Helios Large Display Strain Gauge Meter
Instruction Manual   PD2-6100

HELIOS

MeterView Pro
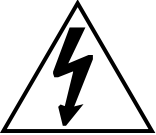USB Install

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Strain Gauge

- 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)
- 15, 30, 150, 300 mV Unipolar Input Ranges
- ±15, ±25, ±150, ±250 mV Bipolar Input Ranges
- Selectable 5 or 10 VDC @350 mA Maximum Sensor Excitation
- Supports up to Twelve (12) 350 Ω Load Cells
- Capture or Programmable Tare Feature
- Max/Min or Peak/Valley Hold Feature
- Auto-Zero Feature Eliminates Zero Drift
- Input Power Options Include 85-265 VAC or 12-24 VDC
- 2 or 4 Relays + Isolated 4-20 mA Output
- Onboard USB & RS-485 Serial Communication Options
- Modbus® RTU Communication Protocol Standard
- Program the Meter from a PC with onboard USB and MeterView Pro

Precision Digital Corporation

PRECISION DIGITAL

Disclaimer

The information contained in this document is subject to change without notice. Precision Digital makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose.

⚠️ **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.

Registered Trademarks

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Introduction

The Helios PD2-6100 is a multi-purpose, easy to use, large-display digital strain gauge & load cell meter ideal for weighing and force measurement applications. With a max current of 350 mA at 10 V, it can support up to twelve (12) 350 Ω load cells (minimum load resistance of 28 Ω), making it ideal for multipoint weight measurement applications. It also features large 1.8 inch superluminous LED digits, which can be read from up to 100 feet away. It is housed in a water-resistant, field mountable, NEMA 4X/IP65 rated enclosure for convenient indoor and outdoor installation.

The meter accepts mV input signals up to 300 mV. Three of the front panel buttons can be custom-programmed for a specific operation. The mV input can be scaled to display the process in two different scales; for example, pounds on the upper display and gallons on the lower display.

A fully loaded Helios PD2-6100 meter comes with four (4) SPDT relays, a 4 20 mA output, one 10 VDC sensor excitation, one 24 VDC power supplies, five (5) digital inputs and four (4) digital outputs, and onboard RS485 serial communications. The four relays can be used for alarm indication or process control applications. The 4-20 mA isolated output, Modbus® RTU serial communications, and digital I/O features make the Helios an excellent addition to any system.

Ordering Information

Standard Models

85-265 VAC Model	12-24 VDC Model	Options Installed
PD2-6100-6H0	PD2-6100-7H0	No Options
PD2-6100-6H7	PD2-6100-7H7	4 relays & 4-20 mA output

Accessories

Model	Description
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.

General

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
Display Assignment	Line 1 and line 2 may be assigned to PV1, PV2, PCT, d r-u, d gross, d nt-g, max/min, max & min, set points, units (line 2 only), or Modbus input.
Units	lb, kg, ounce, gram, ton, metric ton (tonne), custom units.
Programming Methods	Four programming buttons, digital inputs, PC and MeterView Pro software, or Modbus registers.
Noise Filter	Programmable from 2 to 199 (0 will disable filter)
Filter Bypass	Programmable from 0.1 to 99.9% of calibrated span
Rounding	Select 1, 2, 5, 10, 20, 50, or 100 (e.g. rounding = 10, value = 123.45, display = 123.50).
Recalibration	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
Max/Min Display	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
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 Powered over USB for configuration only.
Isolated Sensor Power Supply	Terminals EX+ & EX-: 5 VDC or 10 VDC ± 10%, rated @ 350 mA max *Note: Do not use 24 VDC to power strain gauge bridge.*
Non-Volatile Memory	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
Fuse	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse
Normal Mode Rejection	Greater than 60 dB at 50/60 Hz

Isolation	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
Overvoltage Category	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
Environmental	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 9 for additional details. **Pipe Mounting:** Optional pipe mounting kit (PDA6260) allows for pipe mounting. Sold separately. See Pipe Mounting Instructions on page 10 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

Strain Gauge Input

Inputs	Field selectable: 0-15, 0-30, 0-150, 0-300 mV, ±15, ±25, ±150, ±250 mV, or Modbus PV (Slave)
Accuracy	±0.03% of calibrated span ±1 count
Minimum Load Resistance	14 Ω @ 5 V 28 Ω @ 10 V
Maximum Excitation Current	350 mA @ 5 V or 10 V
Temperature Drift	0.002% of calibrated span/°C max from 0 to 65°C ambient, 0.005% of calibrated span/°C max from -30 to 0°C ambient
Functions	Linear with multi-point linearization
Multi-Point Linearization	2 to 32 points for PV or PV1, 2 to 8 points for PV2 (Dual-scale feature)

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Low-Flow Cutoff	0-999999 (0 disables cutoff function)
Decimal Point	Up to five decimal places or none: *d.ddddd*, *d.dddd*, *d.ddd*, *d.dd*, *d.d*, or *dddddd*

Calibration Range	Input Range	Minimum Span Input 1 & Input 2
	15 mV	0.2 mV
	25 mV, 30 mV	0.4 mV
	150 mV	2.0 mV
	250 mV, 300 mV	4.0 mV
	An Error message will appear if the input 1 and input 2 signals are too close together.	

Input Impedance	Strain Gauge Bridge: Greater than 10 MΩ; mV Source: 200 kΩ

Relays

Rating	2 or 4 SPDT (Form C) internal and/or 4 SPST (Form A) external; 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 16 for details.
Deadband	0-100% of span, user programmable
High Or Low Alarm	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
Relay Operation	Automatic (non-latching) and/or manual reset 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	Process variable (PV), max, min, set points 1-4, Modbus input, or manual control mode
Scaling Range	1.000 to 23.000 mA for any display range
Calibration	Factory calibrated: 4.000 to 20.000 = 4-20 mA output
Analog Out Programming	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break
Accuracy	± 0.1% of span ± 0.004 mA
Temperature Drift	0.4 µA/°C max from 0 to 65°C ambient, 0.8 µA/°C max from -40 to 0°C ambient *Note: Analog output drift is separate from input drift.*
Isolated Transmitter Power Supply	Terminals I+ & R: 24 VDC ± 10%. May be used to power the 4-20 mA output or other devices. Refer to Figure 24 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

RS485 Serial Communications Terminal

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

Modbus® RTU Serial Communications

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

Note: Refer to the Modbus Register Tables for details.

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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
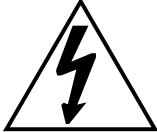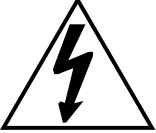
Source Current	10 mA maximum output current
Sink Current	1.5 mA minimum input current
+5 V Terminal	To be used as pull-up for digital inputs only. Connect normally open pushbuttons across +5 V & DI 1-4.
	WARNING! ⚡ *DO NOT* use +5 V terminal to power external devices.

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
Voltage Interruptions	<5%V for 250 periods

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 knockout 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 sensor power supply to output 5 or 10 VDC instead of 24 VDC, see page 10.

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.
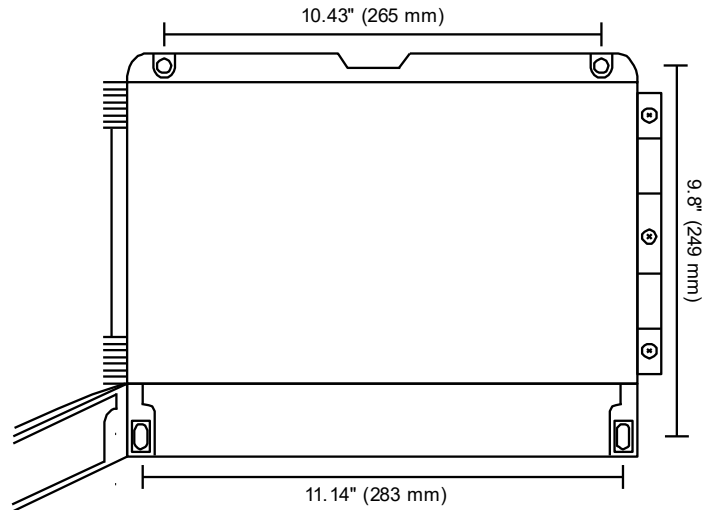
Figure 1. Meter Mounting Holes

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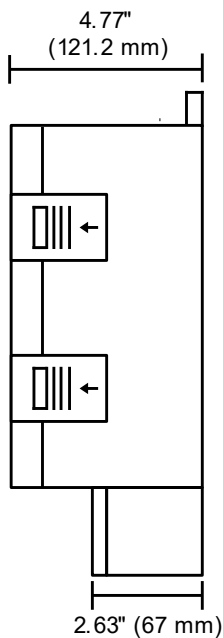
Figure 2. Meter Dimensions - Side View
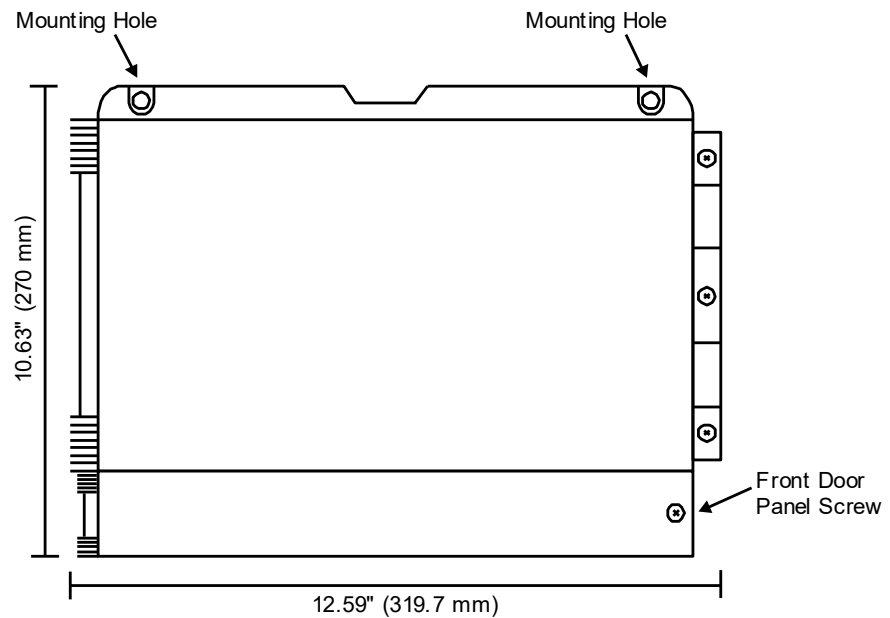
Figure 3. Meter Dimensions – Front View

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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).
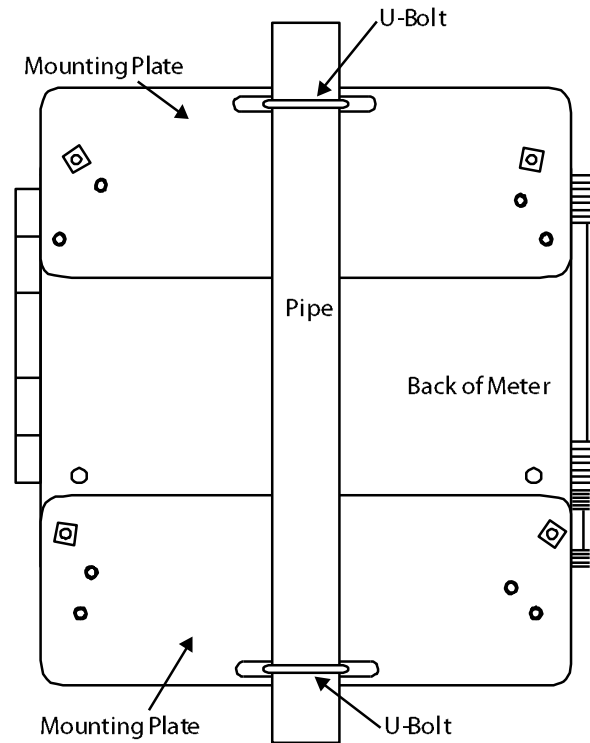
Figure 4. Vertical Pipe Mount Assembly
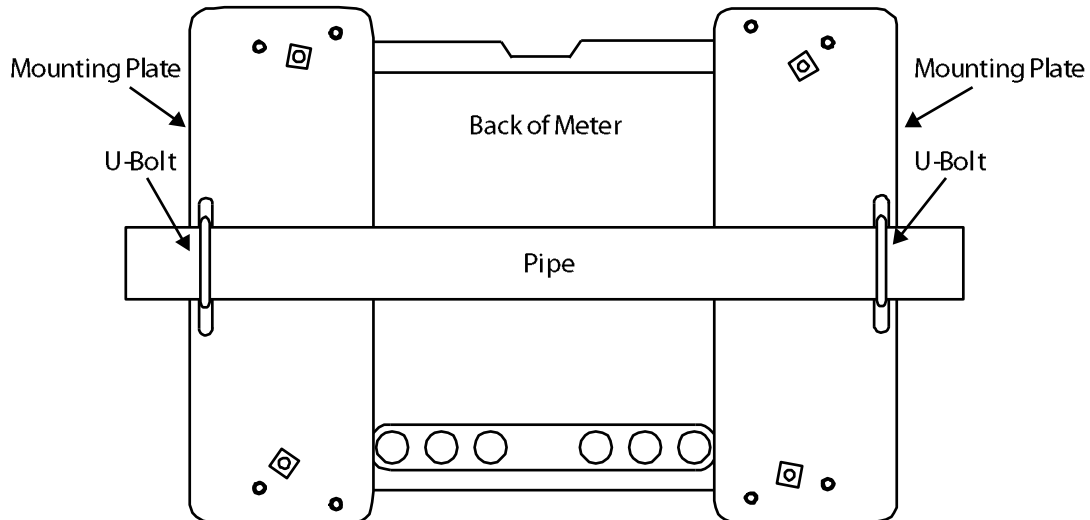
Figure 5. Horizontal Pipe Mount Assembly

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Sensor Excitation Voltage Selection (EX+, EX-)

All meters, including models equipped with the 12-24 VDC power option, are shipped from the factory configured to provide 10 VDC power for the sensor.

If the sensor requires 5 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.
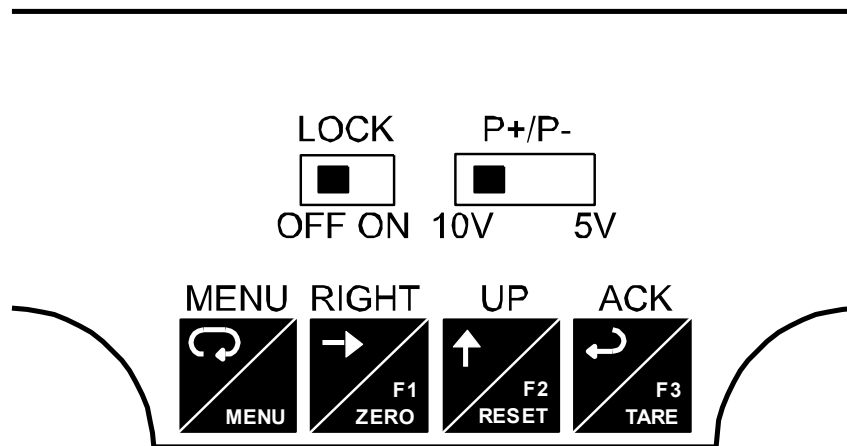
Figure 6. Sensor Excitation Voltage Selection

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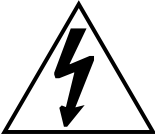
⚠ **Caution**	*Use copper wire with 60°C or 60/75°C insulation for all line voltage connections. Observe all safety regulations. Electrical wiring should be performed in accordance with all applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.*

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 PD2-6100

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 7 on page 12. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.
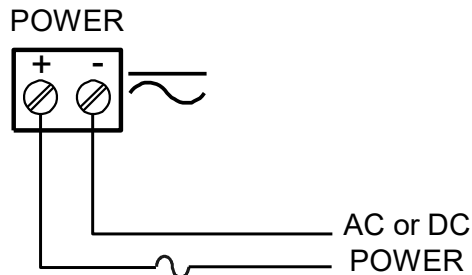
Figure 8. Power Connections

Signal Connections

Signal connections are made to a six-terminal connector labeled SIGNAL. The EX- (negative excitation) terminal is used to sense the sensor excitation voltage for ratiometric operation, when the sensor is powered externally.

