# Analog Input Rate/Totalizer

Instruction Manual

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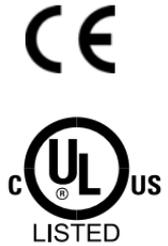
- 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, ±10 V Inputs
- NEMA 4X, IP65 Front
- Universal 85-265 VAC or 12/24 VDC Input Power
- Large Dual-Line 6-Digit Display, 0.60" & 0.46"
- Isolated 24 VDC @ 200 mA Transmitter Power Supply
- Math Functions for Flow & Round Horizontal Tanks
- Programmable Displays & Function Keys
- Sunlight Readable Display
- Rate Displayed as Units per Second, Minute, Hour, or Day
- Total, Grand Total or Non-Resettable Grand Total
- 9-Digit Totalizer with Total Overflow Feature
- 32-Point Linearization, Square Root, or Programmable Exponent
- Multi-Pump Alternation Control
- 2 or 4 Relays + Isolated 4-20 mA Output for Rate or Total
- External 4-Relays & Digital I/O Expansion Modules
- RS-232 & RS-422/485 Serial Communication Options
- -40 to 65°C Operating Temperature Range
- **SEE NOTE (PAGE 5) FOR PROGRAMMING INSTRUCTIONS**

FLOW LINE OPTIONS CORP
742 Mink Av. #126 Murrells Inlet SC. 29576 USA
Tel (330) 331-7331
sales@flo-corp.com

Flow Line Options

www.flo-corp.com

Disclaimer

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⚠ **!**	⚡
CAUTION: Read complete instructions prior to installation and operation of the meter.	**WARNING**: Risk of electric shock or personal injury.

⚡

Warning

This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at his/her own risk. Flow Line Options Corp shall not be held liable for damages resulting from such improper use.

Limited Warranty

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

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- **NOTE: PROGRAM METER WITH METERVIEW PRO SOFTWARE: FREE PROGRAMMING SOFTWARE IS LOADED INTO THE METER AND CONNECTS AND INSTALLES DIRECTLY TO YOUR PC WITH THE PROVIDED USB CABLE FOUND IN THE ENCLOSURE. IT IS NOT NECESSARY TO APPLY AC/DC POWER TO METER TO PROGRAM. SIMPLY CONNECT CABLE TO METER AND PC AND FOLLOW SCREEN PROMPTS.**

Table of Figures

INTRODUCTION

This is a multipurpose, easy to use rate/totalizer ideal for flow rate, total, and control applications. It accepts current and voltage signals (e.g. 4-20 mA, 0-10 V). Three of the front panel buttons can be custom-programmed for specific operation.

The basic model includes an isolated 24 VDC transmitter power supply that can be used to power the input transmitter or other devices. An additional isolated 24 VDC power supply is included with the 4-20 mA output option.

A fully loaded PD6200 rate/totalizer meter has the following: four SPDT relays, 4-20 mA output, and two 24 VDC power supplies. The meter's capabilities may be enhanced by adding the following external expansion modules: four SPST relays (creating an eight-relay rate/totalizer), two digital I/O modules with four inputs and four outputs each, and RS-232 or RS-485 communication adapters.

The eight relays can be used for alarm indication or process control applications, such as pump alternation control. The 4-20 mA isolated output, serial communications, and digital I/O options make the meter an excellent addition to any system.

ORDERING INFORMATION

85-265 VAC Model	12/24 VDC Model	Options Installed
PD6200-6R0-FC	PD6200-7R0-FC	No options
PD6200-6R2-FC	PD6200-7R2-FC	2 relays
PD6200-6R3-FC	PD6200-7R3-FC	4-20 mA output
PD6200-6R4-FC	PD6200-7R4-FC	4 relays
PD6200-6R5-FC	PD6200-7R5-FC	2 relays & 4-20 mA output
PD6200-6R7-FC	PD6200-7R7-FC	4 relays & 4-20 mA output

Accessories

Model	Description
PDA1004-FC	4 SPST (Form A) relays
PDA1044-FC	4 digital inputs & 4 digital outputs (2 may be connected)
PDA1200-FC	Meter copy cable
PDA1232-FC	RS-232 serial adapter
PDA1485-FC	RS-422/485 serial adapter
PDA7485-I-FC	RS-232 to RS-422/485 isolated converter
PDA7485-N-FC	RS-232 to RS-422/485 non-isolated converter
PDA8232-N-FC	USB to RS-232 non-isolated converter
PDA8485-I-FC	USB to RS-422/485 isolated converter
PDA8485-N-FC	USB to RS-422/485 non-isolated converter
PDX6901-FC	Suppressor (snubber): 0.01 µF/470 Ω, 250 VAC

SPECIFICATIONS

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

General

DISPLAY	Main display: 0.6" (15 mm) high, red LEDs Second display: 0.46" (12 mm) high, red LEDs 6 digits: each (-99999 to 999999), with lead zero blanking.
DISPLAY INTENSITY	Eight user selectable intensity levels
DISPLAY UPDATE RATE	5/second (200 ms)
OVERRANGE	Display flashes 999999
UNDERRANGE	Display flashes -99999
PROGRAMMING METHODS	Four front panel buttons, digital inputs, or cloning using Copy function.
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 and two prevent resetting the totals. Pass 1: Allows use of the F1–F3 function keys Pass 2: Allows use of the F1–F3 function keys and changing the set/reset points Pass 3: Restricts all programming and F1–F3 keys and Digital Inputs Total: Prevents resetting the total manually Gtotal: Prevents resetting the grand total manually
NON-VOLATILE MEMORY	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
POWER OPTIONS	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max or jumper selectable 12/24 VDC ± 10%, 15 W max
FUSE	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse

ISOLATED TRANSMITTER POWER SUPPLY	Terminals P+ & P-: 24 VDC $\pm$ 5% @ 200 mA max (standard), (12/24 VDC powered models rated @ 100 mA max). 5 or 10 VDC @ 50 mA max, selectable with internal jumper J4.
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 65°C Storage temperature range: -40 to 85°C Relative humidity: 0 to 90% non-condensing
CONNECTIONS	Removable screw terminal blocks accept 12 to 22 AWG wire, RJ45 for external relays, digital I/O, and serial communication adapters.
ENCLOSURE	1/8 DIN, high impact plastic, UL 94V-0, color: black
MOUNTING	1/8 DIN panel cutout required: 3.622" x 1.772" (92 mm x 45 mm) Two panel mounting bracket assemblies are provided.
TIGHTENING TORQUE	Screw terminal connectors: 5 lb-in (0.56 Nm)
OVERALL DIMENSIONS	4.68" x 2.45" x 5.64" (119 mm x 62 mm x 143 mm) (W x H x D)
WEIGHT	9.5 oz (269 g)
WARRANTY	3 years parts & labor

Process Input

INPUTS	Field selectable: 0-20, 4-20 mA, $\pm$10 V (0-5, 1-5, 0-10 V)
ACCURACY	±0.03% of calibrated span ±1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span
TEMPERATURE DRIFT	0.005% of calibrated span/°C max from 0 to 65°C ambient, 0.01% of calibrated span/°C max from -40 to 0°C ambient
MATH FUNCTIONS	Linear, square root, programmable exponent, or round horizontal tank volume calculation
MULTI-POINT LINEARIZATION	2 to 32 points
PROGRAMMA-BLE EXPONENT	1.0001 to 2.9999

LOW-FLOW CUTOFF	0-999999 (0 disables cutoff function)
DECIMAL POINT	Up to five decimal places or none: *d.ddddd*, *d.dddd*, *d.ddd*, *d.dd*, *d.d*, or *dddddd*
CALIBRATION RANGE	Input Minimum Span Range Input 1 & Input 2 4-20 mA 0.15 mA $\pm$10 V 0.10 V An Error message will appear if the input 1 and input 2 signals are too close together.
INPUT IMPEDANCE	Voltage ranges: greater than 1 MΩ Current ranges: 50 - 100 Ω (depending on resettable fuse impedance)
INPUT OVERLOAD	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.

Rate/Totalizer

DISPLAY ASSIGNMENT	The main (Big) and small (Little) displays may be assigned to rate, total, grand total, alternate R & T, units, and set point.
RATE DISPLAY INDICATION	-99999 to 999999, lead zero blanking. "R" LED illuminates while displaying rate.
TOTAL DISPLAY & TOTAL OVERFLOW	0 to 999,999; automatic lead zero blanking. "T" LED is illuminated while displaying total or grand total. Up to 999,999,999 with total-overflow feature. "oF" is displayed to the left of total overflow and ▲ LED is illuminated.
ALTERNATING DISPLAY	Either display may be programmed to alternate between rate and total or rate and grand total every 10 seconds.
TOTAL DECIMAL POINT	Up to five decimal places or none: *d.ddddd*, *d.dddd*, *d.ddd*, *d.dd*, *d.d*, or *dddddd* Total decimal point is independent of rate decimal point.
TOTALIZER	Calculates total based on rate and field programmable multiplier to display total in engineering units. Time base must be selected according to the time units in which the rate is displayed.
TOTALIZER ROLLOVER	Totalizer rolls over when display exceeds 999,999,999. Relay status reflects display.
TOTALIZER PRESETS	Up to eight, user selectable under setup menu. Any set point can be assigned to total and may be programmed anywhere in the range of the meter for total alarm indication.

PROGRAMMA-BLE DELAY ON RELEASE	0.1 and 999.9 seconds; applied to the first relay assigned to total or grand total.
	If the meter is programmed to reset total to zero automatically when the preset is reached, then a delay will occur before the total is reset.
TOTAL RESET	Via front panel button, external contact closure on digital inputs, automatically via user selectable preset value and time delay, or through serial communications.
TOTAL RESET PASSWORD	Total and grand total passwords may be entered to prevent resetting the total or grand total from the front panel.
NON-RESETTABLE TOTAL	The grand total can be programmed as a non-resettable total by entering the password "050873".

Caution! Once the Grand Total has been programmed as "non-resettable" the feature **cannot** be disabled.

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 @ 125/250 VAC for inductive loads
NOISE SUPPRESSION	Noise suppression is recommended for each relay contact switching inductive loads; see page 23 for details.
RELAY ASSIGNMENT	Relays may be assigned to rate, total, or grand total.
DEADBAND	0-100% of span, user programmable
HIGH OR LOW ALARM	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
RELAY OPERATION	Automatic (non-latching) Latching (requires manual acknowledge) Sampling (based on time) Pump alternation control (2 to 8 relays) Off (disable unused relays) Manual control mode
RELAY RESET	User selectable via front panel buttons, digital inputs, or PC
	1. Automatic reset only (non-latching), when the input passes the reset point or total is reset to zero. 2. Automatic + manual reset at any time (non-latching) 3. Manual reset only, at any time (latching) 4. Manual reset only after alarm condition has cleared (L) *Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.*

TIME DELAY	0 to 999.9 seconds, on & off relay time delays Programmable and independent for each relay.
FAIL-SAFE OPERATION	Programmable and independent for each relay. *Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.*
AUTO INITIALIZATION	When power is applied to the meter, relays will reflect the state of the input to the meter.

Isolated 4-20 mA Transmitter Output

OUTPUT SOURCE	Rate/process, total, grand total, max, min, set points 1-8, 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% FS ± 0.004 mA
TEMPERATURE DRIFT	0.005% of calibrated span/°C from 0 to 65°C ambient, 0.01% of calibrated span/°C from -40 to 0°C ambient *Note: Analog output drift is separate from input drift.*
ISOLATED TRANSMITTER POWER SUPPLY	Terminals I+ & R: 24 VDC ± 5% @ 40 mA maximum; may be used to power the 4-20 mA output or other devices. Refer to Figure 6 on page 20 and Figure 14 on page 24.
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	1 - 247
BAUD RATE	300 - 19,200 bps
TRANSMIT TIME DELAY	Programmable between 0 and 199 ms or transmitter always on for RS-422 communication
DATA	8 bit (1 start bit, 1 stop bit)
PARITY	None
TURN AROUND DELAY	Less than 2 ms (fixed)

Note: Refer to the PDC Serial Communication Protocol manual located at www.flo-corp.com for details.

PDA1044-FC Digital Input & Output Expansion Module

CHANNELS	4 digital inputs & 4 digital outputs per module
SYSTEM	Up to 2 modules for a total of 8 inputs & 8 outputs
DIGITAL INPUT LOGIC HIGH	3 to 5 VDC
DIGITAL INPUT LOGIC LOW	0 to 1.25 VDC
DIGITAL OUTPUT LOGIC HIGH	4.75 to 5 VDC
DIGITAL OUTPUT LOGIC LOW	0 to 0.4 VDC
SOURCE CURRENT	10 mA maximum output current
SINK CURRENT	1.5 mA minimum input current
+5 V TERMINAL	To be used as pull-up for digital inputs only Connect normally open pushbuttons across +5 V & DI1-4.

COMPLIANCE INFORMATION

Safety

UL & c-UL LISTED	USA & Canada UL 508 Industrial Control Equipment
UL FILE NUMBER	E160849
FRONT PANEL	UL Type 4X, NEMA 4X, IP65; panel gasket provided
LOW VOLTAGE DIRECTIVE	EN 61010-1:2001 Safety requirements for measurement, control, and laboratory use

Electromagnetic Compatibility

EMISSIONS	EN 55022:1998/A1:2000/A2:2003 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
IMMUNITY	EN 61000-6-2:2001 EMC heavy industrial generic immunity standard
RFI - Amplitude Modulated	80 -1000 MHz 10 V/m 80% AM (1 kHz)
Electrical Fast Transients	±2kV AC mains, ±1kV other
Electrostatic Discharge	±4kV contact, ±8kV air
RFI - Conducted	10V, 0.15-80 MHz, 1kHz 80% AM
AC Surge	±2kV Common, ±1kV Differential
Surge	1KV (CM)
Power-Frequency Magnetic Field	3 A/m 70%V for 0.5 period
Voltage Dips	40%V for 5 & 50 periods
Voltage Interruptions	<5%V for 250 periods

Note:

Testing was conducted on meters installed through the covers of grounded metal enclosures with cable shields grounded at the point of entry representing installations designed to optimize EMC performance.

SAFETY INFORMATION

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

WARNING: Risk of electric shock or personal injury.

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

INSTALLATION

There is no need to remove the meter from its case to complete the installation, wiring, and setup of the meter for most applications. Instructions are provided for 12 VDC meter power and for 5 or 10 V transmitter power applications, see page 18.

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 Instructions

- Prepare a standard 1/8 DIN panel cutout – 3.622" x 1.772" (92 mm x 45 mm). Refer to Figure 1 for more details.

