Javelin D • Model PD644
Instruction Manual

- Measures DC Voltage up to 300 VDC
- 4 Digit Display, 0.56" (14 mm) High, Red LEDs
- Maximum/Minimum Display
- NEMA 4X, IP65 Front
- 4-20 mA Transmitter
- Universal Power Supply 85-265 VAC
- 12-36 VDC/12-24 VAC Power Option
- Two Relays Option
- RS-485 Serial Communication
- Modbus® RTU Option
- Copy Meter Settings to Other Meters

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INTRODUCTION

The Javelin D is an easy to use digital voltmeter with built-in 4-20 mA isolated transmitter and RS-485 serial communication capability. The four front panel buttons provide quick and simple setup and programming.

The optional Form C relays can be used for alarm indication or process control applications.

The Modbus® RTU serial communication upgrade enables the Javelin D Digital Voltmeter to operate as a Modbus® slave in RS-485 multi-point data acquisition systems.

ORDERING INFORMATION

85-265 VAC Model	12-36 VDC Model	Options Installed
PD644-6R3-14		24 VDC Transmitter Supply
PD644-6R5-14		2 Relays, 24 VDC Supply
	PD644-7R3-04	None
	PD644-7R5-04	2 Relays

All models may be powered from AC or DC. See Specifications for details.

Accessories

Model	Description
PDN-MODBUS	Modbus® RTU upgrade
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
PDX6901	Suppressor (snubber): 0.01 µF/470 Ω, 250 VAC

Plastic, steel, and stainless steel NEMA 4 and cast aluminum explosion-proof enclosures are available to house up to ten meters.

Visit our web site for details on all accessories.

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SAFETY INFORMATION

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

WARNING: Risk of electric shock.

 WARNING

Hazardous voltages exist within enclosure. Installation and service should be performed only by trained service personnel.

SPECIFICATIONS

Except where noted all specifications apply to operation at 77°F (25°C).

General

DISPLAY	0.56" (14 mm) high, red LED Four digits (-1999 to 9999), automatic lead zero blanking.
DISPLAY INTENSITY	Eight intensity levels
DISPLAY UPDATE RATE	Minimum of five times per second
OVERRANGE	Display flashes 9999
UNDERRANGE	Display flashes -1999
PROGRAMMING METHODS	Four front panel buttons, RS-485 interface, or cloning using Copy function
NOISE FILTER	Programmable from 2 to 199 (0 will disable filter)
RECALIBRATION	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
MAX/MIN DISPLAY	Maximum and minimum measured voltages stored until reset by the user or until power to the meter is turned off.
PASSWORD	Programmable password restricts modification of programmed settings.
NON-VOLATILE MEMORY	All programmed settings are stored in non-volatile memory for a minimum of ten years without power.

POWER OPTIONS	AC: 85-265 VAC, 50/60 Hz DC: 90-265 VDC Optional: 12-36 VDC, 12-24 VAC See table for power consumption (*X: number depends on option)	Model	Watts
		PD644-6RX-14*	20
		PD644-7RX-04	6

FUSE	Required fuse: UL Recognized, 5 A maximum, slow blow Up to 6 meters can share one 5 A fuse
ISOLATED POWER SUPPLY OPTION	24 VDC $\pm$ 10% @ 200 mA
NORMAL MODE REJECTION	64 dB at 50/60 Hz
ISOLATION	4 kV from mains 500 V from transmitter to other secondary circuits 500 V from 24 VDC supply to other secondary circuits

ENVIRONMENTAL	Operating temperature range: 32 to 150°F (0 to 65°C)
	Storage temperature range: -40 to 185°F (-40 to 85°C)
	Relative humidity: 0 to 90%, non-condensing
CONNECTIONS	Removable screw terminal blocks accept 12 to 26 AWG wire
ENCLOSURE	1/8 DIN, high impact plastic,
	UL 94V-0, color: gray
MOUNTING	1/8 DIN panel cutout required. Two panel mounting bracket assemblies provided.
TIGHTENING TORQUE	Screw terminal connectors: 5 lb-in (0.56 Nm)
OVERALL DIMENSIONS	2.45" x 4.68" x 4.19" (62 mm x 119 mm x 106 mm) (H x W x D)
WEIGHT	9 oz (255 g) (Including options)
WARRANTY	3 years parts and labor
EXTENDED WARRANTY	1 or 2 years, refer to Price List for details

Voltage Measurement Input

INPUT	0 to 300 VDC
ACCURACY	±0.05% of full scale ±1 count
TEMPERATURE DRIFT	50 PPM/°C from 0 to 65°C ambient
DECIMAL POINT	Up to three decimal places: *d.ddd*, *dd.dd*, *ddd.d*, or *dddd*
INPUT IMPEDANCE	Greater than 1 MΩ
CALIBRATION RANGE	An Error message will appear if input 1 and input 2 signals are too close together.
	Minimum Span: 10 VDC

Safety Compliance

UL LISTED	USA and Canada
	UL 508 Industrial Control Equipment
UL FILE NUMBER	E160849
FRONT PANEL	UL Type 4X, NEMA 4X, IP65; panel gasket provided

Relays Option

RATING	2 SPDT (form C); rated 3 A @ 30 VDC or 3 A @ 250 VAC resistive load; 1/14 HP @ 125/250 VAC for inductive loads
ELECTRICAL NOISE SUPPRESSION	A suppressor (snubber) should be connected to each relay contact switching inductive loads, to prevent disruption to the microprocessor's operation. Recommended suppressor value: 0.01 µF/470 Ω, 250 VAC (Order PDC model number PDX6901).
DEADBAND	0-100% of full scale, user selectable
HIGH OR LOW ALARM	User may program any alarm for high or low trip point.
RELAY OPERATION	Automatic (non-latching) Latching Alternation control Modbus® control
RELAY RESET	User selectable via front panel buttons or serial communication
	Automatic reset only (non-latching)
	Automatic plus manual reset at any time (non-latching)
	Manual reset only at any time (latching)
	Manual reset only after alarm condition has cleared (latching)
	Automatic reset: Relays will automatically reset when the input passes the reset point.
	Manual reset: Front panel ACK button. Pressing ACK re-sets all manually resettable relays.
TIME DELAY	0 to 199 seconds, on and off delays Programmable and independent for each relay
FAIL-SAFE OPERATION	Programmable Independent for each relay
AUTO INITIALIZATION	When power is applied to the meter, relays will reflect the state of the input to the meter.

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

Isolated 4-20 mA Transmitter Output

OUTPUT RANGE	1.00 to 23.00 mA typical
CALIBRATION	Factory calibrated for 4-20 mA
SCALING RANGE	0.00 to 23.99 mA for any display range, see output range above
ACCURACY	± 0.1% F.S. ± 0.004 mA
TEMPERATURE DRIFT	50 PPM/°C from 0 to 65°C ambient Note: Analog output drift is separate from input drift.
ISOLATED TRANSMITTER POWER SUPPLY	24 VDC ± 10% @ 20 mA
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

METER ADDRESS	PDC protocol: 0 - 99 Modbus® protocol: 1 - 247
BAUD RATE	300 – 19,200 bps
TRANSMIT TIME DELAY	Programmable between 0 and 199 ms
DATA	8 bit (1 start bit, 1 stop bit)
PARITY	None, even, or odd (Modbus® only; PDC protocol does not use parity)
BYTE-TO-BYTE TIMEOUT	0.01 – 2.54 sec (Modbus® only)
TURN AROUND DELAY	Less than 2 ms (fixed)

Request or download copies of the Precision Digital Serial Communication Protocol and Modbus® Register Tables specifications for details about serial data communications with Precision Digital products.

INSTALLATION

There is no need to remove the meter from its case to complete the installation, wiring, and setup of the meter.

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.

Panel Mounting

- Prepare a standard 1/8 DIN panel cutout – 3.622" x 1.772" (92 mm x 45 mm). Refer to *Mounting Dimensions*, page 48 for more details.
- Clearance: allow at least 4" (102 mm) behind the panel for wiring.
- Panel thickness: 0.04" - 0.25" (1.0 mm - 6.4 mm). Recommended minimum panel thickness to maintain Type 4X rating: 0.06" (1.5 mm) steel panel, 0.16" (4.1 mm) plastic panel.
- Remove the two mounting brackets provided with the meter (back-off the two screws so that there is ¼" (6.4 mm) or less through the bracket. Slide the bracket toward the front of the case and remove).
- Insert meter into the panel cutout.
- Install mounting brackets and tighten the screws against the panel. To achieve a proper seal, tighten the mounting bracket screws evenly until meter is snug to the panel along its short side. DO NOT OVER TIGHTEN, as the rear of the panel may be damaged.

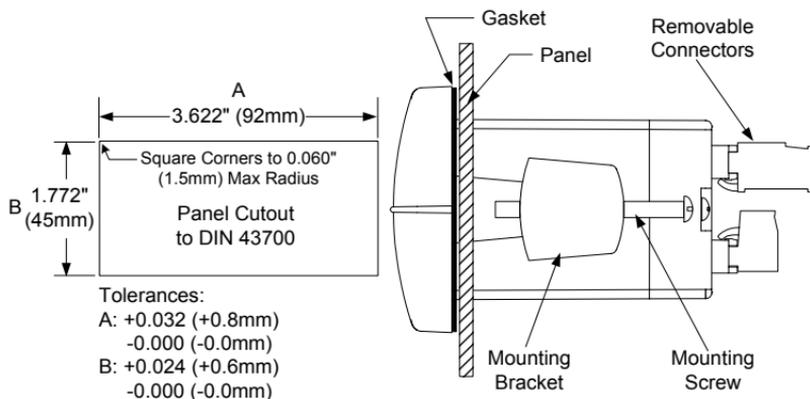**Figure 1. Panel Cutout and Mounting**

Connections

All connections are made to removable screw terminal connectors located at the rear of the meter. You must use copper wire with 60°C or 60/75°C insulation.

> ⚠ **!** 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.