Switch Configuration

Setup and programming is performed both through the front panel buttons and switch settings shown below. The switch configuration must correspond to the setup and programming starting on page 29 (same range, type, etc.).
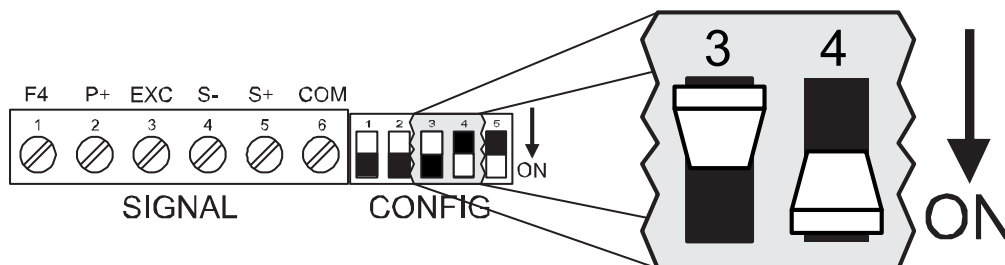
Figure 9. Strain Gauge Configuration Switch

Excitation (Switch 1)

The excitation switch designates whether the meter will use its internal power supply or an external power supply.

Switch 1	ON	Excitation	Internal Excitation	When switch is turned ON, the ProVu's power supply is used.
	OFF	Excitation	External Excitation	When switch is turned OFF, an external power supply is used.

Range (Switch 2)

The range switch adjusts the gain of the internal circuitry. Narrower ranges require more amplification.

Switch 2	ON	Range	Higher internal gain	Turn this switch ON for the following input ranges: 15, 30, ±15, or ±25 mV.
	OFF	Range	Lower internal gain	Turn this switch OFF for the following input ranges: 150, 300, ±150, or ±250 mV.

Polarity (Switch 3)

The polarity switch selects whether the range is unipolar and starts at zero (i.e. 0 to 30 mV) or bipolar and starts at a negative value, or below zero (i.e. -15 to +15 mV).

Switch 3	ON	Polarity	Range starts at zero (unipolar)	Turn this switch ON for the following input ranges: 15, 30, 150, or 300.
	OFF	Polarity	Range starts below zero (bipolar)	Turn this switch OFF for the following input ranges: ±15, ±25, ±150, or ±250 mV.

Source (Switch 4)

The source switch tells the ProVu whether the input is a strain gauge bridge (i.e. Figure 11), or it is a signal from a 2 or 4 wire transducer, or mV source (i.e. Figure 12)

Switch 4	ON	Source	Source is mV input transducer	Turn this switch ON if the connected source is a transducer*
	OFF	Source	Source is strain gauge bridge	Turn this switch OFF if the source is a strain gauge bridge

*Ratio should be set to NO in Setup Input Menu

Shunt Resistor (Switch 5)

The PD6100 provides a means of simulating strain in a strain gauge bridge circuit via a 60.4KΩ shunt resistor included in the meter. This will simulate an approximate 70% full-scale load in the case of a 350Ω strain bridge.

Switch 5	ON	Shunt	Shunt resistor is connected to the input bridge.	Turn switch ON when you want to simulate a strain load
	OFF	Shunt	Shunt resistor is disconnected from the input bridge.	Turn this switch OFF to remove the shunt resistor

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Strain Gauge Connections

The following figures show examples of strain gauge connections.

There is a 5-position DIP switch (CONFIG) to set up the input ranges and ratiometric operation.

NOTE: *Refer to Switch Configuration starting on page 13 for proper switch positioning for the following wiring configurations.*
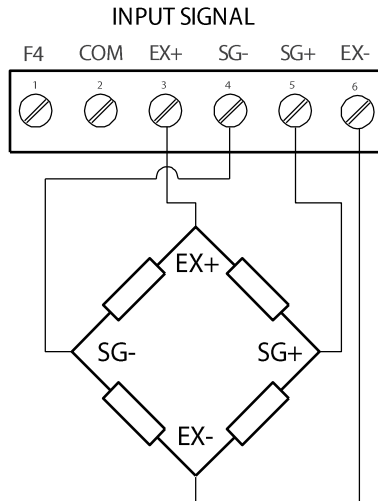
Figure 10. Strain Gauge Powered by Internal Supply
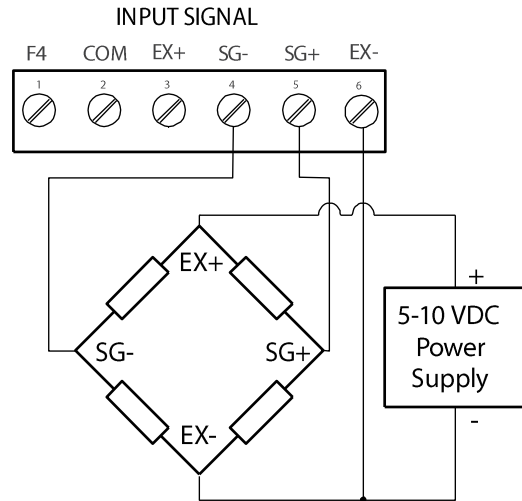
Figure 11. Strain Gauge Powered by External Supply

When connecting multiple strain gauges to the meter, each must be wired in parallel. This is typically done with the use of a junction box.
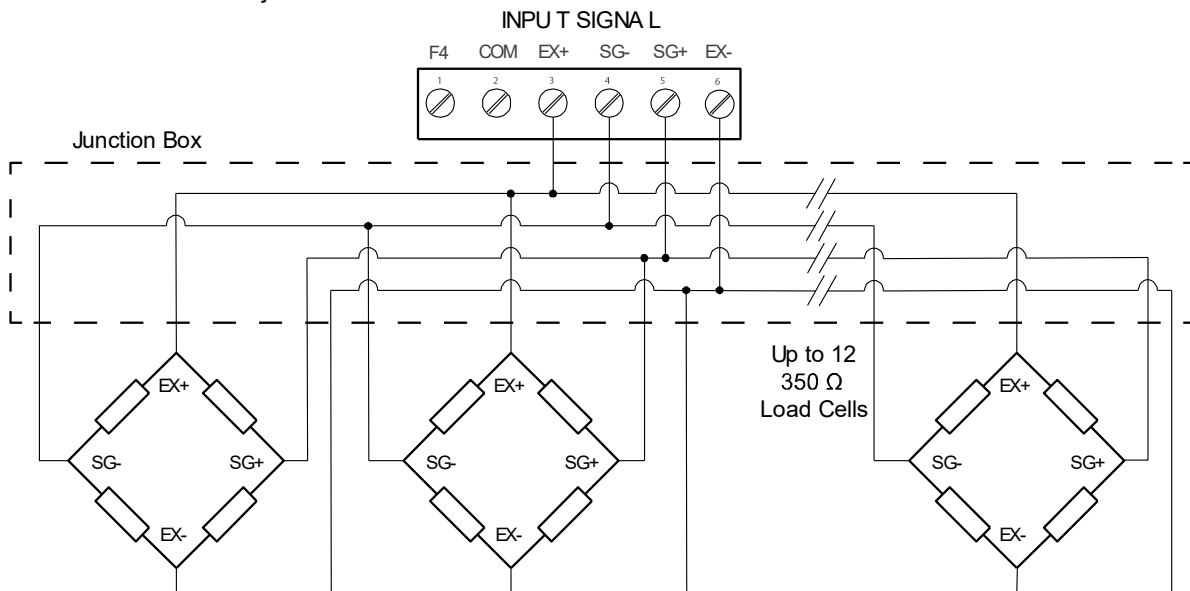
Figure 12. Multiple Strain Gauges Connected Through Junction Box

INPUT SIGNAL

F4   COM   EX+   SG-   SG+   EX-

EX+   SG-   SG+

3-Wire 100 mV Transducer

CONFIG

Notes
- *Two-wire mV signals: Connect positive to SG+ and negative to SG-*
- *Four-wire transducer: Connect EX- to negative power transducer terminal.*
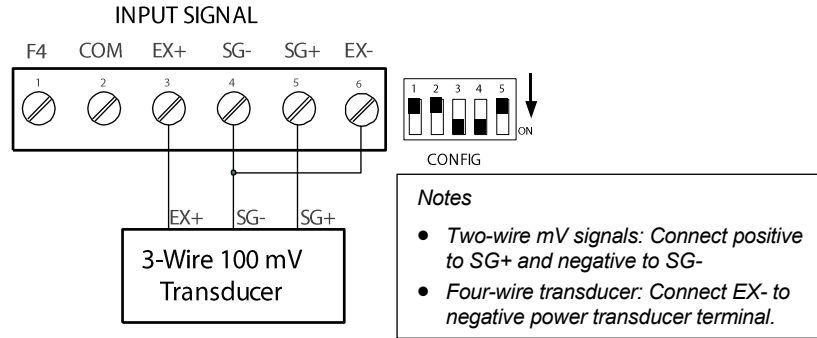
Figure 13. mV Transducer Input Connections

Shunt Calibration

The PD6100 is equipped with a means of simulating strain in a strain gauge bridge circuit, via an included shunt resistor in the meter. This technique is performed by enabling the "shunt resistor" switch (switch 5), which in turn shunts one leg of a connected strain bridge with a predetermined resistive load (60.4k). This technique can be used as a means of verifying instrumentation by simulating a physical input. With no load connected, the enabling of the shunt resistor (switch 5) will simulate approximately a 70% F.S. load in the case of a 350Ω Strain Bridge.

EX+

SG-   SG+

SHUNT 60.4K

EX-
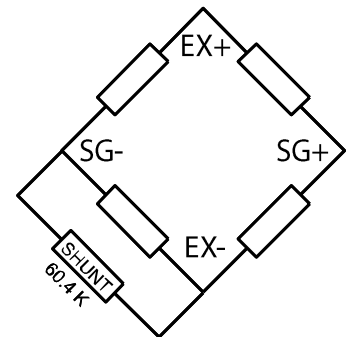
Figure 14. Shunt Resistor

Modbus RTU Serial Communications

Serial communications connection can be made to the onboard RS485 terminal block or USB connector shown in Figure 7. If RS232 is required, an RS485 to RS232 adapter (PDA7485) may be used. See Ordering Information on page 4 for additional information.

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.

RELAY1   RELAY2   RELAY3   RELAY4

1   2   3   4   5   6   1   2   3   4   5   6

C   NC   NO   C   NC   NO   C   NC   NO   C   NC   NO
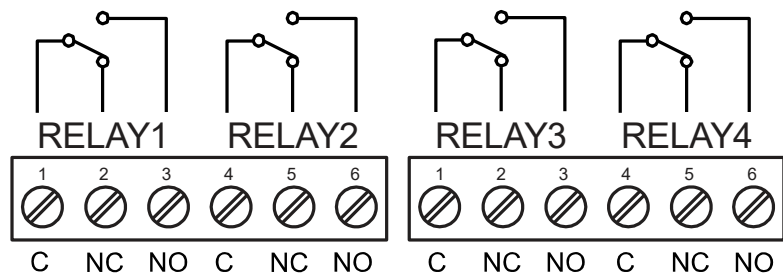
Figure 15. Relay Connections

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:
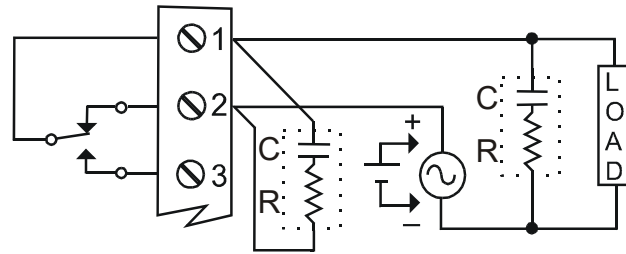
Figure 16. AC and DC Loads Protection

Choose R and C as follows:

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

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

Notes:

1. *Use capacitors rated for 250 VAC.*
2. *RC networks may affect load release time of solenoid loads. Check to confirm proper operation.*
3. *Install the RC network at the meter's relay screw terminals. An RC network may also be installed across the load. Experiment for best results.*

Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.
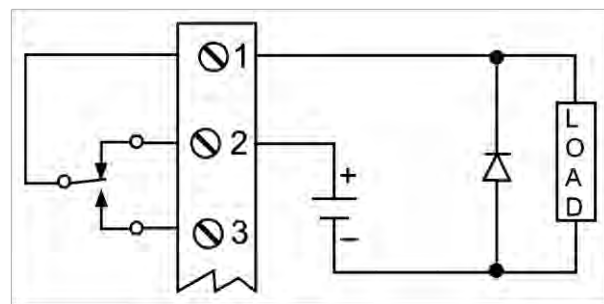
Figure 17. Low Voltage DC Loads Protection

RC Networks 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.

RS485 Output Connections

An RS-485 connector is provided for the use of advanced Modbus® serial communications. This connector converts the serial output of the meter to balanced, full or half-duplex RS-485 signals. 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 Modbus RTU Serial Communications on page 51 for more information).

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.
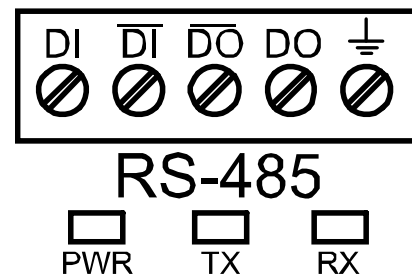
Installation

Figure 18 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 19 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 meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) may be programmed between 1 and 247. The transmit delay may be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop bits.

To change the meter address:

1. Press and hold the **Menu** button for three seconds to access *Advanced Features* menu of the meter.
2. Press **Up** arrow until Serial (5Er iAL) menu is displayed and press **Enter**, AddrE5 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.
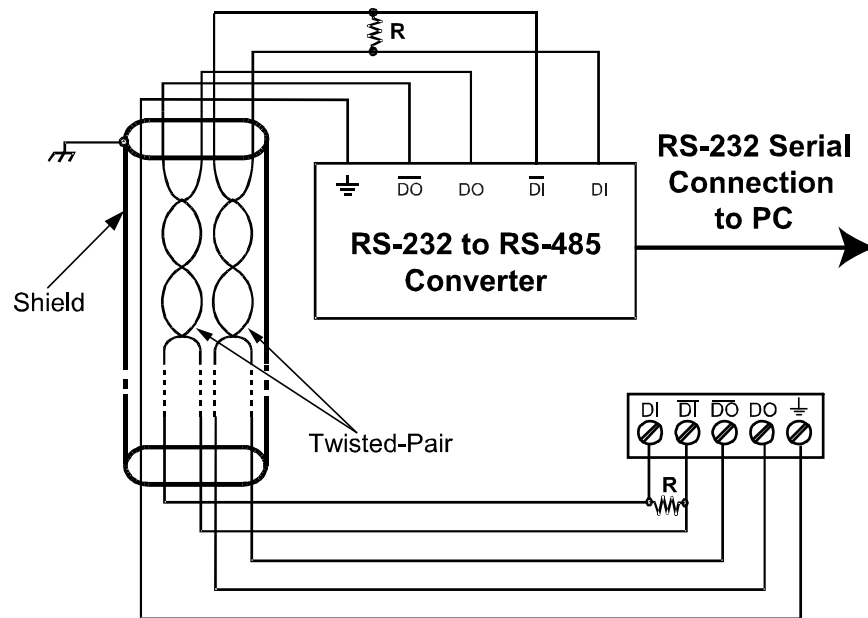
Figure 18. RS-422 or RS-485 Wiring

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.
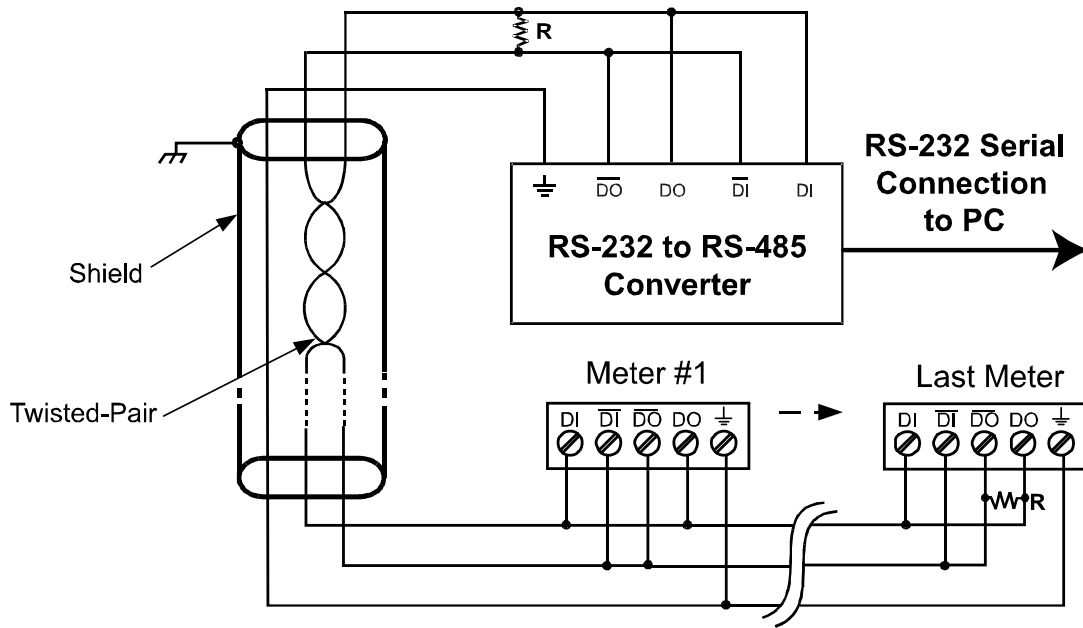
Figure 19. RS-485 Two-Wire Multi-Drop Wiring

