

Helios Large Display Temperature Meter Instruction Manual

PD2-7000



HELIOS



Temperature


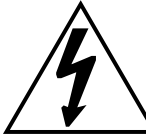
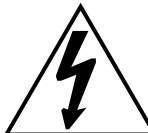
- Large 1.80" Digits
- Dual-Line 6-Digit Display
- Readable from up to 100 Feet (30 Meters) Away
- Superluminous Sunlight Readable Display
- NEMA 4X, IP65 Rated Field Mountable Enclosure
- Operating Temperature Range of -20 to 65°C (-4 to 150°F)
- J, K, T, E, R, S, B, N, C Thermocouples
- 100 or 1000 Ω Platinum, 10 Ω Copper, 120 Ω Nickel RTDs
- 1° or 0.1° Resolution
- Averages up to 10 RTD Sensors
- Automatic Cold Junction Compensation
- Input Power Options Include 85-265 VAC or 12-24 VDC
- Programmable Display & Function Keys
- 2 or 4 Relays + Isolated 4-20 mA Output Options
- Onboard USB & RS-485 Serial Communication Options
- Modbus[®] RTU Communication Protocol Standard
- Program the Meter from a PC with onboard USB and MeterView Pro

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Disclaimer

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 <p>Caution: <i>Read complete instructions prior to installation and operation of the meter.</i></p>	 <p>Warning: <i>Risk of electric shock or personal injury.</i></p>
 <p>Warning!</p>	<p><i>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.</i></p>

Limited Warranty

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

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Introduction

The Helios PD2-7000 is a multi-purpose, easy to use, large-display digital temperature meter. It features large 1.8 inch superluminous LED digits, which can be read in direct sunlight 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 type J, K, T, E, R, S, B, N, and C thermocouples as well as 100 or 1000 Ω platinum, 10 Ω copper, and 120 Ω nickel RTDs. Three of the programming buttons can be set for custom operation. The meter features automatic cold junction compensation for thermocouples and can average up to 10 RTD sensors for precision temperature measurement.

A fully loaded Helios PD2-7000 temperature meter comes with four (4) SPDT relays, a 4 20 mA output, two 24 VDC power supplies, five (5) digital inputs and four (4) digital outputs, and RS485 serial communications.

The four relays can be used for alarm indication or temperature control applications. The large display size, ease of readability, 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
PD2-7000-6H0	PD2-7000-7H0	No Options
PD2-7000-6H7	PD2-7000-7H7	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	Extra Plugs
PDX6901	Suppressor (snubber): 0.01 μ F/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
Resolution	1° or 0.1° for all thermocouples and RTD inputs
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.
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
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 \pm 10%, 15 W max
Powered over USB for configuration only.

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 mounting meter to wall. See Wall Mounting Instructions on page 10 for additional details. Pipe Mounting: Optional pipe mounting kit (PDA6260) allows for pipe mounting. Sold separately. See Pipe Mounting Instructions on page 11 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

Temperature Input

Inputs	Thermocouple: J, K, T, E, R, S, B, N, C; RTD: 100 Ω platinum (0.00385 & 0.00392 coefficients), 10 Ω copper, 120 Ω nickel, 1000 Ω platinum (0.00385 & 0.00392 coefficients)
Cold Junction Reference	Automatic, fixed, no user calibration needed
Temperature Drift	±2°C maximum from 0 to 65°C ambient temperature ±4°C maximum from -20 to 0°C ambient temperature
Offset Adjustment	User programmable offset adjust ±50.0 degrees. This parameter allows the user to apply an offset value to the temperature being displayed.
Input Impedance	Greater than 100 kΩ

Sensor Break Detection	Open TC or RTD sensor indicated by display flashing αPE_n , relays can be programmed to go "On", "Off", or to "Ignore" (<i>Note: Ignore is detected as an upscale condition</i>). Analog output goes to the programmed sensor break value.
RTD Averaging	Up to 10 RTDs connected in parallel can be averaged.

Accuracy & Ranges

Type	Range (°F)	Accuracy	Range (°C)	Accuracy
J	-200 to 2000	±1.8°F	-129 to 1093	±1°C
K	-200 to 2400	±1.8°F	-129 to 1316	±1°C
T	-200 to 752	±1.8°F	-129 to 400	±1°C
E	-200 to 1800	±1.8°F	-129 to 982	±1°C
R	-50 to 3000	±3.6°F	-46 to 1649	±2°C
S	-50 to 3000	±3.6°F	-46 to 1649	±2°C
B	752 to 3300	±3.6°F	400 to 1816	±2°C
N	-100 to 2300	±3.6°F	-73 to 1260	±2°C
C	32 to 4100	±3.6°F	0 to 2260	±2°C
10Ω	-328 to 500	±0.2°F	-200 to 260	±0.1°C
100Ω	-328 to 1562	±0.7°F	-200 to 850	±0.4°C
120Ω	-110 to 500	±0.2°F	-79 to 260	±0.1°C
1000Ω	-328 to 900	±0.7°F	-200 to 482	±0.4°C

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 15 for details.
Deadband High Or Low Alarm	0-100% of span, user programmable 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 <ol style="list-style-type: none"> Automatic reset only (non-latching), when the input passes the reset point. Automatic + manual reset at any time (non-latching) Manual reset only, at any time (latching) Manual reset only after alarm condition has cleared (latching) <p><i>Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.</i></p>
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. <i>Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.</i>
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 <i>Note: Analog output drift is separate from input drift.</i>
Power Supply for Analog Output Loop Or Other Uses	Terminals I+ & R: 24 VDC ± 10%. May be used to power the 4-20 mA output or other devices. Refer to Figure 22 on page 19. 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

Serial Communications

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

Modbus® RTU Serial Communications

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


Note: Refer to the Modbus Register Tables for details.

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

To be used as pull-up for digital inputs only.
Connect normally open pushbuttons across +5 V & DI 1-4.

+5 V Terminal


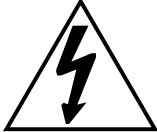
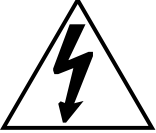
	<p>DO NOT use +5 V terminal to power external devices.</p>
<p>WARNING!</p>	

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

Safety Information

	
Caution: <i>Read complete instructions prior to installation and operation of the meter.</i>	Warning: <i>Risk of electric shock or personal injury.</i>
 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, or setup of the meter. All programming is done through the buttons and switches located under the lower door panel and are accessible by removing the single securing screw. Wires should be run through the conduit entry holes located on the bottom of the meter.

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

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

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.

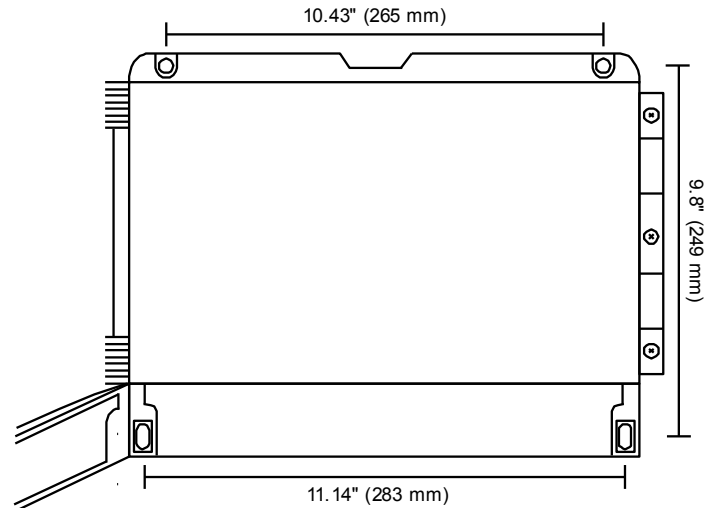


Figure 1. Meter Mounting Holes

Mounting Dimensions

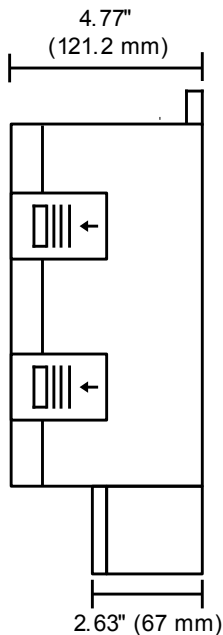


Figure 2. Meter Dimensions - Side View

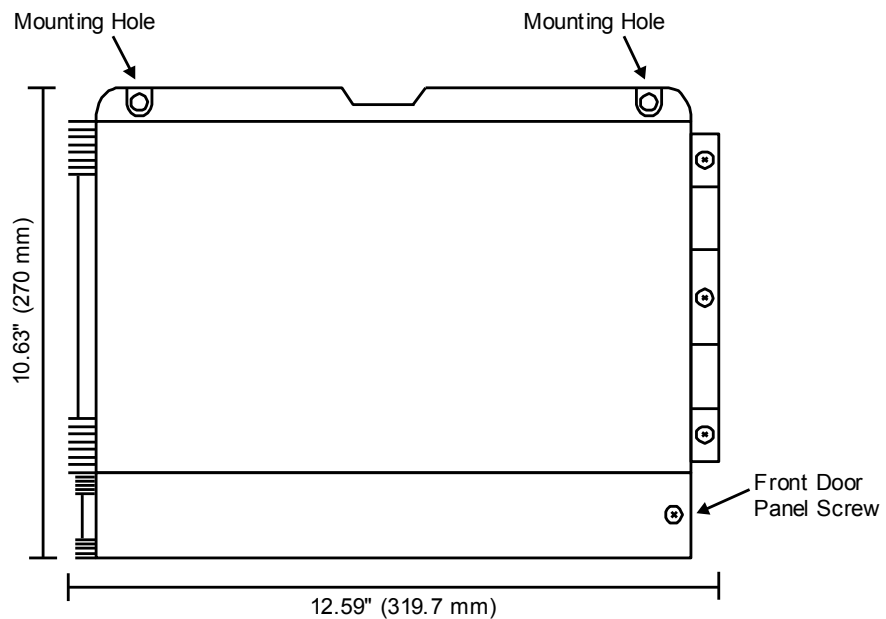


Figure 3. Meter Dimensions – Front View

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).

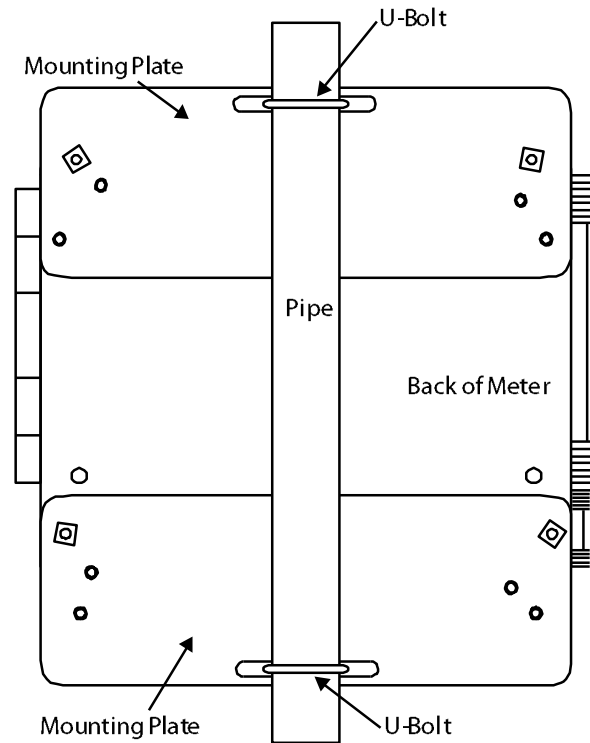


Figure 4. Vertical Pipe Mount Assembly

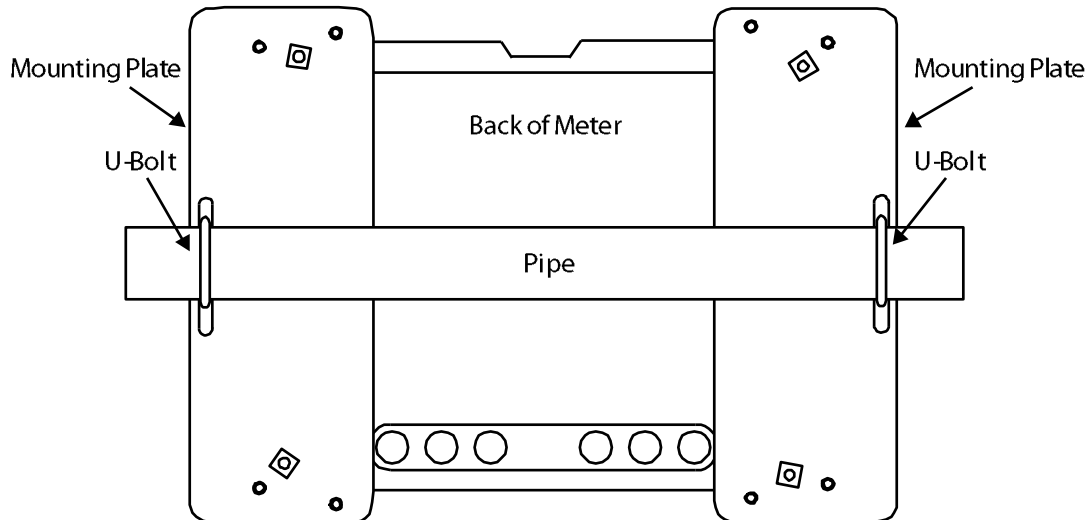



Figure 5. Horizontal Pipe Mount Assembly

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.

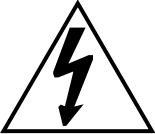


Caution

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.