Connector Labeling

The label on each meter shows the location of all connectors for the particular model. As an example Figure 2 illustrates the connector layout for meters equipped with relays and 4-20 mA transmitter. Other models have different connector arrangements.
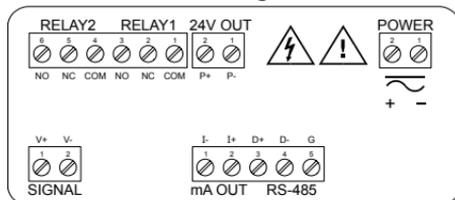
Figure 2. Connector Labeling

Power Connections

Power connections are made to a two position screw terminal connector labeled POWER. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention. The screw terminal power connector is specially keyed to prevent insertion into the wrong receptacle on the meter. **The installer must not remove nor alter the positions of any of the keying inserts.**

POWER CONNECTOR

AC or DC
POWER

UL Recognized External Fuse
5 A Max, 250 V Slow Blow
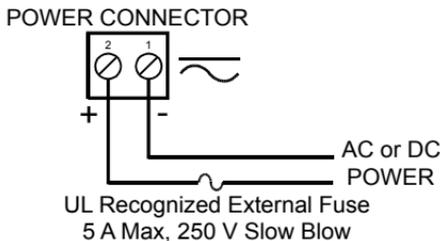
Figure 3. Power Connections

DC Voltage Measurement Connections

Figure 4 shows how to connect the DC voltage to be measured.
The voltage on terminal V- must be at ground potential. Be sure to observe the correct polarity.

⚠	The reversal of polarity can result in damage to the meter and associated data communications equipment and can expose personnel to electrical shock hazards.

SIGNAL
CONNECTOR

0-300 VDC

Figure 4. DC Voltage Signal Connections

Serial Communication

The PD644 can be connected directly to an RS-485 data bus of up to 32 nodes. For systems consisting of more than 32 nodes RS-485 re-peaters are necessary. Serial communication wiring connections to the PD644 are made via the three position screw terminal connector labeled RS-485. Please refer to standard EIA-485 for complete specifications for balanced digital multi-point communications. The use of shielded twisted pair cable is recommended to protect the data signals from elec-tr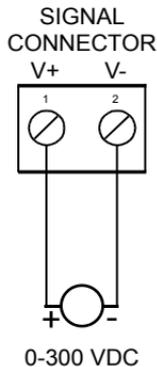ical interference. For long wire runs it is good practice to terminate the bus at both ends with a resistor connected between D+ and D- that matches the characteristic impedance of the cable. A typical value for termination resistors is 120 Ω.
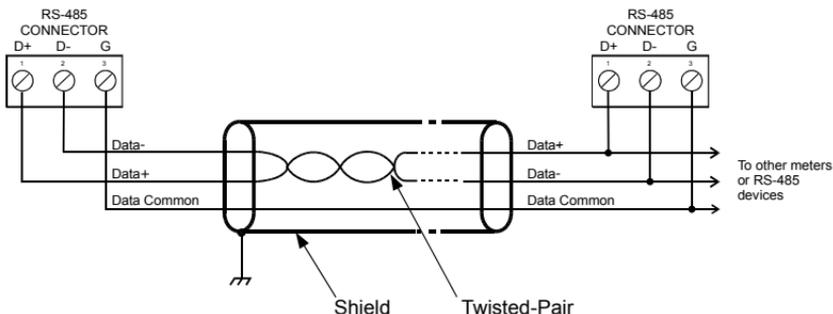
Figure 5. RS-485 Data Bus Connections

For non-multiplexed serial communications with RS-232 data communi-cations equipment such as a personal computer, an RS-232 to RS-485 converter such as the Precision Digital PDA7485 is required. If using a PDA7485, connect the PD644 according to the PDA7485 wiring dia-gram for a two wire RS-485 application.

Relay Output Connections

Relay connections are made to a six-terminal connector labeled RELAY1 RELAY2.

Figure 6. Relay Output 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:
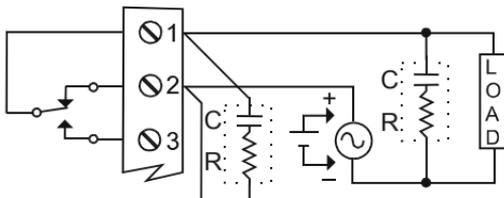
Figure 1. AC and DC Loads Protection

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. Inductive relay rating is 1/14 HP (50 W) at 115/230 VAC
2. Use capacitors rated for 250 VAC.
3. RC networks may affect load release time of solenoid loads. Check to confirm proper operation.
4. Install the RC network at the meter's relay screw terminals. An RC network may also be installed across the load. Experiment for best results.
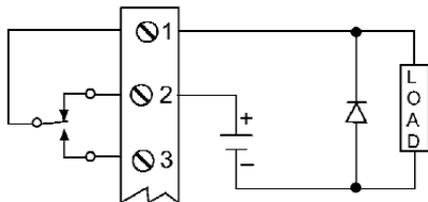
Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

Figure 2. Low Voltage DC Loads Protection

RC Networks Available from Precision Digital

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

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

4-20 mA Output Signal Connections

Connections for the 4-20 mA transmitter are made to the screw terminal connector labeled mA OUT. The 4-20 mA transmitter may be powered from an internal power supply (optional) available at the screw terminal connector labeled 24V OUT or from an external power supply.
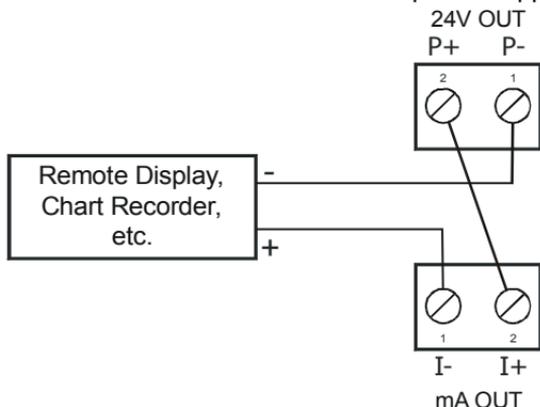
Figure 9. 4-20 mA Transmitter Powered by Meter
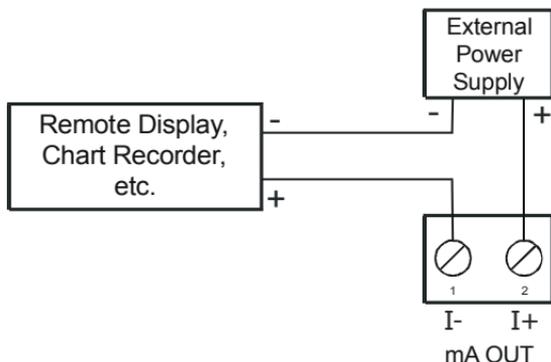
Figure 10. 4-20 mA Transmitter Powered Externally

SETUP AND PROGRAMMING

> - There is **no need to recalibrate** the meter when first received from the factory.
> - The meter is *factory calibrated* prior to shipment. The calibration equipment used at the factory is certified to NIST standards.

Overview

All setup and programming functions are done with the front panel buttons. There are no jumpers involved in the setup process of the meter.

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

Front Panel Buttons and Status LED Indicators

Button Symbol	Description
⟳	**Menu**
▶	**Right arrow/Reset**
▲	**Up arrow/Max**
↵	**Enter/Ack**

LED	Status
1	Alarm 1
2	Alarm 2
S	Set point indicator
R	Reset point indicator

- 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 programming.
- Press the **Up** arrow button to scroll through the menus, decimal point, or to increment the value of a digit.
- Press the **Enter/Ack** button to access a menu or to accept a setting.
- Press and hold the **Right** arrow and the **Menu** buttons, for three seconds, to access the Advanced features of the meter (Tip: press and hold **Right** arrow first then press **Menu**).

Display Functions and Messages

The meter displays various functions and messages during setup/programming and operation. The following table shows the displayed functions and messages with their action or setting description.

Display	Parameter	Action/Setting
SEtu	*Setup*	Enter *Setup* menu
dEc.P	Decimal point	Set decimal point for process inputs
rELY	*Relay*	Enter the *Relay* menu
rLY1	*Relay1*	Relay 1 setup
Act1	*Action1*	Set relay 1 action (automatic, latching, etc.)
Auto	*Automatic*	Set relay for automatic reset
A-m	*Auto-manual*	Set relay for automatic + manual reset any time
LtCH	*Latching*	Set relay for latching operation
L-CL	*Latching-cleared*	Set relay for latching operation with manual reset only after alarm condition has cleared
ALtr	*Alternate*	Set relays for alternation control
oFF	*Off*	Disable relay and front panel status LEDs Disable relay's fail-safe operation
SEt1	*Set1*	Program set point 1
rSt1	*Reset1*	Program reset point 1
rLY2	*Relay2*	Setup relay 2
Act2	*Action2*	Set relay 2 action (automatic, latching, etc.)
SEt2	*Set2*	Program set point 2
rSt2	*Reset2*	Program reset point 2
FLSF	*Fail-safe*	Enter *Fail-safe* menu
FLS1	*Fail-safe1*	Set relay 1 fail-safe operation
on	*On*	Enable fail-safe operation
FLS2	*Fail-safe2*	Set relay 2 fail-safe operation
dLAY	*Delay*	Enter *Time Delay* menu
dLY1	*Delay1*	Enter relay 1 time delay setup

Display	Parameter	Action/Setting
On1	*On1*	Set relay 1 On time delay
OFF1	*Off1*	Set relay 1 Off time delay
dLY2	*Delay2*	Enter relay 2 time delay setup
On2	*On2*	Set relay 2 On time delay
OFF2	*Off2*	Set relay 2 Off time delay
Aout	*Analog output*	Enter the *Analog output* menu
out1	*Output 1*	Program output 1 value (e.g. 4 mA)
out2	*Output 2*	Program output 2 value (e.g. 20 mA)
ProG	*Program*	Enter the *Program* menu
CAL	*Calibrate*	Enter the *Calibrate* menu
ScAL	*Scale*	Enter the *Scale* menu
inP1	*Input 1*	Calibrate input 1 signal or program input 1 value
di51	*Display 1*	Program display 1 value
inP2	*Input 2*	Calibrate input 2 signal or program input 2 value
di52	*Display 2*	Program display 2 value
Err	*Error*	Error, calibration not successful, check signal
PASS	*Password*	Enter the *Password* menu
unLC	*Unlocked*	Program password to lock meter
LoCd	*Locked*	Enter password to unlock meter
9999 - 1999	*Flashing display*	Overrange condition Underrange condition

Main Menu

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

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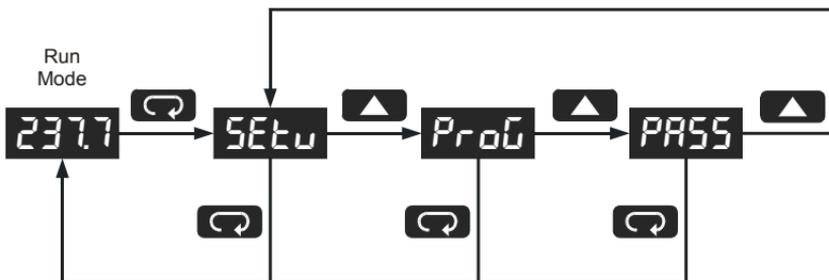
- Press **Menu**, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing **Enter/Ack** are not saved.
- Changes to the settings are saved to memory only after pressing **Enter/Ack**.
- The display moves to the next menu every time a setting is accepted by pressing **Enter/Ack**.