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 20 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
$\perp$	$\perp$
$\overline{DO}$	$\overline{DI}$
DO	DI
$\overline{DI}$	$\overline{DO}$
DI	DO

Figure 20. 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.
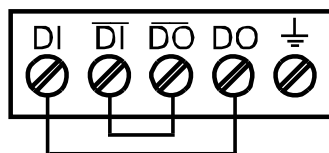
Figure 21. Three-Wire RS485 Connection

Digital I/O Connections

Digital inputs and outputs are provided 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.
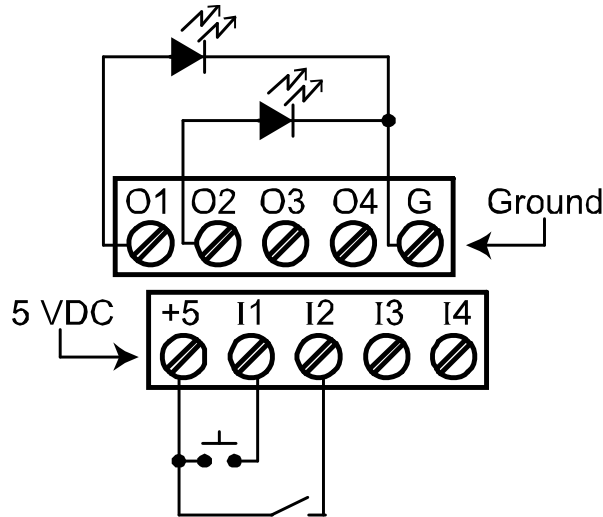
Figure 22. Digital Input and Output Connections

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.
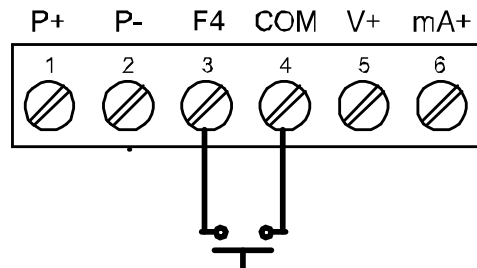
Figure 23. F4 Digital Input Connections

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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.
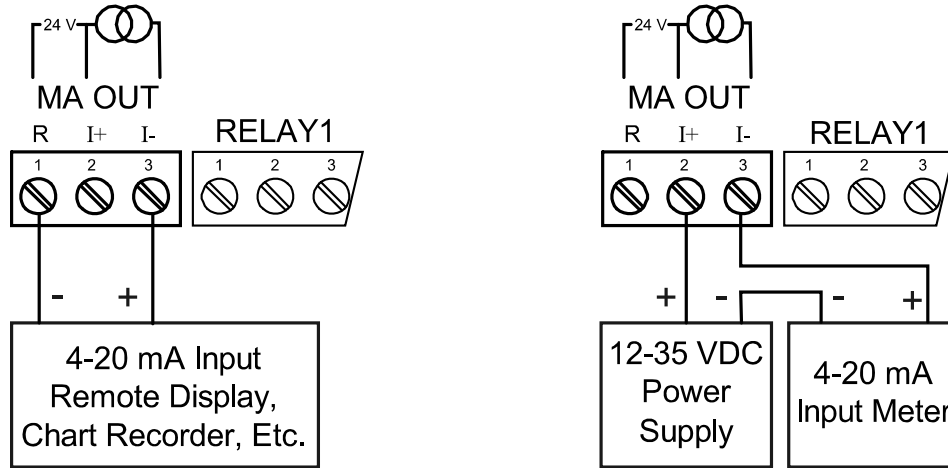
Figure 24. 4-20 mA Output Connections

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 44). 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.
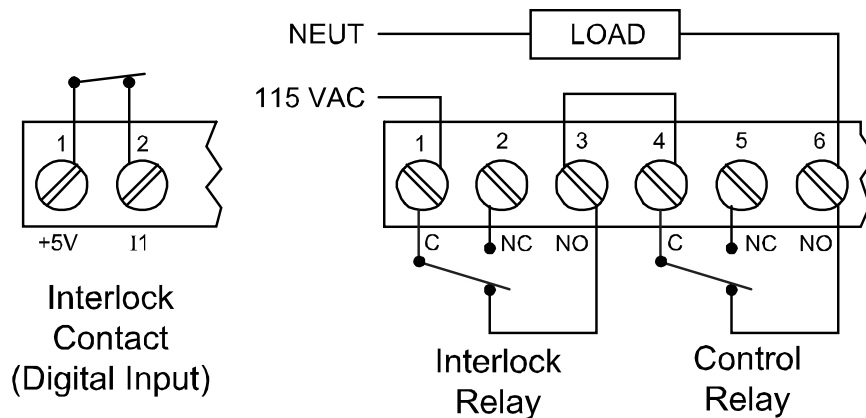
Figure 25. Interlock Connections

Setup and Programming

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.

Overview

There is a 5-position DIP switch used to set the meter input selection. See Figure 9 on page 13 to setup the switch.

Setup and programming is 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.

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.
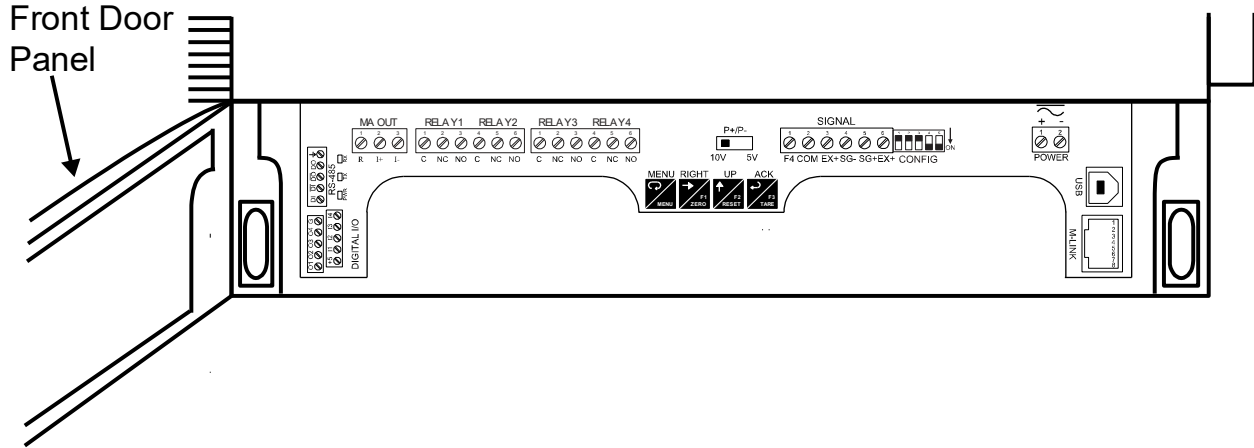
Button Symbol	Description
MENU	**Menu**
RIGHT / F1 ZERO	**Right arrow/F1** **Zero Meter**
UP / F2 RESET	**Up arrow/F2** **Reset Tare**
ACK / F3 TARE	**Enter/F3** **Tare**
Note: *F4 – F8 are digital inputs.*	

LED	Status
1-4	Alarm 1-4 indicator
1-4 M	Flashing: Relay in manual control mode
T G	Flashing: Tare (Net) Gross
1-4	Flashing: Relay interlock switch open
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.*	

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

MeterView® Pro 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.

MeterView Pro Installation

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

Front Door Panel
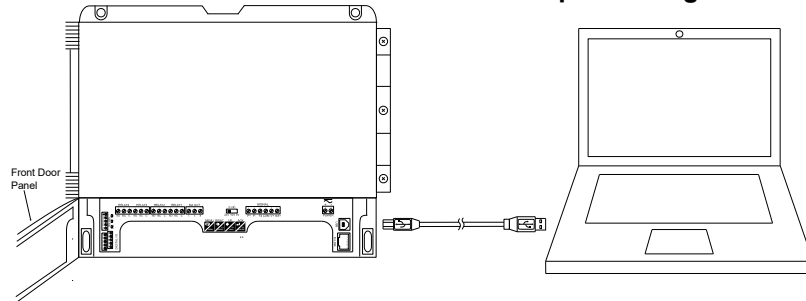
2. Once the driver is installed, an AutoPlay dialog should appear for the drive "MAINSTAL." Click "Open folder to view files." If the computer does not display an AutoPlay dialog for the drive "MAINSTAL," you should open My Computer and double-click on the drive labeled "MAINSTAL."

3. Double-click on the file named "MAStart." The program will open a few windows and install two programs on your computer. Simply follow the 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.
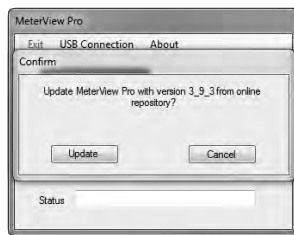
Note: If you decide to update your MeterView Pro software, once the installation has completed, you will be asked if you want to update the setup files located on the meter itself. This way, you will always have the most current version on the meter for future installs.

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

Data logging for one meter at a time is available with MeterView Pro software. More advanced data acquisition may be accomplished by using any Modbus RTU compliant software. Additional information regarding configuration and monitoring of the meter using MeterView Pro software is available online.

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
5EtuP	Setup	Enter *Setup* menu
InPut	Input	Enter *Input* selection menu
PoLAr	Polar	Enter unipolar or bipolar selection menu
un i	Unipolar	Press Enter to select operation with positive signals only (0-30 mV)
b i	Bipolar	Press Enter to select operation with positive & negative signals (±15 mV)
rAnGE	Range	Enter range selection menu
15 m U	15 mV	Set meter for 15 mV input (uni/bi)
25 m U	25 mV	Set meter for ±25 mV input (bi)
30 m U	30 mV	Set meter for 30 mV input (uni)
150m U	150 mV	Set meter for 150 mV input (uni/bi)
250m U	250 mV	Set meter for ±250 mV input (bi)
300m U	300 mV	Set meter for 300 mV input (uni)
rAt io	Ratiometric	Press Enter to select ratiometric operation to compensate for excitation changes.
d-5CAL	Dual-scale	Press Enter to select dual-scale display for some level applications (Select Yes or No)
un it5	Units	Select the display units/tags
dEc Pt	Decimal point	Set decimal point
PU 1	PV1	PV1 decimal point (Level)
PU 2	PV2	PV2 decimal point (Level)
ProG	Program	Enter the *Program* menu
5CALE	Scale	Enter the *Scale* menu
5CAL 1	Scale 1	Enter the *Scale* menu for PV1
5CAL 2	Scale 2	Enter the *Scale* menu for PV2
CAL	Calibrate	Enter the *Calibration* menu
InP 1	Input 1	Calibrate input 1 signal or program input 1 value
d i5 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 i5 2	Display 2	Program display 2 value (up to 32 points)
Error	Error	Error, calibration not successful, check signal or programmed value
d5PLAY	Display	Enter the *Display* menu
L inE 1	Display Line 1	Press Enter to assign the display line 1 parameter (default: PV)
L inE 2	Display Line 2	Press Enter to assign the display line 2 parameter (default: engineering units)
d- IntY	Display intensity	Set display intensity level from 1 to 8
rELAY	Relay	Enter the *Relay* menu
rLY 1	Relay 1	Relay 1 setup
Act 1	Action 1	Set relay 1 action
Auto	Automatic	Set relay for automatic reset
A-mAn	Auto-manual	Set relay for automatic & manual reset any time
LAtCH	Latching	Set relay for latching operation
Lt-CLr	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared

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Display	Parameter	Action/Setting Description
RLtErn	Alternate	Set relay for pump alternation control
SAmPL	Sampling	Set relay for sampling operation
OFF	Off	Disable relay and front panel status LED (Select Off to enable Interlock feature)
SEt 1	Set 1	Program set point 1
rSt 1	Reset 1	Program reset point 1
rLY 2	Relay 2	Relays 2-4 setup
FAiLSF	Fail-safe	Enter *Fail-safe* menu
FLS 1	Fail-safe 1	Set relay 1 fail-safe operation
on	On	Enable fail-safe operation
oFF	Off	Disable fail-safe operation
FLS 2	Fail-safe 2	Set relays 2-8 fail-safe operation
dELAY	Delay	Enter relay *Time Delay* menu
dLY 1	Delay 1	Enter relay 1 time delay setup
On 1	On 1	Set relay 1 On time delay
OFF 1	Off 1	Set relay 1 Off time delay
dLY 2	Delay 2	Enter relays 2-8 time delay setup
brEAH	Loop break	Set relay condition if loop break detected
iGnorE	Ignore	Ignore loop break condition (Processed as a low signal condition)
On	On	Relay goes to alarm condition when loop break is detected
OFF	Off	Relay goes to non-alarm condition when loop break is detected
Aout	Analog output	Enter the *Analog output* scaling menu
diS 1	Display 1	Program display 1 value
Out 1	Output 1	Program output 1 value (e.g. 4.000 mA)
diS 2	Display 2	Program display 2 value
Out 2	Output 2	Program output 2 value (e.g. 20.000 mA)
rESEt	Reset	Press Enter to access the *Reset* menu
rSt Hi	Reset high	Press Enter to reset max display
rSt Lo	Reset low	Press Enter to reset min display
rSt HL	Reset high&low	Press Enter to reset max & min displays
rSt tr	Reset tare	Reset tare
tArE	Tare	Enter Tare menu
CAPtur	Capture	Press Enter to set meter to capture tare using the Tare button
ProG t	Programmable	Press Enter to set meter to programmable tare and enter a value
OFF	Off	Press Enter to disable the tare function
ContrL	Control	Enter *Control* menu
Auto	Automatic	Press Enter to set meter for automatic operation
mAn	Manual	Press Enter to manually control relays or analog output operation
PASS	Password	Enter the *Password* menu
PASS 1	Password 1	Set or enter Password 1
PASS 2	Password 2	Set or enter Password 2
PASS 3	Password 3	Set or enter Password 3
unLoc	Unlocked	Program password to lock meter
Locd	Locked	Enter password to unlock meter
999999 -99999	Flashing	Over/under range condition

Main Menu

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

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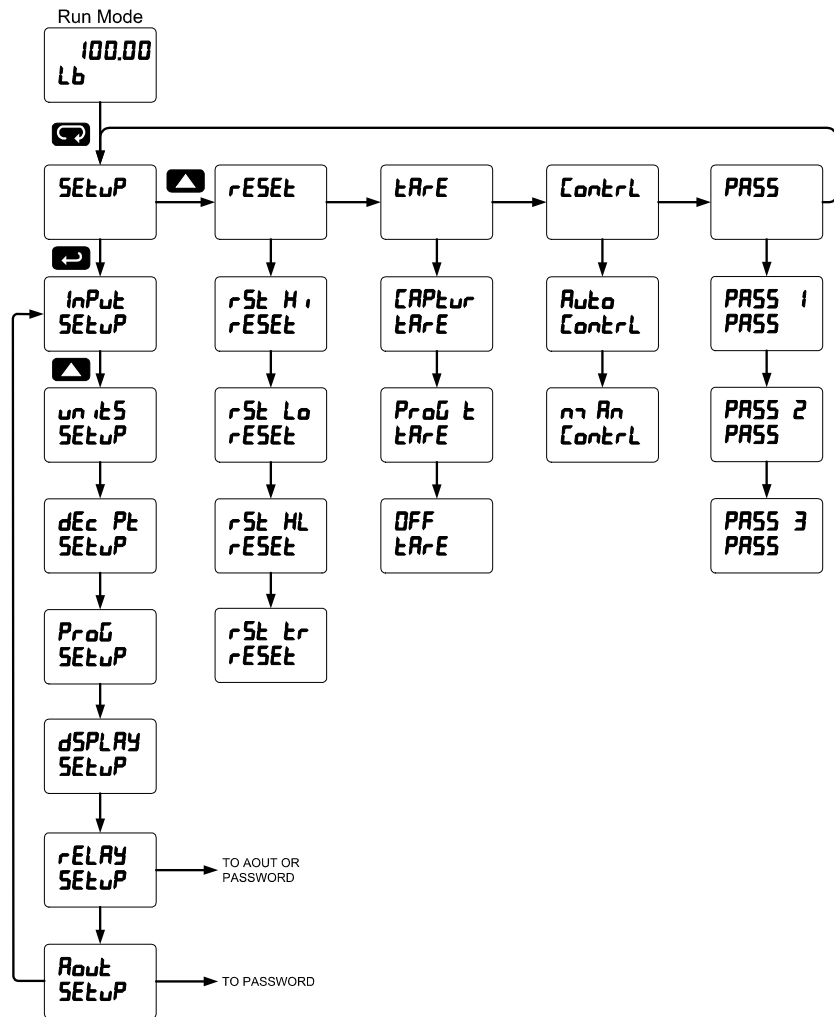
Setting Numeric Values

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

The digit being changed is displayed brighter than the rest.