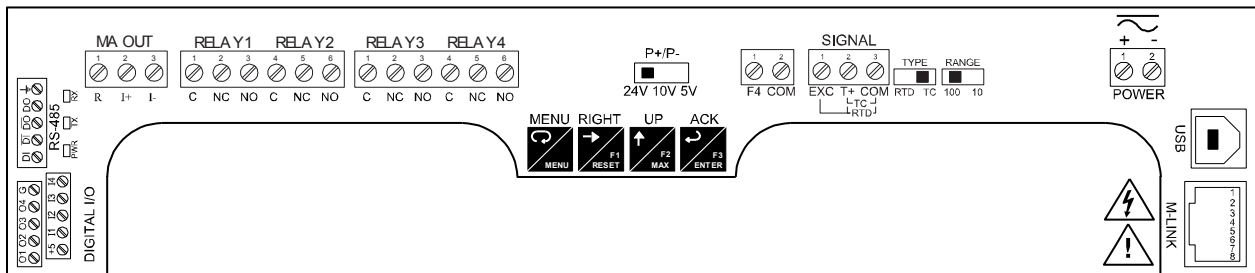
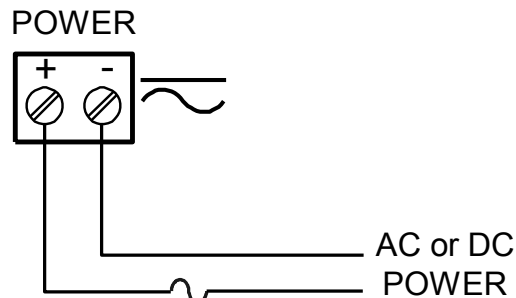


Figure 6. Fully Loaded PD2-7000 Connections

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 6 on page 12. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.



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

Figure 7. Power Connections

Signal Connections

Signal connections are made to a three-terminal connector labeled SIGNAL on Figure 6.

Thermocouple and RTD Connections

The following figures show examples for thermocouple and RTD connections. The TYPE selector switch must be set to the proper position for the meter to accept the selected RTD or TC input. The RANGE selector switch is used to select 100-ohm platinum or 10-ohm copper RTD. The 1000-ohm platinum RTD input uses the same setting as the 100-ohm RTD. The input type is selected using the *Setup* menu. The selected thermocouple input must correspond to the thermocouple sensor and wire type used.

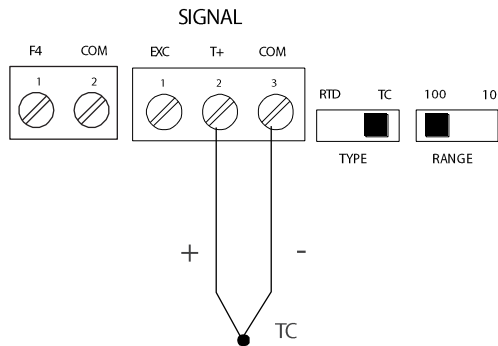


Figure 8. Thermocouple Input Connections

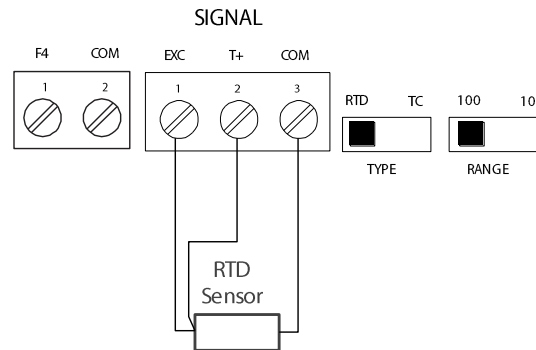


Figure 9. Three-Wire RTD Input Connections

The meter accepts two, three, or four-wire RTDs. The three-wire RTD connection has built-in lead wire compensation.

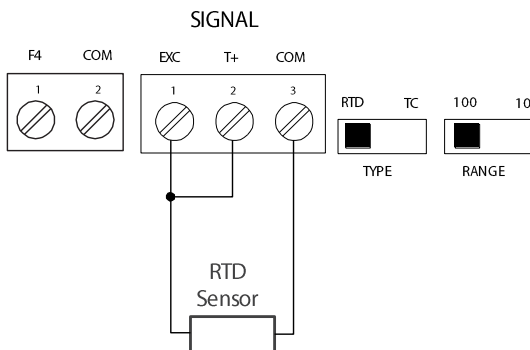


Figure 10. Two-Wire RTD Input Connections

Lead wire compensation for two-wire RTDs can be applied using the *Adjust* menu. See the Advanced Features Menu on page 40.

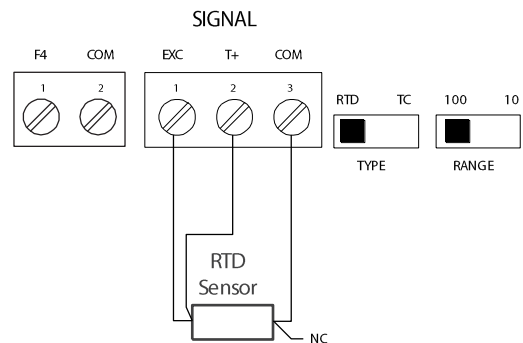


Figure 11. Four-Wire RTD Input Connections

The four-wire RTD connection is similar to the three-wire. One of the leads of a four-wire RTD is not connected and may be clipped off.

The three-wire connection provides sufficient lead wire compensation to obtain accurate readings even with long leads.

Connections for Averaging RTD Sensors

To obtain the average temperature from 2 to 10 RTD sensors, connect all the sensors in parallel and select the number of sensors in the *RTD Total (rtdtot)* menu. See the Advanced Features Menu on page 40.

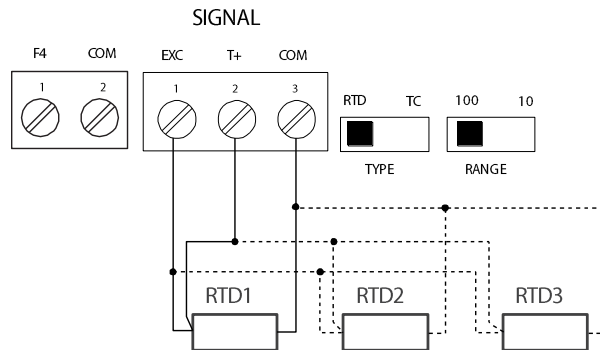


Figure 12. Average Temperature RTD Input Connections

Modbus RTU Serial Communications

Serial communications connection can be made to the onboard RS485 terminal block or USB connector shown in Figure 6. If RS232 is required, an RS485 to RS232 adapter (PDA7485) may be used. See Ordering Information on page 5 for additional information.

Relay Connections

Relay connections are made to two six-terminal connectors labeled RELAY1 – RELAY4 on Figure 6. Each relay's C terminal is common only to the normally open (NO) and normally closed (NC) contacts of the corresponding relay. The relays' C terminals should not be confused with the COM (common) terminal of the INPUT SIGNAL connector.

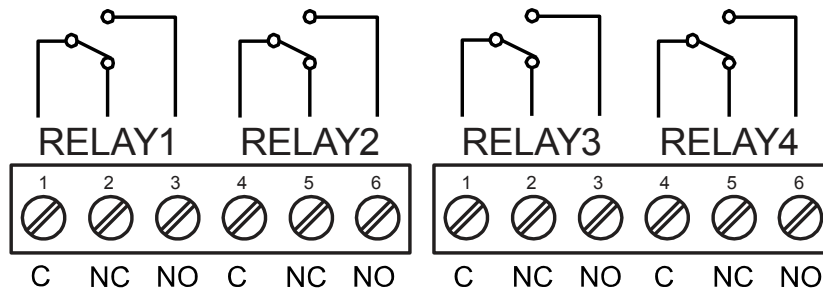


Figure 13. Relay Connections

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:

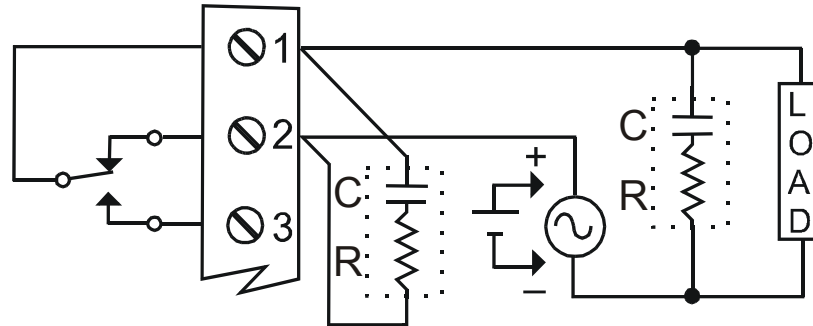


Figure 14. AC and DC Loads Protection

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.

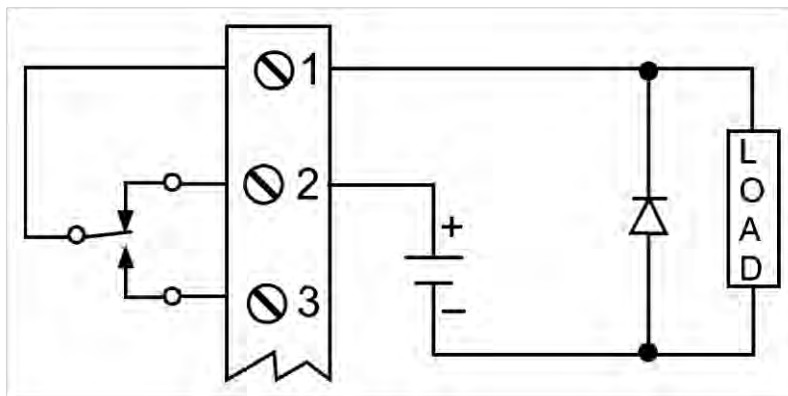


Figure 15. Low Voltage DC Loads Protection

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.

RC Networks Available from Precision Digital

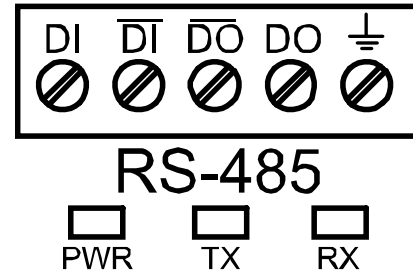
RC networks are available from Precision Digital and should be applied to each relay contact switching an inductive load. Part number: PDX6901.

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 43 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 16 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 17 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 (SERIAL) menu is displayed and press **Enter**, Addr-E5 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.

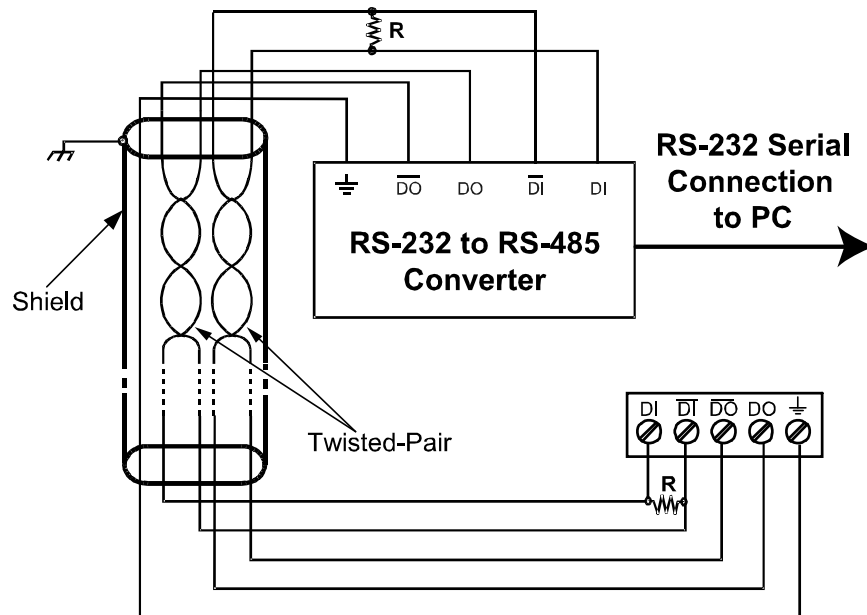


Figure 16. RS-422 or RS-485 Wiring

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.

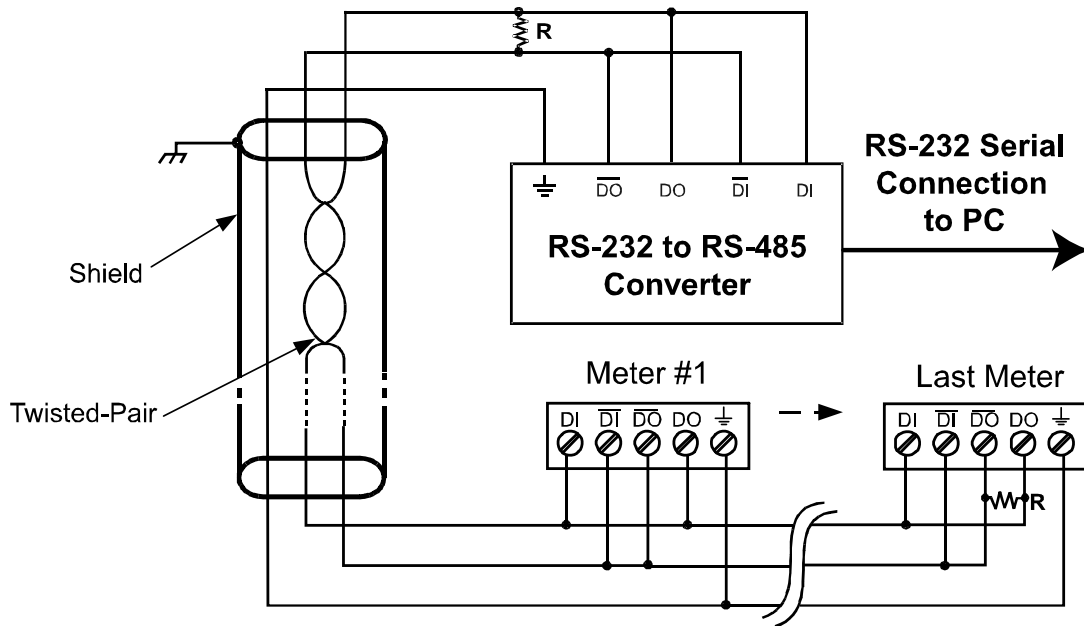


Figure 17. RS-485 Two-Wire Multi-Drop Wiring

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

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

Figure 18. 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.