- Clearance: allow at least 6.0" (152 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.
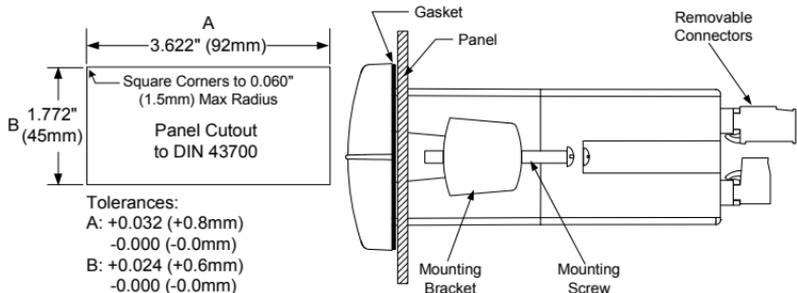
Figure 1: 1/8 DIN Panel Cutout and Mounting

Mounting Dimensions

1.76"
(45 mm)

2.45"
(62 mm)

0.59"
(15 mm)

4.77"
(121 mm)

5.05"
(128 mm)
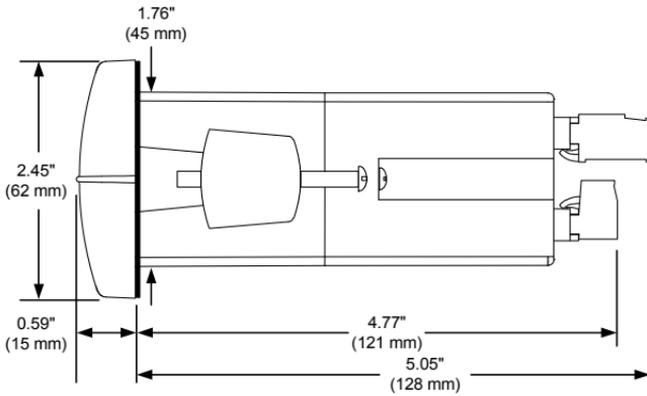
Figure 2: Meter Dimensions - Side View

4.17"
(106 mm)

3.61"
(92 mm)

4.68"
(119 mm)
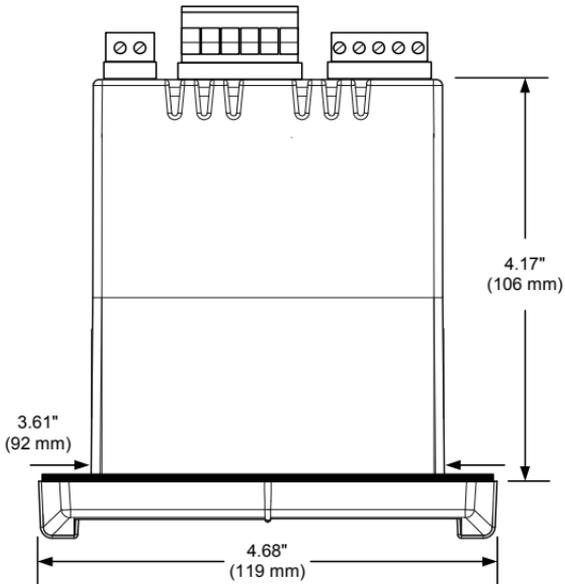
Figure 3: Meter Dimensions - Top View

Configuration for 12 or 24 VDC Power Option

⚠️
Warning!

Do not exceed voltage rating of the selected configuration.

Meters equipped with the 12/24 VDC power option are shipped from the factory ready to operate from 24 VDC.

To configure the meter for 12 VDC power:

1. Remove all the connectors.
2. Unscrew the back cover.
3. Slide the back cover about 1 inch.
4. Configure the J9 jumper, located behind the power connector, for 12 V as shown below.
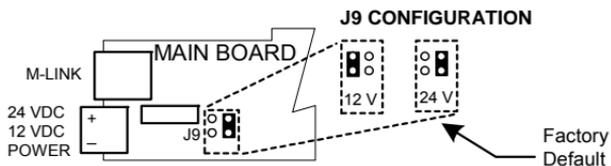
Figure 4: Jumper Configuration for 12/24 VDC Power

Transmitter Supply Voltage Selection (P+, P-)

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

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

To access the voltage selection jumper:

1. Remove all the connectors.
2. Unscrew the back cover.
3. Slide the back cover about 1 inch.
4. Configure the J4 jumper, located behind the input signal connector, for the desired excitation voltage as shown.
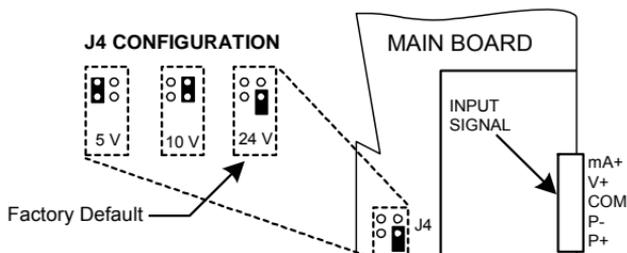
Figure 5: Transmitter Supply Voltage Selection

Connections

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

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

Connectors Labeling

The connectors' label, affixed to the meter, 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.***
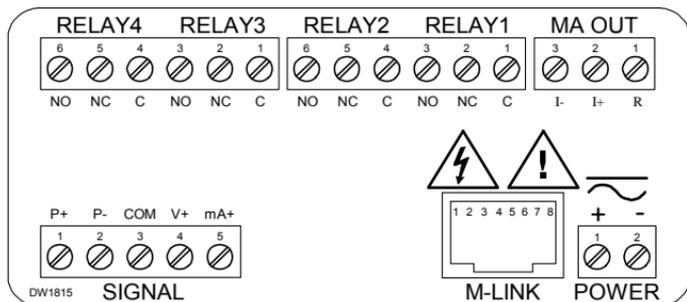
Figure 6: Connector Labeling for Fully Loaded Meter

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 6. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.
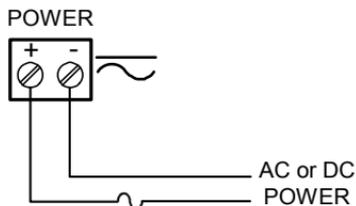
Figure 7: Power Connections

Signal Connections

Signal connections are made to a five-terminal connector labeled SIGNAL on Figure 6. The COM (common) terminal is the return for the 4-20 mA and the ±10 V input signals.

Current and Voltage Connections

The following figures show examples of current and voltage connections.

There are no switches or jumpers to set up for current and voltage inputs. Setup and programming is performed through the front panel buttons.
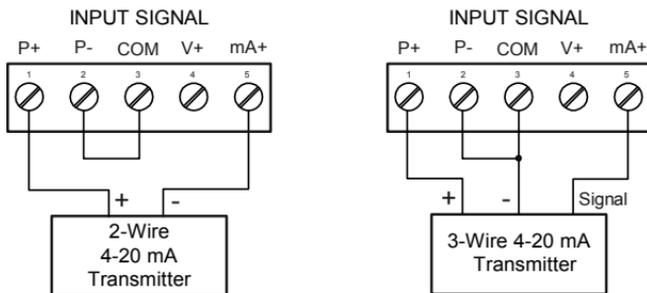
Figure 8: Transmitters Powered by Internal Supply
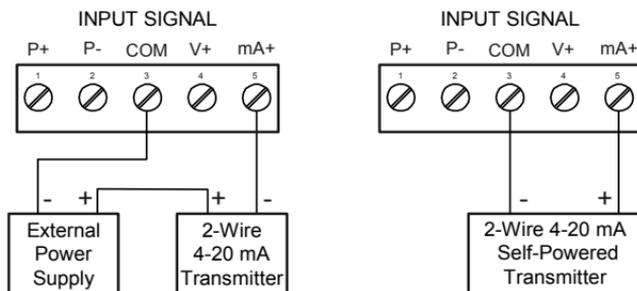
Figure 9: Transmitter Powered by Ext. Supply or Self-Powered

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

The fuse limits the current to a safe level when it detects a fault condition, and automatically resets itself when the fault condition is removed.
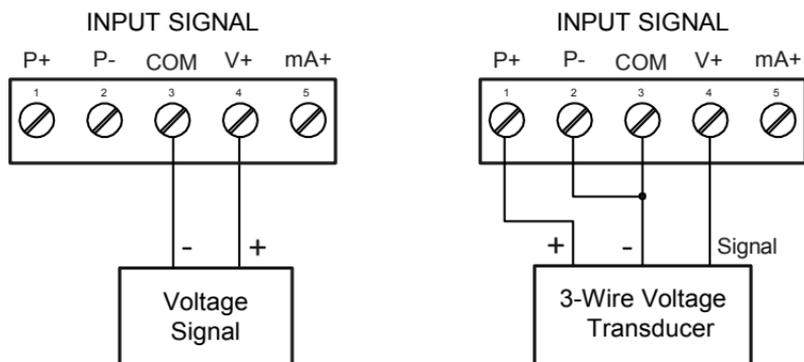
Figure 10: Voltage Input Connections

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

Serial Communications

Serial communications connection is made to an RJ45 connector labeled M-LINK on Figure 6. Use PDA1232-FC for RS-232 interfacing or the PDA1485-FC for RS-422/485 interfacing. The same port is used for interfacing with all expansion modules (e.g. external relays, digital I/O).

Use the PDA1200-FC meter copy cable for meter-to-meter interfacing for cloning purposes (*i.e.* copying settings from one meter to other meters).

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.
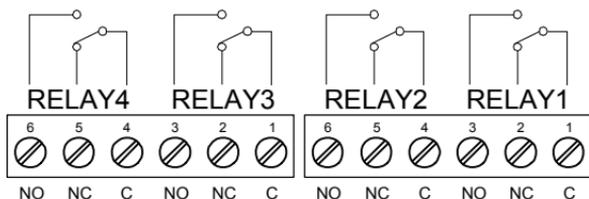
Figure 11: Relay Connections

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:
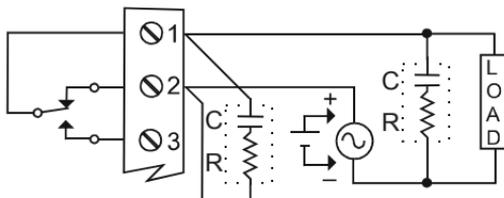
Figure 12: AC and DC Loads Protection

Choose R and C as follows:

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

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

Notes:

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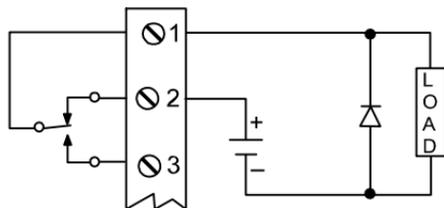
Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

Figure 13: Low Voltage DC Loads Protection

RC Networks Available from Flow Line Options Corp

RC networks are available from Flow Line Options Corp and should be applied to each relay contact switching an inductive load. Part number: PDX6901-FC.

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.
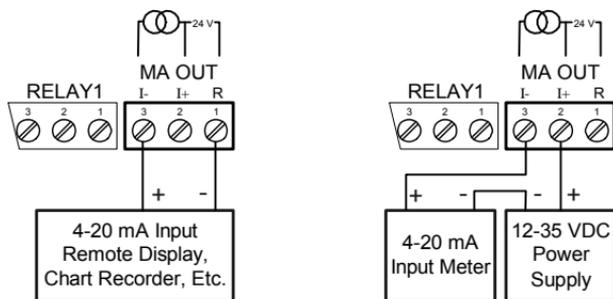
Figure 14: 4-20 mA Output Connections

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. This power supply is capable of sourcing up to 40 mA.

External Relay & Digital I/O Connections

The relay and the digital I/O expansion modules PDA1004-FC & PDA1044-FC are connected to the meter using a CAT5 cable provided with each module. The two RJ45 connectors on the expansion modules are identical and interchangeable; they are used to connect additional modules to the system.

Note: The jumper located between the RJ45 connectors of the PDA1044-FC must be removed on the second digital I/O module in order for the system to recognize it as module #2.

⚡ **Warning!** ***Do not connect or disconnect the expansion modules with the power on!***
More detailed instructions are provided with each optional expansion module.
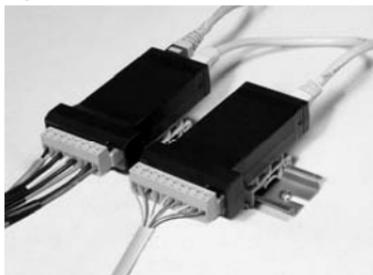
Figure 15: Expansion Modules & DIN Rail Mounting Kit
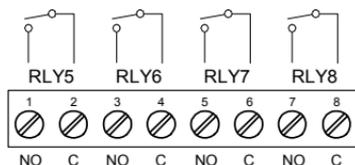
Figure 16: External Relays Module Connections
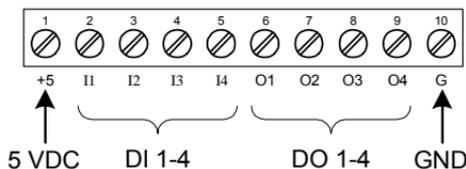
Figure 17: Digital I/O Module Connections

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SETUP AND PROGRAMMING

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

Overview

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

Setup and programming is done through the front panel buttons.

After power and input signal connections have been completed and veri-fied, apply power to the meter.

Front Panel Buttons and Status LED Indicators

Button Symbol	Description		LED	Status
Menu (MENU)	**Menu**		1-8	Alarm 1 – 8 indicator
(F1)	**Right arrow/F1**		R	Rate indicator
(F2)	**Up arrow/F2**		T	Total indicator
(F3)	**Enter/F3**		▲	Total overflow 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 or decimal point programming.
- Press 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.