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

Press the Enter button, at any time, to accept a setting or Menu button to exit without saving changes.
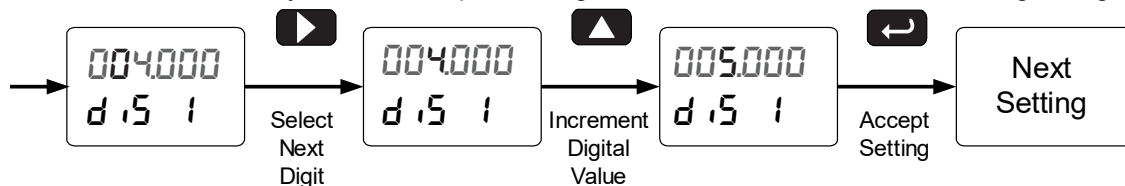
Setting up the Meter (SEtuP)

The *Setup* menu is used to select:

1. Unipolar (e.g. 0-30 mV) or bipolar (e.g. ±25 mV) polarity, input range, ratiometric operation, and dual-scale feature
2. Engineering units
3. Decimal point position
4. Program scaling or live calibration
5. Display parameter and intensity
6. Relay operation
7. 4-20 mA analog output scaling

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

Note: Use the d-SCAL selection to activate the dual-scale level feature - PV1 & PV2 (see introduction on page 6).Set d-SCAL to no if both displays are to be used for anything other than PV1 & PV2.

Note: Scal 1 & Scal 2 are displayed if d-SCAL is selected under the Setup Input menu. They correspond to the PV1 & PV2 scales.
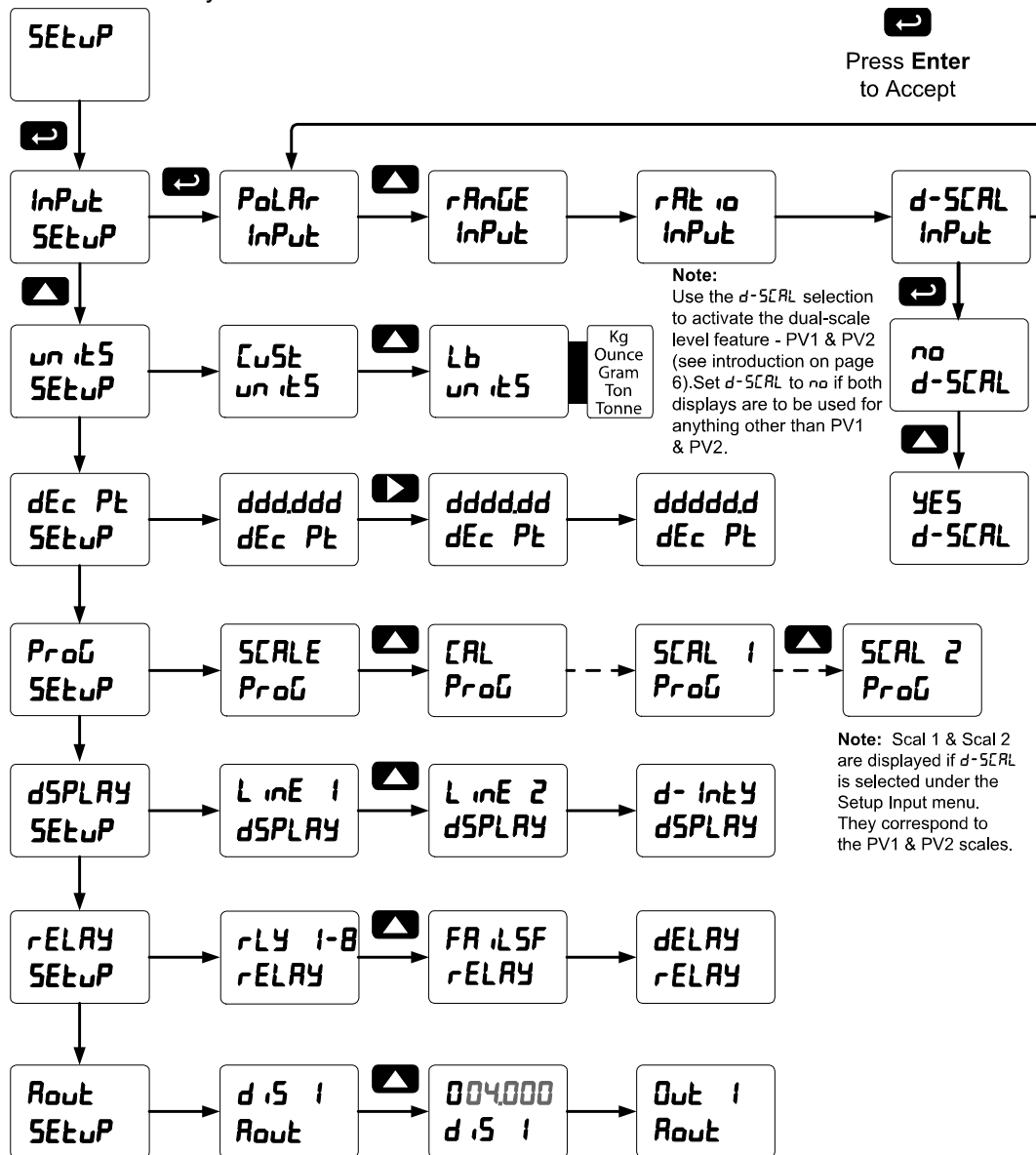
Setting the Input Signal (InPut)

Enter the Input menu to set up the input polarity, range, Ratiometric operation, and dual-scale feature.

The meter is capable of accepting any signal from -250 to 250 mV in bipolar mode or up to 300 mV in unipolar mode.

After selecting "Yes" or "No" for ratio, d-SCAL is displayed. Selecting "Yes" enables the dual-scale feature, allowing scaling of the same input in two different scales (for PV1 & PV2) or displaying the percentage of PV1.
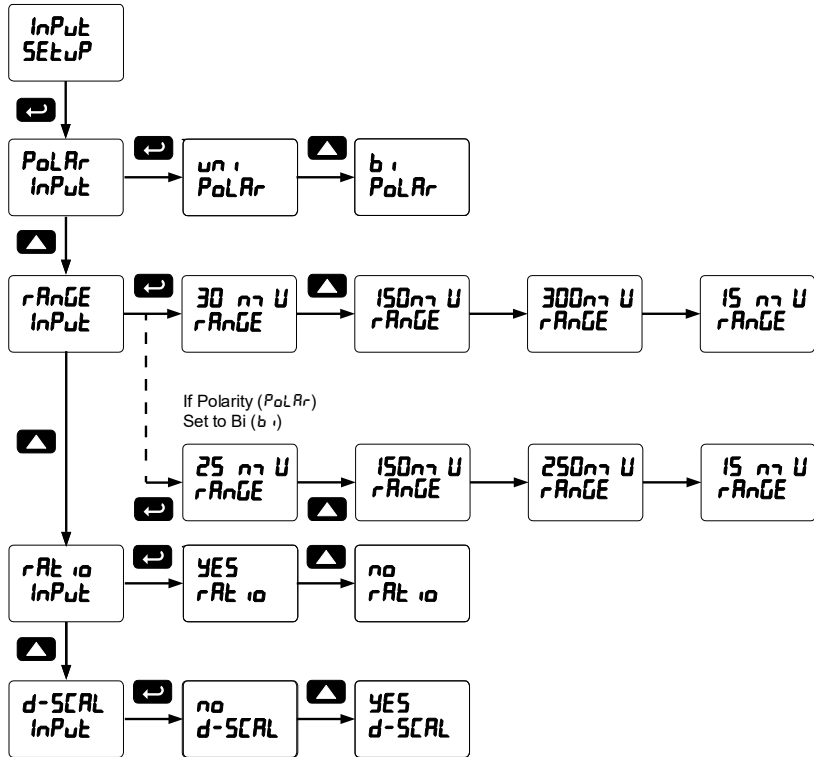
Input Polarity Selection (PoLAr)

Select unipolar operation for inputs in ranges from 0 to 300 mV and select bipolar operation for inputs in ranges from -250 mV to +250 mV. This setting determines the selectable ranges for the millivolt input.

If Polarity (PoLAr) Set to Bi (bi)

Range Selection (rAnGE)

This menu is used to select the input range. The selections listed are determined by the *Polarity* setting.

Unipolar mode: 0-15, 0-30, 0-150, 0-300 mV

Bipolar mode: ±15, ±25, ±150, ±250 mV

Ratiometric Operation (rAtio)

Ratiometric operation corrects the measured strain gauge signal for up to ±5% variation of either the internal or external excitation power supply. In order to use the ratiometric operation, the ratiometric operation menu must be set to yes (YES).

Dual-Scale (d-SCAL)

The analog input can be displayed in two different scales, by enabling the dual-scale feature in the *Setup-Input* menu, see page 28.

To enable the dual-scale feature you must select d-SCAL in the Input selection menu.

Setting the Input Units (un it5)

Enter the pre-defined engineering unit or custom unit. The pre-defined units have automatic conversion factors. This unit will be displayed if d un it is selected as the lower display parameter. See the flow chart on page 34 to access the display menu to show the unit on the lower display.

The custom unit may also be used to enter a display tag.

Pre-defined engineering units: lb, kg, ounce, gram, ton (short), tonne (metric ton). The meter converts the reading according to the unit selected (e.g. 100.00 lb = 45.36 kg = 45359.2 g = 1600 oz).

Unit Conversions: After scaling values in the *Scale* menu have been entered during setup, automatic unit conversions are done when switching from any standard unit to any other standard unit during future changes of the *Units* menu.

Once a standard unit has been selected in the units menu, the user must then set their scaling values for that unit (under the setup menu) in order for that unit's conversion factor to take effect. Otherwise, the meter will allow the user to freely switch between standard unit selections, without applying a conversion factor.

Note that if the dual-scale feature is selected in the *Setup* menu, both PV1 and PV2 will be converted from the original standard unit to the new standard unit. A scaled PV not scaled for the selected units must be reprogrammed. *Example*: If PV 1 is scaled for pounds, and PV 2 scaled for gallons; if the Un it5 selection is changed from Lb to ouncE, PV 2 will need to re-scaled manually back to gallons.
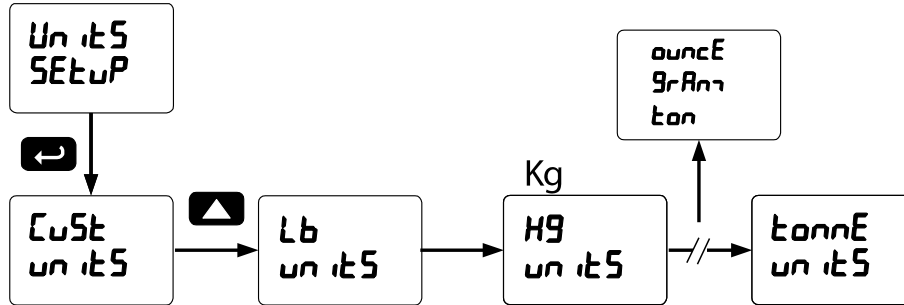
Note: PV1 and PV2 may use different standard units as starting points, however the user must select the unit and complete scaling for both PV1 and PV2 individually. For example, set PV1 equal to "Lbs" and complete the scaling for PV1 only. PV1 is now reading in Lbs. Then, change the units for PV2 to be "Kg" and complete the scaling for PV2. PV2 will read in kilograms and PV1 will reflect the conversion from Lbs to Kgs.

Setting the Input Units or Custom Tags (*unitS*)

Enter the input unit or custom tag that will be displayed if *d unit* is selected as the little display parameter. See the flow chart on page 34 to access the display menu to show the unit or tag on the little display. The engineering units or custom legends can be set using the following 7-segment character set:

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

Notes:

Degree symbol represented by (<) if programming with MeterView® Pro.

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.

Setting the Decimal Point (*dEc Pt*)

The decimal point may be set with up to five decimal places or with no decimal point at all.

Pressing the Right arrow moves the decimal point one place to the right until no decimal point is displayed, and then it moves to the leftmost position. Pressing the Up arrow moves the decimal point one place to the left.

If the dual-scale level feature is selected, the decimal point selections for PV1 & PV2 are enabled.
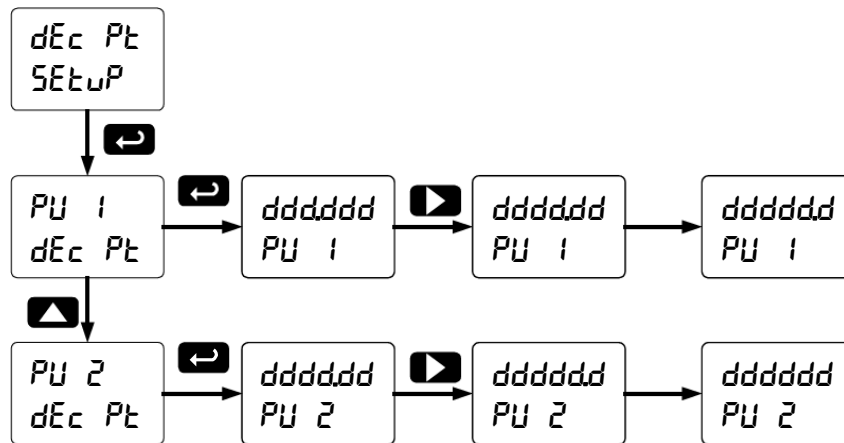
Programming the Meter (*ProG*)

The Program menu contains the Scale and the Calibrate menus. For strain gauge and load cell applications it is recommended to calibrate the meter using the sensor as the input and with ratiometric operation enabled to compensate for small variation in the excitation voltage.

It is **very important** to read the following information, before proceeding to program the meter:

- 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.
- Use the *Scale* menu to scale the process input (e.g. 4-20 mA). A calibrated signal source is not needed to scale the meter.
- Use the *Calibrate* menu to apply a signal from a calibrator or a flowmeter.
- The PD6100 is a single input meter with dual-scale capability.

The *Program* menu contains the *Scale* and the *Calibrate* menus.

Note: The Scale and Calibrate functions are exclusive of each other. The meter uses the last function programmed. Only one of these methods can be employed at a time. The Scale and Calibrate functions can use up to 32 points (default is 2). The number of points should be set in the Advanced Features menu under the Multi-Point Linearization (*L inEAr*) *menu selection prior to scaling and calibration of the meter, see page 52 for details.*

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

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

Program Menu for Single Scale Process
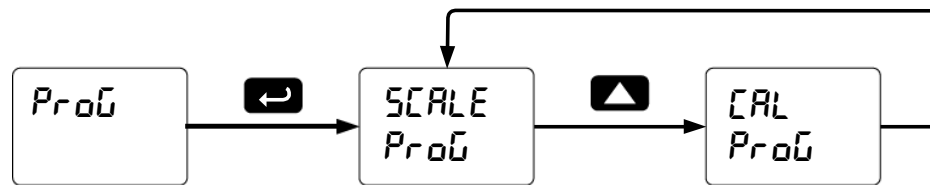
Program Menu for Dual-Scale Level Applications
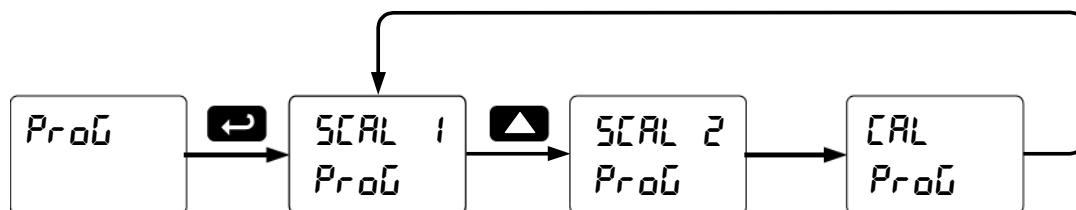
Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu; see Advanced Features Menu, page 49.

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Calibrating the Meter with Strain Gauge/Load Cell (CAL)

> Note: To scale the meter without a signal source refer to Scaling the Meter (SCALE), page 33.

The meter can be calibrated to display the process variable in engineering units by applying the appropriate input signal and following the calibration procedure.