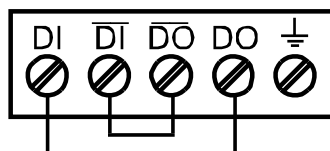


Figure 19. Three-Wire RS485 Connection

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.

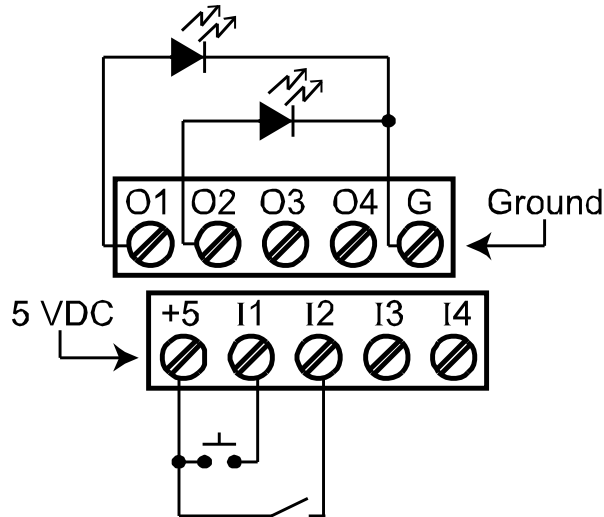


Figure 20. Digital Input and Output Connections

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.

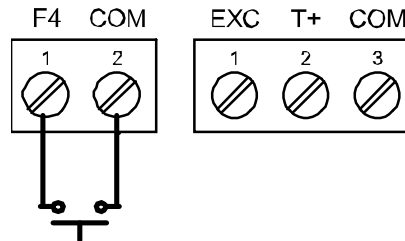


Figure 21. F4 Digital Input Connections

4-20 mA Output Connections

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

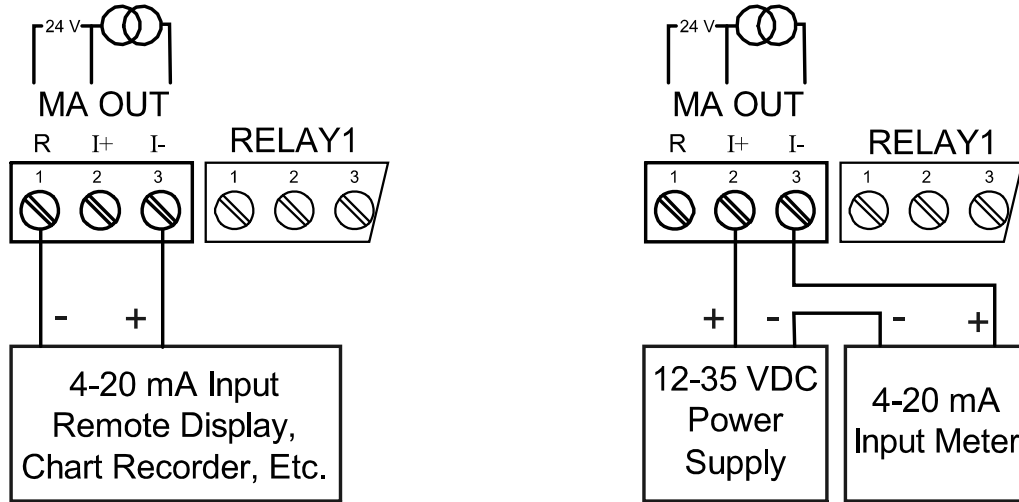


Figure 22. 4-20 mA Output Connections

Analog Output 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 36). 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.

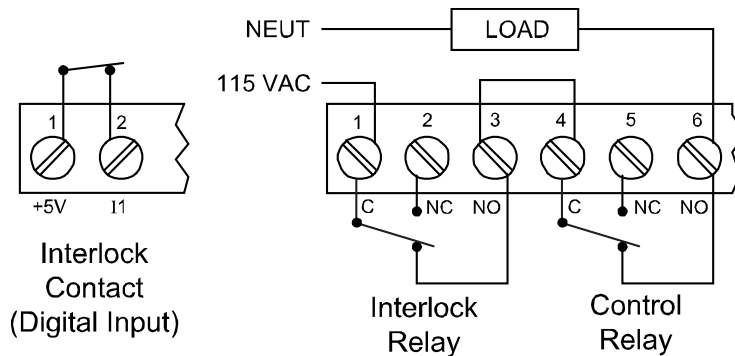


Figure 23. Interlock Connections

Setup and Programming

The meter is factory calibrated prior to shipment to read temperature in degrees Fahrenheit. The calibration equipment is certified to NIST standards.

Overview

There are two switches, located to the right of the signal input connector, used to set the input selection for thermocouple or RTD and for 100-ohm platinum or 10-ohm copper. The 1000-ohm RTD input uses the same setting as the 100-ohm.

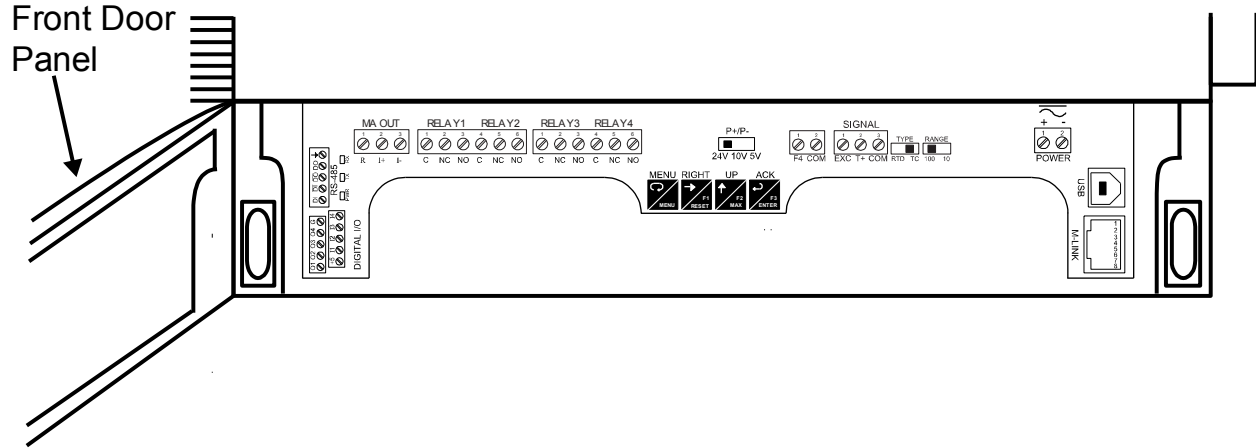
Setup and programming is done through the programming buttons located under the front door panel.

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
	Right arrow/F1
	Up arrow/F2
	Acknowledge (Enter)/F3
<i>Note:</i> F4 – F8 are digital inputs.	

LED	Status
1-4	Alarm 1-4 indicator
1-4 M	Flashing: Relay in manual control mode
T	Flashing: Tare
1-4	Flashing: Relay interlock switch open
<i>Note:</i> LEDs for relays in manual mode flash with the “M” LED every 10 seconds. “M” flashing by itself indicates Aout – manual control is used.	

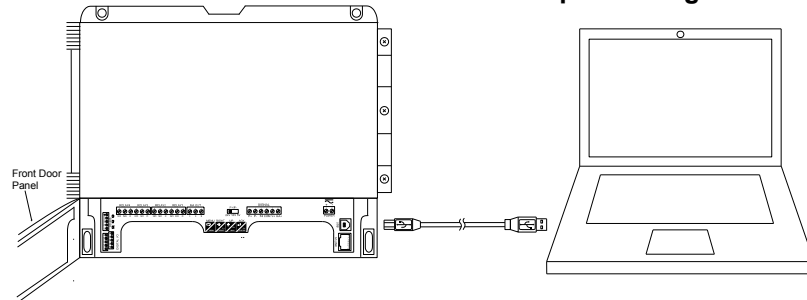
- Press the Menu button to enter or exit the Programming Mode at any time.
- Press the Right arrow button to move to the next digit during digit or decimal point programming.
- Press or hold the Up arrow button to scroll through the menus, decimal point, or to increment the value of a digit.
- Press 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

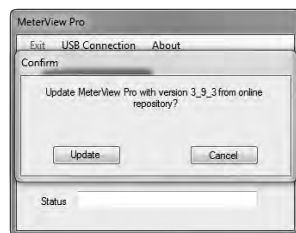
The meter can also be programmed using the PC-based MeterView Pro software included with the meter. This software can be installed on any Microsoft® Windows® (2000/XP/Vista/7/8/10) computer by connecting the meter's onboard USB. The meter is powered by the USB connection, so there is no need to wire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



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 μr tE 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.

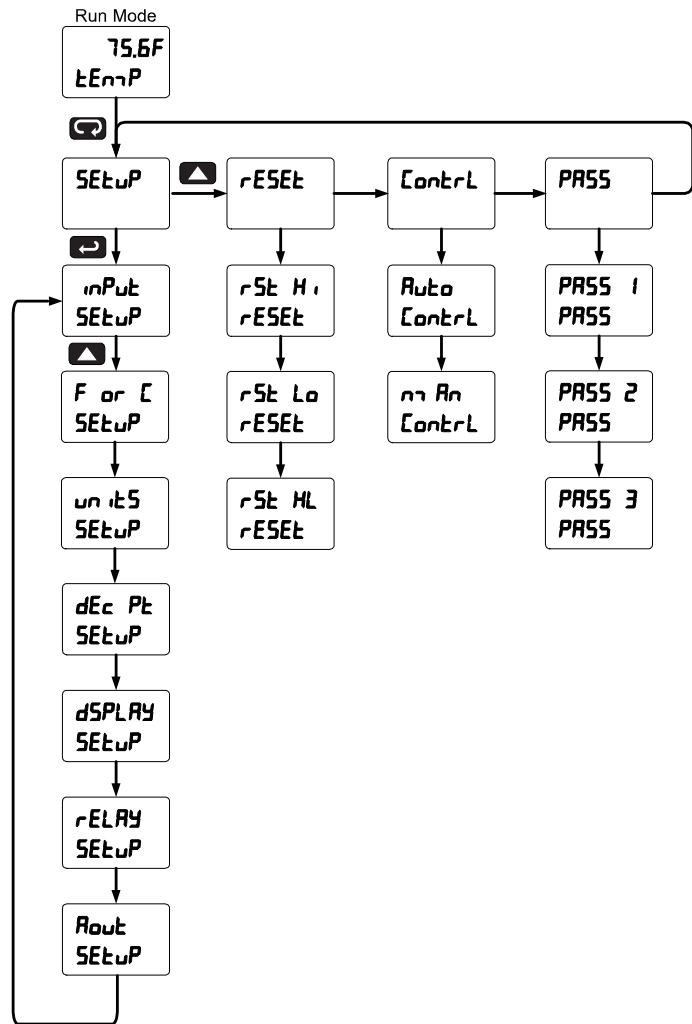
Display	Parameter	Action/Setting Description
SEtUP	Setup	Enter <i>Setup</i> menu
INPut	Input	Enter <i>Input</i> selection menu
tC	TC	Set meter for thermocouple input (J, K, T, E, R, S, B, N, C)
rtd	RTD	Set meter for RTD input (100Pt, 1000Pt, 10Cu, 120Ni)
A385	A385	Set meter for 0.00385 curve
A392	A392	Set meter for 0.00392 curve
F or C	F or C	Press Enter to select degrees F or C
unItS	Units	Select the display units/tags
dEc Pt	Decimal point	Set decimal point (dddd, dddd.d, dddd°F, dddd.dF)
dSPLY	Display	Enter the <i>Display</i> menu
Line 1	Display Line 1	Press Enter to assign the display line 1 parameter (default: PV - temperature)
Line 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 <i>Relay</i> menu
rLY 1	Relay 1	Relay 1 setup
Act 1	Action 1	Set relay 1 action
Auto	Automatic	Set relay for automatic reset
Auto-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
ALtErn	Alternate	Set relay for pump alternation control
SAMP	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
rSEt 1	Reset 1	Program reset point 1
rLY 2	Relay 2	Relays 2-4 setup
FRILSF	Fail-safe	Enter <i>Fail-safe</i> 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 2-4 fail-safe operation
dELAY	Delay	Enter relay <i>Time Delay</i> 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 2-4 time delay setup
brERH	Loop break	Set relay condition if loop break detected