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 the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.
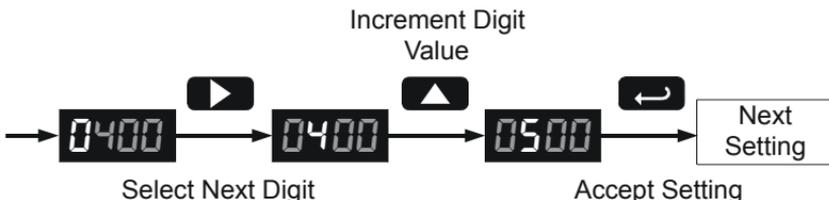
Setting Up the Meter (5Etu)

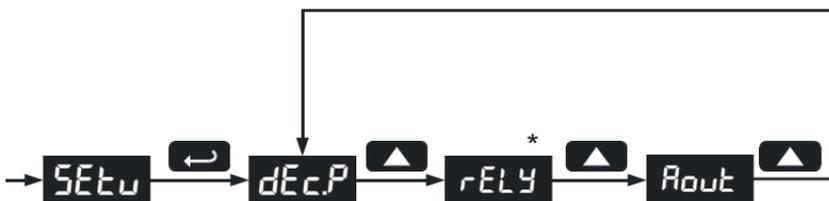The *Setup* menu is used to select:

1. Relay operation

2. 4-20 mA analog output setup

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

* Relay menu is always available even if relays option is not installed. Visual alarm indication is available through front panel LEDs and MeterView software.

Setting the Relay Operation (rELY)

This menu allows you to set up the operation of the relays:

1. Relay action
   a. Automatic reset only (non-latching)
   b. Automatic plus 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. Alternation control (automatic reset only)
   f. Off (relay and status LED disabled)
2. Set point
3. Reset point
4. Fail-safe operation
   a. On (enabled)
   b. Off (disabled)
5. Time delay
   a. On delay (0-199 seconds)
   b. Off delay (0-199 seconds)

From Setup Menu

rELY

rLY1 rLY2 FLSF dLAY

Same Functions as Relay 1

Act1
SEt1
rSt1

FLS1
FLS2

dLY1
dLY2

Press **Enter/Ack** button to access any menu
Press **Menu** button to exit at any time
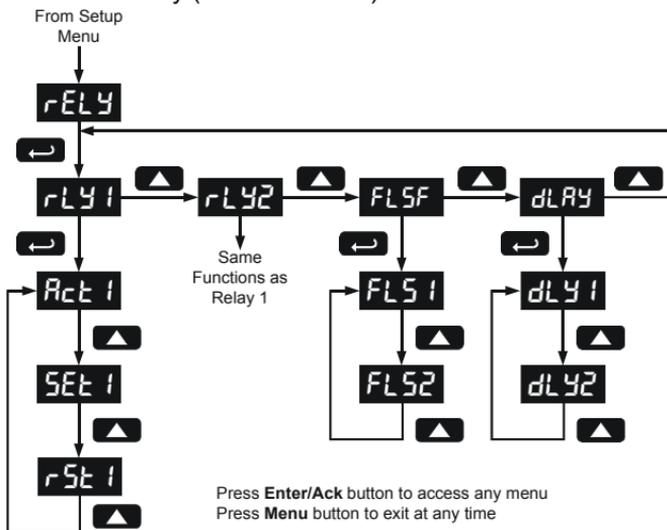
Setting the Relay Action

The relay *Action* menu allows the user to set up the operation of the relays. The relays may be set up for any of the following modes of operation:

1. Automatic reset (non-latching)
2. Automatic plus 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. Alternation control (automatic reset only)
6. Off (relay and status LED disabled)

The following illustration shows relay 1 action setup; relay 2 is set up in a similar fashion.

From Relay 1 Menu

Press **Enter/Ack** button to accept setting
Press **Menu** button to exit at any time
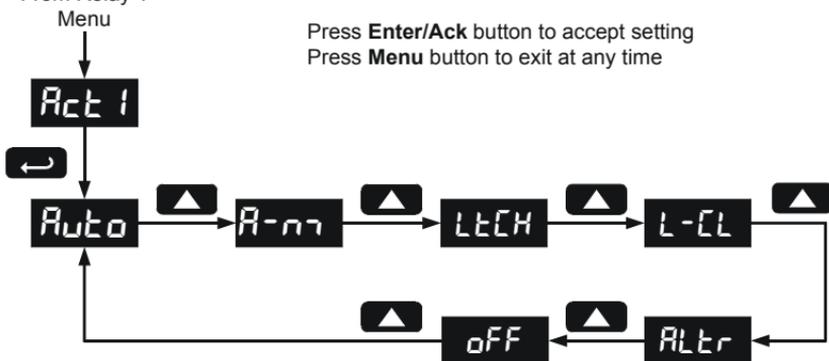
Programming Set and Reset Points

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 set and reset points are programmed the same, relay will reset one count below set point.

Program Set Point

Program Reset Point
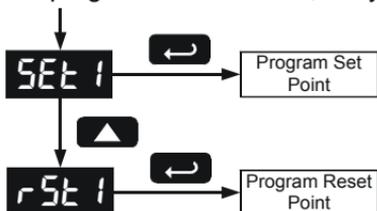
Quick Set Points

Press **Up** arrow and **Menu** at the same time to access set/reset points quickly.

Setting Fail-Safe Operation

The fail-safe operation is set independently for each relay. Select **on** to enable or select **oFF** to disable fail-safe operation.

FL5F

Press **Enter/Ack** button to accept setting
Press **Menu** button to exit at any time

FL51   on   oFF

FL52   on   oFF
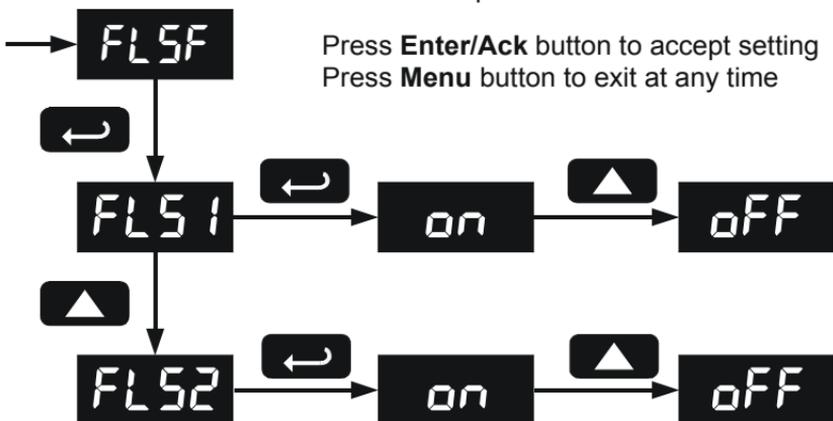
Programming Time Delay

The *On* and *Off* time delays may be programmed for each relay between 0 and 199 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.

dLAY

dLY1   On1   OFF1

dLY2   Program Relay 2 Times   Program On Time Delay   Program Off Time Delay

25
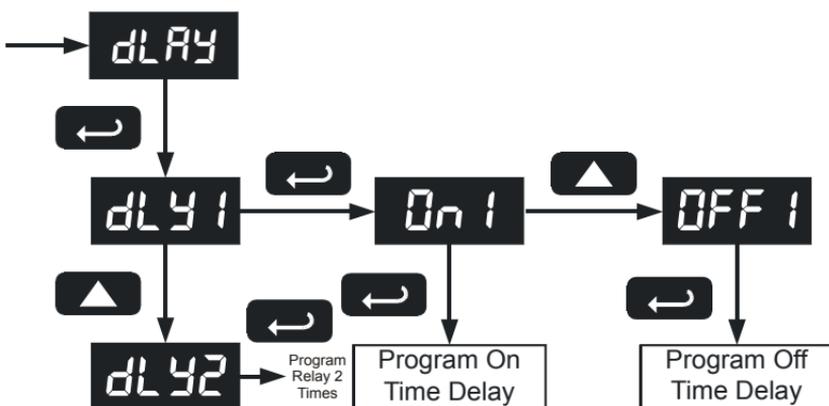
Relay and Alarm Operation

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

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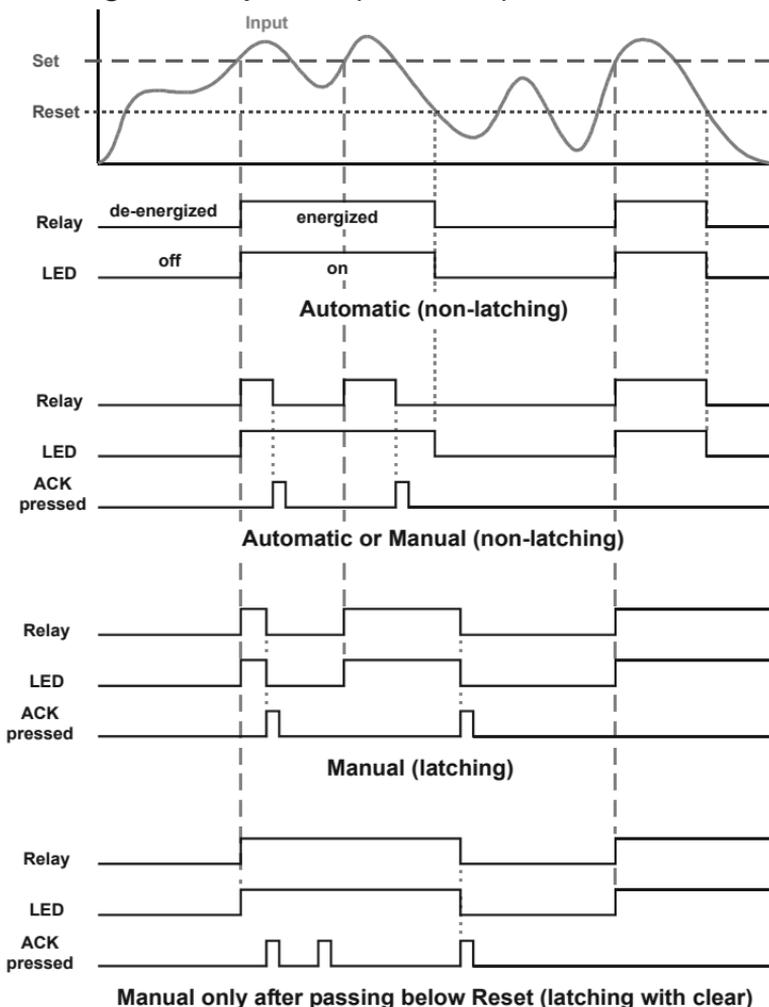
Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing below Reset (latching with clear)