Display Functions and 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
rESEt	*Reset*	Press Enter to access the *Reset* menu
rSt t	*Reset total*	Press Enter to reset total
rSt Gt	*Reset grand total*	Press Enter to reset grand total
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
ContrL	*Control*	Enter *Control* menu
Auto	*Automatic*	Press Enter to set meter for automatic operation
m An	*Manual*	Press Enter to manually control relays or analog output operation
SEtuP	*Setup*	Enter *Setup* menu
InPut	*Input*	Enter *Input* selection menu
m A	*4-20 mA*	Set meter for 4-20 mA input
UoLt	*0-10 VDC*	Set meter for ±10 VDC input
totAL	*Total*	Enable or disable totalizer features
dEc Pt	*Decimal point*	Set decimal point for rate, total, grand total
dSPLAY	*Display*	Enter the *Display* menu
b iG	*Big display*	Press Enter to assign the Main display parameter (default: PV or rate)
L ittLE	*Little display*	Press Enter to assign the small display parameter (default: total)
d-intY	*Display intensity*	Set display intensity level from 1 to 8
rELAY	*Relay*	Enter the *Relay* menu
ASSiGn	*Assignment*	Assign relays to rate, total, or grand total

Display	Parameter	Action/Setting Description
RS iⅭn 1	Assign 1	Relay 1 assignment
rRⱵE	Rate	Assign relay to rate
ⱵoⱵRL	Total	Assign relay to total
Ⅼ ⱵoⱵRL	Grand total	Assign relay to grand total
rLY 1	Relay 1	Relay 1 setup
RcⱵ 1	Action 1	Set relay 1 action
RuⱵo	Automatic	Set relay for automatic reset
R-n⊓ Rn	Auto-manual	Set relay for automatic & manual reset any time
LRⱵⅭH	Latching	Set relay for latching operation (relays assigned to rate)
LⱵ-ⅭLr	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared (relays assigned to rate)
RLⱵErn	Alternate	Set relay for pump alternation control (relays assigned to rate)
5Rn⊓ PL	Sampling	Set relay for sampling operation
ⅭFF	Off	Disable relay and front panel status LED
5EⱵ 1	Set 1	Program set point 1
r5Ⱶ 1	Reset 1	Program reset point 1
rLY 2	Relay 2	Relays 2-8 setup *Note: Relays 5-8 are shown, only if expansion relay module is installed.*
FR iL5F	Fail-safe	Enter *Fail-safe* menu
FL5 1	Fail-safe 1	Set relay 1 fail-safe operation
on	On	Enable fail-safe operation
oFF	Fail-safe off	Disable fail-safe operation
dELRY	Delay	Enter relay *Time Delay* menu
dLY 1	Delay 1	Enter relay 1 time delay setup
Ⅾn 1	On	Set relay 1 On time delay
ⅭFF 1	Off	Set relay 1 Off time delay
brERⱰ	Loop break	Set relay condition if loop break detected (For mA input only)

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Display	Parameter	Action/Setting Description
¡GnorE	*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
Rout	*Analog output*	Enter the *Analog output* scaling menu
d¡5 1	*Display 1*	Program display 1 value
Out 1	*Output 1*	Program output 1 value (e.g. 4.000 mA)
d¡5 2	*Display 2*	Program display 2 value
Out 2	*Output 2*	Program output 2 value (e.g. 20.000 mA)
ProG	*Program*	Enter the *Program* menu
SCRLE	*Scale*	Enter the *Scale* menu
CRL	*Calibrate*	Enter the *Calibrate* menu
InP 1	*Input 1*	Calibrate input 1 signal or program input 1 value
d¡5 1	*Display 1*	Program display 1 value
InP 2	*Input 2*	Calibrate input 2 signal or program input 2 value (up to 32 points)
d¡5 2	*Display 2*	Program display 2 value (up to 32 points)
Error	*Error*	Error, calibration not successful, check signal or programmed value
t tb	*Total time base*	Program total time base
t CF	*Total conversion factor*	Program total conversion factor
t r5t	*Total reset*	Program total rest mode: auto or manual
Gt tb	*Grand total time base*	Program grand total time base
Gt CF	*Grand total conversion factor*	Program grand total conversion factor
Gt r5t	*Grand total reset*	Program grand total rest mode: auto or manual

Display	Parameter	Action/Setting Description
Auto	Automatic	Press Enter to set automatic total reset
t dLY	Time delay	Program time delay for total auto reset
m An	Manual	Press Enter to reset total manually
PASS	Password	Enter the *Password* menu
PASS 1	Password 1	Set or enter Password 1
PASS 2	Password 2	Set or enter Password 2
PASS 3	Password 3	Set or enter Password 3
totAL	Total password	Set or enter password for manual reset
GtotAL	Grand total password	Set or enter password for manual reset
nonrSt	Non-resettable	Non-resettable grand total set after entering "050873" for Gtotal password
unLoc	Unlocked	Program password to lock meter
Locd	Locked	Enter password to unlock meter
999999 / *-99999*	Flashing display	Overrange condition Underrange condition

Main Menu

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

- Press Menu button to enter Programming Mode then press the Up arrow button to scroll main menu.

Run Mode

20.000 m A				

rESEt	Contrl	SEtuP	ProG	PASS
rSt t rESEt	Auto contrl	inPut SEtuP	SCALE ProG	PASS 1 PASS
rSt Gt rESEt	m An contrl	dEc Pt SEtuP	CAL ProG	PASS 2 PASS
rSt H i rESEt		dSPLAY SEtuP	t tb ProG	PASS 3 PASS
rSt Lo rESEt		rELAY SEtuP	t CF ProG	totAL PASS
rSt HL rESEt		Aout SEtuP	t rSt ProG	GtotAL PASS

Grand Total Settings
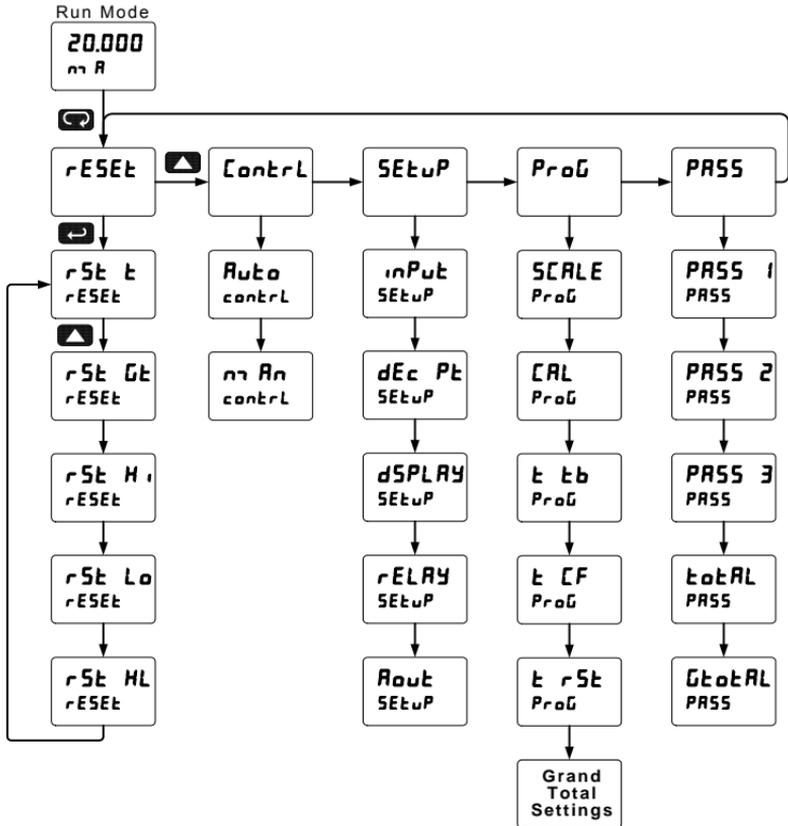
- Press Menu, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing Enter are not saved.
- Changes to the settings are saved to memory only after pressing Enter.
- The display moves to the next menu every time a setting is accepted by pressing Enter.

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

Select Next Digit　　　　Increment Digit Value　　　Accept Setting
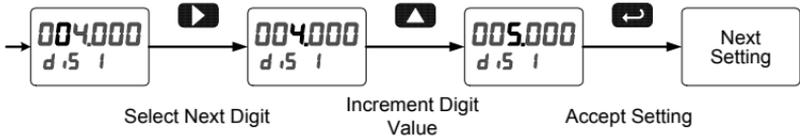
Note: The decimal point is set in the Setup-decimal point menu.

Reset Menu (rE5Et)

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).

Control Menu (Contrl)

The *Control* menu is used to control the 4-20 mA analog output and the relays manually, ignoring the input. Each relay and analog output can be programmed independently for manual control. Selecting automatic control sets all relays and analog output for automatic operation.
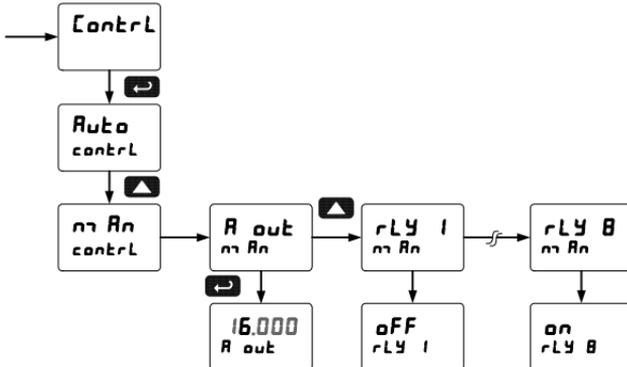
Setting Up the Rate/Totalizer Meter (`SEtuP`)

The *Setup* menu is used to select:

1. Input signal the meter will accept
2. Enable or disable totalizer features
3. Decimal point position
4. Display parameter and intensity
5. Relay operation
6. 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.
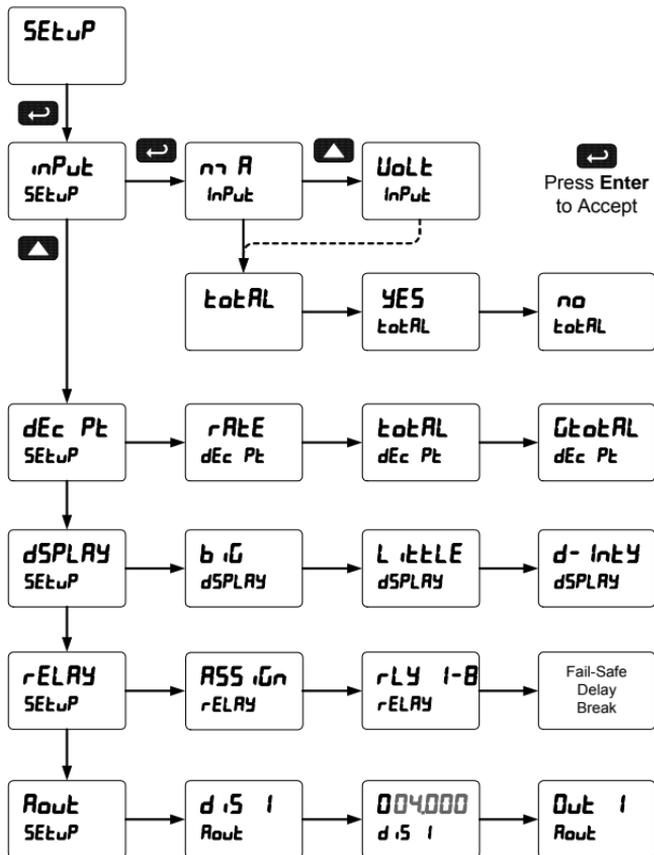
Setting the Input Signal (ınPuƭ)

Enter the *Input* menu to set up the meter to display current (ɱɹ Ꭺ) or voltage (ᴜoʟƭ) inputs.

The current input is capable of accepting any signal from 0 to 20 mA. Select current input to accept 0-20 mA or 4-20 mA signals.

The voltage input is capable of accepting any signal from -10 to +10 VDC. Select voltage input to accept 0-5, 1-5, 0-10, or ±10 VDC signals.

Setting the Totalizer Features (ƭoƭᎪʟ)

Enable or disable the totalizer features by selecting "ꓓᎬ�将" or "ɱo" after the input type has been set up. If the totalizer features are disabled, all the totalizer features and functions are hidden from the menus.

Note: The totalizer continues working in the background.

Setting the Decimal Point (dᎬc Pƭ)

The decimal point may be set with up to five decimal places or with no decimal point at all. The rate, total, and grand total decimal points are independent.

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

Setting the Display Parameter & Intensity (dꗢPʟᎪꓓ)

The main display (b ᵢᏟ) can be programmed to display:

1. Rate value
2. Total or grand total
3. Relay set points
4. Max & min values

The small display (ʟ ᵢƭƭʟᎬ) can be programmed to display:

1. Rate value
2. Total or grand total
3. Relay set points
4. Max & min values
5. Engineering units or custom legends
6. Off (no display)

Display Intensity: The meter has eight display intensity levels to give the best performance under various lighting conditions. Select intensity 8 for outdoor applications.

Character Set for Engineering Units Display (**d un it**)

The small display can be programmed to show engineering units or custom legends using the following 7-segment character set.

0 1 2 3 4 5 6 7 8 9 A b C c d E F G 9 H h I i J P L
n O o P 9 r S t u U H Y 2 - r = C J = ٦ b º

To create the letter "m" use the characters "**n**" followed by "**٦**" to get "**n٦**".

To create the letter "w" use the characters "**u**" followed by "**u**" to get "**uu**".

See the flow chart on the next page to access the display units menu.

Display Setup Menu

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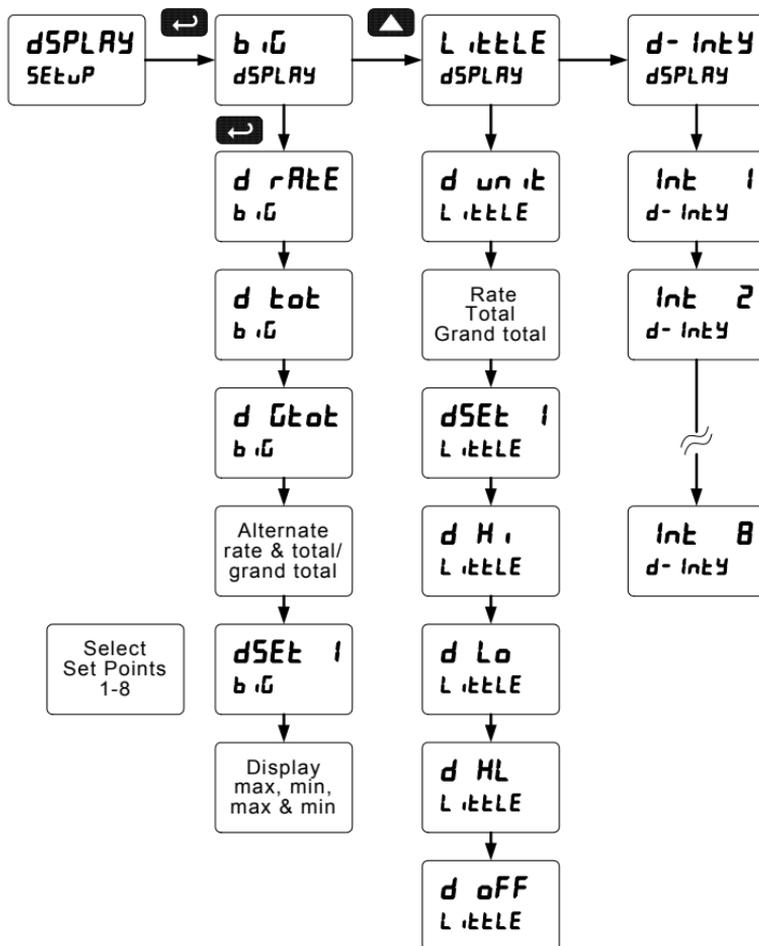
After setting up the input and the display, press the Menu button to exit programming and skip the rest of the setup menu. Press the Menu button again and the Up arrow to reach the *Program* menu and complete the scaling or calibration of the meter.

Programming the Rate/Totalizer (𝖯𝗋𝗈𝖦)

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

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

- Use the *Scale* menu to scale process inputs (e.g. 4-20 mA). A calibrated signal source is not needed to scale the meter.

The *Program* menu contains the following menus:

1. Scale without a signal source
2. Calibrate with a calibrated signal source
3. Total time base & conversion factor
4. Grand total time base & conversion factor
5. Total reset mode for total & grand total

The process inputs may be calibrated or scaled to any display value within the range of the meter.
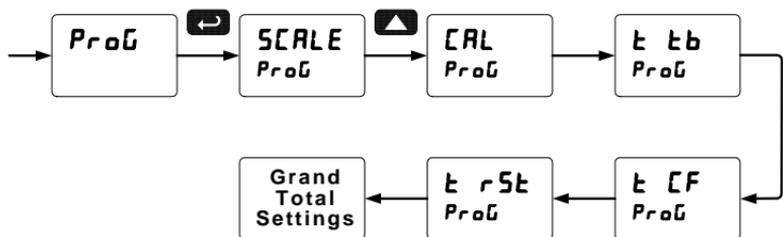
Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu; see *Advanced Features Menu*, page 66.

Multi-Point Calibration & Scaling

The meter is set up at the factory for 2-point linear calibration. The number of points for multi-point calibration/scaling is set up in the *Advanced Features* menu. Up to 32 linearization points may be selected. See page 72 for details.

Scaling the Meter (SCALE)

The process inputs (4-20 mA and ±10 VDC) can be scaled to display the process variable in engineering units.

A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.
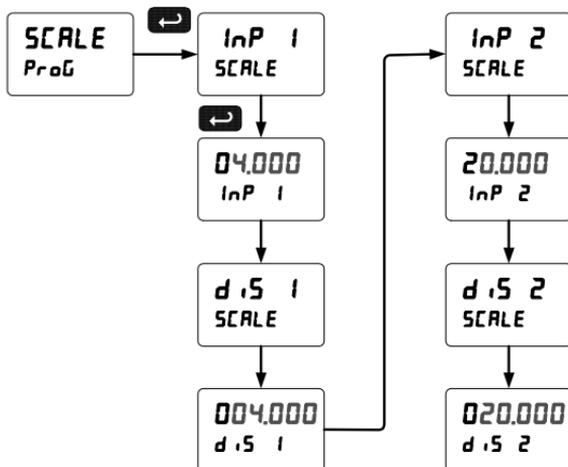
For instructions on how to program numeric values see *Setting Numeric Values*, page 33.

Error Message (*Error*)

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

After the error message is displayed, the meter reverts to input 2 during calibration or scaling and to input 1 during internal calibration, allowing the appropriate input signal to be applied or programmed.

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

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

Minimum Input Span

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

Input range	Input 1 & input 2 span
4-20 mA	0.15 mA
$\pm$10 VDC	0.10 VDC

Time Base, Total Conversion Factor & Total Reset

The time base, total conversion factor, and total reset menus are located in the *Program* menu.

The total and grand total have their own independent settings. This means that one can be displaying the value in gallons while the other displays in million gallons, liters, m^3, etc.

Total & Grand Total Reset

The totals can be programmed for manual or automatic reset. In the automatic reset mode, a programmable time delay is available to reset the total or grand total after the assigned preset is reached.
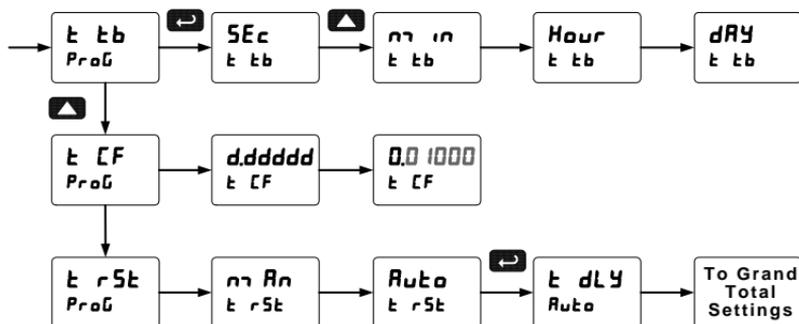
Non-Resettable Totalizer

The total and grand total can be password-protected to prevent unauthorized resets. The grand total can be programmed as a non-resettable total, see page 64 for details.

Calibrating the Meter with External Source (*CAL*)

> To scale the meter without a signal
> source refer to Scaling the Meter
> (*SCALE*) page 39.

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

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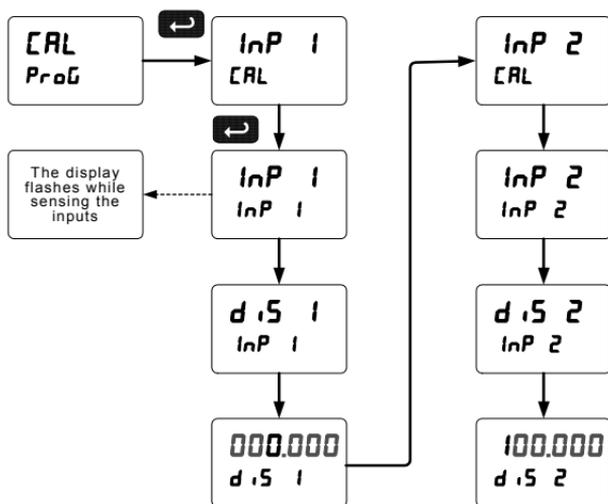
> *Warm up the meter for at least 15 minutes*
> *before performing calibration to ensure*
> *specified accuracy.*

Setting the Relay Operation (rELAY)

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

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

1. Relay assignment
    a. Rate for low and high alarm
    b. Total
    c. Grand total
2. Relay action
    a. Automatic reset only (non-latching)
    b. Automatic + manual reset at any time (non-latching)
    c. Latching (manual reset only)
    d. Latching with Clear (manual reset only after alarm condition has cleared)
    e. Pump alternation control (automatic reset only)
    f. Sampling (the relay is activated for a user-specified time)
    g. Off (relay and status LED disabled)
3. Set and reset points
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)

```
┌─────────┐
│ rELAY   │
│ SEtuP   │
└─────────┘
```

```
┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐
│ ASS iGn │ →  │ rLY   1 │ →  │ FAiLSF  │ →  │ dELAY   │ →  │ brEAH   │
│ rELAY   │    │ rELAY   │    │ rELAY   │    │ rELAY   │    │ rELAY   │
└─────────┘    └─────────┘    └─────────┘    └─────────┘    └─────────┘
```

```
┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐
│ AS iGn1 │    │ Act   1 │    │ FLS   1 │    │ dLY   1 │    │ brEAH1  │
│ ASS iGn │    │ rLY   1 │    │ FAiLSF  │    │ dELAY   │    │ brEAH   │
└─────────┘    └─────────┘    └─────────┘    └─────────┘    └─────────┘
```

```
               ┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐
               │ SEt   1 │    │ on      │    │ on      │    │ iGnorE  │
               │ rLY   1 │    │ FLS   1 │    │ dLY   1 │    │ brEAH1  │
               └─────────┘    └─────────┘    └─────────┘    └─────────┘
```

```
┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐
│ AS iGn8 │    │ rSt   1 │    │ oFF     │    │ oFF     │    │ On      │
│ ASS iGn │    │ rLY   1 │    │ FLS   1 │    │ dLY   1 │    │ brEAH1  │
└─────────┘    └─────────┘    └─────────┘    └─────────┘    └─────────┘
```

```
               ┌─────────────────────────────────────┐    ┌─────────┐
               │ Note: The setup of relays 2-8 follows│    │ OFF     │
               │ the same pattern shown here for      │    │ brEAH1  │
               │ relay 1.                             │    └─────────┘
               └─────────────────────────────────────┘
```
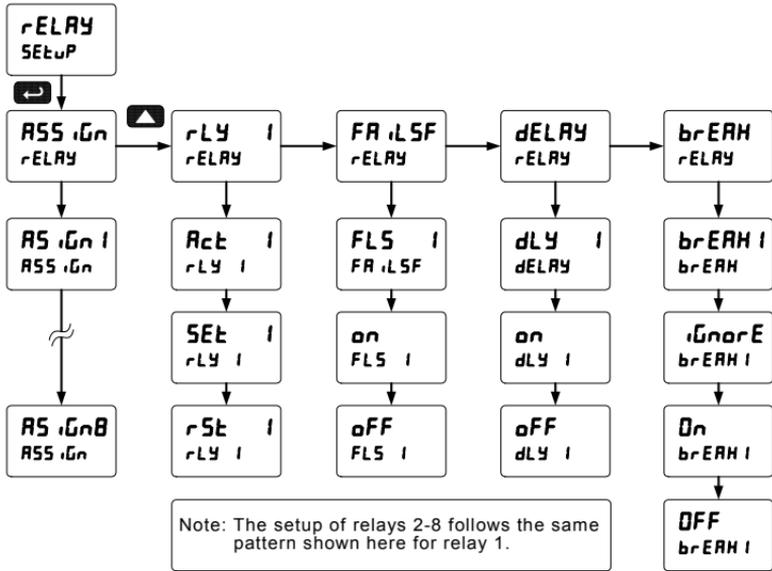
Relay Assignment (ASS iGn)

The relays can be assigned to any of the following parameters:
1. Rate for low or high alarm indication
2. Total for alarm indication
3. Grand total for alarm indication

```
┌─────────┐
│ ASS iGn │
│ rELAY   │
└─────────┘
```

```
┌─────────┐    ┌─────────┐    ┌─────────┐    ┌─────────┐
│ AS iGn1 │ →  │ rAtE    │ →  │ totAL   │ →  │ GtotAL  │
│ ASS iGn │    │ AS iGn1 │    │ AS iGn1 │    │ AS iGn1 │
└─────────┘    └─────────┘    └─────────┘    └─────────┘
```
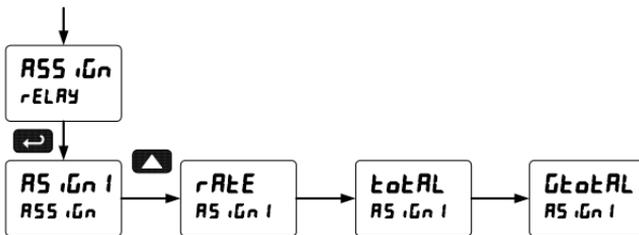
Setting the Relay Action

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

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

The following graphic shows relay 1 action setup; relay 2-8 are set up in a similar fashion.
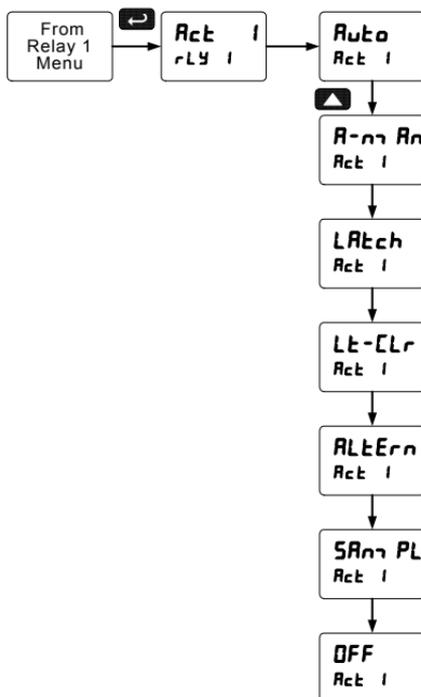
Programming Set and Reset Points

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.
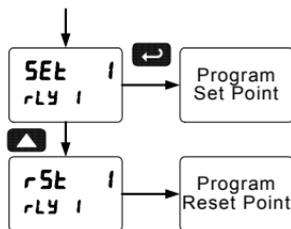
Setting Fail-Safe Operation

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 (Process 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)

Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing below Reset (latching with clear)
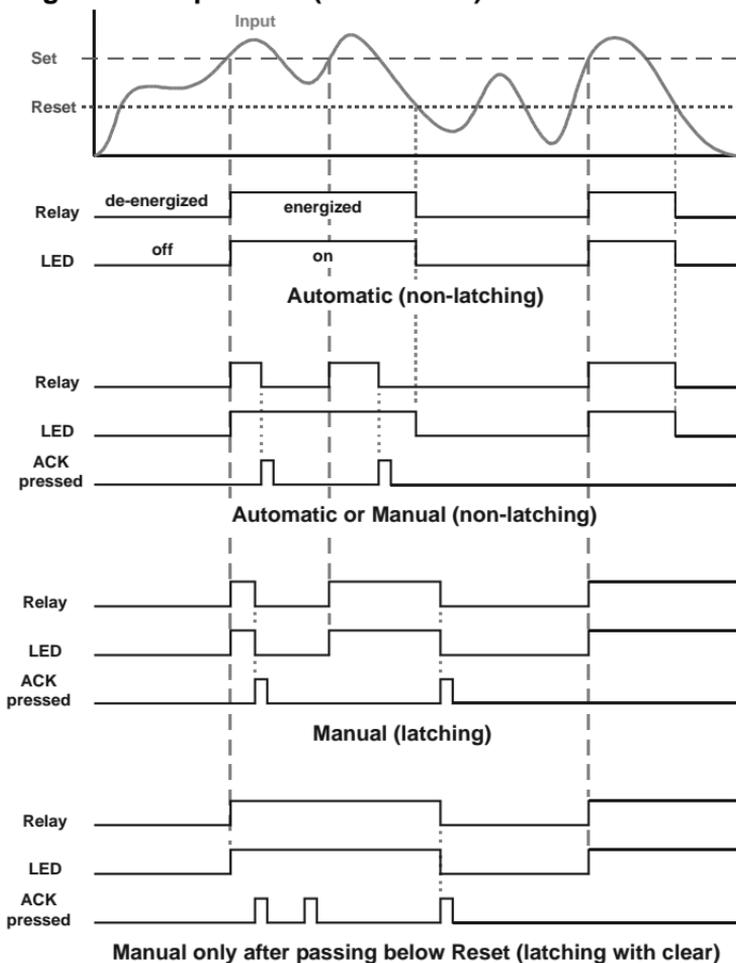
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. To detect a new alarm condition, the signal must go below the set point, and then go above it.

Low Alarm Operation (Set < Reset)

Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing above Reset (latching with clear)
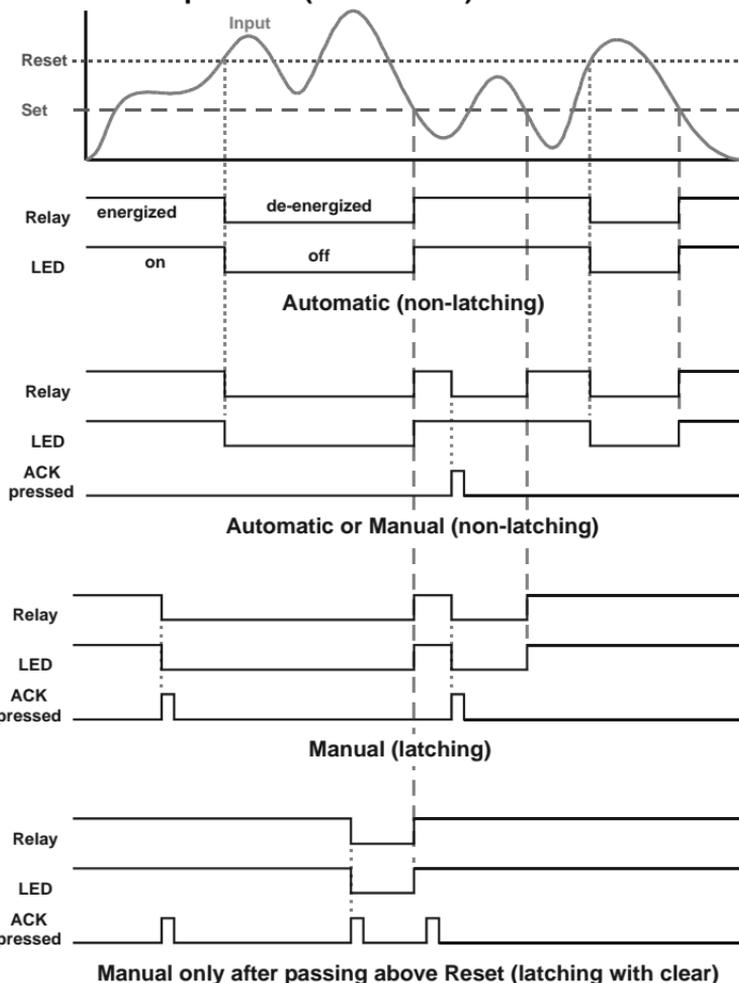
For Manual reset mode, ACK can be pressed anytime to turn "off" relay. For relay to turn back "on", signal must go above set point and then go below it.

