

# **FLOWLINE**



**Model: LI55**  
**DataView™ Level Controller**  
**Instruction Manual**



**FLOWLINE**  
[www.flowline.com](http://www.flowline.com)

10500 Humbolt St. • Los Alamitos CA 90720 USA  
Tel (562) 598-3015 • Fax (562) 431-8507

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**WARNING:** *Risk of electric shock or personal injury.*



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## INTRODUCTION

The DataView LI55 is a multi-purpose, easy to use digital process meter ideal for level, flow rate, temperature, or pressure transmitter 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 a specific operation. The analog input can be scaled to display the process in two different scales; for example the main display could indicate level in feet and the second display could indicate the volume in gallons.

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 digital input is standard.

A fully loaded LI55 meter has the following: four SPDT relays, 4-20 mA output, and two 24 VDC power supplies. The LI55 capabilities may be enhanced by adding a four SPST relays expansion module (creating an eight-relay process meter).

The eight relays can be used for alarm indication or process control applications, such as pump alternation control. The 4-20 mA isolated output, and digital I/O options make the LI55 an excellent addition to any system.

## ORDERING INFORMATION

### Standard Models

85-265 VAC Model	12/24 VDC Model	Options Installed
LI55-1001	LI55-8001	No options
LI55-1201	LI55-8201	2 relays (LI56-1201*)
LI55-1011	LI55-8011	4-20 mA output (LI56-1011*)
LI55-1401	LI55-8401	4 relays (LI56-1401*)
LI55-1211	LI55-8211	2 relays & 4-20 mA output (LI56-1211*)
LI55-1411	LI55-8411	4 relays & 4-20 mA output (LI56-1411*)
*Model number for replacement option card.		

### Accessories

Model	Description
LI56-1400	4 SPST (Form A) relays
LI56-1000	Meter copy cable
LM91-1001	Single Display NEMA 4X Enclosure
LM91-2001	Dual Display NEMA 4X Enclosure

## SPECIFICATIONS

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

### General

<b>DISPLAY</b>	Main display: 0.60" (15 mm) high, red LEDs Second display: 0.46" (12 mm) high, red LEDs 6 digits each (-99999 to 999999), with lead zero blanking
<b>DISPLAY INTENSITY</b>	Eight user selectable intensity levels
<b>DISPLAY UPDATE RATE</b>	5/second (200 ms)
<b>OVERRANGE</b>	Display flashes <b>999999</b>
<b>UNDERRANGE</b>	Display flashes <b>-99999</b>
<b>DISPLAY ASSIGNMENT</b>	The main (Big) and small (Little) displays may be assigned to PV1, PV2, PCT, d r-u, d gross, d nt-g, max/min, max & min, set points, or units (small display only).
<b>PROGRAMMING METHODS</b>	Four front panel buttons or cloning using Copy function.
<b>NOISE FILTER</b>	Programmable from 2 to 199 (0 will disable filter)
<b>FILTER BYPASS</b>	Programmable from 0.1 to 99.9% of calibrated span
<b>RECALIBRATION</b>	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
<b>MAX/MIN DISPLAY</b>	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
<b>PASSWORD</b>	Three programmable passwords restrict modification of programmed settings. Pass 1: Allows use of function keys and digital input Pass 2: Allows use of function keys, digital input and editing set/reset points Pass 3: Restricts all programming, function keys, and digital input.
<b>POWER OPTIONS</b>	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max (LI55-1__1 series). 12/24 VDC $\pm$ 10%, 15 W max (LI55-8__1 series)
<b>ISOLATED TRANSMITTER POWER SUPPLY</b>	Terminals P+ & P-: 24 VDC $\pm$ 10%. 12/24 VDC powered models selectable for 24, 10, or 5 VDC supply (internal jumper J4). 85-265 VAC models rated @ 200 mA max, 12/24 VDC powered models rated @ 100 mA max, @ 50 mA max for 5 or 10 VDC supply.
<b>NON-VOLATILE MEMORY</b>	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
<b>FUSE</b>	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse



<b>NORMAL MODE REJECTION</b>	Greater than 60 dB at 50/60 Hz
<b>ISOLATION</b>	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
<b>OVERVOLTAGE CATEGORY</b>	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
<b>ENVIRONMENTAL</b>	Operating temperature range: -40 to 65°C Storage temperature range: -40 to 85°C Relative humidity: 0 to 90% non-condensing
<b>CONNECTIONS</b>	Removable screw terminal blocks accept 12 to 22 AWG wire, RJ45 for external relays, digital I/O, and serial communication adapters.
<b>ENCLOSURE</b>	1/8 DIN, high impact plastic, UL 94V-0, color: black
<b>MOUNTING</b>	1/8 DIN panel cutout required: 3.622" x 1.772" (92 mm x 45 mm) Two panel mounting bracket assemblies are provided.
<b>TIGHTENING TORQUE</b>	Screw terminal connectors: 5 lb-in (0.56 Nm)
<b>OVERALL DIMENSIONS</b>	4.68" x 2.45" x 5.64" (119 mm x 62 mm x 143 mm) (W x H x D)
<b>WEIGHT</b>	9.5 oz (269 g)
<b>WARRANTY</b>	3 years parts & labor

## Process Input

<b>INPUTS</b>	Field selectable: 0-20, 4-20 mA, $\pm 10$ V (0-5, 1-5, 0-10 V)	
<b>ACCURACY</b>	$\pm 0.03\%$ of calibrated span $\pm 1$ count, square root & programmable exponent accuracy range: 10-100% of calibrated span	
<b>TEMPERATURE DRIFT</b>	0.005% of calibrated span/ $^{\circ}$ C max from 0 to 65 $^{\circ}$ C ambient, 0.01% of calibrated span/ $^{\circ}$ C max from -40 to 0 $^{\circ}$ C ambient	
<b>SIGNAL INPUT CONDITIONING</b>	Linear, square root, programmable exponent, or round horizontal tank volume calculation	
<b>MULTI-POINT LINEARIZATION</b>	2 to 32 points for PV or PV1 2 to 8 points for PV2 (Dual-scale Level feature)	
<b>PROGRAMMABLE EXPONENT</b>	1.0001 to 2.9999	
<b>ROUND H TANK</b>	Diameter & Length: 999.999 inch or cm calculates volume in gallons or liters respectively.	
<b>LOW-FLOW CUTOFF</b>	0-999999 (0 disables cutoff function)	
<b>DECIMAL POINT</b>	Up to five decimal places or none: <i>dddddd, ddddd, dddd, ddd, dd, or d</i>	
<b>CALIBRATION RANGE</b>	Input Range	Minimum Span Input 1 & Input 2
	4-20 mA $\pm 10$ V	0.15 mA 0.10 V
	An error message will appear if the input 1 and input 2 signals are too close together.	
<b>INPUT IMPEDANCE</b>	Voltage ranges: greater than 500 k $\Omega$ Current ranges: 50 - 100 $\Omega$ (depending on resettable fuse impedance)	
<b>INPUT OVERLOAD</b>	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.	
<b>F4 DIGITAL INPUT CONTACTS</b>	3.3 VDC on contact. Connect normally open contacts across F4 to COM.	
<b>F4 DIGITAL INPUT LOGIC LEVELS</b>	Logic High: 3 to 5 VDC Logic Low: 0 to 1.25 VDC	

## Relays

<b>RATING</b>	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 ( $\approx$ 50 W) @ 125/250 VAC for inductive loads
<b>NOISE SUPPRESSION</b>	Noise suppression is recommended for each relay contact switching inductive loads; see page 23 for details.
<b>DEADBAND</b>	0-100% of span, user programmable
<b>HIGH OR LOW ALARM</b>	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
<b>RELAY OPERATION</b>	Automatic (non-latching) and/or manual reset Latching (requires manual acknowledge) with/without clear Pump alternation control (2 to 8 relays) Sampling (based on time) Off (disable unused relays and enable Interlock feature) Manual on/off control mode
<b>RELAY RESET</b>	User selectable via front panel buttons <ol style="list-style-type: none"> <li>Automatic reset only (non-latching), when the input passes the reset point.</li> <li>Automatic + manual reset at any time (non-latching)</li> <li>Manual reset only, at any time (latching)</li> <li>Manual reset only after alarm condition has cleared (latching)</li> </ol> <p><i>Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.</i></p>
<b>TIME DELAY</b>	0 to 999.9 seconds, on & off relay time delays Programmable and independent for each relay
<b>FAIL-SAFE OPERATION</b>	Programmable and independent for each relay. <i>Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.</i>
<b>AUTO INITIALIZATION</b>	When power is applied to the meter, relays will reflect the state of the input to the meter.