The use of a calibrated signal source is strongly recommended to calibrate the meter.
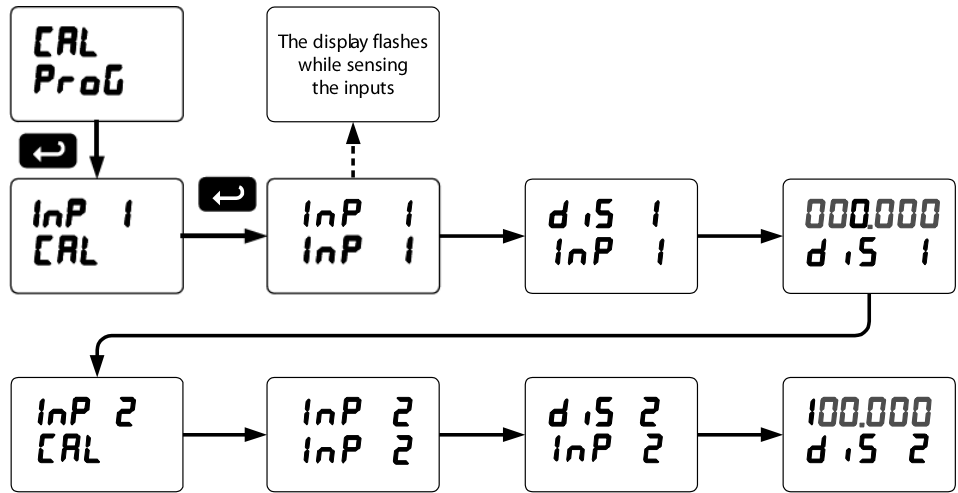
> *Warm up the meter for at least 15 minutes before performing calibration to ensure specified accuracy.*

Multi-Point Calibration & Scaling

The meter is set up at the factory for 2-point linear calibration. The number of points for multi-point calibration/scaling is set up in the *Advanced Features* menu. Up to 32 linearization points may be selected for PV1 and up to 8 linearization points may be selected for PV2. See page 52 for details.

Scaling the Meter (SCALE)

The strain gauge input (e.g. 0-100 mV) can be scaled to display the process variable in engineering units.

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

> For instructions on how to program numeric values see *Setting Numeric Values*, page 26.
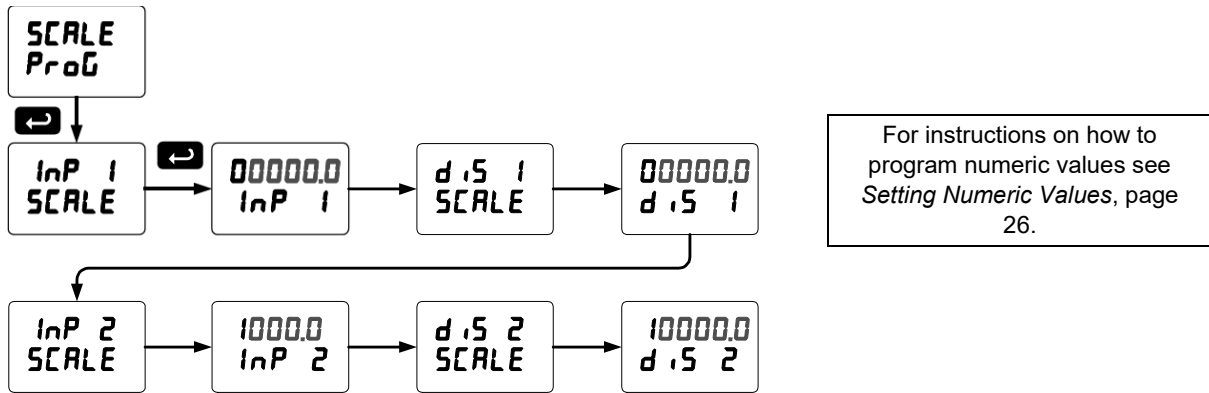
Dual-Scale for Level Application

The analog input can be displayed in two different scales, by enabling the dual-scale feature (d-SCAL) in the *Setup-Input* menu, see page 28.

To enable the dual-scale feature for some level applications you must select d-SCAL in the Input selection menu.

Scaling the Input for PV1 (SCAL 1)   *Scaling the Input for PV2 (SCAL 2)*
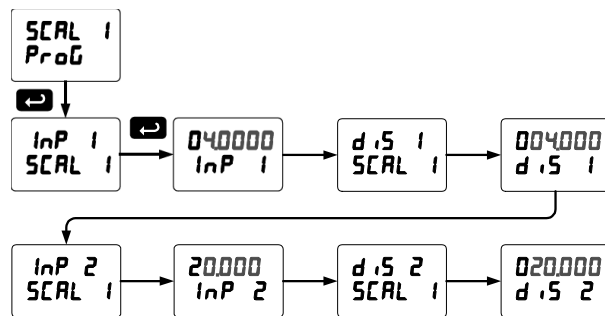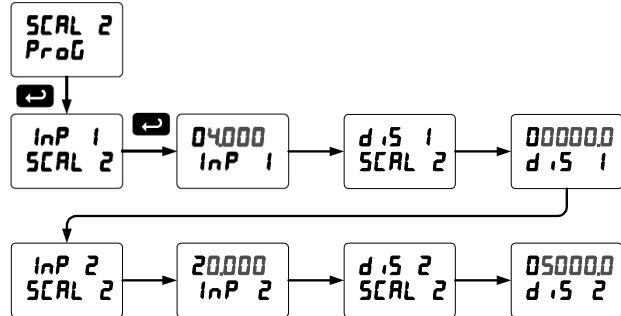
Error Message (Error)

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

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

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

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

Minimum Input Span

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

Input Range	Input 1 & Input 2 Span
15 mV	0.2 mV
25 mV, 30 mV	0.4 mV
150 mV	2.0 mV
250 mV, 300 mV	4.0 mV

Setting the Display Parameter & Intensity (dSPLAY)

The main display (L in E 1) can be programmed to display:

1. Process value 1 (PV1)
2. Process value 2 (PV2)
3. Percent of PV1 (PCT)
4. Relay set points
5. Max & min values
6. Modbus input
7. Display reading and units
8. Display gross
9. Toggle net & gross

The small display (L in E 2) can be programmed to display:

1. Unit
2. Process value 1 (PV1)
3. Process value 2 (PV2)
4. Percent of PV1 (PCT)
5. Relay set points
6. Max & min values
7. Engineering units or custom legends
8. Modbus input
9. Off (no display)
10. Toggle reading and units
11. Display gross
12. Toggle net/gross
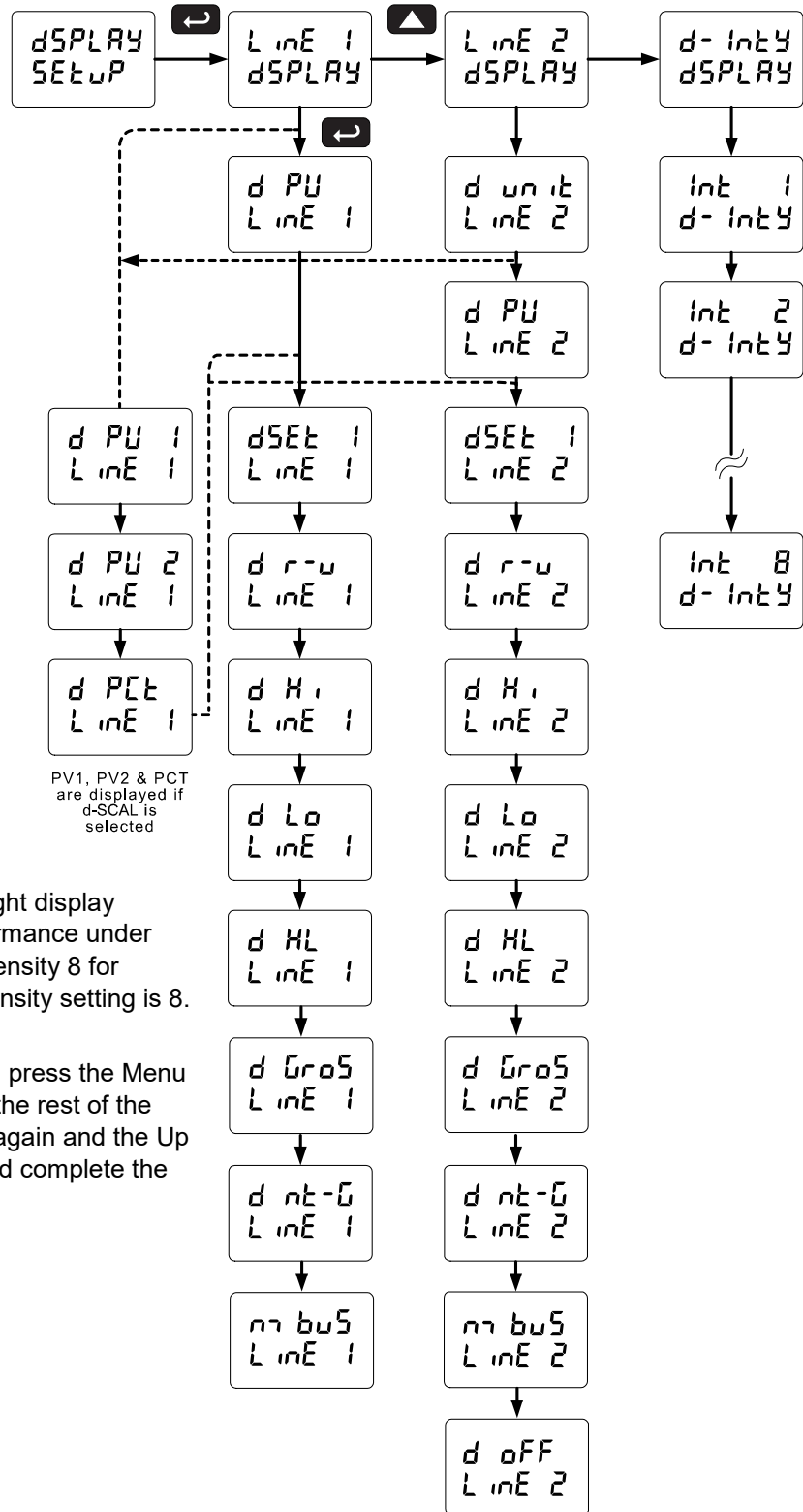
Display Intensity: The meter has eight display intensity levels to give the best performance under various lighting conditions. Select intensity 8 for outdoor applications. The default intensity setting is 8.

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

Setting the Relay Operation (rELAY)

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

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

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

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

35
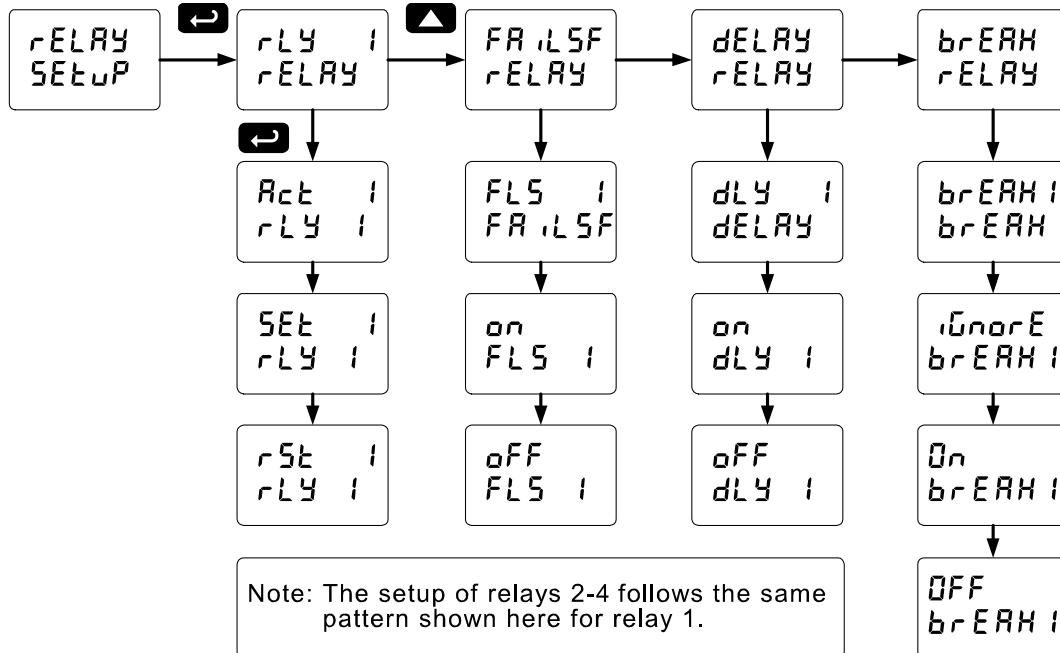
Setting the Relay Action

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 2-8 are set up in a similar fashion.

| From Relay 1 Menu | ↵ | Act 1 rLY 1 | → | Auto Act 1 |

↑

A-m An Act 1

↓

LAtcH Act 1

↓

Lt-CLr Act 1

↓

ALtErn Act 1

↓

SAm PL Act 1

↓

oFF Act 1

| SEt 1 rLY 1 | ↵ | **Program Set Point** |

↑

| rSt 1 rLY 1 | → | **Program Reset Point** |

Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

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

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

Setting Fail-Safe Operation

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

Programming Time Delay

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

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

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

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

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):

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

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

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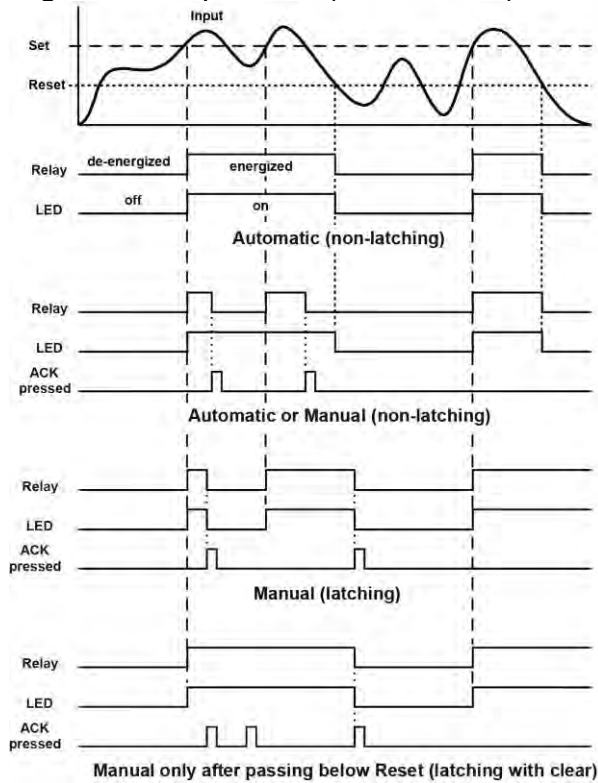
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.
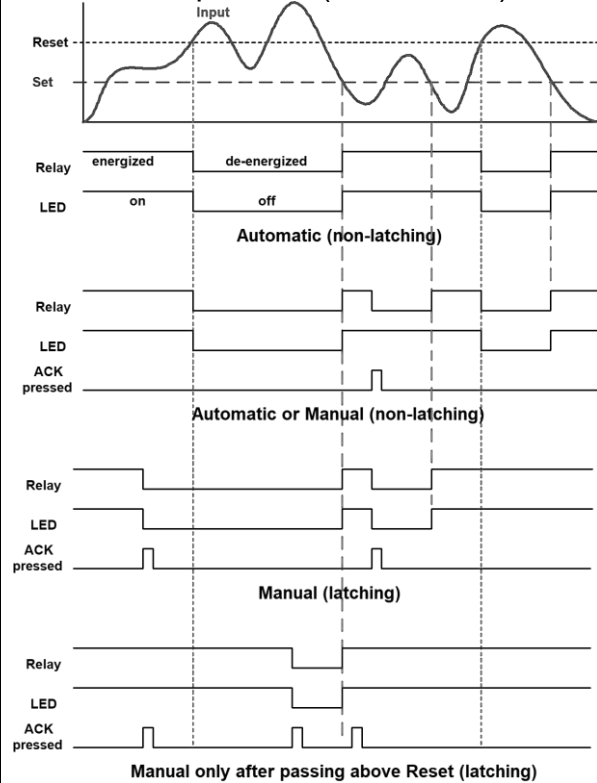
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point and then go below it.