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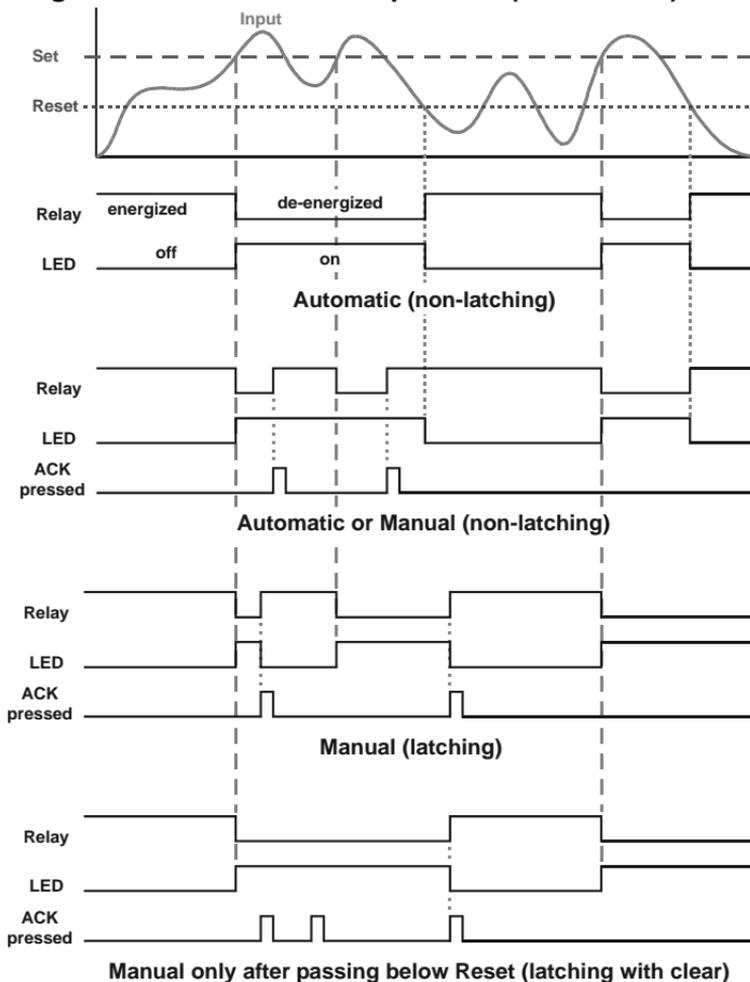
Automatic (non-latching)

Automatic or Manual (non-latching)

Manual (latching)

Manual only after passing below Reset (latching with clear)

*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)
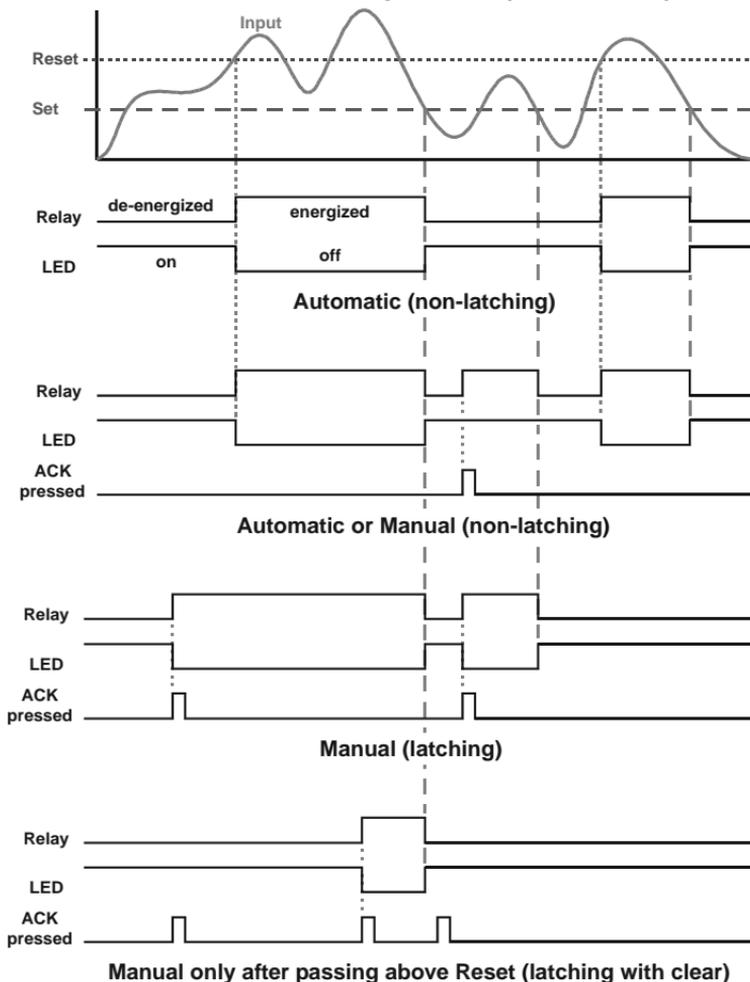
Input

Reset

Set

Relay   de-energized   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)

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

Pump Alternation Control Operation

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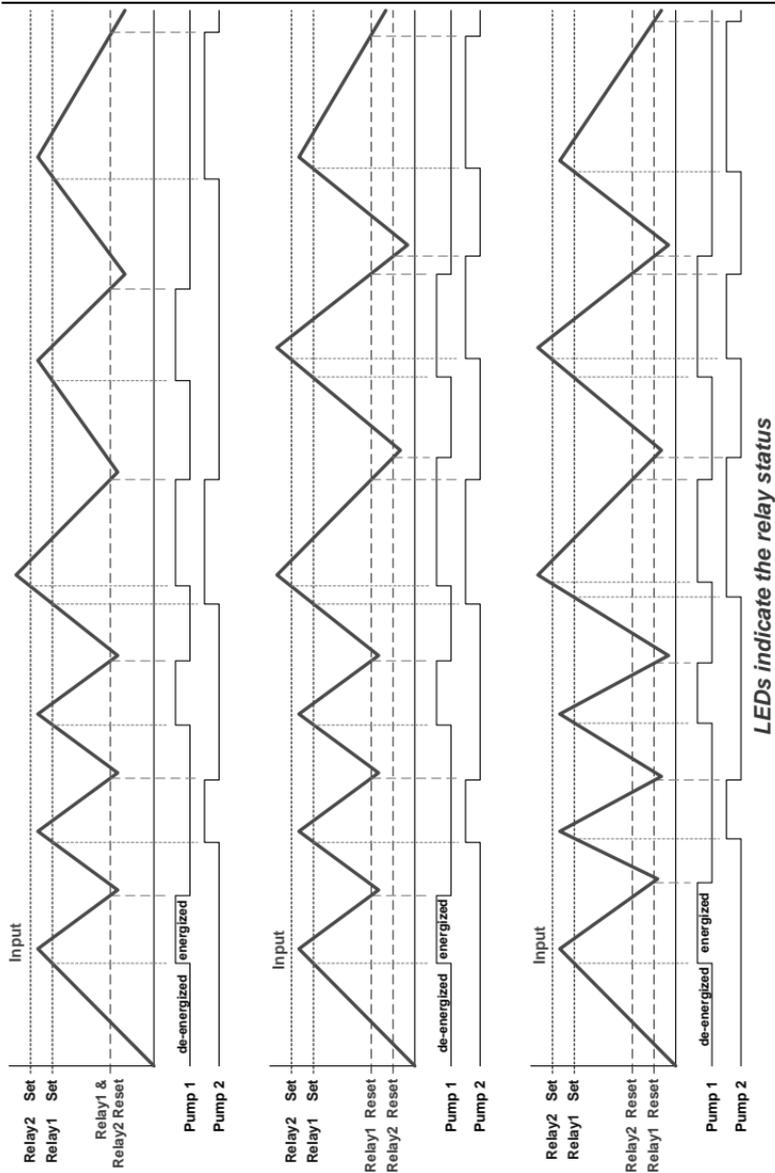
Rate Relay Sampling Operation
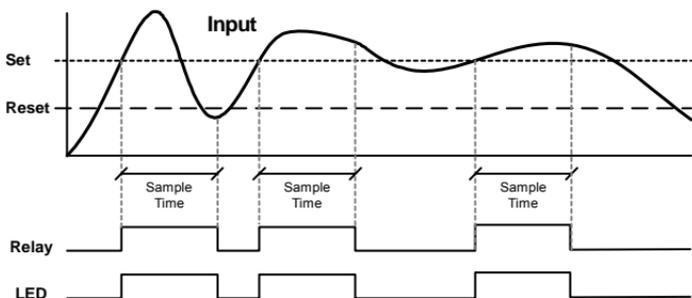
When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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

Total Relay Sampling Operation
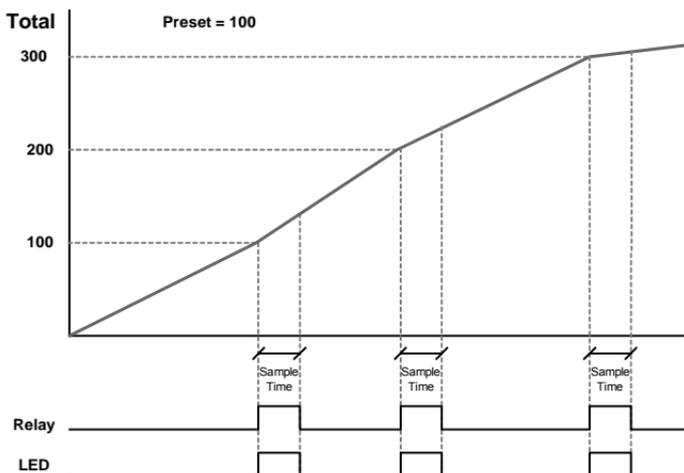
When the total reaches the preset, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the preset value is added to the total.

Signal Loss or Loop Break Relay Operation

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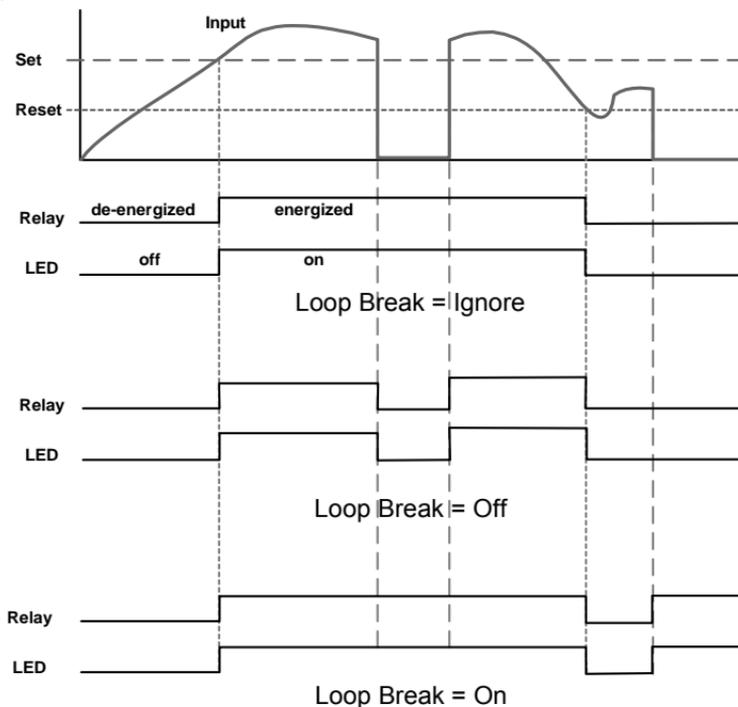
When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

1. Turn on (Go to alarm condition)
2. Turn off (Go to non-alarm condition)
3. Ignore (Process as a low signal condition)

Time Delay Operation

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

On Time Delay
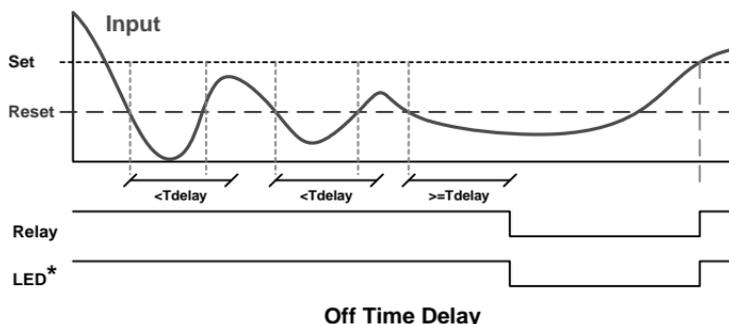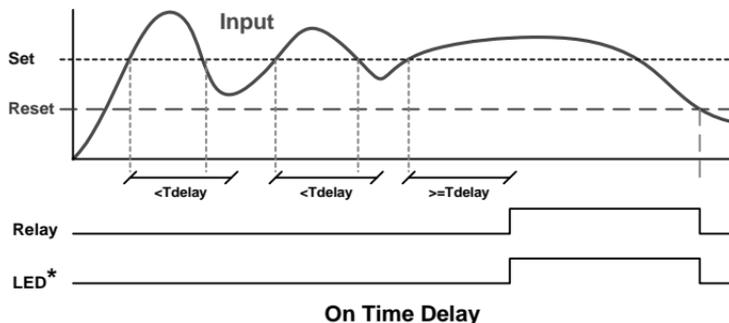
Off Time Delay

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

* Note: If "*Automatic or Manual* (Ⱥ-ᴨ¬ Ⱥᴨ)" 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 optional internal relays and/or 4 external relays expansion module. 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:

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

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

Front Panel LEDs

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

LED	Status	LED	Status
1	Alarm 1	5	Alarm 5
2	Alarm 2	6	Alarm 6
3	Alarm 3	7	Alarm 7
4	Alarm 4	8	Alarm 8

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.

Relay terminology for following tables

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

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

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

Non-Latching Relay (𝑨𝒖𝒕𝒐)
Automatic reset only

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

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.

Non-Latching Relay (𝑨-𝒐𝒏 𝑨𝒏)
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

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.

Latching Relay (𝑳𝑨𝒕𝒄𝑯)
Manual reset any time

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

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.

Latching Relay (Lt-CLr)

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

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.

Acknowledging Relays

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

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

Remotely via a normally open pushbutton wired across one of the digital inputs and the +5 V terminals on the digital I/O modules.

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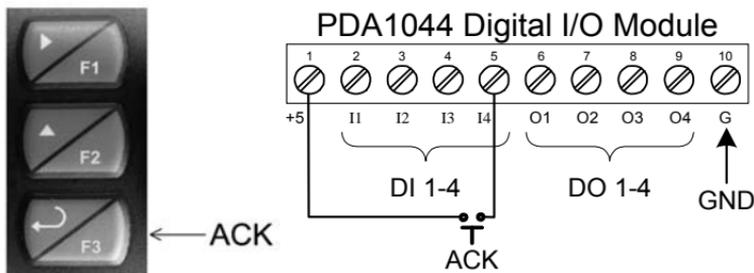

Figure 18: Acknowledge Relays w/Function Key or Digital Input

Pump Alternation Control Applications (ALtErn)

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

Up to 8 relays can be set up to alternate every time an on/off pump cycle is completed. The set points and reset points can be programmed, so that the first pump on is the first pump off.

Application #1: Pump Alternation Using Relays 1 & 2

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

Set and Reset Point Programming

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

Pump Alternation Operation

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

2. The next time level reaches 30.000, pump #2 turns on, when level drops below 10.000 pump #2 turns off.

3. If the level doesn't reach 35.000 pump #1 and pump #2 will be operating alternately.

4. If pump #1 cannot keep the level below 35.000 pump #2 will turn on at 35.000, then as the level drops to 10.000 pump #1 turns off, pump #2 is still running and shuts off below 5.000.

5. Notice that with the set and reset points of pump #2 outside the range of pump #1, the first pump on is the first pump to go off. This is true for up to 8 alternating pumps, if setup accordingly.

6. Relay #3 will go into alarm if the level drops below 4.000 and relay #4 will go into alarm if the level exceeds 40.000.

7. Adding the 4 external relays expansion module allows using the 4 SPDT internal relays for pump alternation and the 4 SPST external relays for high, high-high, low, and low-low alarm indication.

Application #2: Pump Alternation Using Relays 3 & 4

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

Set and Reset Point Programming

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

The following graphics provide a visual representation of a typical pump alternation application with high and low alarm monitoring:
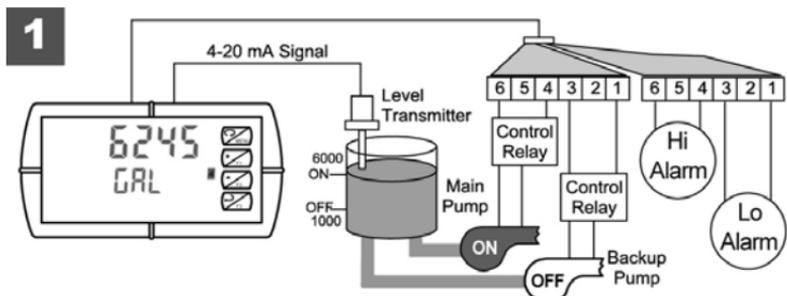
- Relay #4 turns the main pump on at 6000 gallons and turns it off at 1000 gallons.
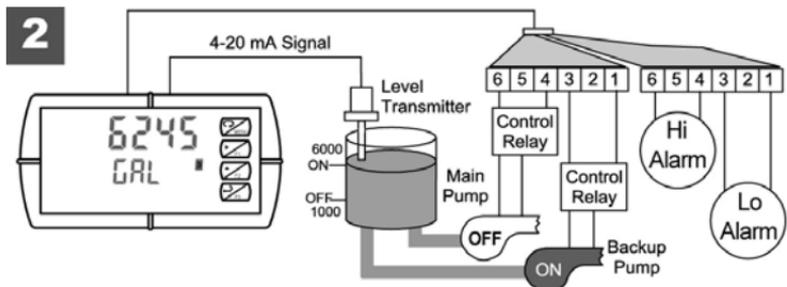
- With the Pump Alternation feature activated, the next time the level reaches 6000 gallons, relay #3 transfers and starts the backup pump.
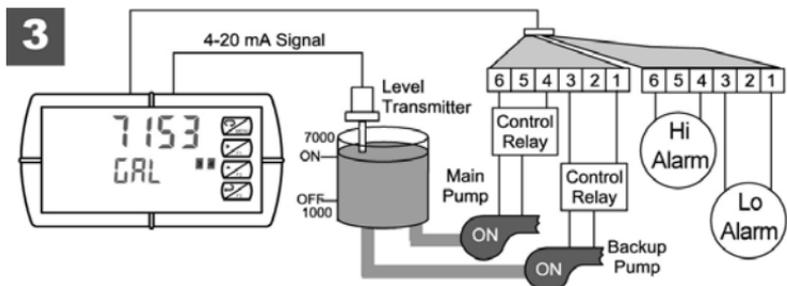
- If the backup pump is not able to keep up, and the level reaches 7000 gallons, relay #4 transfers and starts the main pump as well.
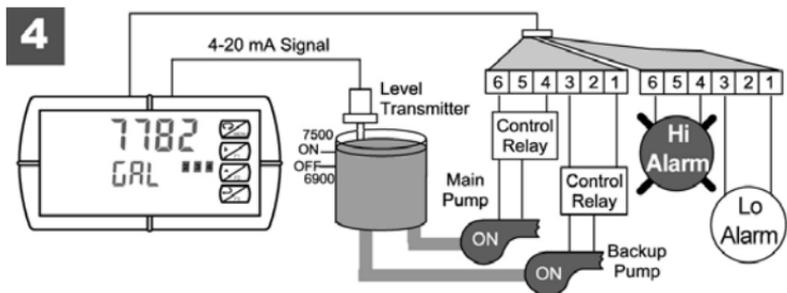
- Relay #2 trips the High Level Alarm at 7500 gallons and resets at 6900 gallons.
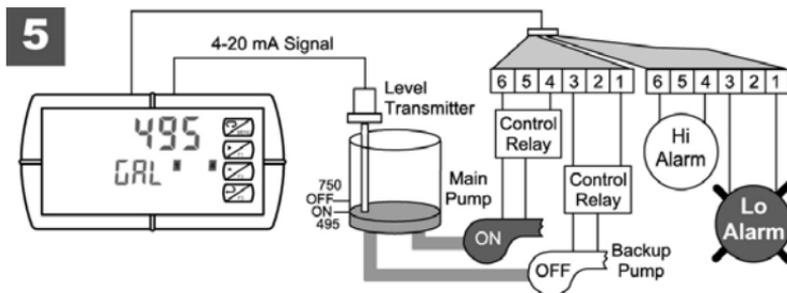
- Relay #1 trips the Low Level Alarm at 495 gallons and resets at 750 gallons.

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.
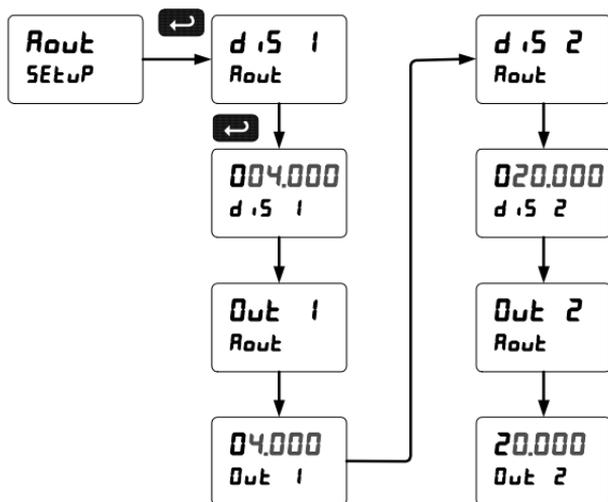
For instructions on how to program numeric values see *Setting Numeric Values*, page 33.

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 and to program the non-resettable totalizer.

> Pass 1: Allows use of the F1–F3 function keys
>
> Pass 2: Allows use of the F1–F3 function keys and changing the set/reset points
>
> Pass 3: Restricts all programming and F1–F3 keys and Digital Inputs
>
> Total: Prevents resetting the total manually
>
> Gtotal: Prevents resetting the grand total manually

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 33.
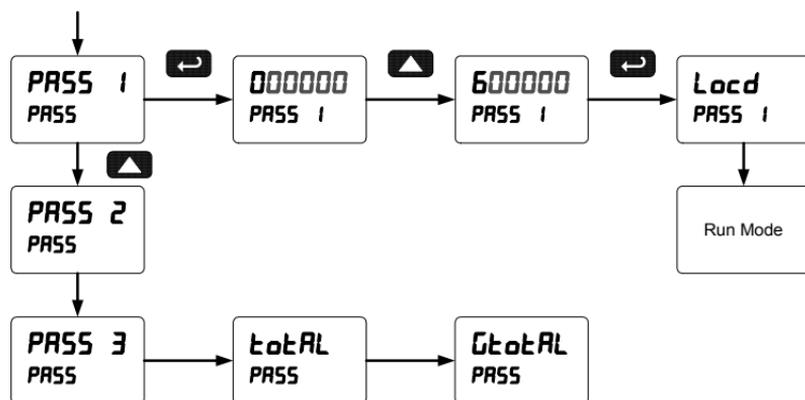
Record the password for future reference. If appropriate, it may be recorded in the space provided.

Model:	
Serial Number:	
Password 1:	__ __ __ __ __ __
Password 2:	__ __ __ __ __ __
Password 3:	__ __ __ __ __ __
Total	__ __ __ __ __ __
GTotal	__ __ __ __ __ __

Total Reset Password & Non-Resettable Total

The total and the grand total can be password-protected to prevent unauthorized total resets.

The grand total can be programmed as a non-resettable total by entering the password "050873".

⚠️ **Caution!**   Once the Grand Total has been programmed as "non-resettable" the feature **cannot** be disabled.

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 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.

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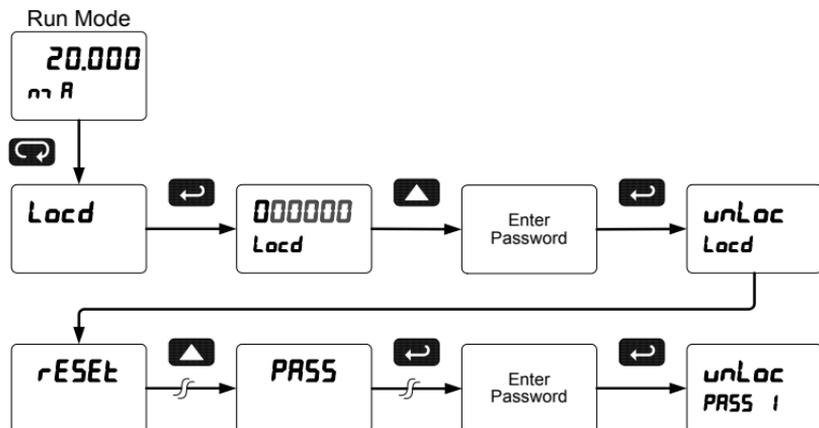
If the correct six-digit password is entered, the meter displays the message `unLoc` (unlocked) and the protection is disabled until a new password is programmed.

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. If you are authorized to make changes, enter the master password 508655 to unlock the meter.

Advanced Features Menu

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

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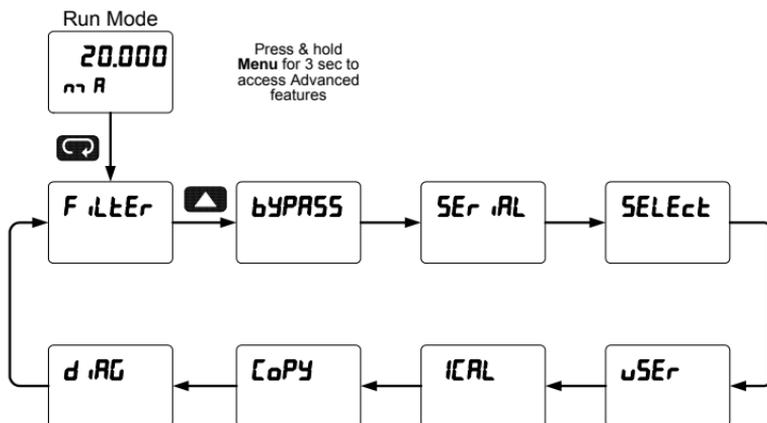
Advanced Features Menu & Display Messages

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

Display	Parameter	Action/Setting
F ıLtr	*Filter*	Set noise filter value
bYPASS	*Bypass*	Set filter bypass value
SEr ıAL	*Serial*	Set serial communication parameters
AddrES	*Address*	Set meter address
bAud	*Baud rate*	Select baud rate
tr dLY	*Transmit delay*	Set transmit delay for serial communication
SELEct	*Select*	Enter the Select menu (function, cutoff, out)
Functn	*Math Function*	Select linear, square root, programmable exponent, or round horizontal tank function
L ınEAr	*Linear*	Set meter for linear function and select number of linearization points
no PtS	*Number of points*	Set meter for 2 to 32-point linearization
S9uArE	*Square root*	Set meter for square root extraction
ProG E	*Programmable exponent*	Set meter for programmable exponent and enter exponent value
rht	*Round horizontal tank*	Set meter for round horizontal tank volume calculation
d ıAnⁿ r	*Diameter*	Enter the tank's diameter in inches
LEnGth	*Length*	Enter the tank's length in inches
CutoFF	*Cutoff*	Set low-flow cutoff
AoutPr	*Analog output programming*	Program analog output parameters
SourcE	*Source*	Select source for the 4-20 mA output
O-rAnG	*Overrange*	Program mA output for display overrange
u-rAnG	*Underrange*	Program mA output for display underrange
brEAH	*Loop Break*	Set relay condition if loop break detected
ForcE	*Force*	Force analog output value for loop break
ıGnorE	*Ignore*	Ignore loop break condition

Display	Parameter	Action/Setting
n⊓ RH	*Maximum*	Program maximum mA output allowed
n⊓ ιn	*Minimum*	Program minimum mA output allowed
CRL ιb	*Calibrate*	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 n⊓ R	*4 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 n⊓ R	*20 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
uSEr	*User I/O*	Assign function keys and digital I/O
F 1	*F1 function key*	Assign F1 function key
F2	*F2 function key*	Assign F2 function key
F3	*F3 function key*	Assign F3 function key
LL 1 1	*Logic level input 1*	Assign logic level input 1 – 8, if expansion modules are connected
LL 0 1	*Logic level output 1*	Assign logic level output 1 – 8, if expansion modules are connected
ιCRL	*Internal source calibration*	Enter internal source calibration (used for scaling the meter without a signal source
C CRL	*Current calibration*	Calibrating 4-20 mA current input (internal reference source used for scaling the input)
C Lo	*Current low*	Calibrate low current input (e.g. 4 mA)
C H ι	*Current high*	Calibrate high current input (e.g. 20 mA)
U CRL	*Voltage calibration*	Calibrating voltage input
U Lo	*Voltage low*	Calibrate low voltage input (e.g. 0 V)
U H ι	*Voltage high*	Calibrate high voltage input (e.g. 10 V)
CoPY	*Copy*	Enter copy function
5End	*Send*	Send meter settings to another meter
donE	*Done*	Copy function completed
d ιRG	*Diagnostics*	Display parameter settings
ιnPut	*Input*	Input selection
Functn	*Function*	Function selected
5CRLE	*Scale*	Scaling parameter

Display	Parameter	Action/Setting
CutoFF	*Cutoff*	Cutoff value
dSPLAY	*Display*	Display assignments
rELAY	*Relays*	Relay settings
Aout	*Analog output*	Analog output scaling
AoutPr	*Analog output programming*	Analog output programming
SErIAL	*Serial*	Serial communication settings
LEd t	*LED test*	Test all LEDs
InFo	*Information*	Display software and S/N information

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.