## Isolated 4-20 mA Transmitter Output

<b>OUTPUT SOURCE</b>	Process variable (PV), max, min, set points 1-8, or manual control mode		
<b>SCALING RANGE</b>	1.000 to 23.000 mA for any display range		
<b>CALIBRATION</b>	Factory calibrated: 4.000 to 20.000 = 4-20 mA output		
<b>ANALOG OUT PROGRAMMING</b>	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break		
<b>ACCURACY</b>	± 0.1% of span ± 0.004 mA		
<b>TEMPERATURE DRIFT</b>	0.4 $\mu\text{A}/^\circ\text{C}$ max from 0 to 65°C ambient, 0.8 $\mu\text{A}/^\circ\text{C}$ max from -40 to 0°C ambient <i>Note: Analog output drift is separate from input drift.</i>		
<b>ISOLATED TRANSMITTER POWER SUPPLY</b>	Terminals I+ & R: 24 VDC ± 10%. May be used to power the 4-20 mA output or other devices. Refer to Figure 5 on page 18 and Figure 16 on page 24. All models rated @ 40 mA max.		
<b>EXTERNAL LOOP POWER SUPPLY</b>	35 VDC maximum		
<b>OUTPUT LOOP RESISTANCE</b>	Power supply	Minimum	Maximum
	24 VDC	10 $\Omega$	700 $\Omega$
	35 VDC (external)	100 $\Omega$	1200 $\Omega$

## COMPLIANCE INFORMATION

### Safety

<b>UL &amp; c-UL LISTED</b>	USA & Canada UL 508 Industrial Control Equipment
<b>UL FILE NUMBER</b>	E193723
<b>FRONT PANEL</b>	UL Type 4X, NEMA 4X, IP65; panel gasket provided
<b>LOW VOLTAGE DIRECTIVE</b>	EN 61010-1:2001 Safety requirements for measurement, control, and laboratory use

### Electromagnetic Compatibility

<b>EMISSIONS</b>	EN 55022:2006/A1:2007 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
<b>IMMUNITY</b>	EN 61326-1:2006 Measurement, control, and laboratory equipment EN 61000-6-2:2005 EMC heavy industrial generic immunity standard
RFI - Amplitude Modulated	80 -1000 MHz 10 V/m 80% AM (1 kHz) 1.4 - 2.0 GHz 3 V/m 80% AM (1 kHz) 2.0 - 2.7 GHz 1 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 70%V for 25 periods
Voltage Interruptions	<5%V for 250 periods

**Note:**

*Testing was conducted on LI55 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.*

*Declaration of Conformity available at [www.flowline.com](http://www.flowline.com)*

**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 setting up a 12/24 VDC powered meter to operate from 12 VDC (see page 18) and for changing the transmitter power supply to output 5 or 10 VDC instead of 24 VDC (see page 18).

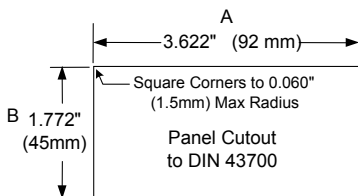
### Unpacking

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 below, 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 1/4" (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.



Refer to page  
17 for mounting  
dimensions

Tolerances:

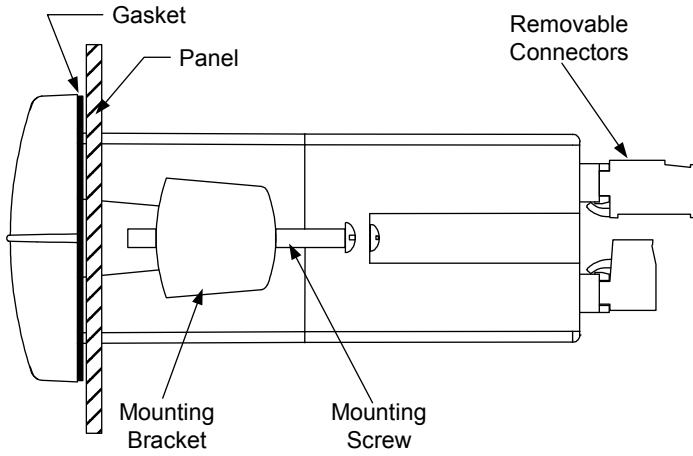
A: +0.032 (+0.8mm)

-0.000 (-0.0mm)

B: +0.024 (+0.6mm)

-0.000 (-0.0mm)