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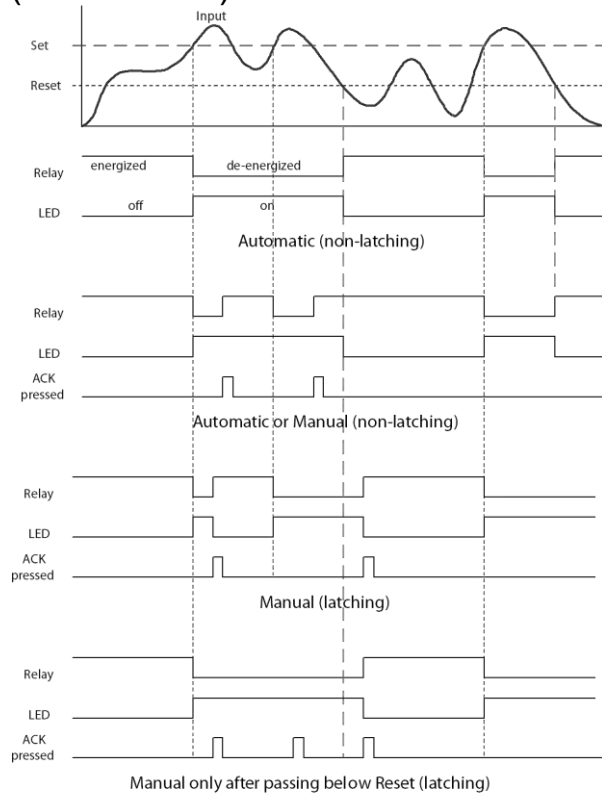
Automatic (non-latching)

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)
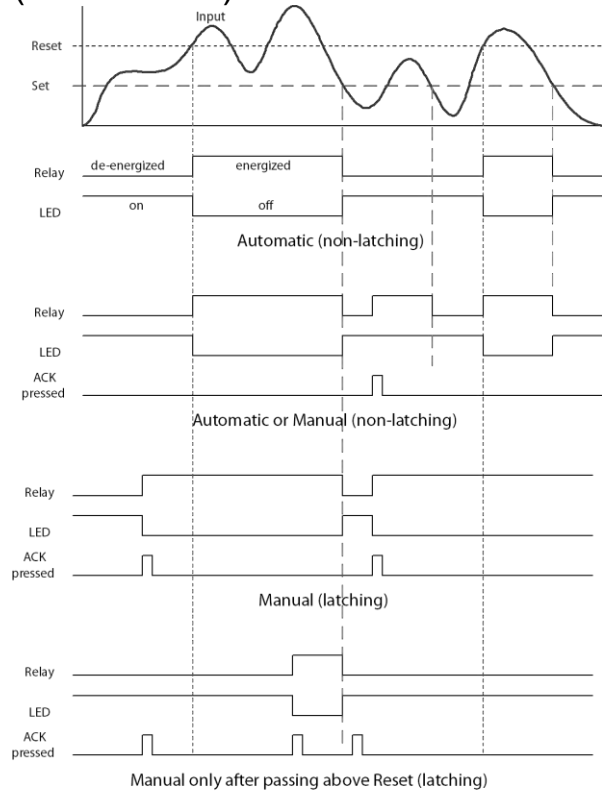
Automatic (non-latching)

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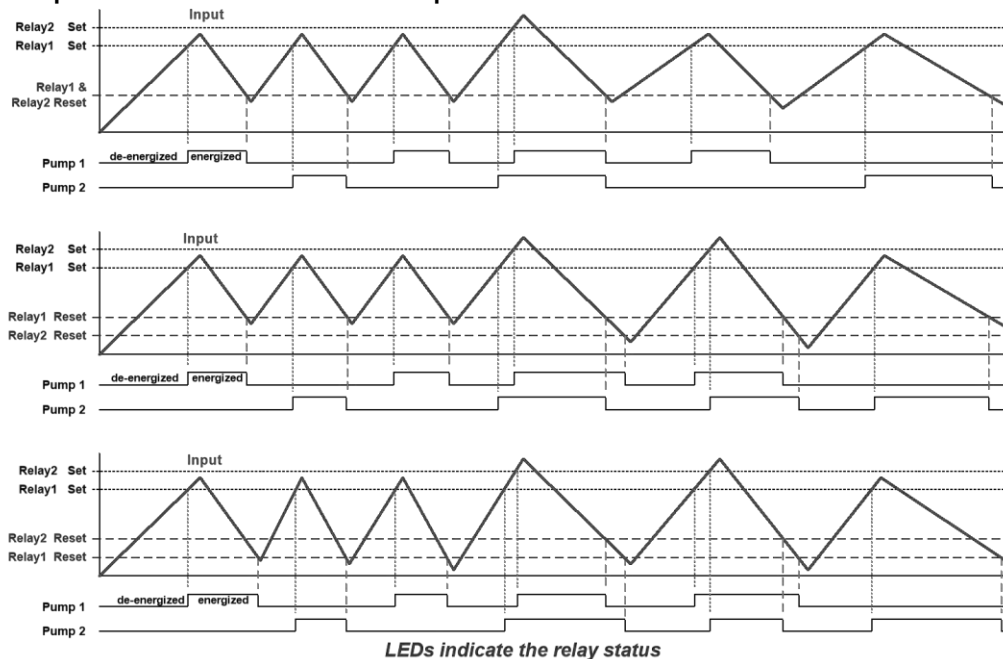
Relay Sampling Operation
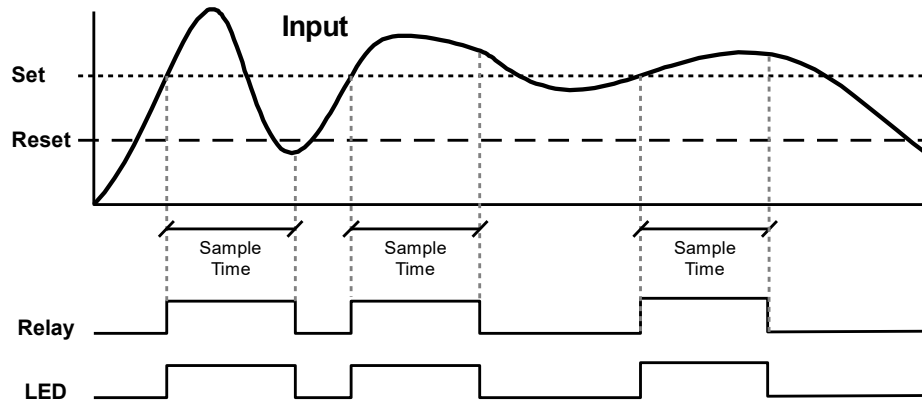
When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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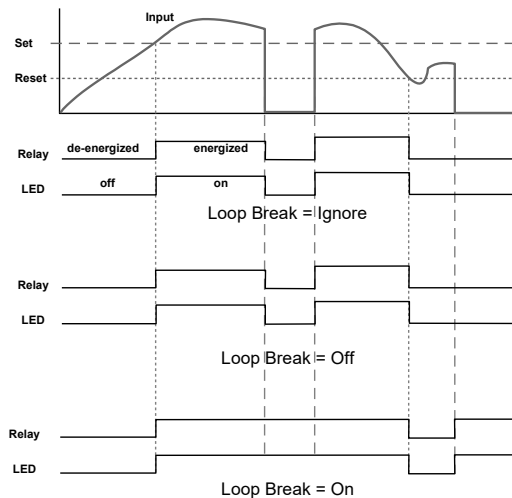
When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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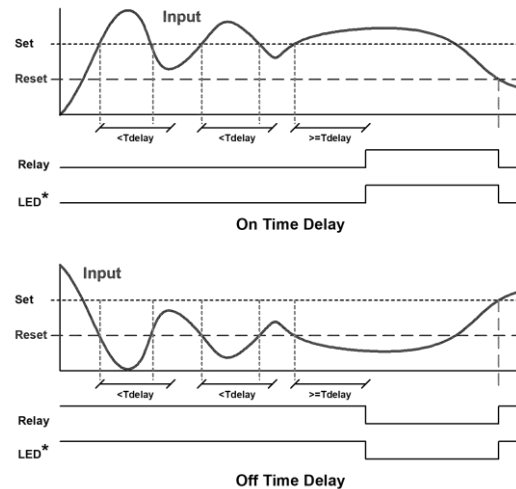
When the signal crosses the set point, the *On* time delay timer starts and the relay trips when the time delay has elapsed. If the signal drops below the set point (high alarm) before the time delay has elapsed, the *On* time delay timer resets and the relay does not change state. The same principle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

Note: If "Automatic or Manual (Ꭿ-ᴨ� Ꭿᴨ)" 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:

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

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

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

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

Latching and Non-Latching Relay Operation

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

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-nr 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 front panel function keys F1-F3 (Default: F3 assigned to ACK).
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 19).

When the ACK button or the assigned digital input is closed, all relays programmed for manual reset are acknowledged.
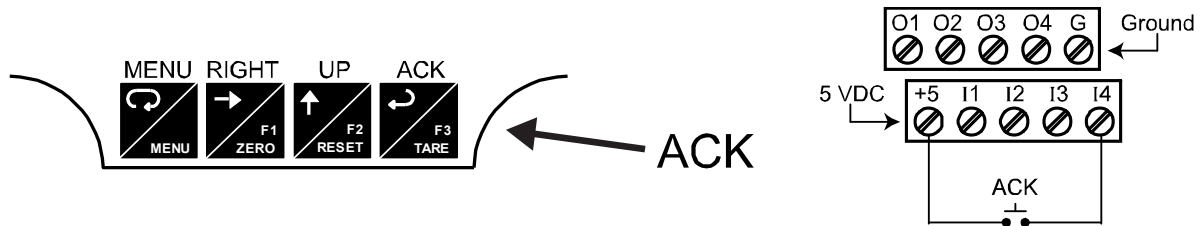
Figure 26. Acknowledge Relays w/Function Key or Digital Input

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 8 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 to10.000, 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.

Application #2: Pump Alternation Using Relays 3 & 4

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

Set and Reset Point Programming			
Relay	Set Point	Reset Point	Function
1	495	750	Controls low alarm
2	7500	6900	Controls high alarm
3	7000	900	Controls backup pump
4	6000	1000	Controls main pump

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

1. Relay #4 turns the main pump on at 6000 gallons and turns it off at 1000 gallons.

2. With the Pump Alternation feature activated, the next time the level reaches 6000 gallons, relay #3 transfers and starts the backup pump.

3. If the backup pump is not able to keep up, and the level reaches 7000 gallons, relay #4 transfers and starts the main pump as well.

4. Relay #2 trips the High Level Alarm at 7500 gallons and resets at 6900 gallons.

5. Relay #1 trips the Low Level Alarm at 495 gallons and resets at 750 gallons.
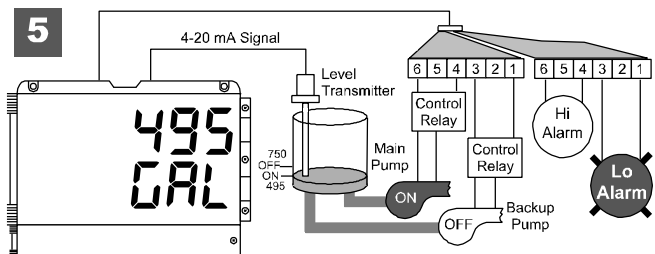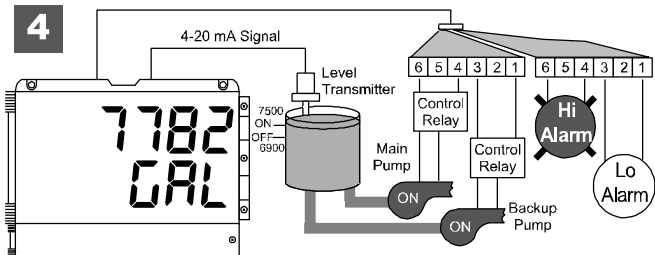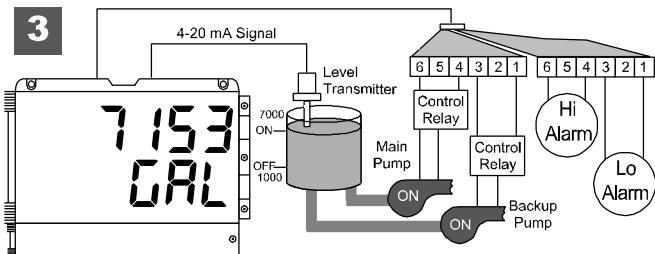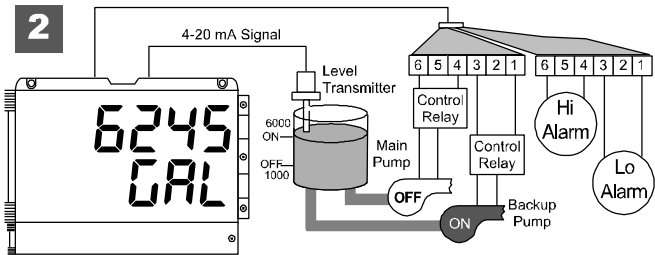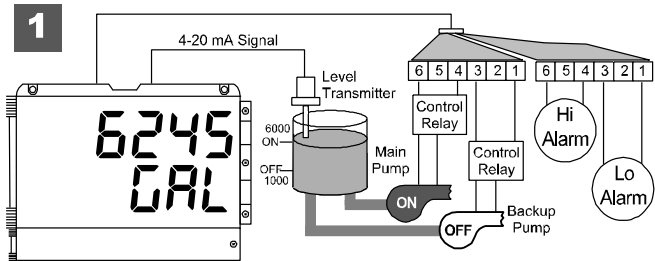
Setting up the Interlock Relay (Force On) Feature

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.

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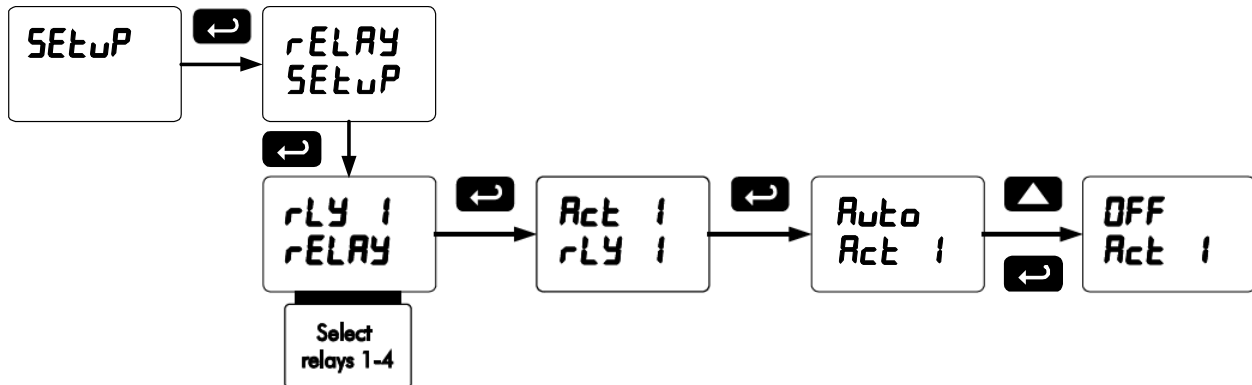
2. In the Advanced features – *User* menu program any of the digital inputs to *Force On* any of the internal relays (1-4).
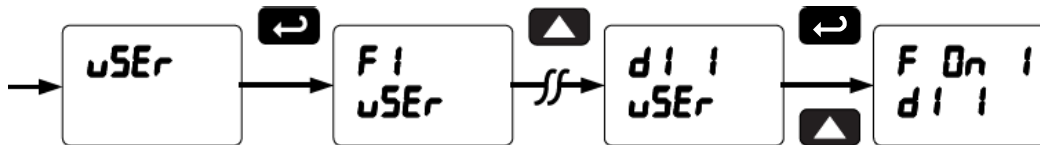
3. Connect a switch or dry contact between the +5V terminal and the corresponding digital input (dI-1 to dI-4) terminal.
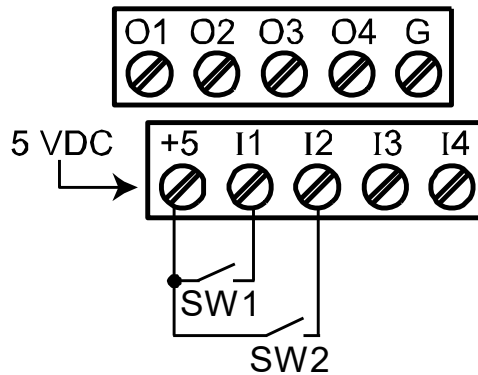
Interlock Relay Operation Example

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

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

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

```
┌──────────┐
│ Rout     │
│ SEtuP    │
└──────────┘
     │ ↵
     ▼
┌──────────┐   ↵   ┌──────────┐     ┌──────────┐     ┌──────────┐
│ d iS  1  │  ──▶  │ 004.000  │ ──▶ │ Out  1   │ ──▶ │ 04.000   │
│ Rout     │       │ d iS  1  │     │ Rout     │     │ Out  1   │
└──────────┘       └──────────┘     └──────────┘     └──────────┘
                                                           │
     ┌─────────────────────────────────────────────────────┘
     ▼
┌──────────┐     ┌──────────┐     ┌──────────┐     ┌──────────┐
│ d iS  2  │ ──▶ │ 020.000  │ ──▶ │ Out  2   │ ──▶ │ 20.000   │
│ A  out   │     │ d iS  2  │     │ Rout     │     │ Out  2   │
└──────────┘     └──────────┘     └──────────┘     └──────────┘
```
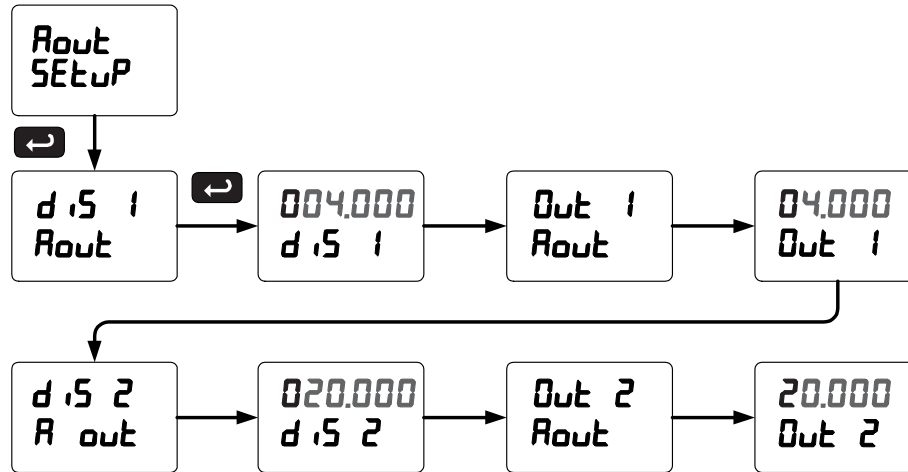
> *For instructions on how to program*
> *numeric values see Setting*
> *Numeric Values, page 26.*

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). The tare value used to zero the display may be reset by selecting "reset tare" (rSt tr).