Display	Parameter	Action/Setting Description
Ignore	Ignore	Ignore loop break condition (Processed as a low signal condition)
On	On	Relay goes to alarm condition when loop break is detected
OFF	Off	Relay goes to non-alarm condition when loop break is detected
Route	Analog output	Enter the <i>Analog output</i> scaling menu
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 <i>Reset</i> 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
Control	Control	Enter <i>Control</i> menu
Auto	Automatic	Press Enter to set meter for automatic operation
Man On	Manual	Press Enter to manually control relays or analog output operation
PASS	Password	Enter the <i>Password</i> 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 -999999	Flashing	Over/under range condition
OPEN	Open	Open Sensor Indication

Main Menu

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

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



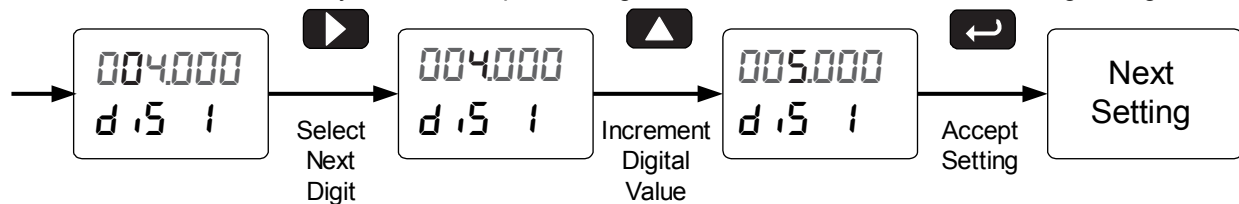
Setting Numeric Values

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)

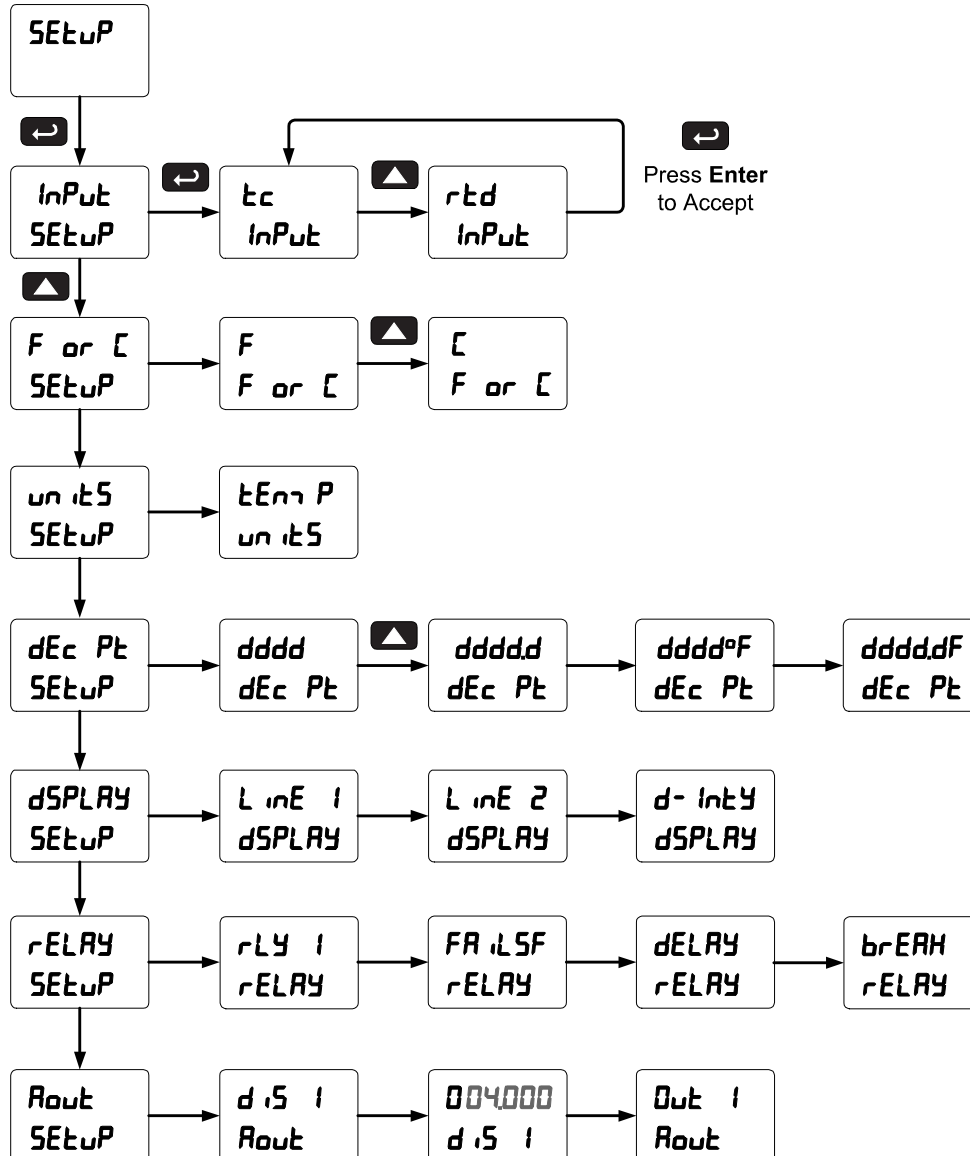
It is **very important** to read the following information, before proceeding to program the meter:

- The meter is factory calibrated prior to shipment to read temperature in degrees Fahrenheit. The calibration equipment is certified to NIST standards.
- There is no need to calibrate the meter, simply select the input type, °F or °C, and decimal point.

The *Setup* menu is used to select:

1. Input type the meter will accept
2. Degrees F or C
3. Select the display units/tags
4. Decimal point position and F or C indication
5. Display parameter and intensity
6. Relay operation
7. 4-20 mA analog output scaling

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



Setting the Input Signal (*inPut*)

Enter the *Input* menu to set up the meter to accept thermocouple (*tC*) or RTD (*rtd*) inputs. The Type selector switch, located at the rear of the meter, must be set accordingly.

The thermocouple input is capable of accepting various types of thermocouples.

The RTD input is capable of accepting various types of RTD sensors. After selecting 100 Pt or 1000Pt, it is necessary to select either A385 (0.00385) or A392 (0.00392) coefficient.

Selecting the Temperature Scale (*F* or *C*)

The meter can display the temperature in degrees Fahrenheit or Celsius.

Setting the Decimal Point (*dEc Pt*)

The temperature may be displayed with one decimal or with no decimal point. The temperature scale can also be displayed with the reading. The degree symbol is available only with no decimal point selected.

Pressing the Up arrow scrolls the decimal point and temperature format selections.

Setting the Display Parameter & Intensity (*dSPLAY*)

The main display (*L inE 1*) can be programmed to display:

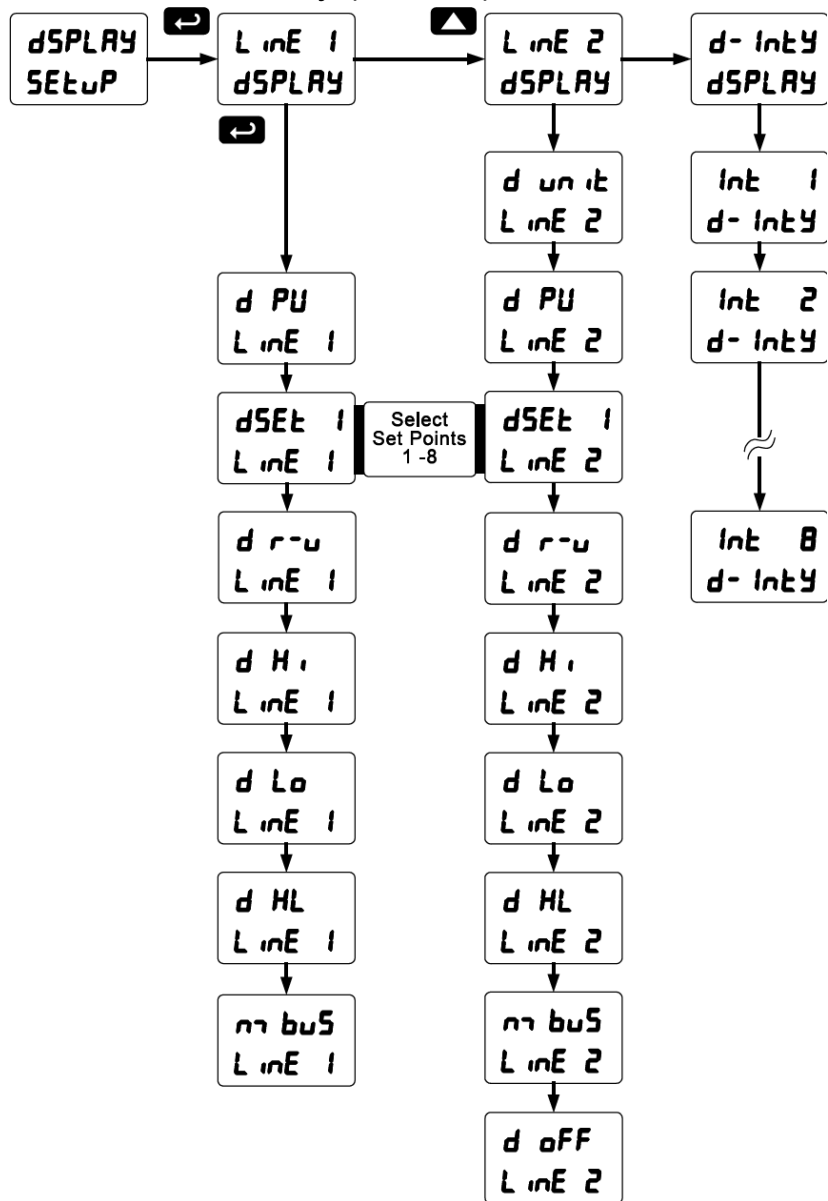
1. Process value
2. Relay set points
3. Max & min values
4. Modbus input
5. Display reading and units

The small display (*L inE 2*) can be programmed to display:

1. Process value
2. Relay set points
3. Max & min values
4. Engineering units or custom legends
5. Modbus input
6. Off (no display)
7. Display reading and units

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 Input Units or Custom Tags (Unit 5)

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 27 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	V	V
1	1	c	c	L	L	w	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 Relay Operation (rELAY)

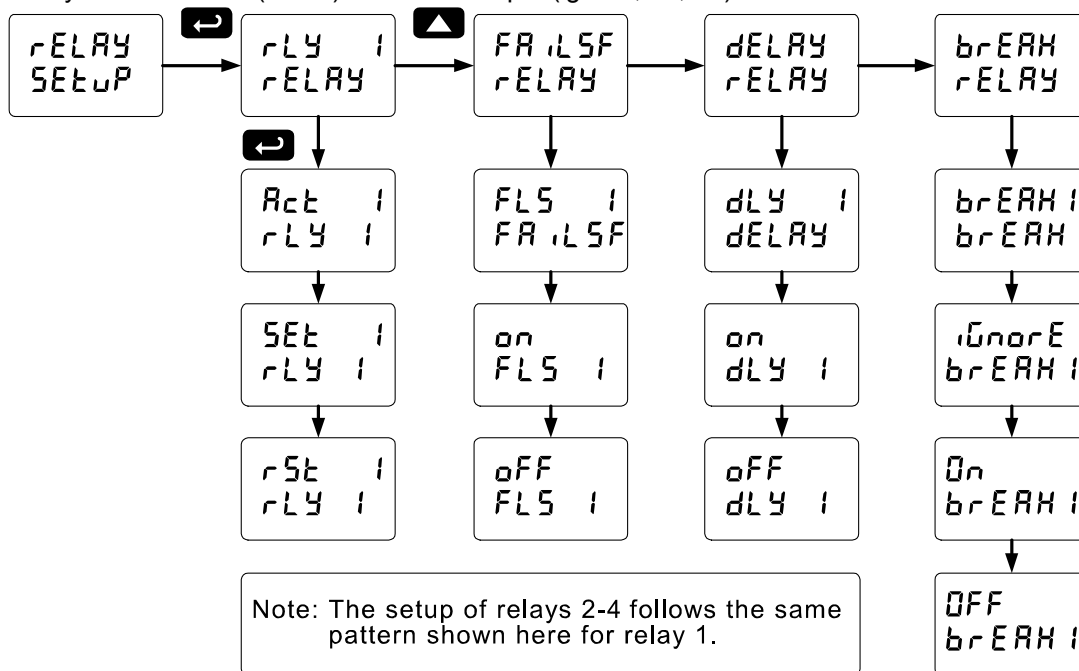
This menu is used to set up the operation of the relays.