Serial Communications (5Er iAL)

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

To communicate with a computer or other data terminal equipment, an RS-232 or RS-422/485 adapter option is required; see *Ordering Information* on page 7 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.***

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

5Er iAL	↵	AddrE55 5Er iAL	▲	bAud 5Er iAL	→	tr dLY 5Er iAL
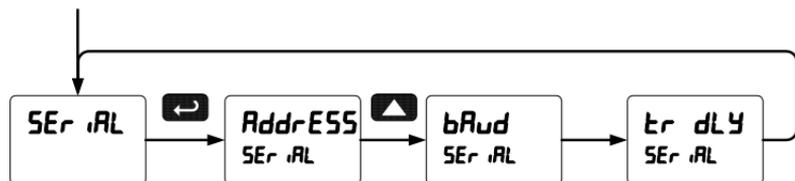
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The address may be programmed from 1 to 247. The transmit delay may be set between 0 and 199 ms.

The meter can also be connected to another meter allowing the user to copy all the settings from one meter to another, using the *Copy* function.

Select Menu (ꟅELEꞆ)

The *Select* menu is used to select the math function applied to the input (linear, square root, programmable exponent, or round horizontal tank), low-flow cutoff, and analog output programming. The multi-point lineari-zation is part of the linear function selection.
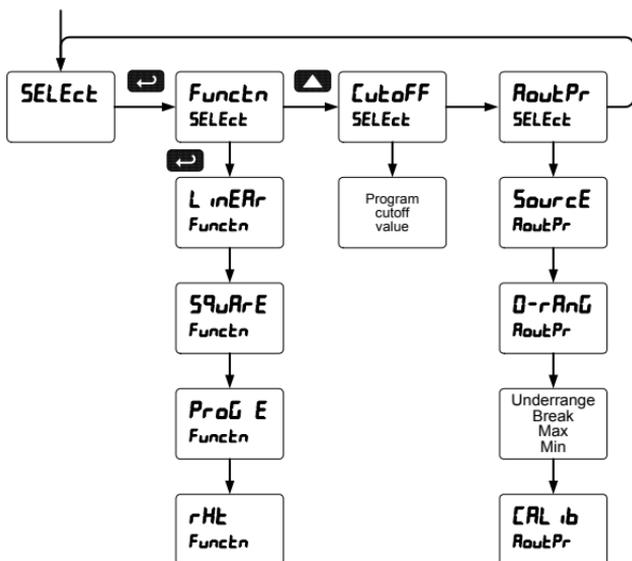
Math Function Selection (Funcꞇn)

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

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

Square Root Linearization (ꟅꞁuꞆrE)

The square root function can be used to linearize the signal from a diffe-rential pressure transmitter and display flow rate in engineering units.

Programmable Exponent Linearization (ProG E)

The programmable exponent can be used to linearize the signal from level transmitters in open-channel flow applications using weirs and flumes.

Multi-Point Linearization (L inEAr)

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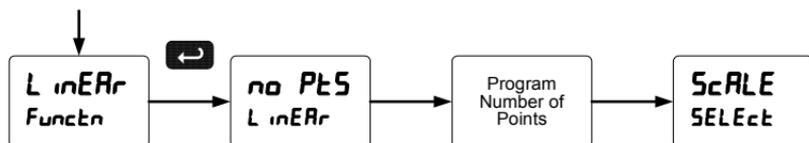
Round Horizontal Tank Linearization (rHt)

This function automatically calculates the volume in a round horizontal tank with flat ends.

Set the display for the desired decimal point and engineering units before entering the round horizontal tank function. Enter the diameter and the length in inches and the results are given in US gallons.

The meter can be scaled to display the volume in any engineering unit.
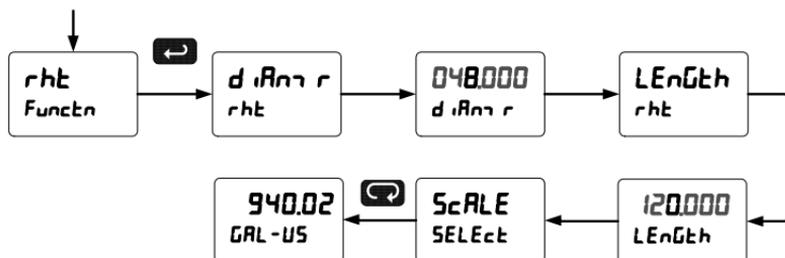
Low-Flow Cutoff (`CutoFF`)

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

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

Analog Output Programming (`AoutPr`)

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

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

Analog Output Source

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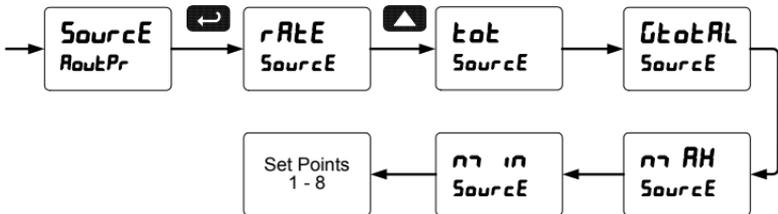
Analog Output Calibration

To perform the analog output calibration it's 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.

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Programmable Function Keys User Menu (𝗎𝖲𝖤𝗋)

The *User* menu allows the user to assign the front panel function keys F1, F2, F3 and up to eight digital inputs to access most of the menus or to activate functions immediately (e.g. Reset max & min). Up to eight digital outputs can be assigned to a number of actions and functions executed by the meter (e.g. Alarms, relay acknowledgement, etc.).
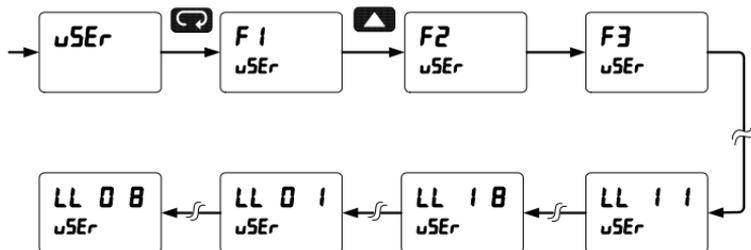
Function Keys & Digital I/O Available Settings

Display	Description	Display	Description
AcK	Acknowledge relays	b iG H i	Max on big display
rESEt	Reset menu	b iG Lo	Min on big display
rSt t	Reset total	b iG HL	Max/min big display
rSt Gt	Reset grand total	L ittLE	Little display menu
rSt H i	Reset max	L it H i	Max on little display
rSt Lo	Reset min	L it Lo	Min on little display
rSt HL	Reset max & min	L it HL	Max/min little display
rELAY	Relay menu	d iSAbL	Disable function key
SEt 1	Set point 1 - 8	m Enu	Menu button
rLY d	Disable relay	r iGht	Right arrow button
rLY E	Enable relay	uP	Up arrow button
O HoLd	Relay output hold	EntEr	Enter button
dSPLAY	Display menu	ALm 1	Alarm 1 – 8
b iG	Big display menu		

Internal Source Calibration (*ICAL*)

> The meter is factory calibrated prior to ship-
> ment to read in milliamps and volts depending
> on the input selection. The calibration equip-
> ment is certified to NIST standards.

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

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

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

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

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

1. Press and hold the Menu button for three seconds to access the advanced features of the meter.
2. Press the Up arrow button to scroll to the *Internal calibration* menu (*ICAL*) and press Enter.
3. The meter displays either current calibration (*C CAL*) or voltage cali-bration (*U CAL*), according to the input setup. Press Enter to start the calibration process.

Example of *Internal Calibration* for current input:

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

5. After the display stops flashing, a number is displayed with the left-most 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 signal being cali-brated, typically 4.000 mA.

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

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

For instructions on how to program numeric values see *Setting Numeric Values,* page 30.
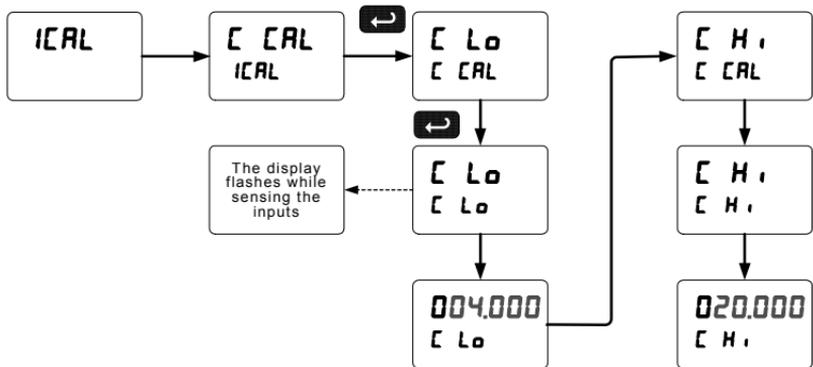
The graphic above shows the calibration of the current input. The voltage input is calibrated in a similar way.

Tips:

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

Error Message (Error)

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

After the error message is displayed, the meter reverts to input 2 during calibration or scaling and to input 1 during internal calibration, allowing the appropriate input signal to be applied or programmed.

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

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

Minimum Input Span

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

Input range	Input 1 & input 2 span
4-20 mA	0.15 mA
±10 VDC	0.10 VDC

Meter Copy Function (ᒲoPY)

The *Copy* function is used to copy (or clone) all the settings from one meter to other meters requiring exactly the same setup and programming (*i.e.* type of input, scaling, decimal point, filter, bypass, etc.).

⚠ **Warning!**

Only the PDA1200-FC meter copy cable must be used for meter-to-meter interfacing. The PDA1200-FC is a special eight-conductor flat cable with two wires swapped.

Using standard CAT5 or other cable will cause damage to both meters.

PDA1200-FC Meter Copy Cable

Figure 19: Meter Copy Connection

Copy Function Requirements

To successfully copy settings from one meter to another, both meters must have:
1. *Same software version*
2. *Same baud rate setting*

See *Determining Software Version*,
        page 82 for instructions.

Meter Copy or Cloning Instructions

⚠ **Caution!**	*Do not connect the two meters to the same signal source while cloning. Internal calibration may be affected.*

1. Connect two meters using a PDA1200-FC meter copy cable.

⚡ **Warning!**	*Using standard CAT5 or other cable will cause damage to both meters.* *Use PDA1200-FC meter copy cable only.*

2. Do not connect the two meters to the same signal source.
3. Power up both meters. Leave Clone meter in Run Mode.
4. Enter the *Advanced Features* menu of the Master meter see *Advanced Features Menu* page 66.
5. Scroll to the *Copy* function using the Up arrow button then press Enter.
6. The meter displays the message 5End. Press Enter, the display flashes while sending data. The message donE is displayed when copying is completed.
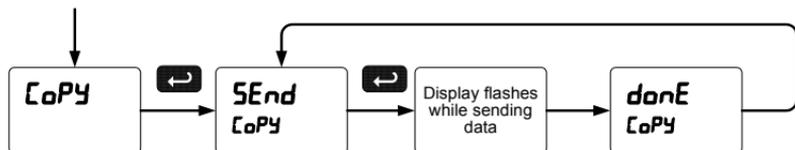
7. The Clone meter displays the message CPY rC while being programmed then the message donE when copying is completed. The meter initializes and returns to Run Mode using the same settings as the Master.
8. If meter to be cloned does not respond to the data being sent, refer to *Copy Function Requirements* above.

METER OPERATION

The meter is capable of accepting current (0-20 mA, 4-20 mA) and voltage signals (0-5 V, 1-5 V, 0-10 V, ± 10 V) and displaying these signals in engineering units from -99999 to 999999 (*e.g.* a 4-20 mA signal could be displayed as -50.000 to 50.000).

The dual-line display can be customized by the user to operate in such a way as to satisfy a specific application. Typically the main display is used for the process variable; while the second display is used engineering units, custom legend, or set point indication.

Front Panel Buttons Operation

Button Symbol	Description
	Press to enter or exit Programming Mode, view settings, or exit max/min readings
	Press to reset max/min readings or other parameter/function assigned through the *User* menu
	Press to display max/min readings or other parameter/function assigned through the *User* menu
	Press to acknowledge relays or other parameters/function assigned through the *User* menu

Function Keys 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.

Maximum/Minimum Readings

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

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

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

To display max reading using function key with factory defaults:

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

To display max/min readings continuously:

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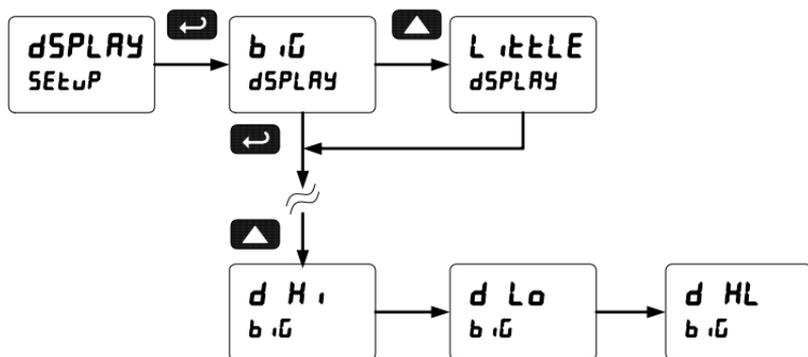
TROUBLESHOOTING

The rugged design and the user-friendly interface of the meter should make it unusual for the installer or operator to refer to this section of the manual. However, due to the many features and functions of the 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 ɪAG)

The *Diagnostics* menu is located in the *Advanced Features* menu, to access *Diagnostics* menu see *Advanced Features Menu*, page 66.

It provides an easy way to view the programmed parameter settings for troubleshooting purposes. 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 67.

Determining Software Version

To determine the software version of a meter:

1. Go to the *Diagnostics* menu (d ɪAG) and press Enter button.
2. Press Up arrow button and scroll to Information menu (ɪnFo).
3. Press Enter to access the software number (SFt), version (UEr), and serial number (Sn) 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 66.
2. Press Up arrow to go to *Diagnostics* menu
3. Press and hold Right arrow for five seconds, press Enter when display flashes rESEt.
   Note: If Enter is not pressed within three seconds, the display returns to the *Diagnostics* menu.
4. The meter goes through an initialization sequence (similar as on power-up), and loads the factory default settings.

Run Mode

Press & hold Menu for 3 sec to access Advanced features

Press & hold right arrow for 3 sec to reset meter
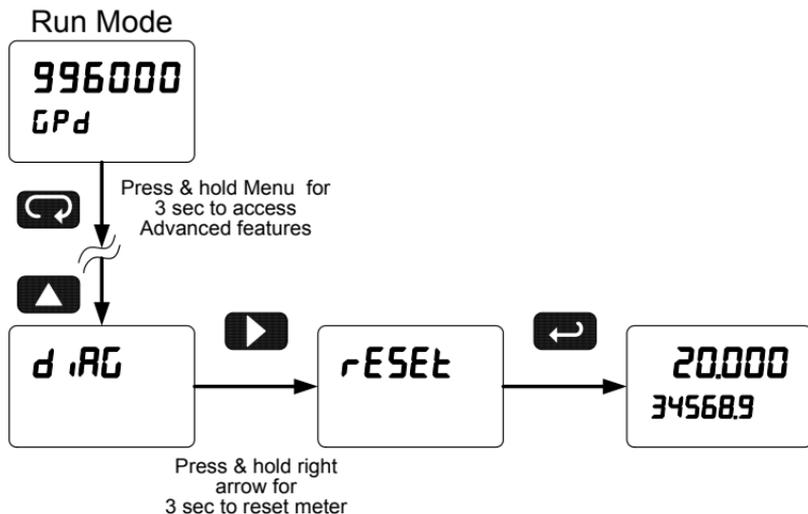
Factory Defaults & User Settings

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

Model: _____   S/N: _____   Date: _____

Parameter	Display	Default Setting	User Setting
Input type	*inPut*	4-20 mA	
Total	*YES*	Total enabled	
Filter	*FiLtEr*	10	
Bypass	*bYPASS*	0.2	
Function	*Functn*	Linear	
Number of points	*no PtS*	2	
Programming	*ProG*	Scale	
Input 1	*InP 1*	4.000 mA	
Display 1	*diS 1*	4.000	
Input 2	*InP 2*	20.000 mA	
Display 2	*diS 2*	20.000	
Decimal point	*ddd.ddd*	3 places	
Cutoff value	*CutoFF*	0.000 (disabled)	
Display assignment	*dSPLAY*		
Big display (Main)	*biG*	Rate/Process	
Little display (Small)	*LittLE*	Total value	
Display intensity	*d-IntY*	6	
Total time base	*t tb*	Second	
Total conversion factor	*t CF*	1.000	
Total reset	*t rSt*	Manual	
Grand total time base	*Gt tb*	Second	
Grand total conversion factor	*t CF*	1.000	
Grand total reset	*t rSt*	Manual	
Relay 1 assignment	*ASiGn 1*	Total	

Parameter	Display	Default Setting	User Setting
Relay 2 assignment	A5 ιGn2	Total	
Relay 3 assignment	A5 ιGn3	Rate	
Relay 4 assignment	A5 ιGn4	Rate	
Relay 1 action	Act 1	Automatic	
Relay 1 set point	SEt 1	1.000	
Relay 1 reset point	rSt 1	0.000	
Relay 2 action	Act 2	Automatic	
Relay 2 set point	SEt 2	2.000	
Relay 2 reset point	rSt 2	0.000	
Relay 3 action	Act 3	Automatic	
Relay 3 set point	SEt 3	3.000	
Relay 3 reset point	rSt 3	2.500	
Relay 4 action	Act 4	Automatic	
Relay 4 set point	SEt 4	4.000	
Relay 4 reset point	rSt 4	3.500	
Fail-safe relay 1	FLS 1	Off	
Fail-safe relay 2	FLS 2	Off	
Fail-safe relay 3	FLS 3	Off	
Fail-safe relay 4	FLS 4	Off	
On delay relay 1	On 1	0.0 sec	
Off delay relay 1	OFF 1	0.0 sec	
On delay relay 2	On 2	0.0 sec	
Off delay relay 2	OFF 2	0.0 sec	
On delay relay 3	On 3	0.0 sec	
Off delay relay 3	OFF 3	0.0 sec	
On delay relay 4	On 4	0.0 sec	
Off delay relay 4	OFF 4	0.0 sec	
Loop break relay 1	ιGnorE	Ignore	
Loop break relay 2	ιGnorE	Ignore	
Loop break relay 3	ιGnorE	Ignore	

Parameter	Display	Default Setting	User Setting
Loop break relay 4	⌐GnorE	Ignore	
Display 1 analog out	d ،5 ¹	4.000	
Output 1 value	☐ut ¹	4.000 mA	
Display 2 analog out	d ،5 2	20.000	
Output 2 value	☐ut 2	20.000 mA	
Source analog output	SourcE	Rate/process	
Overrange output	☐-rAnG	21.000 mA	
Underrange output	u-rAnG	3.000 mA	
Loop break output	brEAK	1.000 mA	
Maximum output	n⊓ AK	23.000 mA	
Minimum output	n⊓ ،n	0.000 mA	
Serial address	AddrE5	001	
Baud rate	bAud	2400	
Transmit delay	tr dLY	10 ms	
F1 function key	F ¹	Reset max & min	
F2 function key	F2	Big display: Max (Hi)	
F3 function key	F3	Acknowledge relays	
Logic level input 1	LL ¹ ¹	Menu	
Logic level input 2	LL ¹ 2	Right arrow	
Logic level input 3	LL ¹ 3	Up arrow	
Logic level input 4	LL ¹ 4	Enter	
Logic level output 1	LL ☐ ¹	Alarm 1	
Logic level output 2	LL ☐ 2	Alarm 2	
Logic level output 3	LL ☐ 3	Alarm 3	
Logic level output 4	LL ☐ 4	Alarm 4	
Password 1	PA55 ¹	000000 (unlocked)	
Password 2	PA55 2	000000 (unlocked)	
Password 3	PA55 3	000000 (unlocked)	
Total password	totAL	000000 (unlocked)	
Grand total password	GtotAL	000000 (unlocked)	

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 password-protected, enter correct six-digit password to unlock
Meter displays error message during calibration (*Error*)	Check: 1. Signal connections 2. Input selected in *Setup* menu 3. Minimum input span requirements

Meter displays
   999999
   -99999
	Check:
	1. Input selected in *Setup* menu
	2. Corresponding signal at Signal connector

Display is unstable	Check:
	  • Input signal stability and value
	  • Display scaling vs. input signal
	  • Filter and bypass values (increase)

Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: 1. Math function selected: Linear, square root, etc. 2. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check: 1. Display assignment, it might be displaying max, min, or set point.
Display alternates between 1. *Hi* and a number 2. *Lo* and a number	Press Menu to exit max/min display readings.
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 application programs	Check: 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.

Alphabetical List of Display Functions & Messages

Display	Parameter	Action/Setting Description
20 ∩ A	*20 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
4 ∩ A	*4 mA output*	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
999999 -99999	*Flashing display*	Overrange condition Underrange condition
AcH	*Acknowledge*	Acknowledge relays
Act 1	*Action 1*	Set relay 1 action
AddrES	*Address*	Set meter address
ALn 1	*Alarm 1*	Assign digital output to Alarm 1 – 8
ALtErn	*Alternate*	Set relay for pump alternation control (relays assigned to rate)
A-n An	*Auto-manual*	Set relay for automatic & manual reset any time
Aout	*Analog output*	Analog output scaling
AoutPr	*Analog output programming*	Analog output programming
AS Gn 1	*Assign 1*	Relay 1 assignment
ASS Gn	*Assignment*	Assign relays to rate, total, or grand total
Auto	*Automatic*	Press Enter to set meter for automatic operation
Auto	*Automatic*	For automatic reset
bAud	*Baud rate*	Select baud rate
b G	*Big display*	Press Enter to assign the Main display parameter (default: PV or rate)
b G H	*Max on big display*	Assign digital input to display max on the main display
b G HL	*Max/min big display*	Assign digital input to toggle max/min on the main display
b G Lo	*Min on big display*	Assign the digital input to display min on the main display
brEAH	*Loop break*	Set relay condition if loop break detected (For mA input only)

Display	Parameter	Action/Setting Description
bYPASS	*Bypass*	Set filter bypass value
C CAL	*Current calibration*	Calibrating 4-20 mA current input (internal reference source used for scaling the input)
C H ı	*Current high*	Calibrate high current input (e.g. 20 mA)
C Lo	*Current low*	Calibrate low current input (e.g. 4 mA)
CAL	*Calibrate*	Enter the *Calibrate* menu
CAL ıb	*Calibrate*	Calibrate 4-20 mA output (internal reference source used for scaling the output)
ContrL	*Control*	Enter *Control* menu
CoPY	*Copy*	Enter copy function
CutoFF	*Cutoff*	Cutoff value
dEc Pt	*Decimal point*	Set decimal point for rate, total, grand total
dELAY	*Delay*	Enter relay *Time Delay* menu
d ıAG	*Diagnostics*	Display parameter settings
d ıAmʒ r	*Diameter*	Enter the tank's diameter in inches
d- ıntY	*Display intensity*	Set display intensity level from 1 to 8
d ıS 1	*Display 1*	Program display 1 value
d ıS 2	*Display 2*	Program display 2 value
d ıSAbL		Disable function key
dLY 1	*Delay 1*	Enter relay 1 time delay setup
donE	*Done*	Copy function completed
dSPLAY	*Display*	Enter the *Display* menu
EntEr	*Enter Button*	Assign digital input to Enter button
Error	*Error*	Error, calibration not successful, check signal or programmed value
F 1	*F1 function key*	Assign F1 function key
F2	*F2 function key*	Assign F2 function key
F3	*F3 function key*	Assign F3 function key
FA ıLSF	*Fail-safe*	Enter *Fail-safe* menu
F ıLtr	*Filter*	Set noise filter value

Display	Parameter	Action/Setting Description
FLS 1	*Fail-safe 1*	Set relay 1 fail-safe operation
ForcE	*Force*	Force analog output value for loop break
Functn	*Function*	Select linear, square root, programmable exponent, or round horizontal tank function
G totRL	*Grand total*	Assign relay to grand total
Gt CF	*Grand total conversion factor*	Program grand total conversion factor
Gt rSt	*Grand total reset*	Program grand total rest mode: auto or manual
Gt tb	*Grand total time base*	Program grand total time base
GtotRL	*Grand total password*	Set or enter password for manual reset
ICRL	*Internal source calibration*	Enter internal source calibration (used for scaling the meter without a signal source
IGnorE	*Ignore*	Ignore loop break condition
InFo	*Information*	Display software and S/N information
InP 1	*Input 1*	Calibrate input 1 signal or program input 1 value
InP 2	*Input 2*	Calibrate input 2 signal or program input 2 value (up to 32 points)
InPut	*Input*	Input selection
LRtCH	*Latching*	Set relay for latching operation (relays assigned to rate)
LEd t	*LED test*	Test all LEDs
LEnGth	*Length*	Enter the tank's length in inches
L inERr	*Linear*	Set meter for linear function and select number of linearization points
L it H i	*Max on little display*	Assign digital input to display max on the small display
L it HL	*Max/min little display*	Assign the digital input to toggle max/min on the small display
L it Lo	*Min on little display*	Assign digital input to display min on the small display

Display	Parameter	Action/Setting Description
L ɪttLE	*Little display*	To assign the small display parameters
LL ɪ ɪ	*Logic level input 1*	Assign logic level input 1 – 8, if expansion modules are connected
LL ᴏ ɪ	*Logic level output 1*	Assign logic level output 1 – 8, if expansion modules are connected
Locd	*Locked*	Enter password to unlock meter
Lt-CLr	*Latching-cleared*	Set relay for latching operation with manual reset only after alarm condition has cleared (relays assigned to rate)
ɱ A	*4-20 mA*	Set meter for 4-20 mA input
ɱ An	*Manual*	To manually control
ɱ AH	*Maximum*	Program maximum mA output allowed
ɱ Enu	*Menu button*	Assign digital input to Menu button
ɱ ɪn	*Minimum*	Program minimum mA output allowed
no PtS	*Number of points*	Set meter for 2 to 32-point linearization
nonr St	*Non-resettable*	Non-resettable grand total set after entering "050873" for Gtotal password
ᴏ HoLd		Relay output hold
ᴏFF	*Off*	Disable relay and front panel status LED
	Fail-safe off	Disable fail-safe operation
	Off	Relay goes to non-alarm condition when loop break is detected
ᴏFF ɪ	*Off*	Set relay 1 Off time delay
ᴏn	*On*	Relay goes to alarm condition when loop break is detected
		Enable fail-safe operation
ᴏn ɪ	*On*	Set relay 1 On time delay
ᴏ-rAnɢ	*Overrange*	Program mA output for display overrange
ᴏut ɪ	*Output 1*	Program output 1 value (e.g. 4.000 mA)
ᴏut 2	*Output 2*	Program output 2 value (e.g. 20.000 mA)
PASS	*Password*	Enter the *Password* menu
PASS ɪ	*Password 1*	Set or enter Password 1

Display	Parameter	Action/Setting Description
PASS 2	*Password 2*	Set or enter Password 2
PASS 3	*Password 3*	Set or enter Password 3
ProG	*Program*	Enter the *Program* menu
ProG E	*Programmable exponent*	Set meter for programmable exponent and enter exponent value
rAtE	*Rate*	Assign relay to rate
rELAY	*Relay*	Enter the *Relay* menu
rESEt	*Reset*	To access the *Reset* menu
rht	*Round horizontal tank*	Set meter for round horizontal tank volume calculation
r iGht		Right arrow button
rLY 1	*Relay 1*	Relay 1 setup
rLY 2	*Relay 2*	Relays 2-8 setup *Note: Relays 5-8 are shown, only if expansion relay module is installed.*
rLY d		Disable relay
rLY E		Enable relay
rSt 1	*Reset 1*	Program reset point 1
rSt Gt	*Reset grand total*	To reset grand total
rSt H i	*Reset high*	Press Enter to reset max display
rSt HL	*Reset high & low*	Press Enter to reset max & min displays
rSt Lo	*Reset low*	Press Enter to reset min display
rSt t	*Reset Total*	Reset total
SAm PL	*Sampling*	Set relay for sampling operation
SCALE	*Scale*	Enter the *Scale* menu
SELEct	*Select*	Enter the Select menu (function, cutoff, out)
SEnd	*Send*	Send meter settings to another meter
SEr iAL	*Serial*	Set serial communication parameters
SEt 1	*Set 1*	Program set point 1
SEtuP	*Setup*	Enter *Setup* menu

Display	Parameter	Action/Setting Description
SourcE	*Source*	Select source for the 4-20 mA output
SquArE	*Square root*	Set meter for square root extraction
t CF	*Total conversion factor*	Program total conversion factor
t dLY	*Time delay*	Program time delay for total auto reset
t rSt	*Total reset*	Program total rest mode: auto or manual
t tb	*Total time base*	Program total time base
totAL	*Total*	Enable or disable totalizer features
tr dLY	*Transmit delay*	Set transmit delay for serial communication
unLoc	*Unlocked*	Program password to lock meter
uP	*Up arrow button*	To assign digital input to up arrow button
u-rAnG	*Underrange*	Program mA output for display underrange
uSEr	*User I/O*	Assign function keys and digital I/O
U CAL	*Voltage calibration*	Calibrating voltage input
U Hi	*Voltage high*	Calibrate high voltage input (e.g. 10 V)
U Lo	*Voltage low*	Calibrate low voltage input (e.g. 0 V)
UoLt	*0-10 VDC*	Set meter for ±10 VDC input

NOTES

<u>NOTES</u>

How to Contact Flow Line Options

- For Technical Support please
  Call: (330)468-0180
  Fax: (330)468-0185
  Email: sales@flo-corp.com

- For Sales Support or to place an order please
  Call: (330)468-0180
  Fax: (330)468-0185
  Email: sales@flo-corp.com

- For the latest version of this manual please visit
  www.flo-corp.com