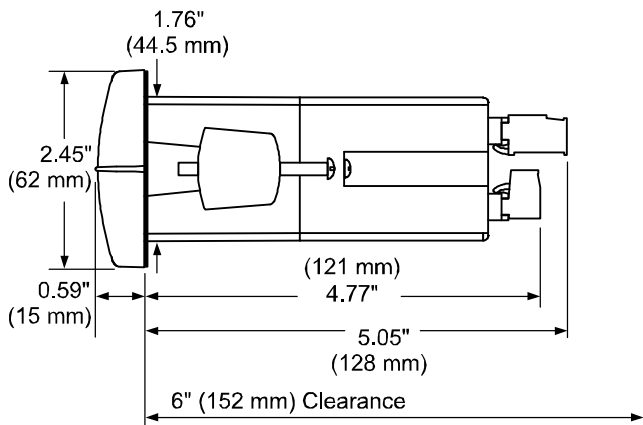
**Figure 1. 1/8 DIN Panel Cutout Dimensions**



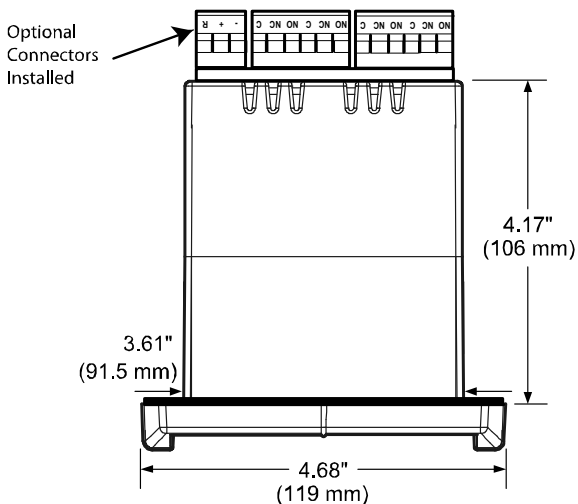
**Figure 2. Panel Mounting Details**



## Mounting Dimensions



**Figure 3. Meter Dimensions - Side View**



**Figure 4. Meter Dimensions - Top View**

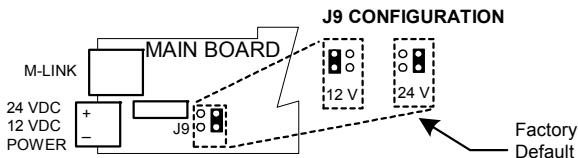
**Configuration for 12 or 24 VDC Power****Warning!**

*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 5. Jumper Configuration for 12/24 VDC Power**

(Applies to LI55-8\_\_1 version only)

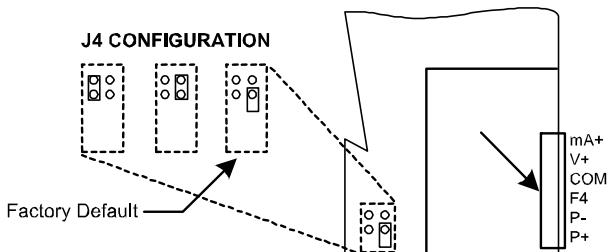
### Transmitter Supply Voltage Selection (P+, P-)

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 wiring connectors.
2. Unscrew the back cover.
3. Slide out the back cover by about 1 inch.
4. Configure the J4 jumper, located behind the input signal connector, for the desired excitation voltage as shown.



**Figure 6. Transmitter Supply Voltage Selection**  
(Do not change if using a Flowline 4-20 mA transmitter)

## Connections

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



*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.*

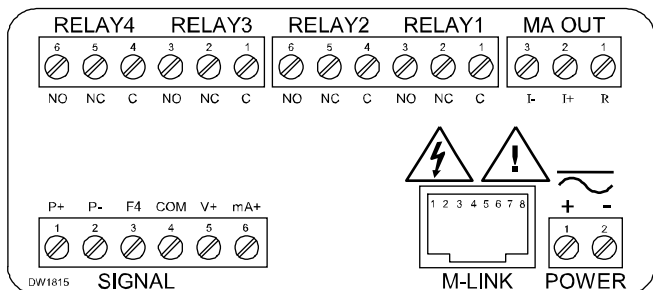
## Connectors Labeling

The connectors' label, affixed to the meter, shows the location of all connectors available with requested configuration.