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)

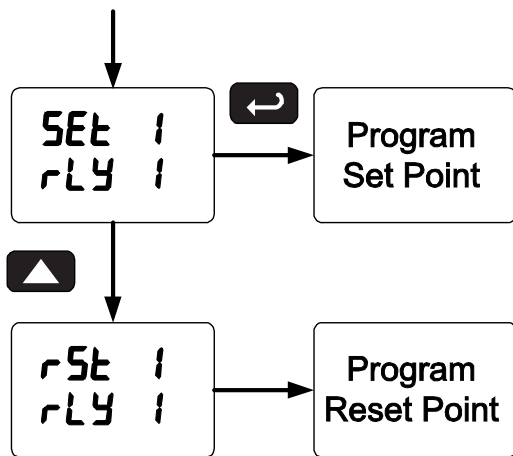
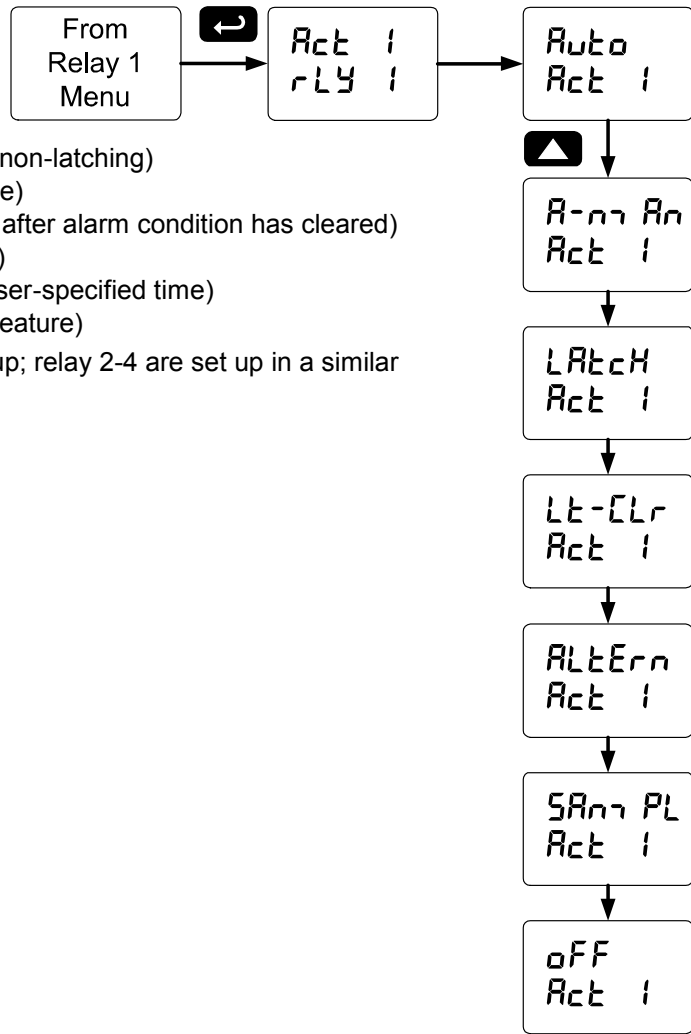


Setting the Relay Action

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. Relay alternation (automatic reset only)
6. Sampling (the relay is activated for a user-specified time)
7. Off (relay state controlled by Interlock feature)

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



Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

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

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

Setting Fail-Safe Operation

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

Programming Time Delay

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

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

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

Relay Action for 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):

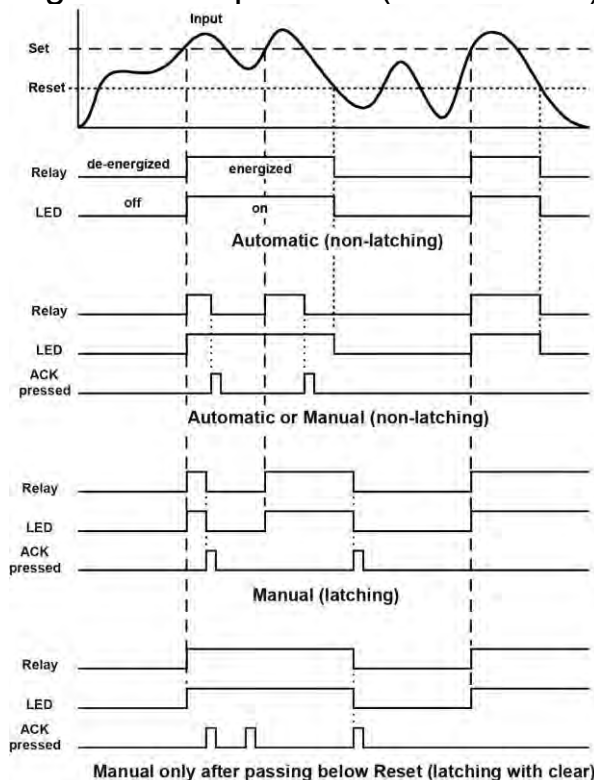
1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
3. Ignore (Processed as a low signal condition)

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

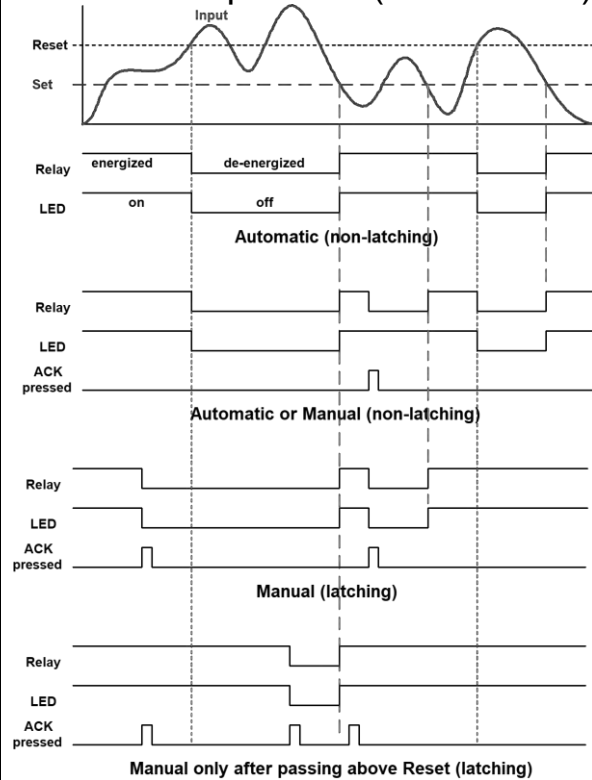
The following graphs illustrate the operation of the relays, status LEDs, and ACK button.

High Alarm Operation (Set > Reset)



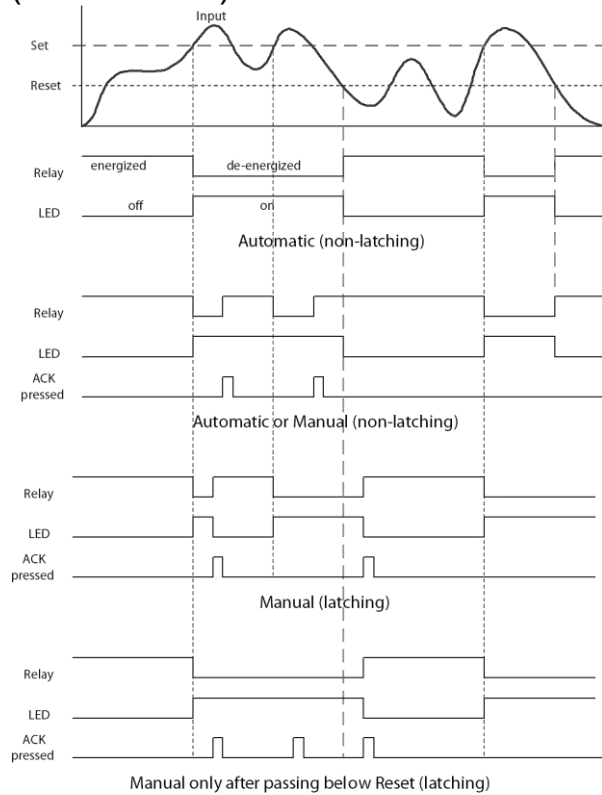
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

Low Alarm Operation (Set < Reset)



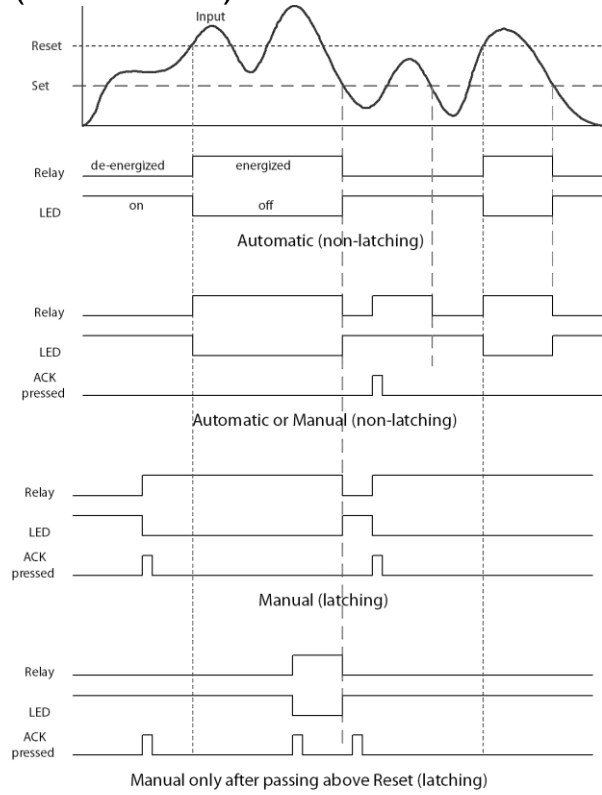
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point and then go below it.

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



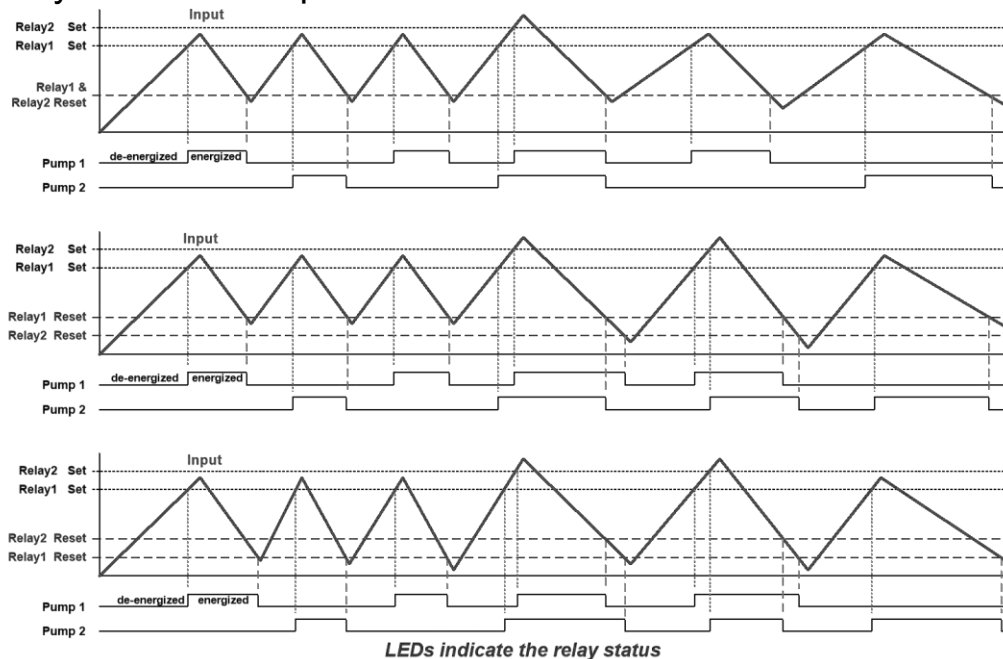
Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

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

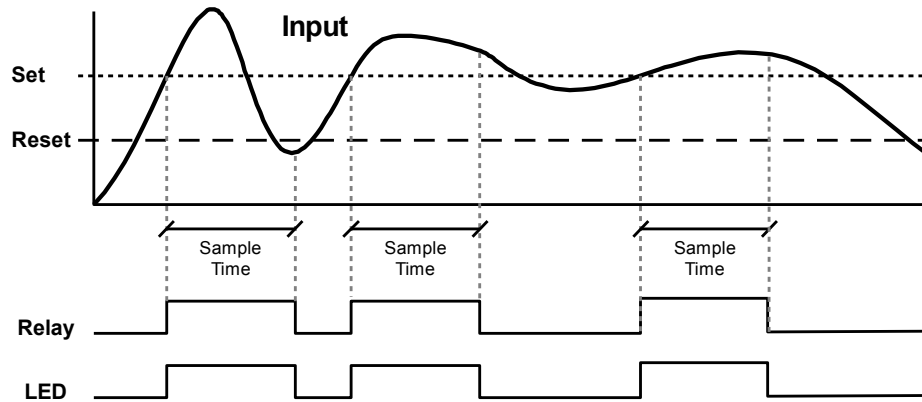


Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.

Relay Alternation Operation



Relay Sampling Operation

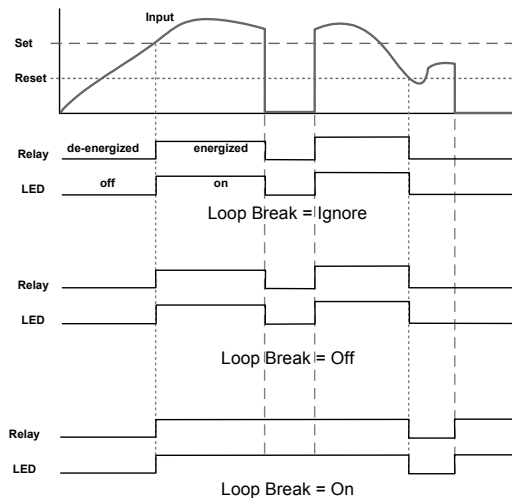


When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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.

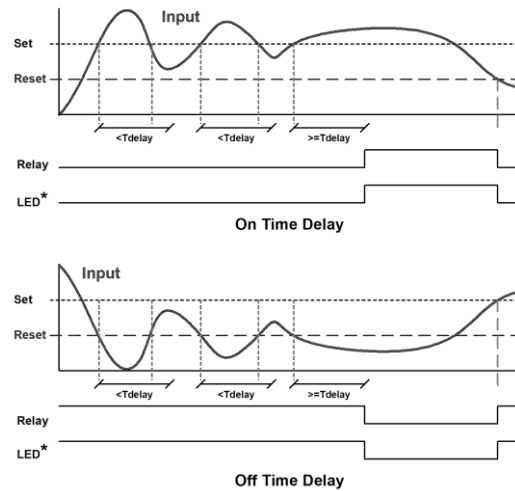


When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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 (A-n, Rn)" reset mode is selected, the LED follows the reset point and not the relay state when the relay is acknowledged.