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

Low Alarm Operation (Set < Reset)
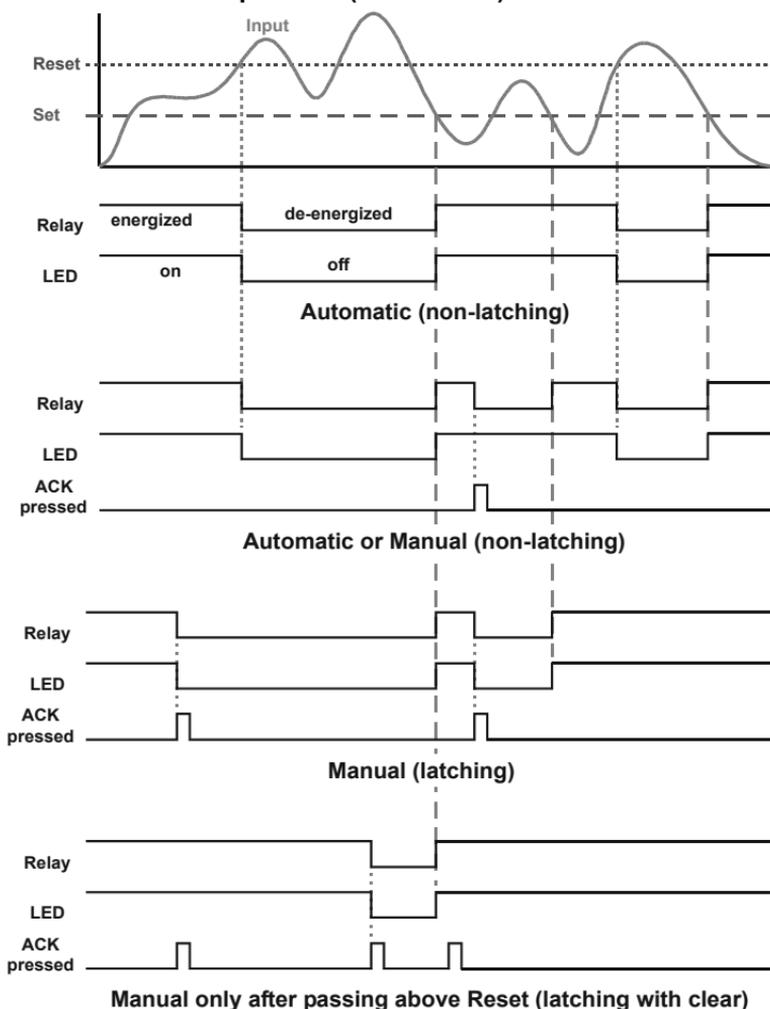
Input

Reset

Set

Relay	energized	de-energized
LED	on	off

Automatic (non-latching)

Relay

LED

ACK pressed

Automatic or Manual (non-latching)

Relay

LED

ACK pressed

Manual (latching)

Relay

LED

ACK pressed

Manual only after passing above Reset (latching with clear)

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

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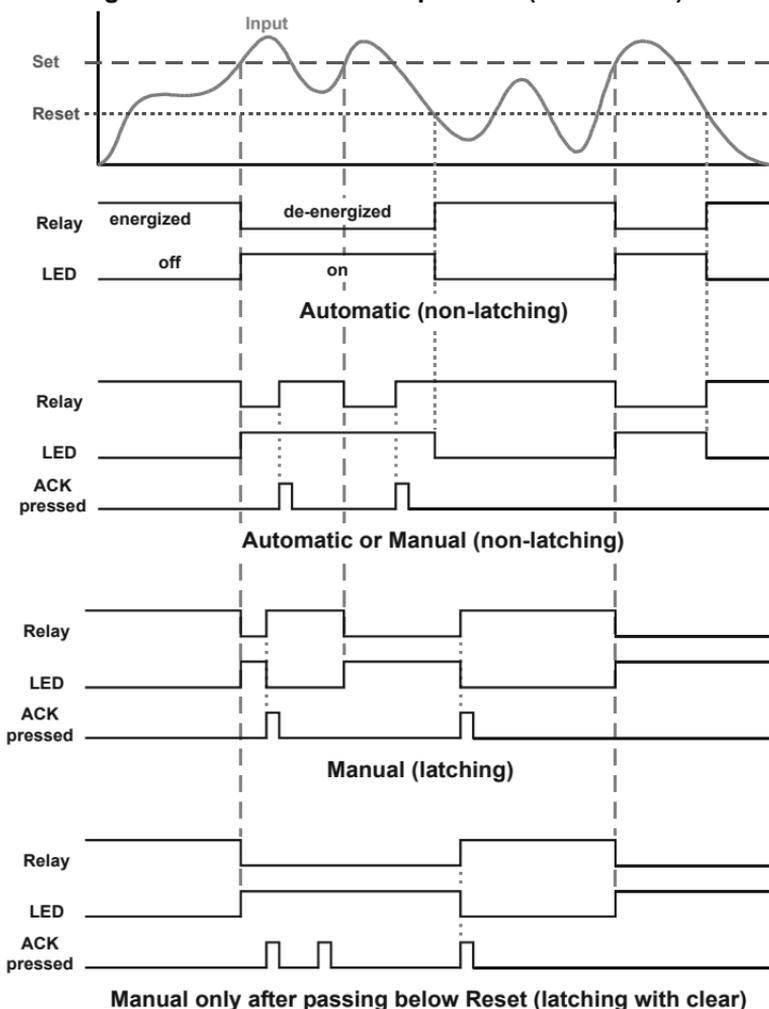
Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing below Reset (latching with clear)

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

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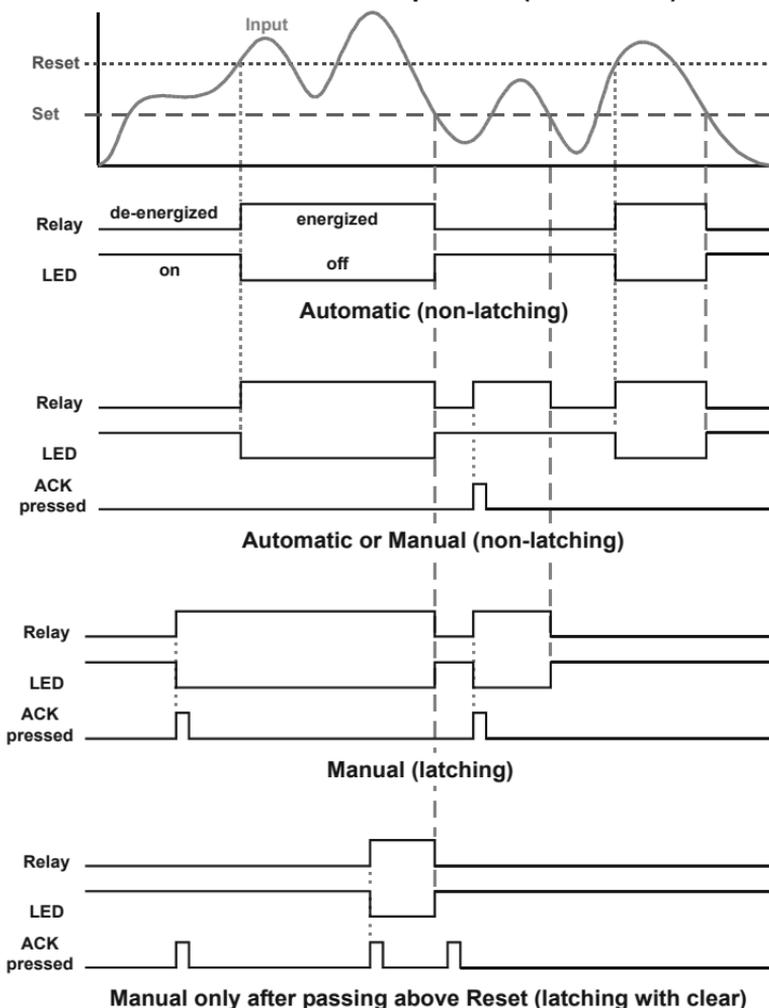
Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing above Reset (latching with clear)

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

Time Delay Operation

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

On Time Delay
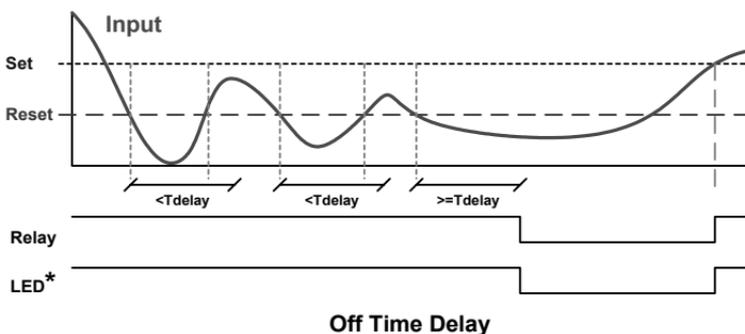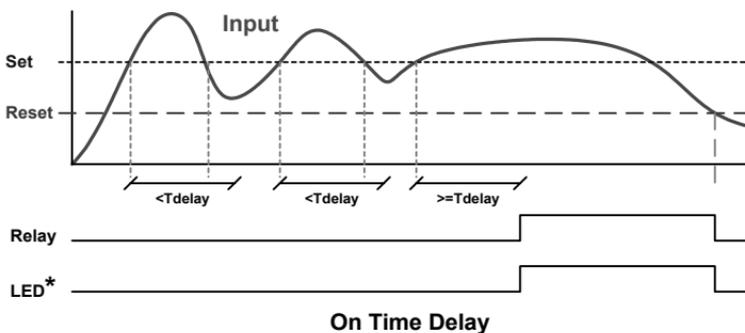
Off Time Delay

If 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.