**Warning!**

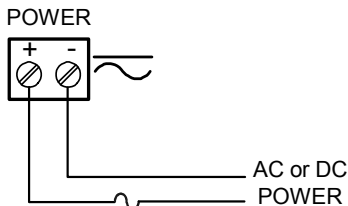
***Do not connect any equipment other than Flowline's expansion modules, cables, or meters to the RJ45 M-LINK connector. Otherwise damage will occur to the equipment and the meter.***



**Figure 7. Connector Labeling for Fully Loaded LI55**

## Power Connections

The external power source to DataView is connected through a two-terminal connector labeled POWER on Figure 7 on page 20. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.



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

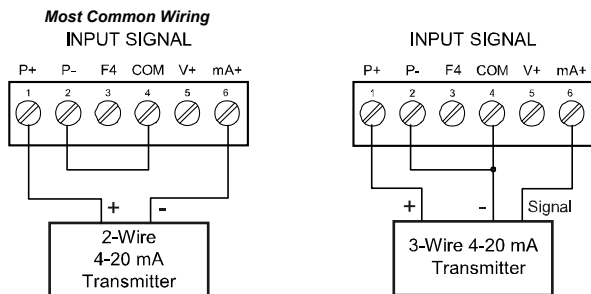
**Figure 8. Power Connections**

## Signal Connections

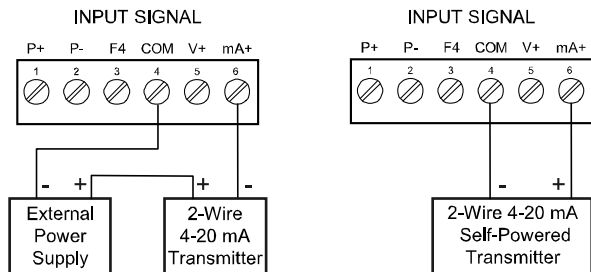
Signal connections are made to a six-terminal connector labeled SIGNAL on Figure 7. The COM (common) terminal is the return for the 4-20 mA and the  $\pm 10$  V input signals.

### 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.



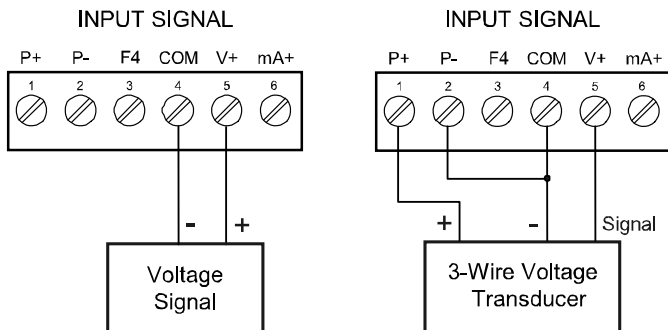
**Figure 9. Transmitters Powered by Internal Supply**



**Figure 10. 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.

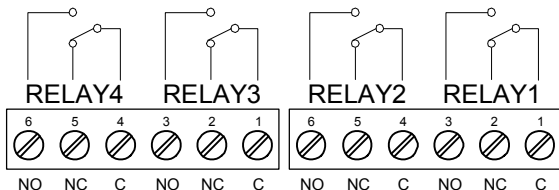


**Figure 11. Voltage Input Connections**

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

### Relay Connections

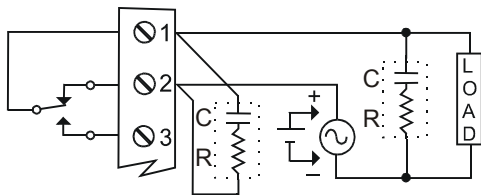
Relay connections are made to two six-terminal connectors labeled RELAY1 – RELAY4 on Figure 7. Each relay's C terminal is common only to the normally open (NO) and normally closed (NC) contacts of the corresponding relay. The relays' C terminals should not be confused with the COM (common) terminal of the INPUT SIGNAL connector.



**Figure 12. 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 13. AC and DC Loads Protection**

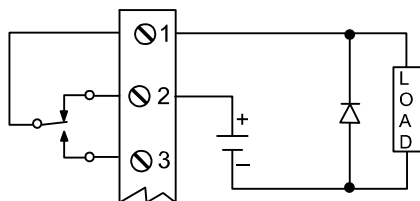
Choose R and C as follows:

R: 0.5 to 1  $\Omega$  for each volt across the contacts

C: 0.5 to 1  $\mu\text{F}$  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 14. Low Voltage DC Loads Protection**

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

## F4 Digital Input Connections

A digital input, F4, is standard on the meter. This digital input is connected with a normally open contact across F4 and COM, or with an active low signal applied to F4.