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 (Αυτο)

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 (Α-πρ Απ)

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 (ΛΡεεΗ)

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 (Λε-εΛρ)

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

Manual reset only after alarm condition has cleared

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

Acknowledging Relays

There are 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 18).

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

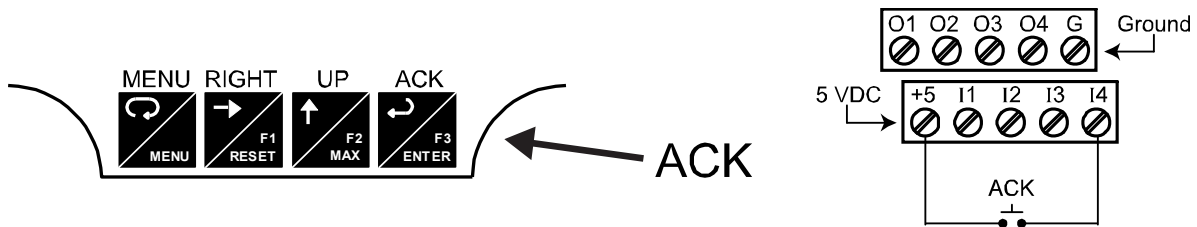
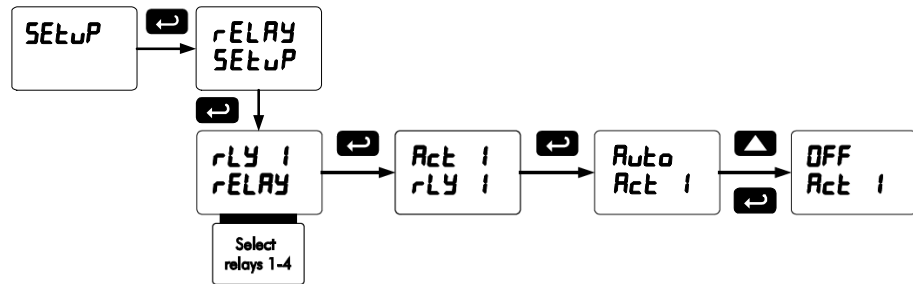


Figure 24. Acknowledge Relays with Function Key or Digital Input

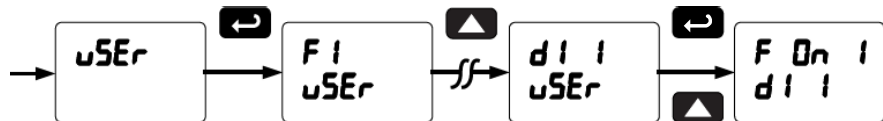
Setting up the Interlock Relay (Force On) Feature

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

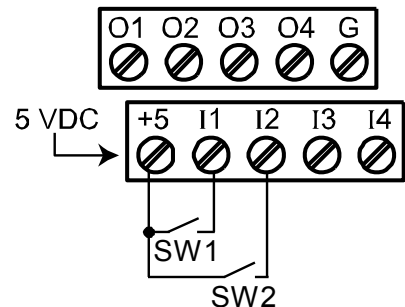
1. Access the Setup – Relay – Action menu and set the action to off.



2. In the Advanced features – User menu program any of the digital inputs to Force On any of the internal relays (1-4).



3. Connect a switch or dry contact between the +5V terminal and the corresponding digital input (dI-1 to dI-4) terminal.



Interlock Relay Operation Example

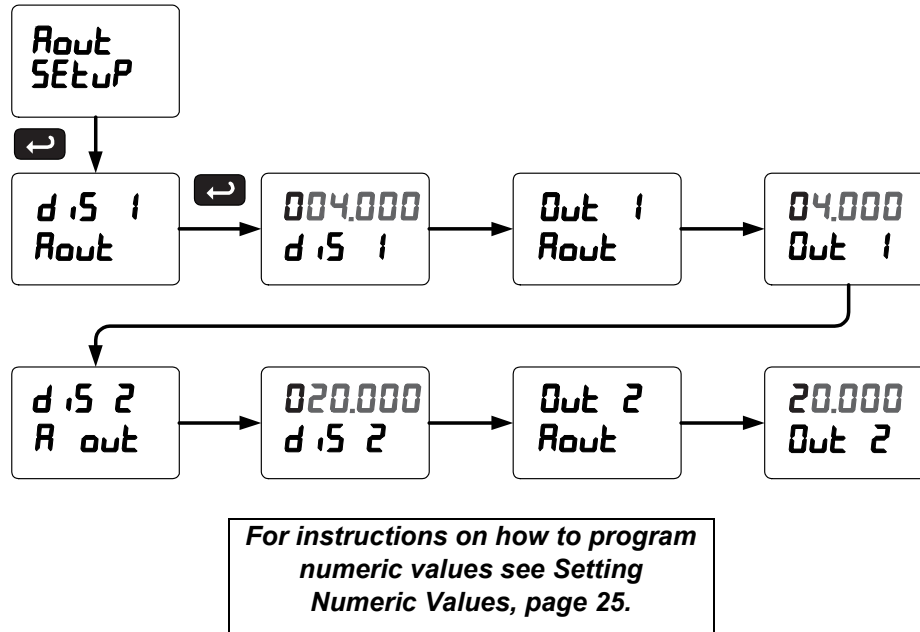
Relays 1 & 2 are configured to energize (their front panel LEDs are off) when SW1 & SW2 switches (above) are closed. If the contacts to these digital inputs are opened, the corresponding front panel LEDs flash indicating this condition. The processes being controlled by the interlock relay will stop,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

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

Scaling the 4-20 mA Analog Output (Aout)

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.

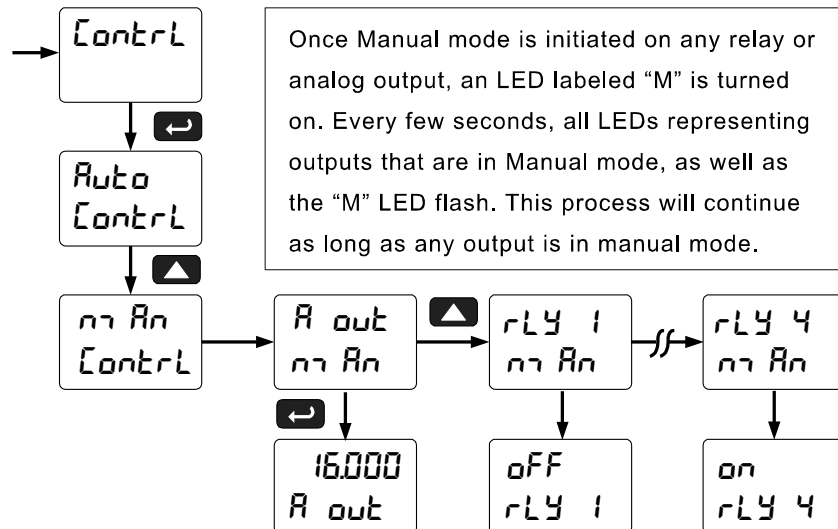


Reset Menu (rESEt)

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” (r5t HL). The tare value used to zero the display may be reset by selecting “reset tare” (r5t tr).

Control Menu (Control)

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



Setting up the Password (*PASS*)

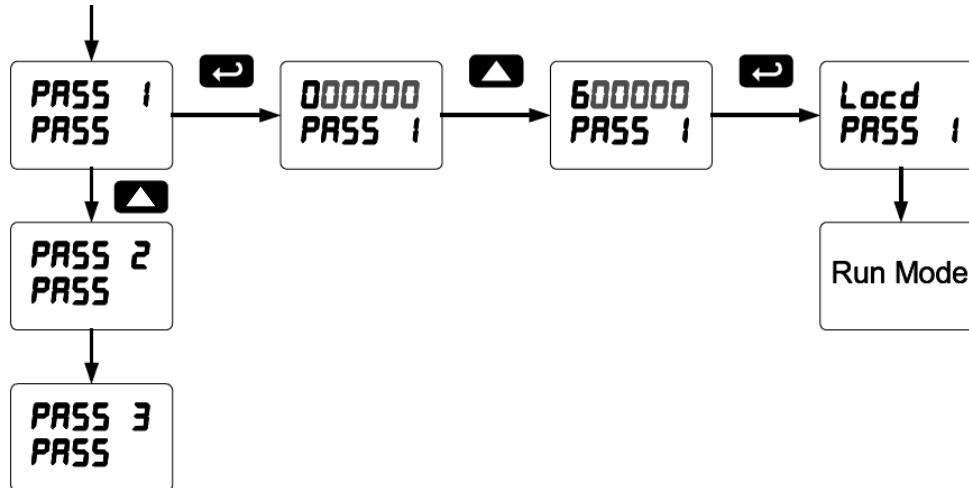
The *Password* menu is used for programming three levels of security to prevent unauthorized changes to the programmed parameter settings.

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 25.

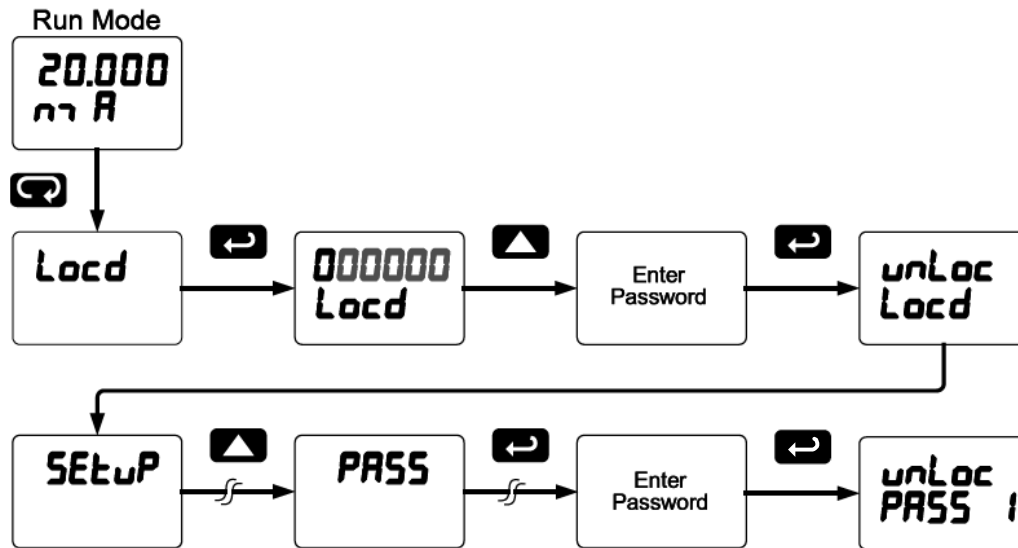


Making Changes to a Password Protected Meter

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.

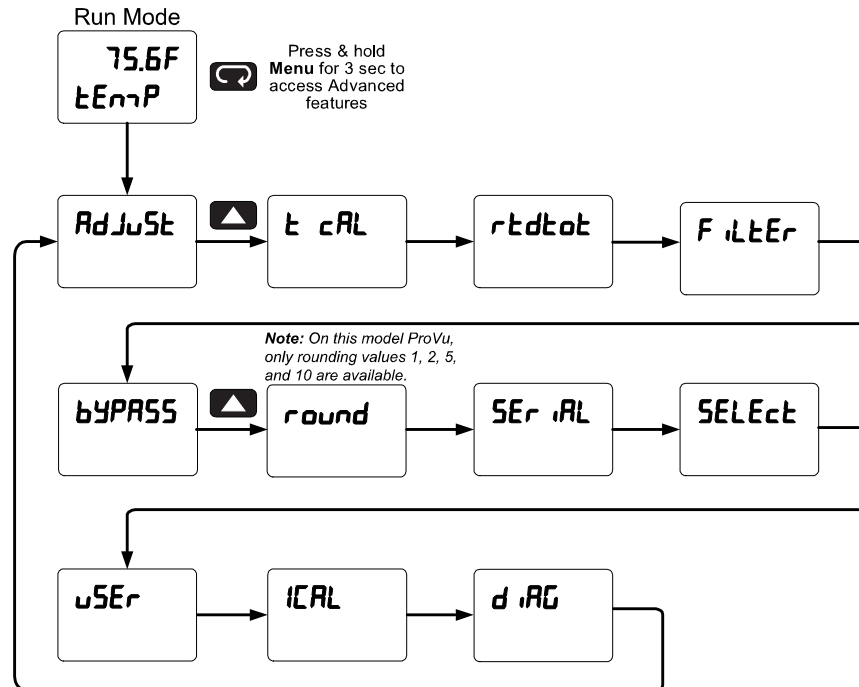
If the password entered is incorrect, the meter displays the message *Locd* (Locked) for about two seconds, and then it returns to Run Mode. To try again, press Enter while the *Locked* message is displayed.

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
RdJusT	Adjust	Set adjust value to offset temperature reading
t cAL	T Cal	Enter temperature calibration menu
t Lo	T Low	Apply the low temperature input (e.g. 32°F)
t Hi	T High	Apply the high temperature input (e.g. 1000°F)
rtdtot	RTD Total	Set the number of RTDs connected in parallel to obtain average temperature
F iLEr	Filter	Set noise filter value
bYPASS	Bypass	Set filter bypass value
round	Round	Set the rounding value for display variables
SEr iAL	Serial	Set serial communication parameters
SLAVE id	Slave ID	Set slave ID or meter address
bAud	Baud rate	Select baud rate
tr dLY	Transmit delay	Set transmit delay for serial communication
PRr itY	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)

Display	Parameter	Action/Setting
RoutePr	Analog output programming	Program analog output parameters
Source	Source	Select source for the 4-20 mA output
OverRange	Overrange	Program mA output for display overrange
UnderRange	Underrange	Program mA output for display underrange
Break	Break	Set input break condition operation
Max mA	Maximum	Program maximum mA output allowed
Min mA	Minimum	Program minimum mA output allowed
Calibrate	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 mA	4 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 mA	20 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
User I/O	User I/O	Assign function keys and digital I/O
F1	F1 function key	Assign F1 function key
F2	F2 function key	Assign F2 function key
F3	F3 function key	Assign F3 function key
F4	F4 function	Assign F4 function (digital input)
DI 1	Digital input 1	Assign digital input 1 – 4, if expansion modules are connected
DO 1	Digital output 1	Assign digital output 1 – 4, if expansion modules are connected
Internal	Internal source calibration	Enter internal source calibration (used for scaling the meter without a signal source)
Measured temp reference	Measured temp reference	Enter the measured reference temperature in degrees Celsius (e.g. 25.0)
0 mV	0 mV	Apply 0.000 mV input Internal Calibration
100 mV	100 mV	Apply 100.000 mV input
Diagnostics	Diagnostics	Display parameter settings
LED test	LED test	Test all LEDs
Info	Information	Display software and S/N information
Erase	Erase	Delete the MeterView Pro installation files from the meter

Offset Adjust (*Adj*)

This parameter allows the user to select an offset adjustment to the temperature being displayed. Offset adjustment values can be either positive or negative and can be any number within $\pm 50.0^{\circ}\text{F}$ ($\pm 27.8^{\circ}\text{C}$). The offset adjustment value is programmed through the *Adjust* menu.

The offset adjustment feature can be useful to compensate for errors due to thermocouple junctions or excessive lead wire resistance in RTDs.

Note: The offset adjustment value is not reset to zero when the type of temperature sensor is changed (i.e. TC type or RTD curve). Celsius/Fahrenheit conversion must be made manually by the user.

Recalibration of the Meter (*Cal*)

The *Calibration* (*Cal*) menu is used to **recalibrate** the thermocouple and RTD inputs.

Allow at least 30 minutes warm-up time before performing recalibration procedure to ensure specified accuracy.

- The meter is factory calibrated prior to shipment to read temperature in degrees Fahrenheit. The calibration equipment is certified to NIST standards.
- There is no need to calibrate the meter, simply select the input type, °F or °C, and decimal point.
- Check calibration of the meter at least every 12 months.

Recommended Calibration Points

To recalibrate the meter, it is recommended to use the Fahrenheit scale; this will give a greater degree of accuracy to the calibration. The scale can be changed to the Celsius scale after calibration is completed. The meter will display temperature accurately in any scale. The following table shows the recommended low and high calibration points for all types.

Type of input	Input 1 (Low)	Input 2 (High)	Check (Middle)
Type J	32°F	1184°F	600°F
Type K	32°F	1895°F	960°F
Type T	32°F	698°F	360°F
Type E	32°F	1652°F	800°F
Type R	32°F	3110°F	1500°F
Type S	32°F	3110°F	1500°F
Type B	32°F	3110°F	1500°F
Type N	32°F	1472°F	700°F
Type C	500°F	3650°F	1800°F
10 Ω Cu RTD	32°F 9.035 Ω	450°F 18.032 Ω	200°F 12.639 Ω
100 Ω Pt RTD (0.00385)	32°F 100 Ω	1148°F 320.12 Ω	590°F 215.61 Ω
100 Ω Pt RTD (0.00392)	32°F 100 Ω	1148°F 324.49 Ω	590°F 217.89 Ω
120 Ω Ni RTD	32°F 120 Ω	410°F 315.31 Ω	221°F 205.22 Ω
1000 Ω Pt RTD (0.00385)	32°F 1000 Ω	900°F 2750.4 Ω	450°F 1876.5 Ω
1000 Ω Pt RTD (0.00392)	32°F 1000 Ω	900°F 2785.1 Ω	450°F 1893.7 Ω

Recalibration Procedure

1. Connect signal to the meter using the appropriate wire (e.g. type J thermocouple wire to recalibrate type J input), see page 13.
2. Set up the meter to accept the selected input (e.g. type J T/C), see page 26.
3. Set up the meter to display temperature in degrees Fahrenheit.
4. Apply signal corresponding to input 1 (32°F) and program the display to read 32.0.
5. Apply signal corresponding to input 2 (1184°F for type J) and program the display accordingly.
6. After the meter accepts input 2, the display returns to reading mode. This completes the recalibration procedure for the selected input.

Noise Filter (*FILTER*)

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

Noise Filter Bypass (*BYPASS*)

The noise filter bypass changes the behavior of the 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.

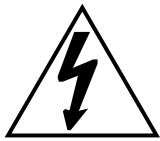
Rounding Feature (*ROUND*)

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. This setting affects the last two digits, regardless of decimal point position. Valid rounding values are 1, 2, 5, and 10.

Modbus RTU Serial Communications (*SERIAL*)

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 5 for details.



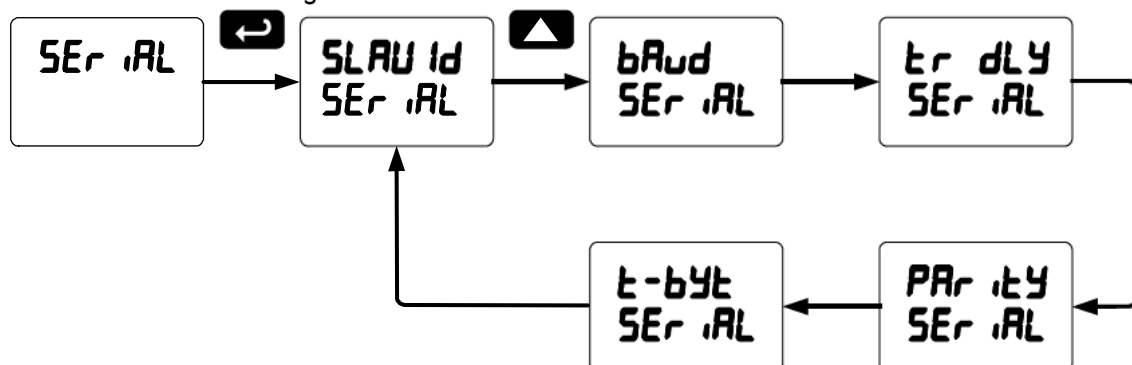
Warning!

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 or 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.

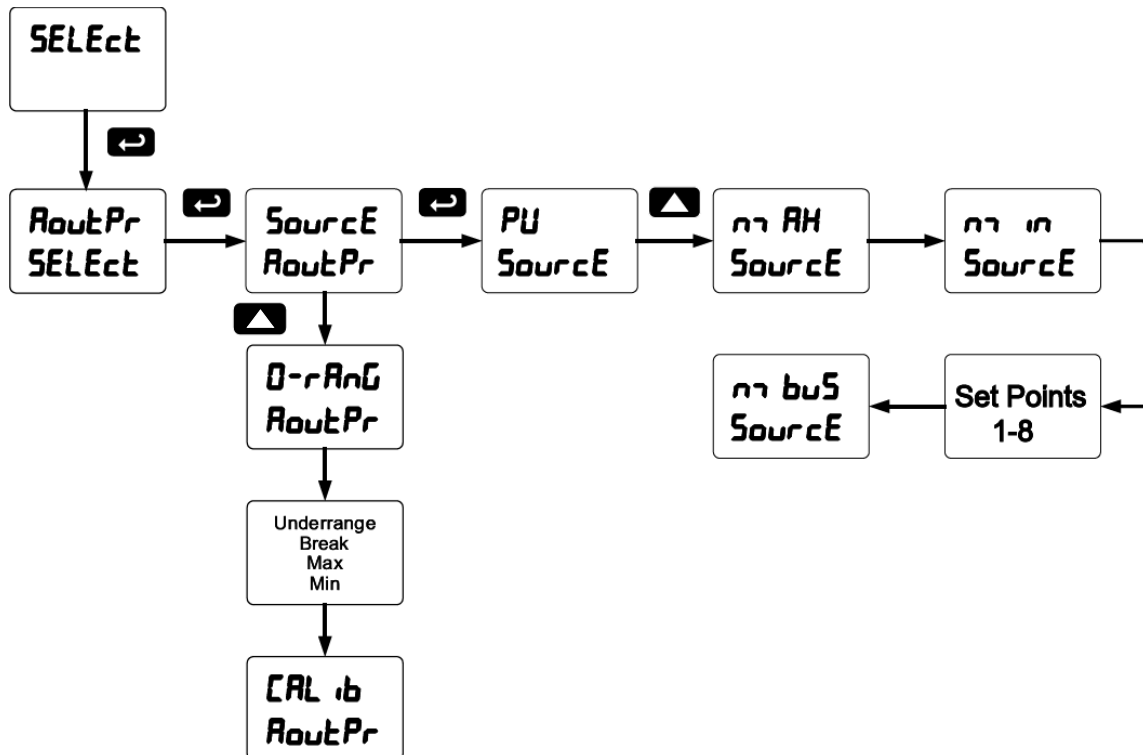
Analog Output Programming (*RoutPr*)

The *Analog Output Programming* menu, located in the *Select* 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.



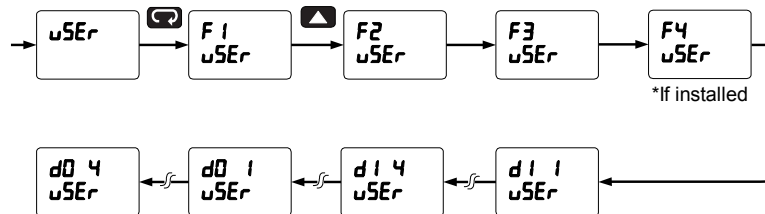
Analog Output Calibration

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.



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
rSE H1	Reset the stored maximum display value
rSE Lo	Reset the stored minimum display value
rSE HL	Reset the stored maximum & minimum display values
tARE	Capture tare and zero the display
rSE tR	Reset captured tare and resume normal operation
rELAY	Directly access the relay menu
SEt I*	Directly access the set point menu for relay 1 (*through 8)
rLY d	Disable all relays until a button assigned to <i>enable relays (rLY E)</i> is pressed
rLY E	Enable all relays to function as they have been programmed
O HoLd	Hold current relay states as they are until a button assigned to <i>enable relays (rLY E)</i> is pressed
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.
Ln1 H1	Display maximum display value on line 1
Ln1 Lo	Display minimum display value on line 1
Ln1 HL	Display maximum & minimum display values on line 1

Display	Description
Ln2 H1	Display maximum display value on line 2
Ln2 Lo	Display minimum display value on line 2
Ln2 HL	Display maximum & minimum display values on line 2
F On I*	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 36 for details about interlock relays.
Control	Directly access the control menu
d,SRbL	Disable the selected function key or digital I/O
RcH	Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching
rESEt	Directly access the reset menu
nEnu	Mimic the menu button functionality (digital inputs only)
r,GMt	Mimic the right arrow/F1 button functionality (digital inputs only)
uP	Mimic the up arrow/F2 button functionality (digital inputs only)
EntEr	Mimic the enter/F3 button functionality (digital inputs only)
ALn1 I*	Provide indication when alarm 1 (*through 8) has been triggered (digital outputs only)

Internal Source Calibration (ICAL)

The meter is factory calibrated prior to shipment to read temperature in degrees Fahrenheit. The calibration equipment is certified to NIST standards.

The Internal Calibration (ICAL) is a function used at the factory to calibrate all the thermocouple and RTD ranges. This procedure should only be used by qualified personnel. To recalibrate the meter for a specific input and range, refer to page 42 Recalibration of the Meter (RECAL).

Notes:

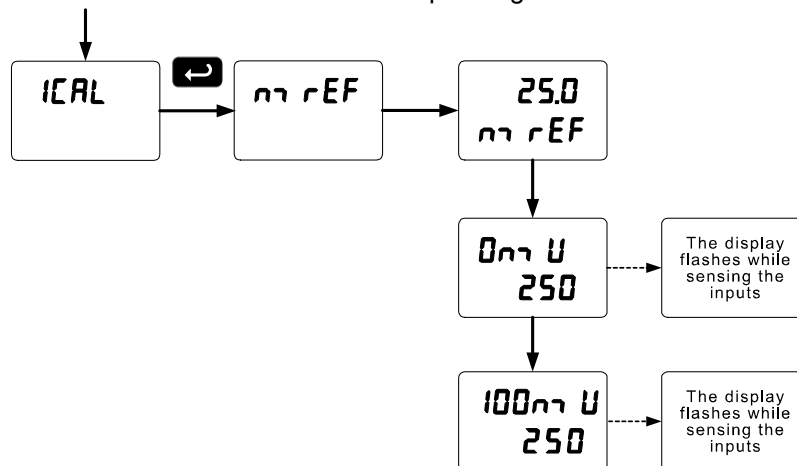
1. If meter is in operation and it is intended to accept only one input type (e.g. 100 Pt), recalibration of other inputs is not necessary.
2. Allow the meter to warm up for at least 30 minutes before performing the calibration procedure.
3. Use the **Recalibration of the Meter** (RECAL) procedure found on page 42.

The Internal calibration menu is part of the Advanced Features menu. This procedure should only be used by qualified personnel.

Note: Most users should not require the use of the Internal Calibration procedure. The T CAL procedure should be used instead of the ICAL procedure.

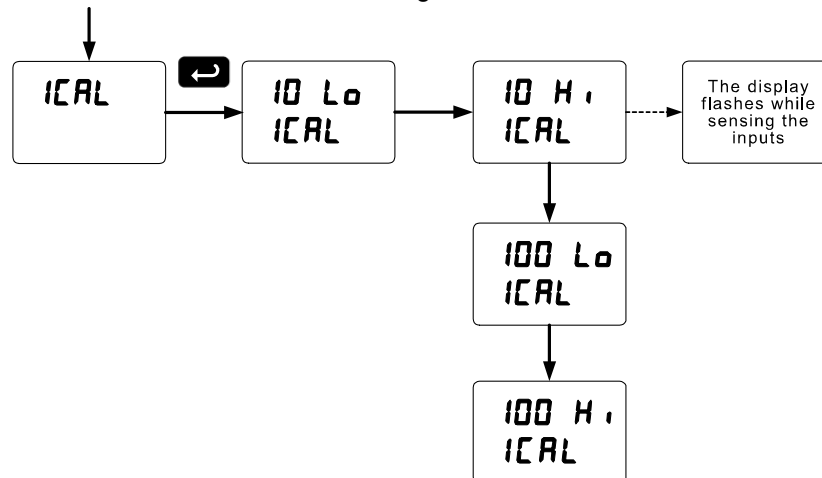
Thermocouple Input Internal Calibration (ICAL)

1. Set the Type selector switch in the TC position and using copper wire connect a precision mV calibrator to the input.
2. In the Setup menu select the input: TC – Type J.
3. Press and hold the Menu button for three seconds to access the advanced features of the meter.
4. Press the Up arrow button to scroll to the *Internal calibration* menu (ICAL) and press Enter.
5. The meter displays either current calibration (REF). Press Enter to start the calibration process.
6. Measure the room temperature in degrees Celsius using a reliable reference, enter the room temperature (e.g. 25.0), and press Enter.
7. The meter displays 0 mV, apply an input equal to 0.000 mV and press Enter. The display flashes while accepting the 0 mV input; press Enter again when the display stops flashing.
8. The meter displays 100 mV, apply an input equal to 100.000 mV and press Enter. The display flashes while accepting the 100 mV input; press Enter again when the display stops flashing.
9. Apply 0 mV, the meter should read room temperature.
10. This completes the calibration of all the thermocouple ranges.



RTD Input Internal Calibration (ICAL)

1. Set the Type selector switch in the RTD position and the Range switch in the 10 position. Using 3 wires connect a precision calibrator resistance output to the meter.
2. In the *Setup* menu select the input: RTD – 100 Pt – A385.
3. Access the *Advanced Features* menu and scroll to the *ICAL* menu and press Enter.
4. The meter displays the message (10 Lo ICAL). Apply 9.035 ohm and press Enter. The display flashes for a moment while the meter is accepting the low input signal for the 10-ohm RTD. After the display stops flashing, press Enter again.
5. The meter displays the message (10 Hi ICAL). Apply 18.032 ohm and press Enter. The display flashes for a moment while the meter is accepting the high input signal for the 10-ohm RTD. After the display stops flashing, press Enter again.
6. The meter displays the message (100 Lo ICAL). **Do NOT press Enter.**
7. Move the Range selector switch to the 100 position. Apply 100 ohm and press Enter. The display flashes for a moment while the meter is accepting the low input signal for the 100-ohm RTD.
8. The meter displays the message (100 Hi ICAL). Apply 320.12 ohm and press Enter. The display flashes for a moment while the meter is accepting the high input signal for the 100-ohm RTD.
9. At the end of the calibration process the meter should read 1148.0F with the 320.12 ohm input applied.
10. This completes the calibration of all the RTD ranges.



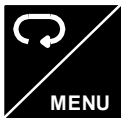
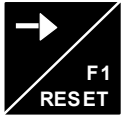


Meter Operation

The meter is capable of accepting a variety of thermocouples and RTDs.

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 engineering units, custom legend, or set point indication.

Additionally, the meter can be set up to display the thermocouple or RTD 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.

Buttons Operation

Button Symbol	Description
<p>MENU</p> 	Press to enter or exit Programming Mode, view settings, or exit max/min readings
<p>RIGHT</p> 	Press to reset max/min readings or other parameter/function assigned through the <i>User</i> menu
<p>UP</p> 	Press to display max/min readings or other parameter/function assigned through the <i>User</i> menu
<p>ACK</p> 	Press to acknowledge relays or other parameters/function assigned through the <i>User</i> 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 above shows the factory default settings for F1, F2, and F3.

Digital Input Operation

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

Maximum/Minimum Readings

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

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

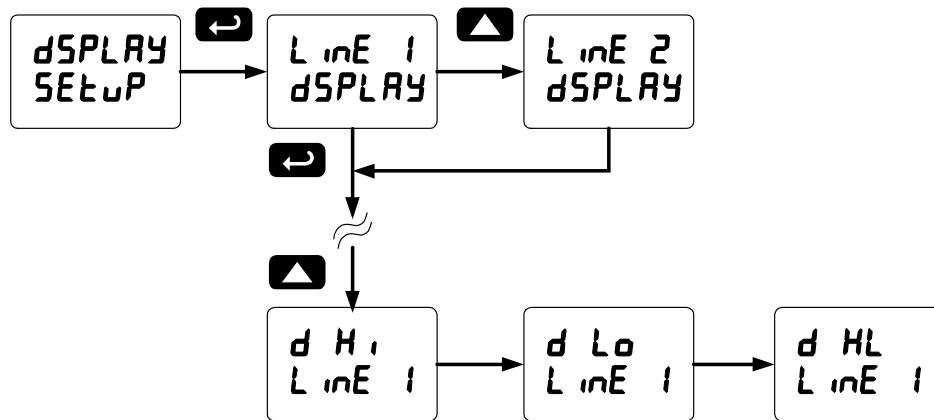
Any of the F1-F3 function keys (buttons) and the digital inputs can be programmed to reset the max & min readings. The meters are set at the factory to display the max reading by pressing the Up arrow/F2 button and to use the Right arrow/F1 button to access the *Reset* menu.

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 40.

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

For a description of the diagnostic messages, see *Advanced Features Menu & Display Messages*, page 40.

Determining Software Version

To determine the software version of a meter:

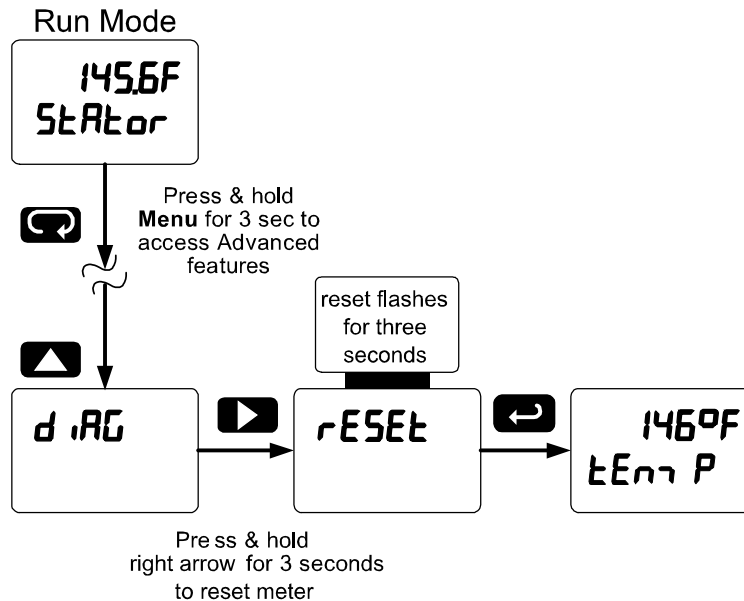
1. Go to the *Diagnostics* menu (*d iAG*) and press Enter button.
2. Press Up arrow button and scroll to Information menu (*inFa*).
3. Press Enter to access the software number (*5Ft*) and version (*4Er*) information. Write down the information as it is displayed. Continue pressing Enter until all the 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 40.
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.



Factory Defaults & User Settings

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

Parameter	Display	Default Setting
Input type	<i>INPut</i>	Type J TC
Temp scale	<i>F or C</i>	°F
Adjust	<i>ADJUST</i>	0.0
RTD total	<i>RTDtot</i>	1
Filter	<i>FILTEr</i>	70
Bypass	<i>bYPASS</i>	0.2
Round	<i>round</i>	1
Decimal point	<i>ddd°F</i>	No decimal
Upper display	<i>bG</i>	PV: Temperature
Lower display	<i>LtLE</i>	Eng units: Temp
Display intensity	<i>d-intY</i>	8
Relay 1 action	<i>Act 1</i>	Automatic
Relay 1 set point	<i>SEt 1</i>	100
Relay 1 reset point	<i>rSt 1</i>	50
Relay 2 action	<i>Act 2</i>	Automatic
Relay 2 set point	<i>SEt 2</i>	200
Relay 2 reset point	<i>rSt 2</i>	150
Relay 3 action	<i>Act 3</i>	Automatic
Relay 3 set point	<i>SEt 3</i>	300
Relay 3 reset point	<i>rSt 3</i>	250
Relay 4 action	<i>Act 4</i>	Automatic
Relay 4 set point	<i>SEt 4</i>	400
Relay 4 reset point	<i>rSt 4</i>	350
Fail-safe relay 1	<i>FLS 1</i>	Off
Fail-safe relay 2	<i>FLS 2</i>	Off
Fail-safe relay 3	<i>FLS 3</i>	Off
Fail-safe relay 4	<i>FLS 4</i>	Off
On delay relay 1	<i>On 1</i>	0.0 sec
Off delay relay 1	<i>OFF 1</i>	0.0 sec
On delay relay 2	<i>On 2</i>	0.0 sec
Off delay relay 2	<i>OFF 2</i>	0.0 sec
On delay relay 3	<i>On 3</i>	0.0 sec
Off delay relay 3	<i>OFF 3</i>	0.0 sec
On delay relay 4	<i>On 4</i>	0.0 sec
Off delay relay 4	<i>OFF 4</i>	0.0 sec
Input break relay 1	<i>IgnorE</i>	Ignore
Input break relay 2	<i>IgnorE</i>	Ignore
Input break relay 3	<i>IgnorE</i>	Ignore
Input break relay 4	<i>IgnorE</i>	Ignore

Parameter	Display	Default Setting
Display 1 analog out	<i>d1 1</i>	0.0
Output 1 value	<i>Out 1</i>	4.000 mA
Display 2 analog out	<i>d1 2</i>	2000.0
Output 2 value	<i>Out 2</i>	20.000 mA
Source analog output	<i>Source</i>	Process Variable
Overrange output	<i>OverRNG</i>	21.000 mA
Underrange output	<i>UnderRNG</i>	3.000 mA
Input break output	<i>brERH</i>	1.000 mA
Maximum output	<i>max RH</i>	23.000 mA
Minimum output	<i>min</i>	1.000 mA
Slave ID	<i>SLAVE id</i>	247
Baud rate	<i>baud</i>	9600
Transmit delay	<i>tr dLY</i>	10 ms
Parity	<i>PAR itY</i>	Even
Byte-to-byte timeout	<i>t-byt</i>	010 (0.1 sec)
F1 function key	<i>F1</i>	Reset max & min
F2 function key	<i>F2</i>	Upper display: Max (Hi)
F3 function key	<i>F3</i>	Acknowledge relays
F4 function	<i>F4</i>	Acknowledge relays
Digital input 1	<i>d1 1</i>	Menu
Digital input 2	<i>d1 2</i>	Right arrow
Digital input 3	<i>d1 3</i>	Up arrow
Digital input 4	<i>d1 4</i>	Enter
Digital output 1	<i>dO 1</i>	Alarm 1
Digital output 2	<i>dO 2</i>	Alarm 2
Digital output 3	<i>dO 3</i>	Alarm 3
Digital output 4	<i>dO 4</i>	Alarm 4
Password 1	<i>PASS 1</i>	000000 (unlocked)
Password 2	<i>PASS 2</i>	000000 (unlocked)
Password 3	<i>PASS 3</i>	000000 (unlocked)

Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, <code>LoCd</code> is displayed	Meter is password-protected, enter correct six-digit password to unlock
Meter displays error message during calibration (<code>ERROR</code>)	Check: <ol style="list-style-type: none"> 1. Signal connections 2. Input selected in <i>Setup</i> menu 3. Minimum input span requirements
Meter displays <code>999999</code> <code>-999999</code>	Check: <ol style="list-style-type: none"> 1. Input selected in <i>Setup</i> menu 2. Corresponding signal at Signal connector
Display is unstable	Check: <ol style="list-style-type: none"> 1. Input signal stability and value 2. Display scaling vs. input signal 3. Filter and bypass values (increase)
Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: <ol style="list-style-type: none"> 1. Signal input conditioner selected: Linear, square root, etc. 2. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check display assignment, it might be displaying max, min, or set point.
Display alternates between <code>H i</code> and a number <code>Lo</code> and a number	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: <ol style="list-style-type: none"> 1. Fail-safe in <i>Setup</i> menu 2. Wiring of relay contacts
Relay and status LED do not respond to signal	Check: <ol style="list-style-type: none"> 1. Relay action in <i>Setup</i> menu 2. Set and reset points
Flashing relay status LEDs	Relays in manual control mode or relay interlock switches opened.
Meter not communicating with application programs	Check: <ol style="list-style-type: none"> 1. Serial adapter and cable 2. Serial settings 3. Meter address and baud rate
If the display locks up or the meter does not respond at all	Cycle the power to reboot the microprocessor.
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.