*The LED is not affected by Time Delay when "Automatic or Manual" reset mode is selected. Rather the LED follows the set and reset points.

Alternation Control Operation
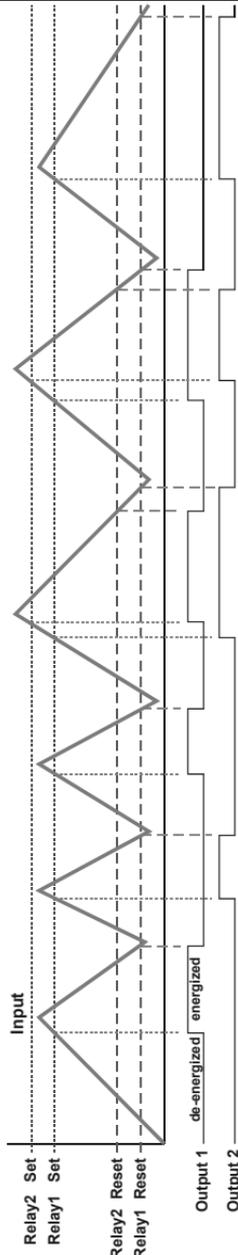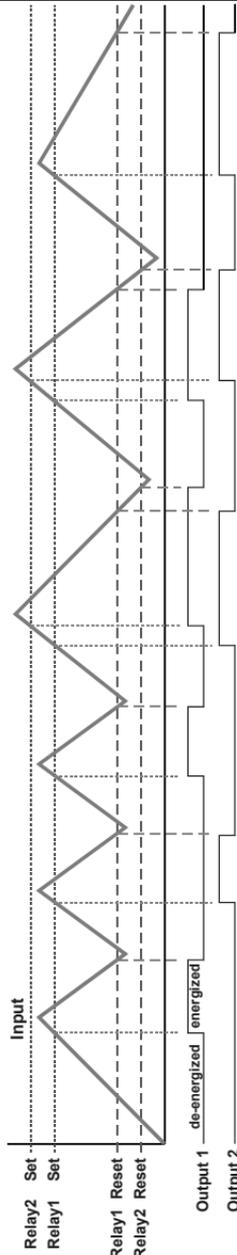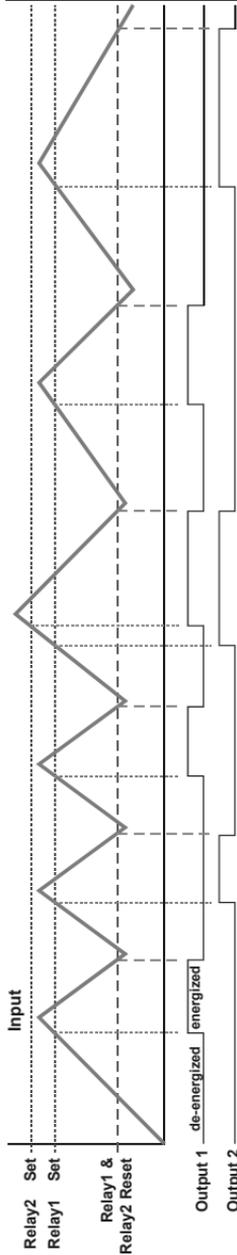
LEDs indicate the relay status

Scaling the 4-20 mA Analog Output (Rout)

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

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

The *Analog Output* menu is used to program:

1. 4-20 mA output based on display values
2. Sensor break value in mA

Press Enter to Accept Setting

Press Up to Set Digit Value

Press Right to Select Next Digit

Press Menu to Exit at any Time

Set Display 1 Value

Set Output 1 Value

Scale Output 2
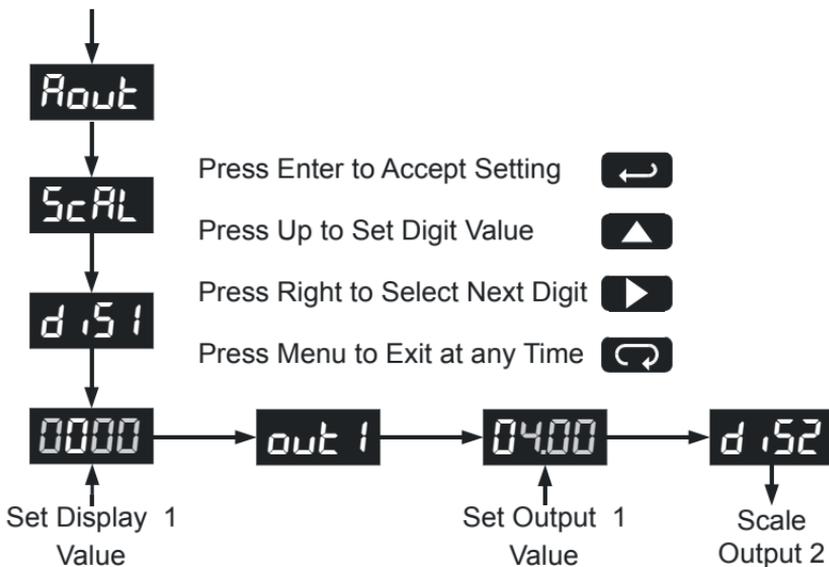
Analog Output when Display is Out of Range

The analog output reflects the display out of range conditions as follows:

Input Condition	Display	Analog Output
Underrange	Flashing -1999	3.00 mA
Overrange	Flashing 9999	21.00 mA

Programming the Meter (ProG)

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

- There is **no need to recalibrate** the meter when first received from the factory.
- The meter is *factory calibrated* prior to shipment. The calibration equipment used at the factory is certified to NIST standards.
- Simply connect the power and signal to the proper terminals, and turn the power on. *No calibration needed!* (when the meter is first received from the factory).

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

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

ProG → ↵ → ScAL → ▲ → CAL
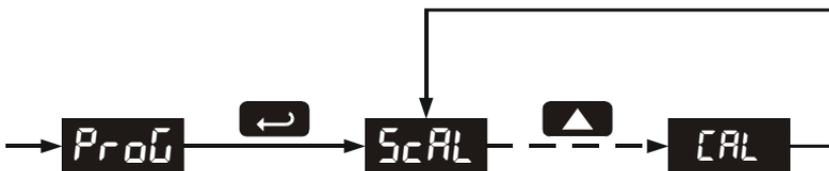
Additional parameters, not needed for most applications, are programmed with the *Advanced* features menu, see *Advanced Features Menu*, page 37.

Scaling the Meter (5cAL)

The 0 to 300 VDC input can be scaled to display convenient engineering units.

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

5cAL	Press Enter to Accept Setting	↵
	Press Up to Set Digit Value	▲
inP1	Press Right to Select Next Digit	▶
	Press Menu to Exit at any Time	↺

| 000.0 → | d 15 1 → | 000.0 → | inP2 |

Set Input 1   Set Display 1   Scale
Value   Value   Input 2
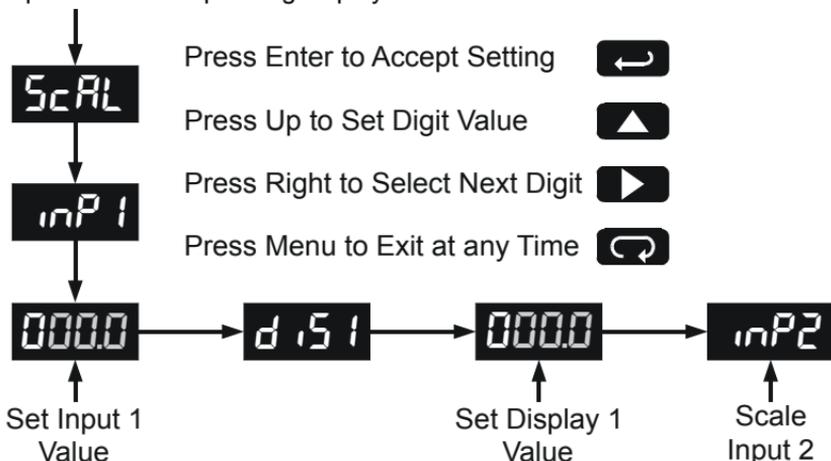
Calibrating the Meter (CAL)

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

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

See *Scaling the Meter* for Button Functions Description

| CAL |
| ↵ |

| inP1 → | d 15 1 → | 04.00 → | inP2 |

Display
Flashes
During   Set Display 1   Calibrate
Sampling   Value   Input 2
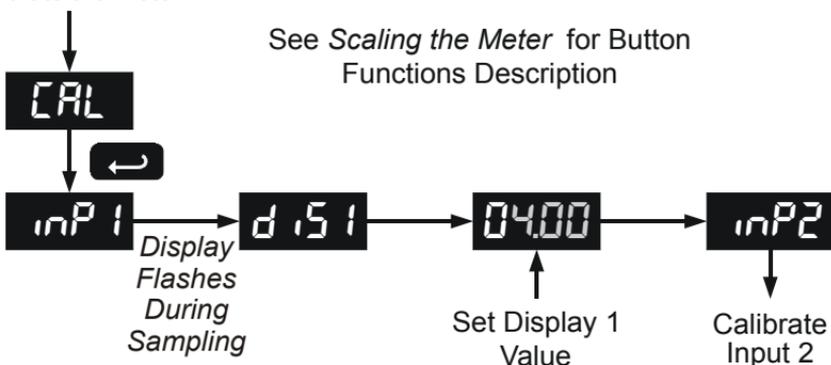
Error Message (*Err*)

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

After the error message is displayed, the meter reverts to input 1, allowing acceptable input voltages to be applied or valid data to be entered.

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

1. Input signal is not connected to the proper terminals or it is connected backwards.
2. Input span was less than 10 VDC.
3. Same input signal used for both calibration points.

Recalibrating Process Inputs (*ICRL*)

The *Internal Calibration* (*ICRL*) menu, located in the Advanced features menu, is used to recalibrate the voltage input so that the Scaling feature has accurate reference points. Recalibration is recommended at least every twelve months if using the scaling feature.

Refer to **Internal Calibration (ICal)**, page 44 for instructions.
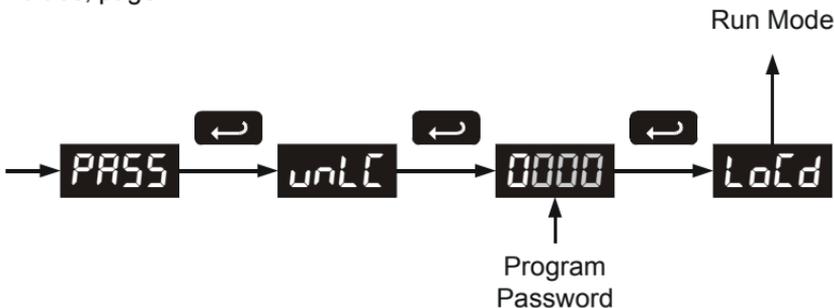
Setting Up the Password (*PASS*)

The *Password* menu is used to program a four-digit password to prevent unauthorized changes to the programmed parameter settings.

Locking the Meter

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

For instructions on how to program numeric values see *Setting Numeric Values*, page 22.

Run Mode

Program
Password

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

Model:	
Serial Number:	
Password:	__ __ __ __

Unlocking the Meter

If the meter is password protected, the correct password must be entered in order to make changes to the parameter settings.

Run Mode
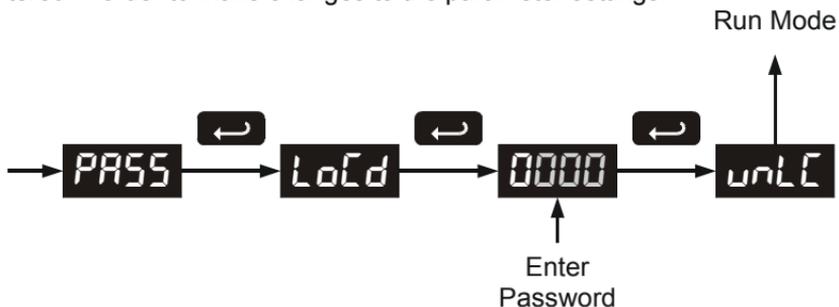
Enter
Password

Entering the correct four-digit number sets the password to 0000, disabling the protection.

Changes to the programmed parameter settings are allowed only with the password set to 0000.

If the password entered is incorrect, the meter displays *LoCd* (Locked) for three seconds, then allows you to try again.

Forgot the Password?

The password may be disabled by the following procedure:

1. Note display reading prior to pressing the Menu button. Ignore decimal point and sign.

2. Access the *Password* menu, add 2 to the noted reading and enter that number as the password (e.g. display reading = -1.23, password = 0125).

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 **Right** arrow and the **Menu** buttons, for three seconds, to access the Advanced features of the meter (Tip: press and hold **Right** arrow first then press **Menu).**

Press for Three Seconds

FLtr

bYPS

SErL

Press **Enter/Ack** to Access
Menu or to Accept Setting

Press **Up** to Scroll Menu and
to Increment Digit Value

CoPY

Press **Right** to Select Next Digit

SELc

Press **Menu** to Exit at any Time

1 CAL

d iAG
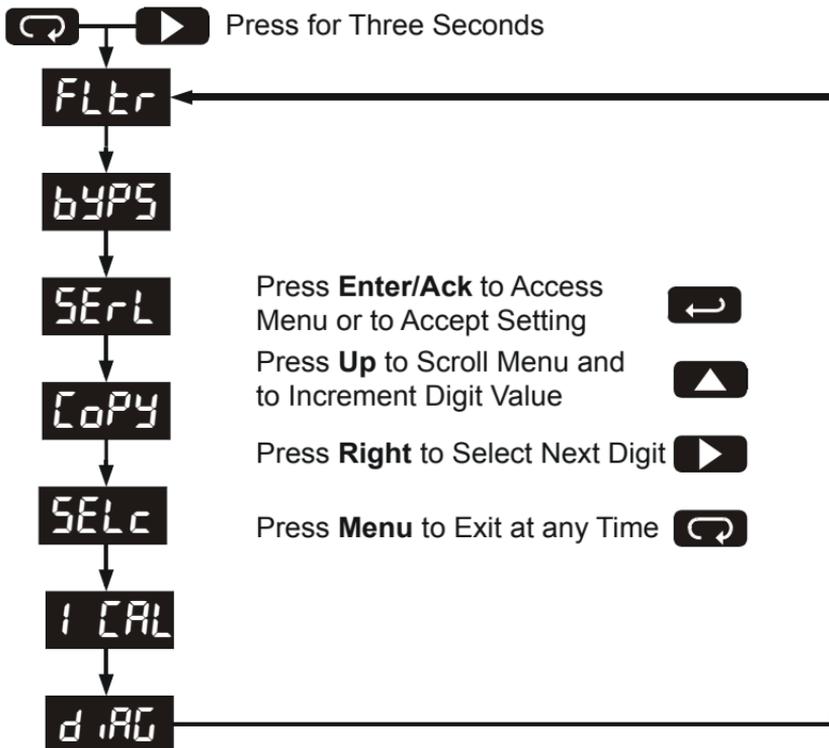
Advanced Features Menu & Display Messages

Display	Parameter	Action/Setting
FLtr	*Filter*	Set noise filter value
bYPS	*Bypass*	Set filter bypass value
SErL	*Serial*	Set serial communication parameters
Prot	*Protocol*	Enter the Protocol menu
PdC	*PDC*	Select PDC protocol
mbS	*Modbus®*	Select Modbus® protocol
Addr	*Address*	Set meter address
bAud	*Baud rate*	Select baud rate
trdE	*Transmit delay*	Set transmit delay for serial communication
PrtY	*Parity*	Select none, even, or odd (Modbus® only)
tbYt	*Byte-to-byte*	Program byte-to-byte timeout (silent time – Modbus® only)
CoPY	*Copy*	Enter copy function
SEnd	*Send*	Send meter settings to another meter
donE	*Done*	Copy function completed
SELc	*Select*	Enter the Select menu (output, intensity)
out	*Output*	Set meter for either relay or analog output (factory set only – corresponding option installed)
IntY	*Intensity*	Select display intensity
Aout	*Analog output*	Set meter for analog output option
rELY	*Relay*	Set meter for relay option
d iAG	*Diagnostics*	Display parameter settings
LEd	*LED*	Test display
CFG	*CFG*	Display meter configuration
ICAL	*Initial calibration*	Enter initial calibration
rELY	*Relays*	Display relay settings
GoFF	*Gain/offset*	Display gain and offset
Aout	*Analog output*	Display analog output settings

Display	Parameter	Action/Setting
SErL	*Serial*	Display serial communication settings
InFo	*Information*	Display software version and serial number information

Noise Filter (FLtr)

Most applications do not require changing this parameter. It is intended to help attain a steady display with an unsteady (noisy) input signal.

The field selectable noise filter averages any minor or quick changes in the input signal and displays the reading with greater stability.

Increasing the filter value will help stabilize the display, however this will slow down the display response to changes in the input signal.

The filter level may be set anywhere from 2 to 199.

Setting filter value to zero disables filter function, and bypass setting becomes irrelevant.

Noise Filter Bypass (bYPS)

The meter can be programmed to filter small input changes, but allow larger input changes to be displayed immediately, by setting the bypass value accordingly.

If the input signal goes beyond the bypass value, it will be displayed immediately with no averaging done on it.

The noise filter bypass value may be set anywhere from 0.2 to 99.9. It corresponds to percentage of full scale.

Increasing the bypass value may slow down the display response to changes in the input signal.

Serial Communications (5ErL)

The meter is equipped with serial communications capability as a standard feature using PDC Serial Communication Protocol. The Modbus® RTU Protocol is optional and may be purchased at any time.

To communicate with a computer or other data communications equipment which lacks an RS-485 interface, an RS-232 to RS-485 adapter such as the Precision Digital PDA7485 is required. Please refer to *Ordering Information* on page 3 for details.

When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The address may be programmed from 00 to 99 for PDC protocol and from 1 to 247 for Modbus® protocol. The transmit delay may be set between 0 and 199 ms.

Select Menu (5ELc)

The *Select* menu is used to select the display intensity. Selection of analog output is a factory setting depending on the option installed.

- Output options are installed and set up at the factory.
- Changing the output selection will cause erroneous operation.
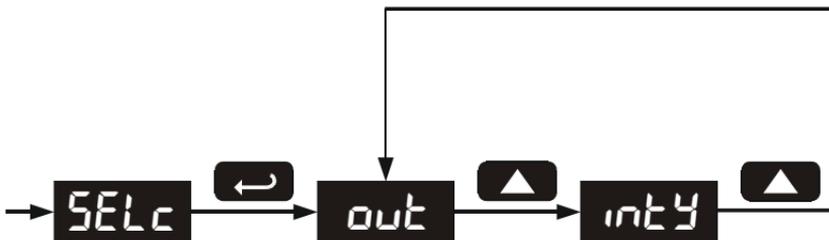
The *Output* selection menu is for factory use only.
Do not change the selection!

Display Intensity (ınｔ닝)

The Display Intensity function provides a selection from eight brightness levels to accommodate a wide variety of ambient lighting conditions.
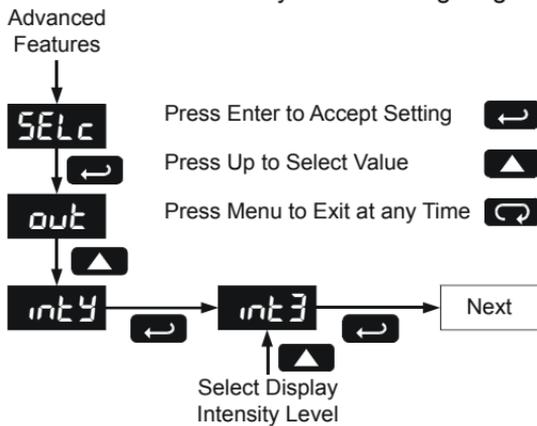
Meter Copy Function (*CoPY*)

The *Copy* function is used to copy (or clone) all the settings from one meter to other meters requiring exactly the same setup and program-ming (alarms, filter, bypass, etc.). The copy function must not be en-gaged while more that two meters are connected together.

Figure 11. Meter Copy Connection

Copy Function Requirements

To copy settings from one meter to an-other, both meters must have:

    1. Same software version
    2. Same baud rate setting
    3. PDC protocol selected

See *Determining Software Version*,
page 49 for instructions.

Meter Copying Instructions

1. Connect the RS-485 terminals of the two meters according to this table.

Master	Clone
D+	D+
D-	D-
G	G

2. Power up both meters. Leave the Clone meter in Run Mode.
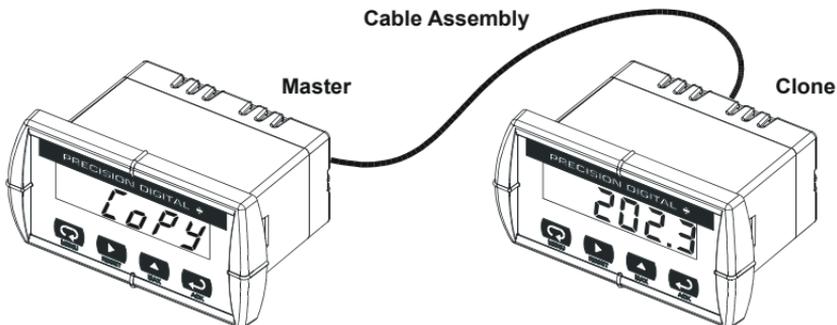3. Enter the *Advanced* features menu of the Master meter, see *Advanced Features Menu*, page 37.
4. Scroll to *Copy* function using **Up** arrow button then press **Enter/Ack**.
5. The meter displays the message 5End. Press **Enter/Ack**, the display flashes while sending data. The message donE is displayed when copying is completed.

Advanced
Features

*Display
Flashes While
Sending*

CoPY → 5End → donE

Press **Menu** to Exit and
Return to Run Mode
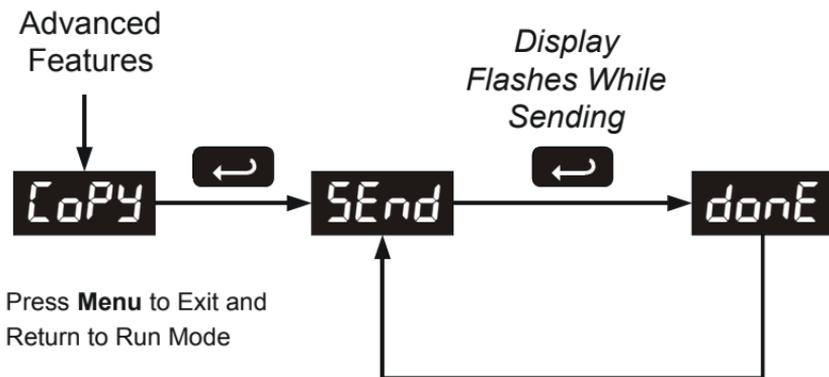
6. The Clone meter displays the memory block numbers in hexadecimal sequence then the message donE when copying is completed. The Clone meter then initializes and returns to Run Mode using the same settings as the Master.
7. If meter to be cloned does not respond to the data being sent, refer to *Copy Function Requirements* above.
8. If desired, move the connector to the next Clone meter and press **Enter/Ack** to repeat the process.

Internal Calibration (ICRL)

> - There is **no need to recalibrate** the meter when first received from the factory.
> - The meter is ***factory calibrated*** prior to shipment. The calibration equipment used at the factory is certified to NIST standards.
> - Allow the meter to warm up for at least 15 minutes before performing the internal calibration procedure.

The internal calibration allows the user to scale the meter without applying a signal.

The use of calibrated signal sources is necessary to perform the internal calibration of the meter.

Check calibration of the meter at least every 12 months.

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

1. Press and hold the **Right** arrow and the **Menu** buttons, for three seconds, to access the Advanced features of the meter (Tip: press and hold **Right** arrow first then press **Menu).**
2. Press the **Up** arrow button to scroll to the *Internal calibration* menu and press **Enter/Ack**.
3. The meter displays voltage (UoLt). Press **Enter/Ack** to start the calibration process.
4. The meter displays *VLow* (u Lo) prompt. Apply the lower voltage input signal and press **Enter/Ack**. The display flashes for a moment while meter is sampling the input.
5. After the display stops flashing, a number is displayed with the leftmost digit brighter than the rest. The bright digit is the active digit that can be changed by pressing the **Up** arrow button. Press the **Right** arrow button to move to the next digit.
6. Set the display value to correspond to the input voltage being applied.
7. The display moves to the high input calibration (u H ı). Apply the higher voltage input signal and press **Enter/Ack**.
8. Set the display for the high input calibration in the same way as it was set for the low input calibration.

Set Display Value
for Low Input

*Display
Flashes
During
Sampling*

Calibrate
High Input
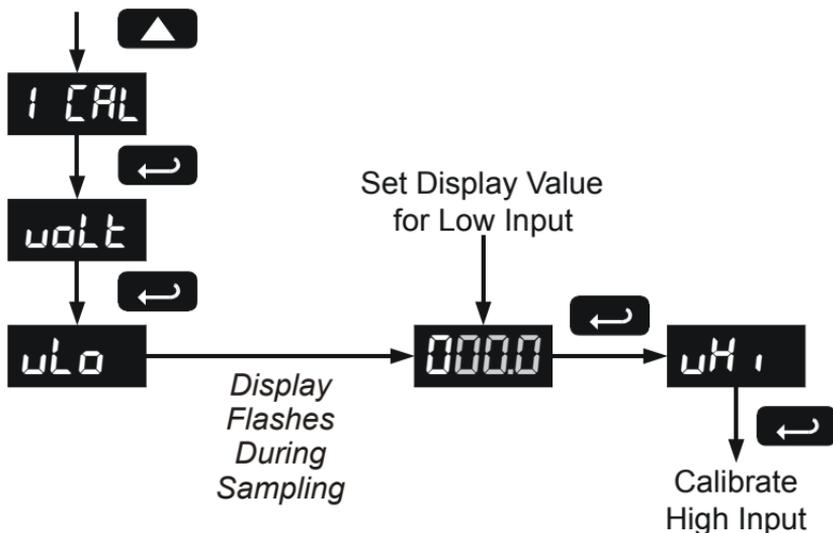
Notes:

- Low and high input signals can be anywhere between 0 and 300 VDC.
- Observe minimum input span requirement of 10 VDC between input 1 and input 2.
- The inputs must not be negative, even slightly.

Error Message (*Err*)

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

After the error message is displayed, the meter reverts to input 1, allowing acceptable input voltages to be applied.

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

1. Input signal is not connected to the proper terminals or it is connected backwards.
2. Input span was less than 10 VDC.
3. Same input signal used for both calibration points.

OPERATION

The meter is capable of accepting positive DC voltage signals and displaying these signals in engineering units from -1999 to 9999.

Front Panel Buttons Operation

Button Symbol	Description
	Press to enter or exit Programming Mode, view settings, or exit Max/Min display
	If displaying Max or Min reading, press to reset Max or Min reading
	Press to display Max reading If displaying Max reading, press to display Min reading
	Press to acknowledge relays If displaying Max or Min reading, press to override Max/Min display timeout

Maximum and Minimum Readings

The main function of the front panel buttons during operation is to display the maximum and minimum readings.
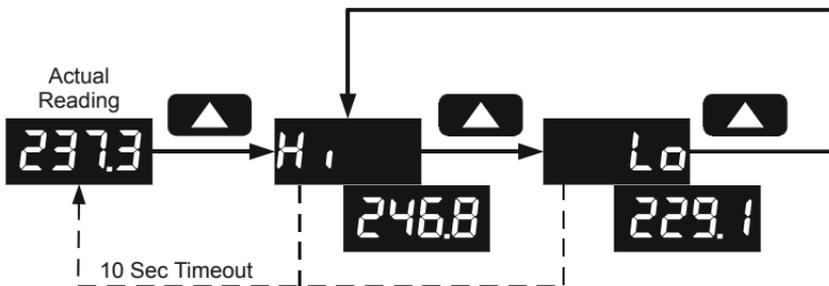
Press **Up** to Display and to Toggle Between Max & Min

Press **Enter** to Hold Max/Min

Press **Right** to Reset Max/Min

Press **Menu** to Exit Max/Min

1. Press **Up** arrow/**Max** button to display maximum reading since the last reset/power-up.
2. Press **Up** arrow/**Max** again to display the minimum reading since the last reset/power-up.
3. Press **Enter/Ack** to hold Max/Min display reading, the meter will continue to track new Max/Min readings.
4. If **Enter/Ack** is not pressed, the Max/Min display reading will time out after ten seconds and the meter will return to displaying the actual reading.
5. Press **Right** arrow/**Reset** button to reset Max/Min while reading is being displayed. Max/Min display readings are reset to actual reading.

MOUNTING DIMENSIONS
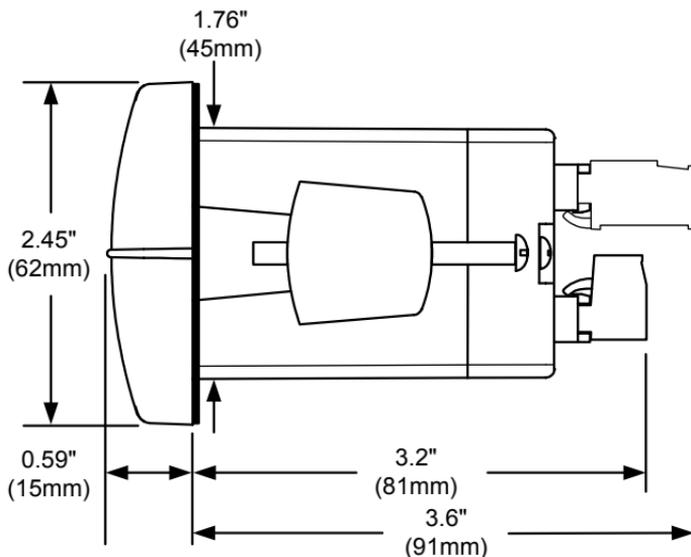
Figure 12. Meter Dimensions – Side View
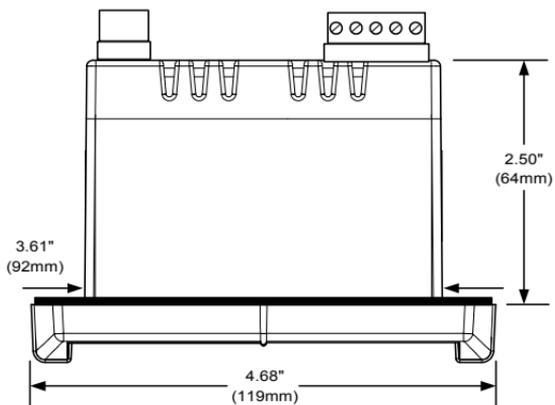
Figure 13. Case Dimensions - Top View

TROUBLESHOOTING

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

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

Diagnostics Menu (ᴅ ıᴿᴳ)

The *Diagnostics* menu is located in the *Advanced* features menu, to access *Diagnostics* menu see *Advanced Features Menu*, page 37.

It provides an easy way to view the programmed parameter settings for troubleshooting purposes. Press the **Enter/Ack** button to view the settings and the **Menu** button to exit at any time.

For a description of the diagnostics messages see *Advanced Features Menu & Display Messages*, page 38.

Determining Software Version

To determine the software version of a meter:

1. Go to the *Diagnostics* menu (ᴅ ıᴿᴳ) and press **Enter/Ack** button.
2. Press **Up** arrow/**Max** button and scroll to Information menu (ınᶠᴏ).
3. Press **Enter/Ack** to access the software number (ᔕᶠᴸ), version (ᴜᴱᵣ), and serial number (ᔕn) information. Write down the information as it is displayed. Continue pressing **Enter/Ack** until all the information is displayed.

Factory Defaults & User Settings

The following table shows the factory setting for most of the programmable parameters on the meter. Next to the factory setting, the user should record the setting for the particular application.

Model: PD644-_____   S/N: _____   Date: _____

Parameter	Display	Default Setting	User Setting
Programming	ProG	Scale	
Input 1	InP1	000.0 VDC	
Display 1	di51	000.0	
Input 2	InP2	200.0 VDC	
Display 2	di52	200.0	
Decimal point	dddd	1 decimal place	
Relay 1	rLY1		
Action 1	Act1	Automatic	
Set 1	5Et1	70.0	
Reset 1	r5t1	60.0	
Relay 2	rLY2		
Action 2	Act2	Automatic	
Set 2	5Et2	100.0	
Reset 2	r5t2	90.0	
Fail-safe	FL5F		
Fail-safe 1	FL51	Off	
Fail-safe 2	FL52	Off	
Time delay	dLAY		
On delay 1	On1	0 sec	
Off delay 1	OFF1	0 sec	
On delay 2	On2	0 sec	
Off delay 2	OFF2	0 sec	

| Parameter	Display	Default Setting	User Setting
Output	Rout ScAL		
Display 1	d iS i	0.0	
Output 1	out i	4.00 mA	
Display 2	d iS2	200.0	
Output 2	out2	20.00 mA	
Password	PASS	0000 (unlocked)	
Advanced Features			
Filter	FLtr	10	
Bypass	bYPS	0.2	
Serial settings	SErL		
Protocol	PdC	PDC protocol	
Address	Addr	00	
Baud rate	bAud	2400	
Trans delay	trdE	10 ms	
Output option	on	Factory set only	
Display intensity	intY	Level 2	
Modbus[®]			
Address	Addr	247	
Parity	PrtY	Even	
Byte-to-byte timeout*	tbYt	0.01 sec	

* The byte-to-byte timeout setting might be updated automatically depending on the baud rate selected and the previous timeout setting. The minimum timeout allowed is saved to memory if a lower value is entered (e.g. If user enters 0.00 with a baud rate of 300, 0.06 is saved).

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 37.
2. Press **Up** arrow to go to *Diagnostics* menu
3. Press and hold **Right** arrow/Reset for five seconds, press **Enter/Ack** when display flashes rE5Et.
   Note: If **Enter/Ack** is not pressed within three seconds, display returns to *Diagnostics* menu.
4. The meter goes through an initialization sequence (same as on power-up), and loads the factory default settings.
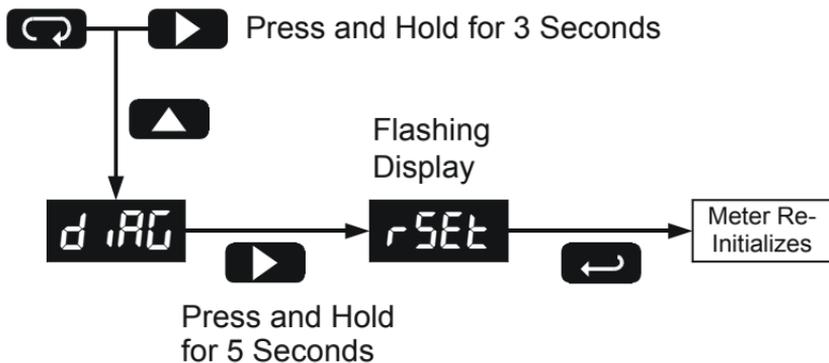
Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector.
Not able to change setup or pro-gramming, $LoCd$ is displayed	Meter is locked, enter correct four-digit password to unlock.
Meter displays error message during calibration (Err)	Check: 1. Signal connections 2. Input selected in *Setup* menu 3. Minimum input span requirements
Meter displays ● 9999 ● -1999	Voltage at Signal connector out of range.
Display alternates between 1. Hi and a number 2. Lo and a number	Press **Menu** to exit Max/Min display readings.
Display response is too slow	Check filter and bypass values.
If the display locks up or the meter does not respond at all	Cycle the power to restart the microprocessor.
Relay operation is reversed	Check: 1. Fail-safe in Setup menu 2. Wiring of relay contacts
Relay and status LED do not respond to signal	Check: 1. Relay action in Setup menu 2. Set and reset points
Meter not communicating with other devices	Check: 1. Serial converter and wiring 2. Serial protocol selected 3. Meter address and baud rate
Meter flashes $Err2$ at power on.	Hardware failure. Contact Technical Support to arrange for repair.
Other symptoms not described above	Call Contact Technical Support for assistance.

USER INTERFACE QUICK REFERENCE GUIDE

Run Mode → **Display Max/Min**

Setup

Program

Password

Locked   Unlocked

Scale

Scale Input   **Calibrate**

Calibrate Input

Decimal Point

dddd

d . ddd

dd . dd

ddd . d

Relays

Relay 1

Relay 2

Failsafe

Delays

Action

Set Point

Reset Point

Auto

Auto & Manual

Latch

Latch w/Clear

Alternate

Off

To Set Point

Analog Output

Scale

Failsafe 1

Failsafe 2

To Delays

Scale Analog

Delay 1

Delay 2

On

Off

To Analog Output

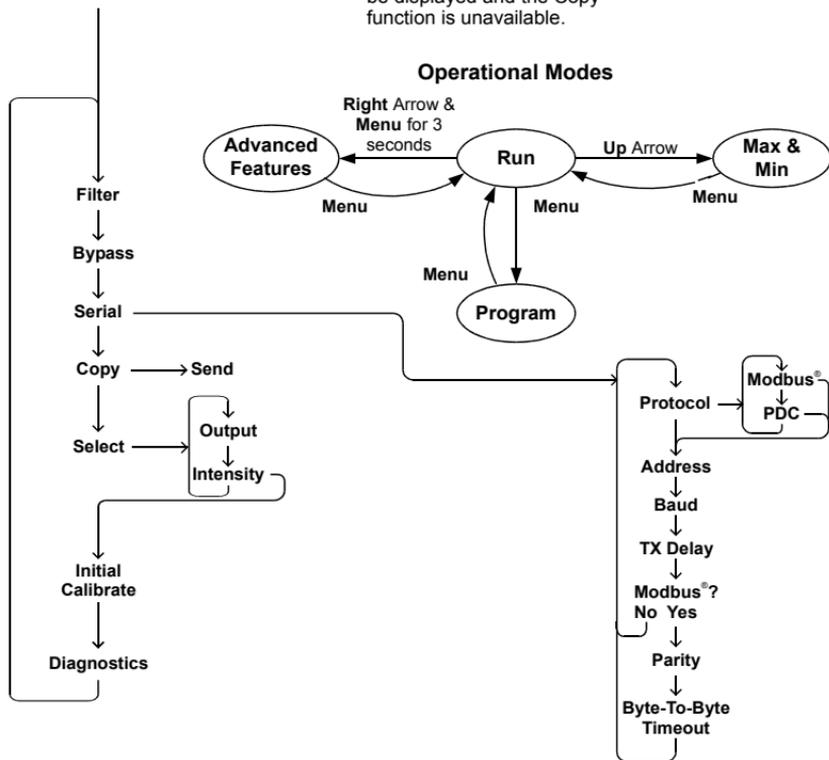| Pushbutton	Function
Menu	Go to Programming Mode or leave Programming, Advanced Features, and Max/Min Modes.
Right Arrow	Move to next digit.
Up Arrow	Move to next selection or increment digit.
Enter/Ack	Accept selection/value and move to next selection.

Right Arrow & **Menu** held for 3 seconds enters Advanced Features

Max/Min Mode
While in Run Mode, pressing **Up** Arrow will initiate Max/Min Mode. **Up** Arrow toggles between Max & Min displays, and **Right** Arrow resets the Max/Min to the current value. Press **Menu** or wait 10 seconds to return to Run Mode. Pressing **Enter/Ack** will disable the 10 second timeout and continuously display Max or Min.

Press & hold **Right** arrow and **Menu** for 3 seconds to access Advanced Features Menu

When the meter is locked programmable settings can only be displayed and the Copy function is unavailable.

Operational Modes

Right Arrow & **Menu** for 3 seconds

Advanced Features

Up Arrow

Run

Max & Min

Menu

Menu

Menu

Menu

Menu

Program

Filter
↓
Bypass
↓
Serial
↓
Copy → Send
↓
Select → Output
↓   Intensity
↓
Initial Calibrate
↓
Diagnostics

Protocol → Modbus®
↓   PDC
Address
↓
Baud
↓
TX Delay
↓
Modbus®?
No Yes
↓
Parity
↓
Byte-To-Byte Timeout

How to Contact Precision Digital

- For Technical Support please
  Call: (800) 610-5239 or (508) 655-7300
  Fax: (508) 655-8990
  Email: support@predig.com

- For Sales Support or to place an order please
  Call: (800) 343-1001 or (508) 655-7300
  Fax: (508) 655-8990
  Email: sales@predig.com

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