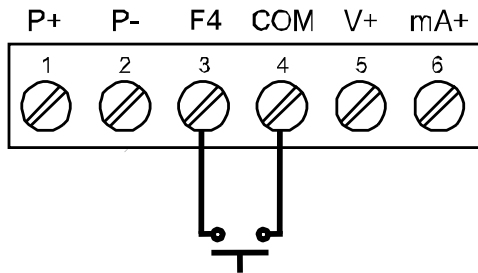


Figure 15. F4 Digital Input Connections

## 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.

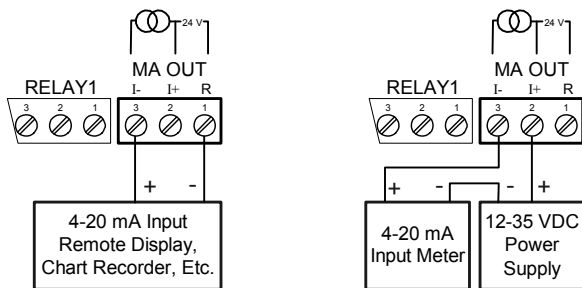


Figure 16. 4-20 mA Output Connections

## 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.



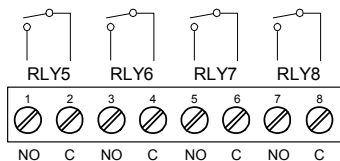
## External Relays Connections

The relay expansion module LI56-1400 is 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.



**Warning!**

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

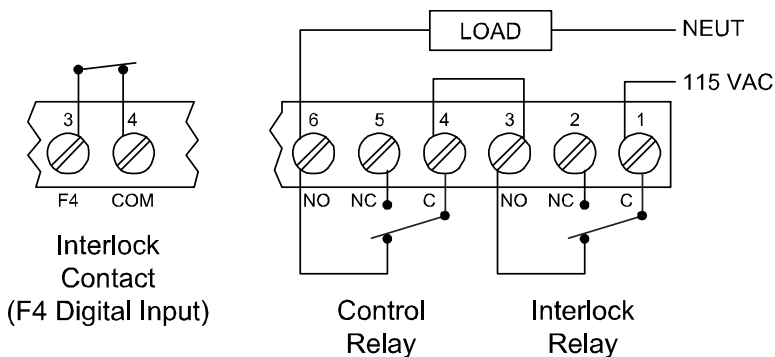


**Figure 17. External Relays Module Connections**

## Interlock Relay Feature

As the name implies, the interlock relay feature reassigns one, or more, alarm/control relays for use as interlock relay(s). An Interlock contact is wired to the digital input and triggers the interlock relay. This feature is enabled by configuring the relay and digital input (see page 70).

In one example, a dry interlock contacts are connected in series to the F4 digital input which will be used to force on (energize) the assigned interlock power relay when all interlock contacts are closed (safe). The interlock relay front panel LED flashes when locked out. The interlock relay would be wired in-series with the load (N/O contact). See below.



**Figure 18. Interlock Connections**

## SETUP AND PROGRAMMING

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

### Overview

There 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 verified, apply power to the meter.

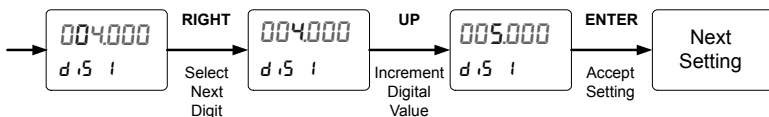
## Setting Numeric Values

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

The digit being changed is displayed brighter than the rest.

Press and hold Up button to auto-increment the display value.

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



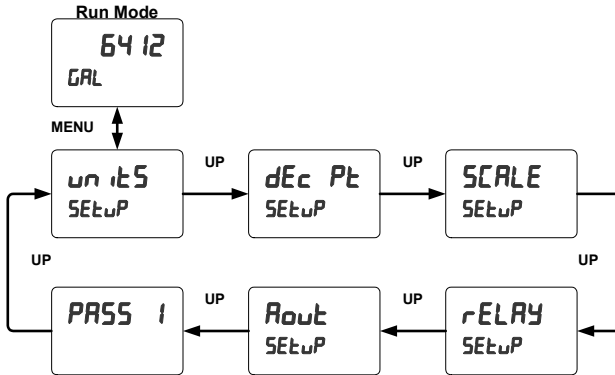
## Menu Levels

The DataView has three menu levels available for quicker setup and programming.

### Main Menu

The Main Menu contains all of the most commonly used features of the DataView meter. These features are duplicated and expanded upon by the Full Menu, see page 40.

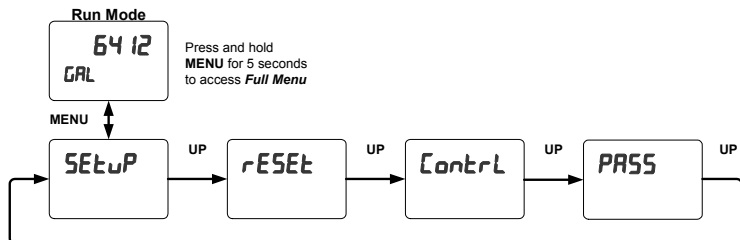
See Main Menu on page 34 for more details.



## Full Menu

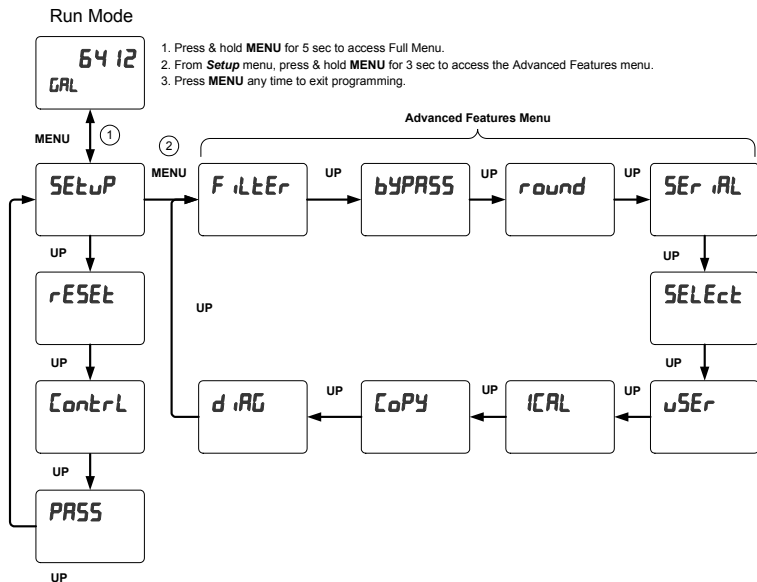
The Full Menu features added functionality and settings allowing for a more customized setup and programming. It consists of the following functions: Setup, Reset, Control, and Password.

Press and hold the Menu button for 5 seconds to enter the Full Menu. Press the Menu button to exit. See Full Menu on page 37 for more details.



### Advanced 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 5 seconds to enter the full main menu. From *Setup*, press and hold the Menu button for 3 seconds to access the advanced features of the meter. See Advanced Features Menu on page 75 for more details.



## Front Panel Buttons and Status LED Indicators



Button Symbol	Description
	Menu
	Right
	Up
	Enter
<p><i>Note:</i> F4 is a digital input. Alarms 5-8 are enabled when relay expansion module is installed.</p>	

LED	Status
1-8	Alarm 1-8 indicator
1-8 M	Flashing: Relay in manual control mode
T	Flashing: Tare
1-8	Flashing: Relay interlock switch open
<p><i>Note:</i> LEDs for relays in manual mode flash with the "M" LED every 10 seconds. "M" flashing by itself indicates Aout – manual control is used.</p>	

- Press the Menu button to enter or exit the Programming Mode at any time.
- Press the Right button to move to the next digit during digit or decimal point programming.
- Press or hold the Up 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.



## Main Menu Display Functions & Messages

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

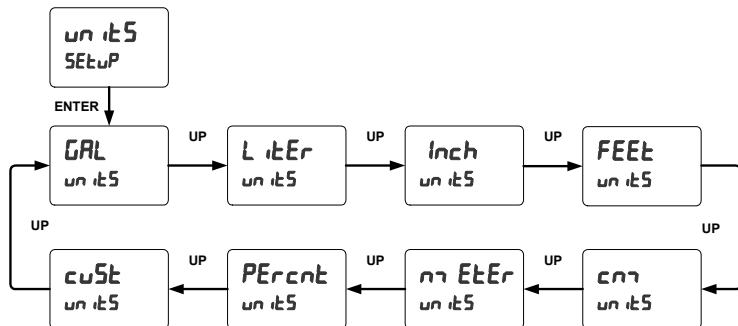
Display	Parameter	Action/Setting Description
units	Units	Select the display units/tags
GAL	Gallon	Set unit display to gallon
LITER	Liter	Set unit display to liter
inch	Inch	Set unit display to inch
FEET	Feet	Set unit display to feet
cm	Centimeter	Set unit display to centimeter
METER	Meter	Set unit display to meter
PERCENT	Percent	Set unit display to percent
CUSTOM	Custom	Set a custom unit display
DEC Pt	Decimal point	Set decimal point
SCALE	Scale	Enter the Scale menu
Empty Pt	Empty	Enter value at 4 mA
Full	Full	Enter value at 20 mA
RELAY	Relay	Enter the Relay menu
RELAY 1	Relay 1	Relay 1 setup
SET 1	Set 1	Program set point 1
RESET 1	Reset 1	Program reset point 1
RELAY 2	Relay 2	Relays 2-8 setup. <i>Note: Relays 5-8 shown only if expansion relay module is installed.</i>
ROUT	Analog output	Enter the Analog output scaling menu
Empty Pt	Empty	Enter display value for 4 mA
Full	Full	Enter display value for 20 mA
PASS 1	Password 1	Set or enter Password 1
unlock	Unlocked	Program password to lock meter
lock	Locked	Enter password to unlock meter
999999 -999999	Flashing	Over/under range condition



### Setting the Units (uN tS)

Select units from list or enter a custom tag to be shown on the lower display. Press the Up button to scroll through the unit choices. Press Enter to accept unit choice.

For custom units press the Up button to scroll through characters. Press the Right button to move to the next segment. Up to six characters may be configured for units. Press Enter to accept settings.



### Setting the Decimal Point (dEc Pt)

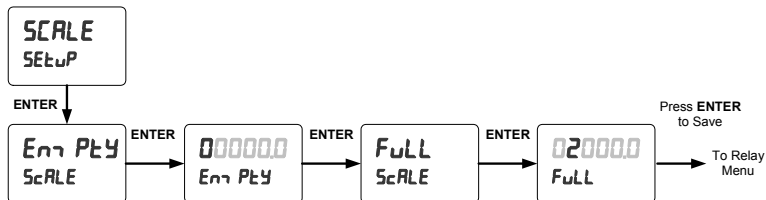
To set the decimal point see page 44 for details.

### Scaling the Meter (SCALE)

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

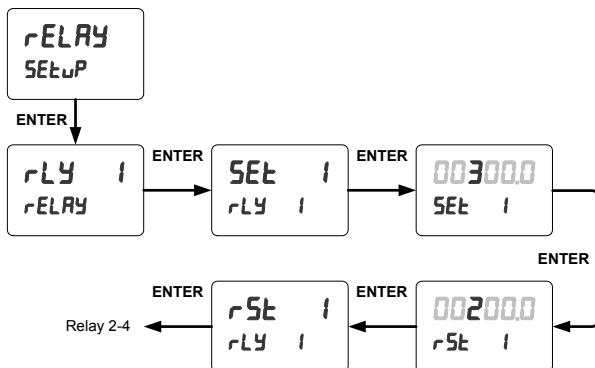
A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.

Enter the Empty value for when the input is 4 mA. Enter the Full value for when the input is 20 mA.



### Setting the Relay Operation (rELAY)

To set the relay's setpoints and reset points see Programming Set and Reset Points on page 54.



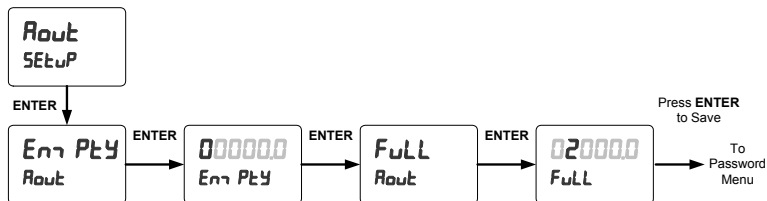
### Scaling the 4-20 mA Analog Output (Rout)

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

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

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

Enter the Empty value for when the input is 4 mA. