rLY d	Disable all relays until a button assigned to *enable relays* (rLY E) is pressed
rLY E	Enable all relays to function as they have been programmed
O HoLd	Hold current relay states and analog output as they are until a button assigned to *enable relays* (rLY E) is pressed

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 iSAbL	Disable the selected function key or digital I/O
Contrl	Directly access the control menu
n]Enu	Mimic the menu button functionality (digital inputs only)
r iGht	Mimic the right arrow/F1 button functionality (digital inputs only)
uP	Mimic the up arrow/F2 button functionality (digital inputs only)
EntEr	Mimic the enter/F3 button functionality (digital inputs only)
F on 1*	Force relay 1 (*through 4) into the on state. This function is used in conjunction with a digital input expansion module to achieve interlock functionality. See page **52** for details about interlock relays.
ALrn] 1*	Provide indication when alarm 1 (*through 8) has been triggered (digital outputs only)

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Digital Input Menu (d I I)

*If installed, there are up to 8 digital inputs and outputs.

**There are up to eight Set Points available.

Digital Output Menu (dO I)

*If installed, there are up to 8 digital inputs and outputs.

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.

1.800.561.8187   www.itm.com   information@itm.com

4-20 mA 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 μA 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.

4-20 mA Output Calibration Procedure

1. Wire the PD6080/6081 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 page 20 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 the Analog Output Programming (*RoutPr*)/Calibration (*CAL ib*) menu and press **Enter**.
4. The display will show *4 mA*. The PD6080/6081 mA output should now be close to 4 mA. Press **Enter** and the display will show *04.000*. Enter the actual value read by the digital mA meter and press **Enter**.
5. The display will show *20 mA*. The PD6080/6081 mA output should now be close to 20 mA. Press **Enter** and the display will show *20.000*. Enter the actual value read by the digital mA meter and press **Enter**.
6. The PD6080/6081 will now calculate the calibration factors and store them.
7. Press Menu to exit and return to *Run Mode*.

Internal Source Calibration (*iCAL*)

The meter is factory calibrated prior to shipment to read in milliamps and volts depending on the input selection. The calibration equipment is certified to NIST standards.

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

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

Notes:

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

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

1. Press and hold the Menu button for three seconds to access the advanced features of the meter.
2. Press the Up arrow button to scroll to the *Internal calibration* menu (*iCAL*) and press Enter.
3. Select channel A (*Ch-A*) or channel B (*Ch-b*) and press enter.
4. The meter displays either current calibration (*C CAL*) or voltage calibration (*U CAL*), according to the input setup. Press Enter to start the calibration process.

Example of Internal Calibration for current input:

5. The meter displays *low* input current message (C Lo). Apply the low input signal and press Enter. The display flashes for a moment while the meter is accepting the low input signal.

6. After the display stops flashing, a number is displayed with the leftmost digit brighter than the rest. The bright digit is the active digit that can be changed by pressing the Up arrow button. Press the Right arrow button to move to the next digit.

7. Set the display value to correspond to the input signal being calibrated, typically 4.000 mA.

8. The display moves to the *high* input calibration (C Hi). Apply the high input signal and press Enter.

9. Set the display for the high input calibration, in the same way as it was set for the low input calibration, typically 20.000 mA.

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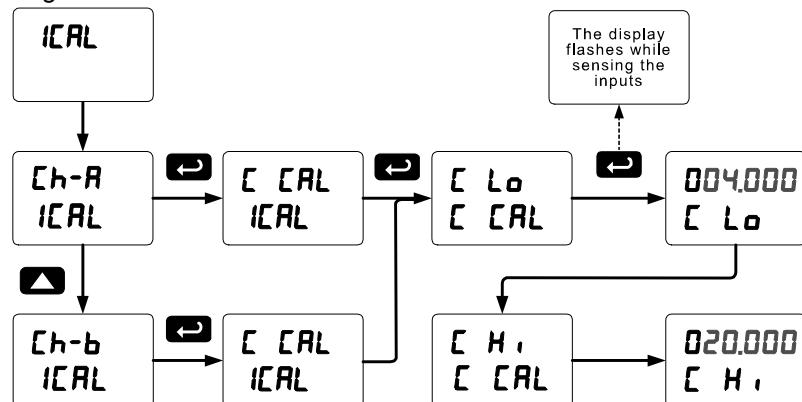
Tips:

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

Error Message (Error)

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

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

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

Minimum Input Span

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

Input Range	Input 1 & Input 2 Span
4-20 mA	0.15 mA
±10 VDC	0.01 VDC

Scanner Operation

The PD2-6080/1 scanner is capable of operating as a Modbus Master, Slave or Snooper. As a Slave, the PD2-6080/1 requires connection to a Master device: PLC, DCS, etc. As a Master, the PD2-6080/1 interfaces up to sixteen slave devices and can alternately display their Process Variables. As a Snooper, it can be connected anywhere in the RS-485 bus to read any of the variables being requested by the Master device.

Four math channels (C1-C4) are available to perform operations on any PV or math channel, with adder and factor constants, and display the results. Engineering units or tags may be displayed with all PVs or math channels. Another level of Math functions can be performed on the resultant math channel Math2. For example, the operator can use the Math2 Channel to calculate the Sum of all other Math Channels, which may have each performed a different Math function.

The dual-line display can be customized by the user. Typically, the upper display is used to display the PV, while the lower display is used to display the tag for each PV.

Additionally, the scanner can be set up to display any input or math channel on the upper display and alternate between tag & units on the lower display. The relays and analog output can be programmed to operate based on any PV or math channel.

The scanner is capable of accepting two analog input channels (A and B) of either current (0-20 mA, 4-20 mA) or voltage signals (0-5 V, 1-5 V, 0-10 V, $\pm$ 10 V) and displaying these signals in engineering units from -99999 to 999999 (*e.g.* a 4-20 mA signal could be displayed as -50.000 to 50.000). The analog input channels must be mapped to PVs using the IDs 256-259.

Button Operation

Button Symbol	Description
MENU / MENU	Press to enter, exit Programming Mode, or exit max/min readings
RIGHT / F1 PREV	Press to move to the previous PV or math channel
UP / F2 NEXT	Press to move to the next PV or math channel
ACK / F3 SCAN	Press once to pause scanning, press again to resume scanning

Function Key Operation

During operation, the programmable function keys operate according to the way they have been programmed in the *Advanced Features – User* menu.
The table above shows the factory default settings for F1, F2, and F3.

Digital Input Operation

Five (5) digital inputs, F4-F8, come standard on the meter. These digital inputs are programmed identically to function keys F1, F2, and F3. The inputs are triggered with a contact closure to +5 (COM in the case of F4, see Digital I/O Connections on page 18 for details), or with an active low signal. During operation, digital inputs operate according to the way they are programmed in the *Advanced Features – User* menu.

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Maximum/Minimum Readings

The max & min readings (peak & valley) reached by the PVs or math channels can be displayed either continuously or momentary:

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

Troubleshooting

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

Diagnostics Menu (d iAG)

The *Diagnostics* menu is located in the *Advanced Features* menu, to access *Diagnostics* menu see Advanced Features Menu, page 55.

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

For a description of the diagnostic messages, *see* Advanced Features Menu & Display Messages, page 56.

Determining Software Version

To determine the software version of a meter:

1. Go to the *Diagnostics* menu (d iAG) and press Enter button.
2. Press Up arrow button and scroll to Information menu (InFo).
3. Press Enter to access the software number (SFt) and version (UEr) information. Write down the information as it is displayed. Continue pressing Enter until all the information is displayed.
4. The meter returns to Run Mode after displaying all the settings.

Reset 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*, page 55.
2. Press Up arrow to go to *Diagnostics* menu
3. Press and hold Right arrow for three seconds, press Enter when display flashes rESEt.
   Note: If Enter is not pressed within three seconds, the display returns to the *Diagnostics* menu.
4. The meter goes through an initialization sequence (similar as on power-up), and loads the factory default settings.

Run Mode

996000
GPd

Press & hold **Menu** for 3 sec to access Advanced features

reset flashes for three seconds

d iAG   →   rESEt   →   20.000 m A

Press & hold right arrow for 3 seconds to reset meter
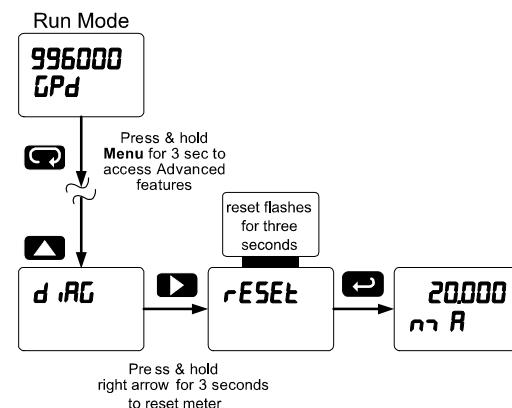
Testing the Display LEDs

Enter the Diagnostic menu and press the **ENTER** button to get to the LED Test menu (LEd t). Press the **ENTER** button to activate the LED Test. The PD2-6080/1 will cycle through all digits, decimal points, and relay indicators to enable the operator to see that all are functioning properly. Press the **ENTER** button again to access the Information menu (InFo). Press the **MENU** button to return to *Run Mode*.

Factory Defaults & User Settings

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

Parameter	Display	Default Setting
Mode	ꭑ odE	Master
Function Code	FunCod	03
PV Number	PU.nbr	PV1-PV4 Enabled
Slave ID PV1-16	SLAU. Id	001 - 016
Register Number PV1-16	rEG.nbr	40001
Data Type PV1-16	dAtA	Float
Byte Order	1234	Big-endian
Polling Time	t-PoLL	5.0 second
Slave Response Timeout	t-rESP	10.0 second
Serial	SEr iAL	
Scanner ID	SCAn. Id	246
Baud	bAud	9600
Parity	PAr ity	Even
Byte-to-byte timeout	t-bYtE	0.01 second
Setup	SEtuP	
Tag PV1-16	tAG PU1	PV 1 – PV 16
Units PV1-16	Un itS PU1	FEET
Units C1-4	Un itS Ch C1	UnitC1 – UnitC4
Display Format PV1-16	Forꭑ t PU1	Dec (PD2-6080) Ft-In-16 (PD2-6081)
Display Format C1-4	Forꭑ t Ch C1	Decimal
Display decimal point	d iSP.dP	ddd.ddd
Float decimal point	FLot.dP	ddd.ddd
Number of points	no PtS	2 (all PVs and C channels)
Scaling	SCALE PU 1	All
Input 1	InP 1	0.000
Display 1	d iS 1	0.000
Input 2	InP 2	10.000
Display 2	d iS 2	10.000
Math, channel C1-4	Suꭑ	Sum
Adder (constant P)	AddEr	0.000
Factor (constant F)	FActor	1.000

Parameter	Display	Default Setting
Filter	F iLtEr	
Filter, PV 1	Ch-A	70
Filter, PV 2	Ch-b	70
Bypass, PV 1	bYPASS	0.2
Bypass, PV 2	bYPASS	0.2
Round	round	1
Cutoff	CutoFF	
Cutoff value, PV 1	Ch-A	0.000 (disabled)
Cutoff value, PV 2	Ch-b	0.000 (disabled)
Display assignment	dSPLAY	
Display Line 1	d PU	Display PV
Display Line 2	d tAG	Display tag
Display intensity	d- IntY	8
Relay 1 assignment	PU 1	PV 1
Relay 1 action	Act 1	Automatic
Relay 1 set point	SEt 1	1.000
Relay 1 reset point	rSt 1	0.500
Relay 2 assignment	PU 2	PV 2
Relay 2 action	Act 2	Automatic
Relay 2 set point	SEt 2	2.000
Relay 2 reset point	rSt 2	1.500
Relay 3 assignment	PU 3	PV 3
Relay 3 action	Act 3	Automatic
Relay 3 set point	SEt 3	3.000
Relay 3 reset point	rSt 3	2.500
Relay 4 assignment	PU 4	PV 4
Relay 4 action	Act 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

Parameter	Display	Default Setting	Parameter	Display	Default Setting
Off delay relay 1	OFF 1	0.0 sec	Underrange output	u-rAnG	3.000 mA
On delay relay 2	On 2	0.0 sec	Comm. break output	brEAK	1.000 mA
Off delay relay 2	OFF 2	0.0 sec			
On delay relay 3	On 3	0.0 sec	Maximum output	m AH	23.000 mA
Off delay relay 3	OFF 3	0.0 sec	Minimum output	m in	1.000 mA
On delay relay 4	On 4	0.0 sec	F1 function key	F1	Previous PV
Off delay relay 4	OFF 4	0.0 sec	F2 function key	F2	Next PV
Comm. break relay 1	On	On	F3 function key	F3	Scan/Pause
Comm. break relay 2	On	On	F4 function (digital input)	F4	Acknowledge relays
Comm. break relay 3	On	On	Digital input 1	di 1	Menu
			Digital input 2	di 2	Right arrow
Comm. break relay 4	On	On	Digital input 3	di 3	Up arrow
			Digital input 4	di 4	Enter
Display 1 analog out	dis 1	00.00.00	Digital output 1	dO 1	Alarm 1
			Digital output 2	dO 2	Alarm 2
Output 1 value	Out 1	4.000 mA	Digital output 3	dO 3	Alarm 3
Display 2 analog out	dis 2	20.00.00	Digital output 4	dO 4	Alarm 4
Output 2 value	Out 2	20.000 mA	Password 1	PASS 1	000000 (unlocked)
Source analog output	SourcE	PV 1	Password 2	PASS 2	000000 (unlocked)
Overrange output	O-rAnG	21.000 mA	Password 3	PASS 3	000000 (unlocked)

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Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, **Locd** is displayed	Scanner is password-protected, enter correct six-digit password to unlock
Scanner displays error message during scaling (**Error**)	Check: Input 2 must greater than Input 1, Input 3 must be greater than Input 2, etc.
Scanner displays 1. **999999** **-99999**	Indicating overrange or underrange condition Check the input data value and scaling in *Setup* menu
Display stop scanning, ■LED indicator flashing	Check: 1. Stop on alarm feature has been enabled Press PREV or NEXT to resume scanning
Displays **brEAH** 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 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 Snooper cannot read the same PV twice, check setup
Scanner experiencing faults and communication breaks	Check: 1. Increase response time (**t-rESP**) and/or transmit delay (**tr dLY**). This may require some trial and error, as these are dependent upon the number of devices on the bus. 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 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 Check format selected: Dec or Ft&In
Relay operation is reversed	Check: 1. Fail-safe in *Setup* menu Wiring of relay contacts
Relay and status LED do not respond to signal	Check: 1. Relay action in *Setup* menu 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.
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 map changes ahead of time, rather than at random.

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