Tare Menu (tArE)

The *Tare* menu is used to select the tare mode. There are three modes of operation: *Capture Tare*, *Programmable Tare*, and *Off*.

Capture Tare: Pressing the Tare key zeroes the display and the "T" indicator flashes indicating that tare is applied to the reading (e.g. Net weight).

Programmable Tare: Program a known value to be subtracted from the display value to obtain the net value. Pressing Reset tare clears the tare value to zero. Programmable Tare will not tare negative PVs. Use Capture Tare for negative PVs.

Off: Tare function is disabled and pressing Tare key has no effect.

Tare Functionality (tArE)

The tare function zeroes out the display. In the case of scale weight, tare is used to eliminate container weight and provide net weight readings.

Before tare   **After capture tare**   **After reset tare**

Control Menu (Contrl)

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.
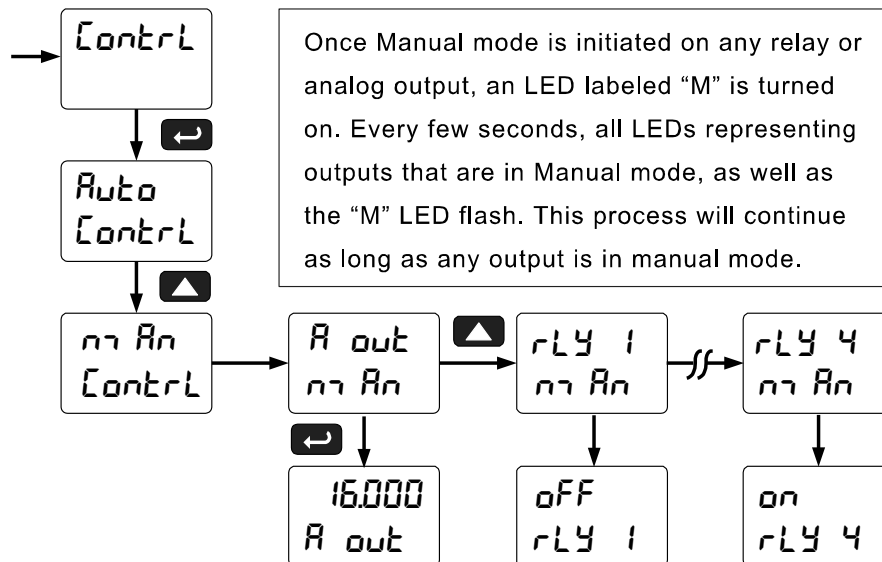
Setting up the Password (𝖯𝖠𝖲𝖲)

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 26.
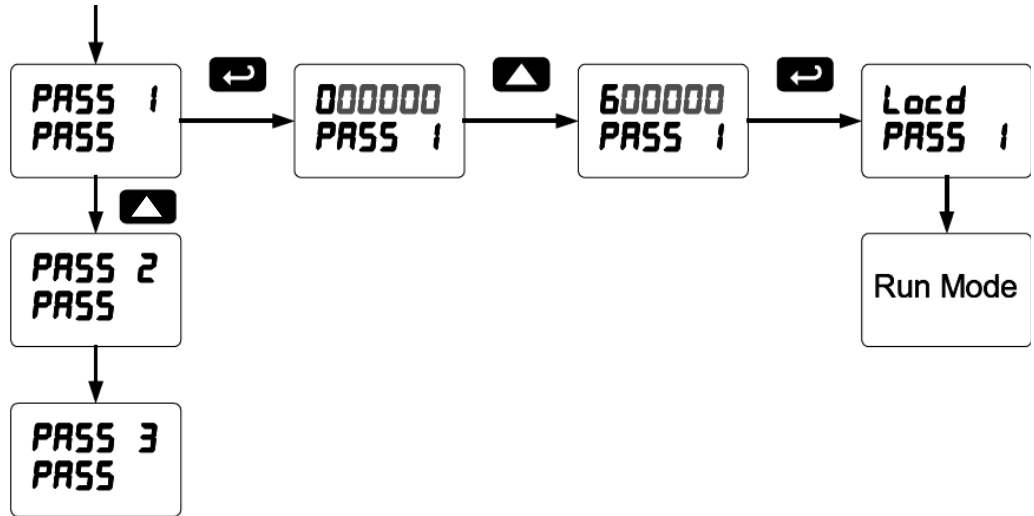
Making Changes to a Password Protected Meter

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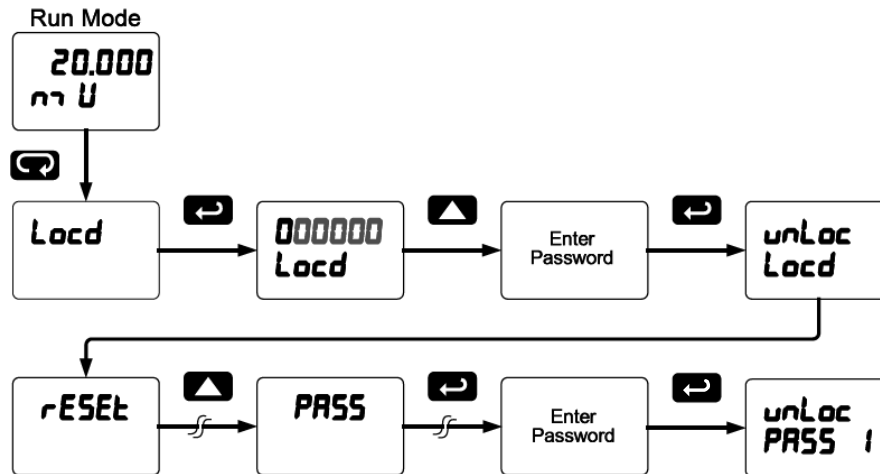
If the correct six-digit password is entered, the meter displays the message *unLoc* (*unlocked*) and the protection is disabled until a new password is programmed.

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.

Advanced Features Menu

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

Press and hold the Menu button for three seconds to access the advanced features of the meter.
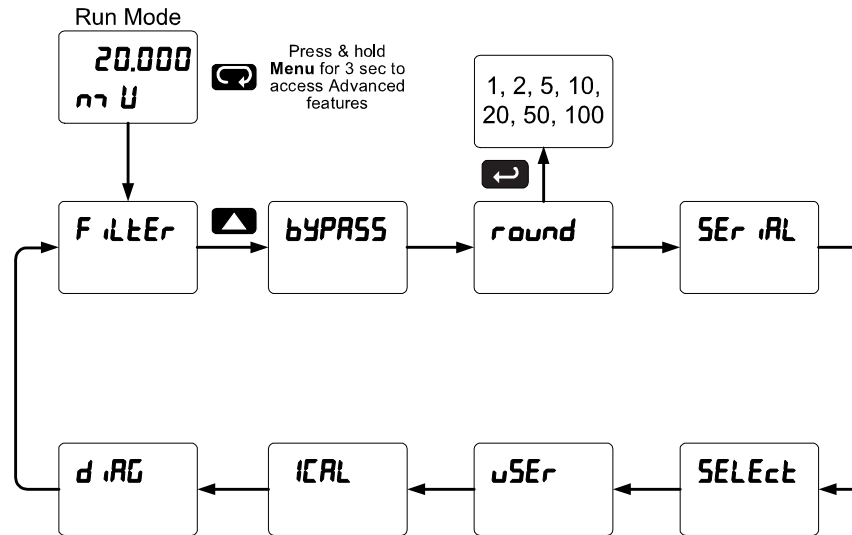
Advanced Features Menu & Display Messages

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

Display	Parameter	Action/Setting
F ıLtEr	Filter	Set noise filter value
bYPASS	Bypass	Set filter bypass value
round	Round	Set the rounding value for display variables
SEr ıAL	Serial	Set serial communication parameters
SLAUE ıd	Slave ID	Set slave ID or meter address
bAud	Baud rate	Select baud rate
tr dLY	Transmit delay	Set transmit delay for serial communication
PAr ıtY	Parity	Select parity Even, Odd, or None with 1 or 2 stop bits
t-bYt	Time byte	Set byte-to-byte timeout
SELEct	Select	Enter the Select menu (function, cutoff, out)
Functn	Signal input conditioning	Select linear, square root, programmable exponent, or round horizontal tank function
L ınEAr	Linear	Set meter for linear function and select number of linearization points
PU 1	PV1	Select PV1 number of linearization points
PU 2	PV2	Select PV2 number of linearization points
no PtS	Number of points	Set PV1 for 2 to 32-point linearization Set PV2 for 2 to 8-point linearization
SquArE	Square root	Set meter for square root extraction
ProG E	Programmable exponent	Set meter for programmable exponent and enter exponent value

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Display	Parameter	Action/Setting
rht	*Round horizontal tank*	Set meter for round horizontal tank volume calculation
Inch	*Dimension*	Calculate volume in gallons
cm	*Dimension*	Calculate volume in liters
dIAm r	*Diameter*	Enter the tank's diameter in inches
LEnGth	*Length*	Enter the tank's length in inches
CutoFF	*Cutoff*	Set low cutoff
Auto 0	*Auto Zero*	Enter the Auto Zero function (on/off)
AoutPr	*Analog output programming*	Program analog output parameters
SourcE	*Source*	Select source for the 4-20 mA output
O-rAnG	*Overrange*	Program mA output for display overrange
u-rAnG	*Underrange*	Program mA output for display underrange
brEAH	*Break*	Set input break condition operation
m AH	*Maximum*	Program maximum mA output allowed
m in	*Minimum*	Program minimum mA output allowed
CAL ib	*Calibrate*	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 m A	*4 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 m A	*20 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
uSEr	*User I/O*	Assign function keys and digital I/O
F 1	*F1 function key*	Assign F1 function key
F2	*F2 function key*	Assign F2 function key
F3	*F3 function key*	Assign F3 function key
F4	*F4 function*	Assign F4 function (digital input)
d 1	*Digital input 1*	Assign digital input 1 – 4, if expansion modules are connected
d0 1	*Digital output 1*	Assign digital output 1 – 4, if expansion modules are connected
ICAL	*Internal source calibration*	Enter internal source calibration (used for scaling the meter without a signal source)
15m U	*15 mV calibration*	Calibrate 15 mV input range (internal reference source used for scaling the input)
20m U	*20 mV calibration*	Calibrate 30 mV input range (internal reference source used for scaling the input)
100m U	*100 mV calibration*	Calibrate 150 mV input range (internal reference source used for scaling the input)
200m U	*200 mV calibration*	Calibrate 300 mV input range (internal reference source used for scaling the input)
StroFF	*Strain offset*	Calibrate the offset of the input circuit
U Lo	*mV low*	Calibrate low mV input (e.g. 0 mV)
U H i	*mV high*	Calibrate high mV input (e.g. 100 mV)
d iAG	*Diagnostics*	Display parameter settings
LEd t	*LED test*	Test all LEDs
InFo	*Information*	Display software and S/N information
ErASE	*Erase*	Delete the MeterView Pro installation files from the meter

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Noise Filter (F ilEEr)

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

Noise Filter Bypass (bYPASS)

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

Rounding Feature (round)

The rounding feature is used to give the user a steadier display with fluctuating signals. Rounding is used in addition to the filter function.
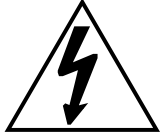
Rounding causes the display to round to the nearest value according the rounding selected. See examples below:

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

Modbus RTU Serial Communications (SEr iAL)

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

The meter may be connected to a PC for initial configuration via the onboard micro USB connection. For ongoing digital communications with a computer or other data terminal equipment, an RS-232, or RS-485 option is required; see *Ordering Information* on page 4 for details.

> **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.***

Note: More detailed instructions are provided with each optional serial communications adapter.

Note: Refer to the Modbus Register Tables for details.

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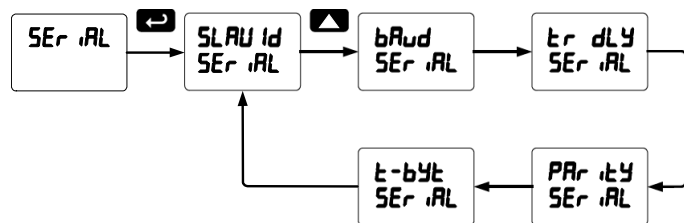
Select Menu (SELEct)

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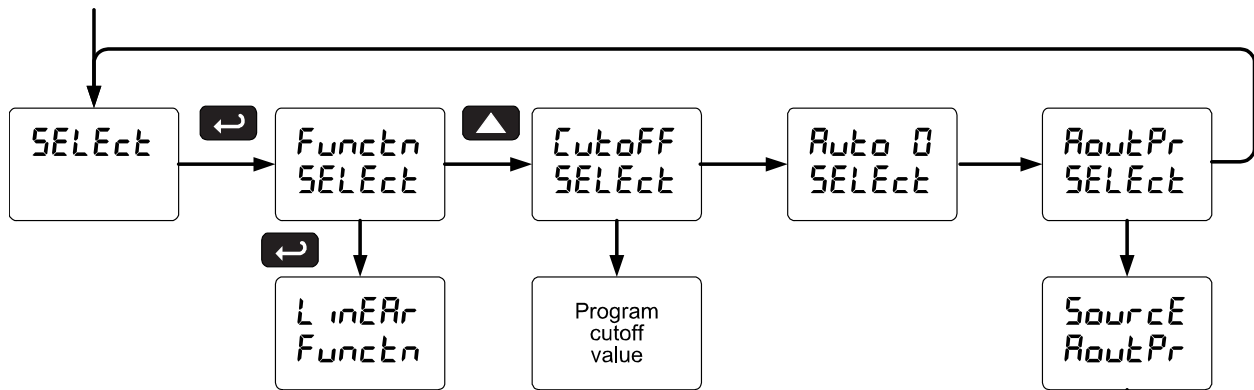
Signal Input Conditioning (Functn)

The *Function* menu is used to select the signal input conditioner applied to the input: linear, square root, programmable exponent, or round horizontal tank volume calculation. The multi-point linearization is part of the linear function selection.

Meters are set up at the factory for linear function with 2-point linearization. The linear function provides a display that is linear with respect to the input signal.

Multi-Point Linearization (L inEAr)

Meters are set up at the factory for linear function with 2-point linearization. Up to 32 linearization points can be selected for PV1 under the linear function. The multi-point linearization can be used to linearize the display for non-linear signals such as those from level transmitters used to measure volume in odd-shaped tanks or to convert level to flow using weirs and flumes with complex exponent.

If the dual-scale level feature has been selected, the menus for PV1 & PV2 are enabled. PV2 can be programmed with up to 8 linearization points.
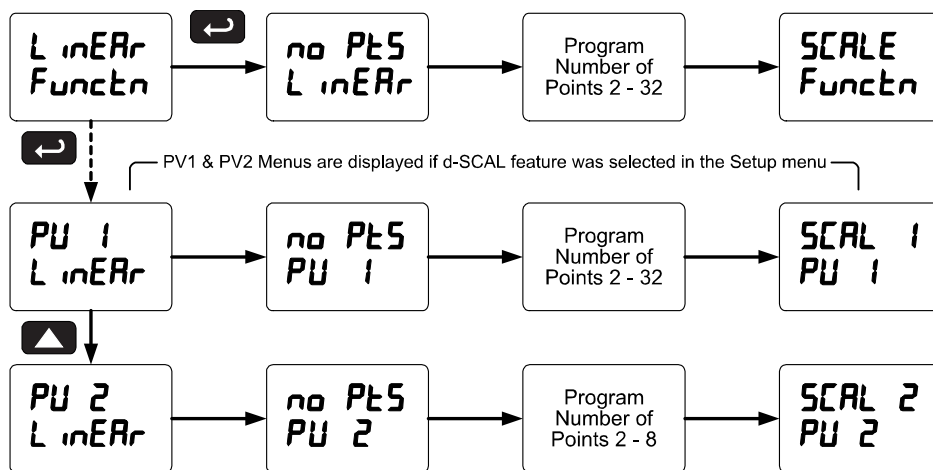
Auto-Zero (Auto 0)

Auto-zero corrects for drift that can occur over time that causes the input signal to slowly change. The meter will continue to read zero despite slow and small changes to the input signal. The auto-zero value represents the percent of full scale drift that the meter will correct.

Under normal circumstances, when the signal increases quickly, by an amount greater than the auto-zero percent of full scale, the value will not be adjusted for. Slow signal changes that occur over time at

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increments less than the auto-zero value, will not register on the meter (example: dust on a load cell or sensor drift over time).

Low Cutoff (*CutoFF*)

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

The cutoff value may be programmed from 0 to 999999. The meter will display zero below the cutoff value. Programming the cutoff value to zero disables the cutoff feature.

Analog Output Programming (*AoutPr*)

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

1. Source: Source for generating the 4-20 mA output (e.g. PV)
2. Overrange: Analog output value with display in overrange condition
3. Underrange: Analog output value with display in underrange condition
4. Break: Analog output value when loop break is detected
5. Max: Maximum analog output value allowed regardless of input
6. Min: Minimum analog output value allowed regardless of input
7. Calibrate: Calibrate the internal 4-20 mA source reference used to scale the 4-20 mA output

Analog Output Source

The source for generating the 4-20 mA output may be assigned to the process variable, maximum or minimum value reached by the process, one of the set points, or the Modbus PV input.
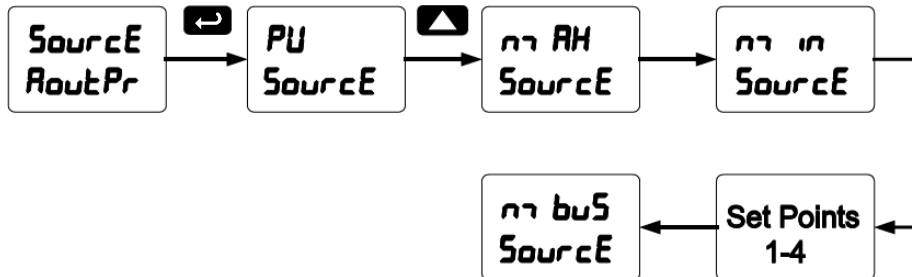
Analog Output Calibration

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

Programmable Function Keys User Menu (*uSEr*)

The *User* menu allows the user to assign the front panel function keys F1, F2, and F3, the digital input F4 (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.

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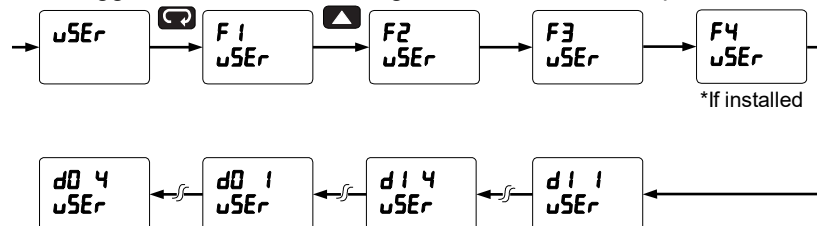
Function Keys & Digital I/O Available Settings

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

| Display	Description	Display	Description
rSt Hi	Reset the stored maximum display value	Ln2 Hi	Display maximum display value on line 2
rSt Lo	Reset the stored minimum display value	Ln2 Lo	Display minimum display value on line 2
rSt HL	Reset the stored maximum & minimum display values	Ln2 HL	Display maximum & minimum display values on line 2
tArE	Capture tare and zero the display	2Ero	Zero the display (this is different from *capture tare* because it cannot be reset)
rSt tr	Reset captured tare and resume normal operation	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 44 for details about interlock relays.
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	Contrl	Directly access the control menu
O Hold	Hold current relay states as they are until a button assigned to *enable relays* (rLY E) is pressed	d iSAbL	Disable the selected function key or digital I/O
		AcH	Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching
d Hold	Hold the current display value momentarily while the function key or digital input is active. The process value will continue to be calculated in the background.	rESEt	Directly access the reset menu
		mEnu	Mimic the menu button functionality (digital inputs only)
Ln1 Hi	Display maximum display value on line 1	riGHt	Mimic the right arrow/F1 button functionality (digital inputs only)
Ln1 Lo	Display minimum display value on line 1	uP	Mimic the up arrow/F2 button functionality (digital inputs only)
Ln1 HL	Display maximum & minimum display values on line 1	EntEr	Mimic the enter/F3 button functionality (digital inputs only)
Ln2mU	Display the mV input on line 2	ALm1 1*	Provide indication when alarm 1 (*through 8) has been triggered (digital outputs only)

Tare (tArE)

The tare function zero's out the display. In the case of scale weight, tare is used to eliminate container weight and provide net weight readings. There are two tare functions; Capture Tare and Reset Tare.

When the capture tare function is used, the display reading is offset by the displayed amount to make the displayed value zero. This modified display value is the net value. The originally displayed value without the tare offset is the gross value. Both may be chosen as a display option.

Before tare   **After capture tare**   **After reset tare**
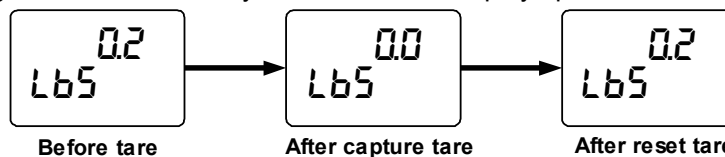
Reset tare removes the display offset of the net value, and the gross and net values become the same until a new capture tare is entered.

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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. *mV input: If meter is in operation and it is intended to accept only one input range (e.g. 0-30 mV), recalibration of other ranges is not necessary.*
> 2. *Strain gauge: If the meter is intended to accept a strain gauge bridge input, it is recommended to use the CAL function with ratiometric compensation turned on.*
> 3. *Allow the meter to warm up for at least 15 minutes before performing the internal source calibration procedure.*

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

1. Press and hold the Menu button for three seconds to access the advanced features of the meter.
2. Press the Up arrow button to scroll to the *Internal calibration* menu (ICAL) and press Enter.
3. The meter displays the first input range (15 mV), press the Up arrow to select any other range (e.g. 100mV. Press Enter to start the calibration process.

Example of *Internal Calibration* for 100 mV input range:

1. The meter displays the message "StroFF" (strain offset), short the SG+, SG- terminals and press Enter. The *low* input message is displayed (V Lo). Apply the low input signal (e.g. 0.00 mV) and press Enter. The display flashes for a moment while the meter is accepting the low input signal.
2. 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.
3. Set the display value to correspond to the input signal being calibrated; typically 0.00 mV.
4. The display moves to the *high* input calibration (V Hi). Apply the high input signal and press Enter.
5. Set the display for the high input calibration, in the same way as it was set for the low input calibration, typically 100.00 mV.
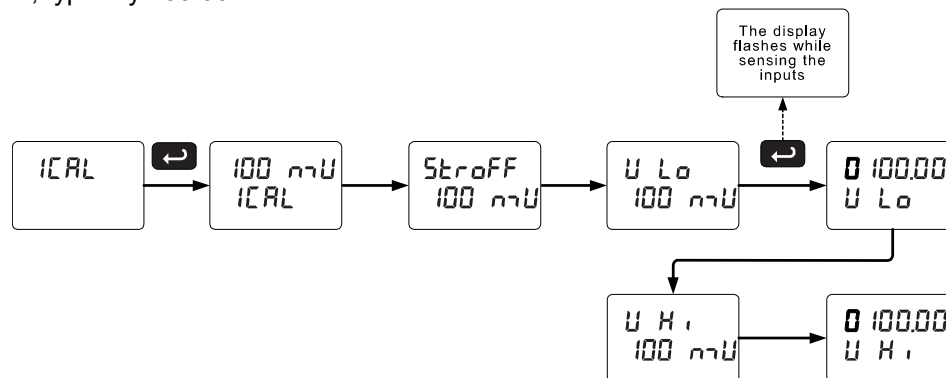
The graphic above shows the calibration of the 100 mV input range. The other input ranges are calibrated in a similar way.

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
15 mV	0.2 mV
25 mV, 30 mV	0.4 mV
150 mV	2.0 mV
250 mV, 300 mV	4.0 mV

Meter Operation

The meter is capable of accepting any signal from -250 to 250 mV in bipolar mode, or 0 to 300 mV in unipolar mode, and displaying these signals in engineering units from -99999 to 999999 (*e.g.* a 0-100 mV signal could be displayed as 0 to 50000). The dual-line display can be customized by the user to operate in such a way as to satisfy a specific application. Typically the upper display is used for the process variable; while the lower display is used for engineering units, custom legend, or set point indication.

The input signal can be scaled to display the process in two different scales; for example the upper display could indicate weight in pounds and the lower display could indicate percent of maximum weight capacity. The meter can also be set up to display the analog input on the upper display and the Modbus input on the lower display. The relays and analog output can be programmed to operate from the Modbus PV input if the Modbus input has been assigned to the big (main) display.

During operation, the meter can be either tared or zeroed. The tare feature is useful for momentarily zeroing out of the display, in the case where there is additional weight than what is intended to be measured (e.g. a bucket on the scale is being filled with material). The meter will display a T to indicate that the display has been tared and taring is resettable via the reset tare operation. The zero feature is useful for permanent zeroing of the meter, in the case where there has been drift in the strain gauge output over time. The zero feature will zero out the display without indication or the ability to reset.

Button Operation

Button Symbol	Description
MENU (MENU)	Press to enter or exit Programming Mode, view settings, or exit max/min readings
RIGHT (F1 ZERO)	Press to reset max/min readings or other parameter/function assigned through the *User* menu
UP (F2 RESET)	Press to display max/min readings or other parameter/function assigned through the *User* menu
ACK (F3 TARE)	Press to acknowledge relays or other parameters/function assigned through the *User* menu

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 on the previous page 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 19 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.

Maximum/Minimum Readings

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

1. Display briefly by assigning to the F1-F3 function keys or to the digital inputs in the *User* menu.
2. Display continuously by assigning either display to max/min through the *Display* menu.

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

To display max reading using function key with factory defaults:

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

To display max/min readings continuously:

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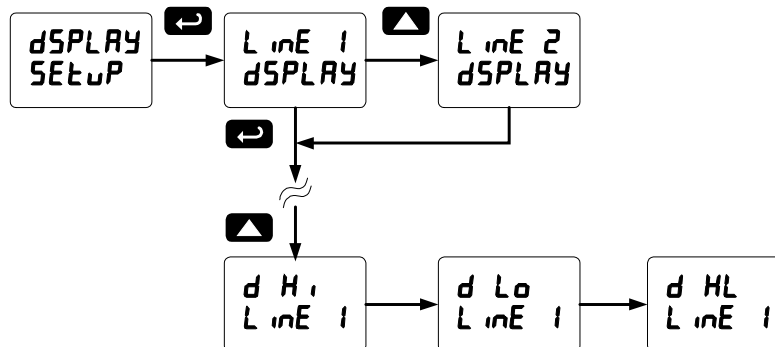
Troubleshooting

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 49.

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 messages, *see Advanced Features Menu &* Display Messages, page 49.

Determining Software Version

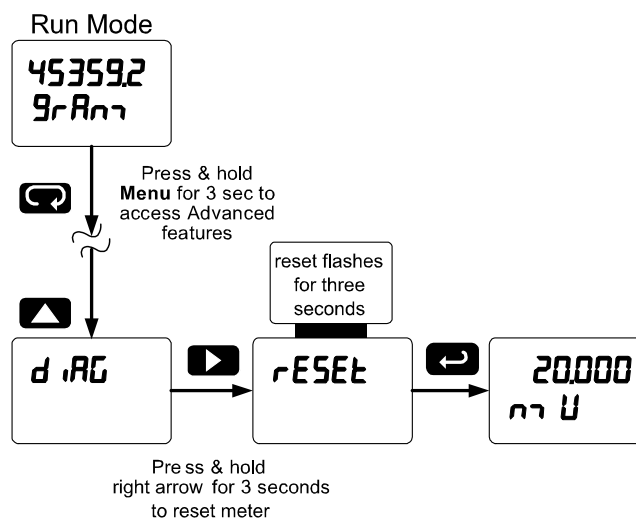To determine the software version of a meter:

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

Reset Meter to Factory Defaults

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

Instructions to load factory defaults:

1. Enter the *Advanced Features* menu. See *Advanced Features Menu*, page 49.
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

45359.2		
9rAm⌐		

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

reset flashes for three seconds

d iAG → rESEt → 20.000 / ⌐ U

Press & hold right arrow for 3 seconds to reset meter

Note: The dual-scale selection for some level applications (d-SCAL) is not reset to the single scale factory default. This can be changed using the Setup – Input menu.

Factory Defaults & User Settings

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

Parameter	Display	Default Setting	Parameter	Display	Default Setting
Input type	PoLAr	Polar = Uni	On delay relay 1	On 1	0.0 sec
Input Range	rAnGE	Range = 30mV	Off delay relay 1	OFF 1	0.0 sec
Ratiometric	rAt io	Ratio = Yes	On delay relay 2	On 2	0.0 sec
Dual-scale	d-SCAL	No (Single scale)	Off delay relay 2	OFF 2	0.0 sec
Filter	F iLtEr	70	On delay relay 3	On 3	0.0 sec
Bypass	bYPASS	0.2	Off delay relay 3	OFF 3	0.0 sec
Rounding	round	1	On delay relay 4	On 4	0.0 sec
Function	Functn	Linear	Off delay relay 4	OFF 4	0.0 sec
Number of points	no PtS	2	Display 1 analog out	d iS 1	0.00
Programming	ProG	Scale			
Input 1	InP 1	0.00 mV	Output 1 value	Out 1	4.000 mA
Display 1	d iS 1	0.00	Display 2 analog out	d iS 2	100.00
Input 2	InP 2	100.00 mV			
Display 2	d iS 2	100.00	Output 2 value	Out 2	20.000 mA
Decimal point	ddd.ddd	3 places	Source analog output	SourcE	Process Variable
Cutoff value	CutoFF	0.000 (disabled)			
Auto-zero	Auto 0	0.05% of Full Scale	Overrange output	O-rAnG	21.000 mA
Display assignment	dSPLAY		Underrange output	u-rAnG	3.000 mA
Upper display	b iG	PV: Process variable	Maximum output	m AH	23.000 mA
			Minimum output	m in	1.000 mA
Lower display	L ittLE	Eng units: mV	Slave ID (Address)	SLAU id	247
Display intensity	d- intY	8			
Relay 1 action	Act 1	Automatic	Baud rate	bAud	9600
Relay 1 set point	SEt 1	10.00	Transmit delay	tr dLY	10 ms
Relay 1 reset point	rSt 1	5.00	Parity	PAr itY	Even
			Byte-to-byte timeout	t-bYt	010 (0.1 sec)
Relay 2 action	Act 2	Automatic	F1 function key	F 1	Zero
Relay 2 set point	SEt 2	20.00	F2 function key	F2	Reset Tare
Relay 2 reset point	rSt 2	15.00	F3 function key	F3	Tare
Relay 3 action	Act 3	Automatic	F4 Function	F4	Acknowledge relays
Relay 3 set point	SEt 3	30.00	Digital input 1	di 1	Menu
Relay 3 reset point	rSt 3	25.00	Digital input 2	di 2	Right arrow/F1
			Digital input 3	di 3	Up arrow/F2
Relay 4 action	Act 4	Automatic	Digital input 4	di 4	Enter/F3
Relay 4 set point	SEt 4	40.00	Digital output 1	dO 1	Alarm 1
Relay 4 reset point	rSt 4	35.00	Digital output 2	dO 2	Alarm 2
			Digital output 3	dO 3	Alarm 3
Fail-safe relay 1	FLS 1	Off	Digital output 4	dO 4	Alarm 4
Fail-safe relay 2	FLS 2	Off	Password 1	PASS 1	000000 (unlocked)
Fail-safe relay 3	FLS 3	Off	Password 2	PASS 2	000000 (unlocked)
Fail-safe relay 4	FLS 4	Off	Password 3	PASS 3	000000 (unlocked)

Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, *Locd* is displayed	Meter is password-protected, enter correct six-digit password to unlock
Meter displays error message during calibration (*Error*)	Check: Signal connections Input selected in *Setup* menu Minimum input span requirements
Meter displays *999999* *-99999*	Check: Input selected in *Setup* menu Corresponding signal at Signal connector
Display is unstable	Check: Input signal stability and value Display scaling vs. input signal Filter and bypass values (increase)
Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: Signal input conditioner selected: Linear, square root, etc. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check: Display assignment, it might be displaying max, min, or set point.
Display alternates between *H* and a number *Lo* and a number	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: Fail-safe in *Setup* menu Wiring of relay contacts
Relay and status LED do not respond to signal	Check: Relay action in *Setup* menu Set and reset points
Flashing relay status LEDs	Relays in manual control mode or relay interlock switches opened.
Meter not communicating with application programs	Check: Serial adapter and cable Serial settings Meter address and baud rate
If the display locks up or the meter does not respond at all	Cycle the power to reboot the microprocessor.
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.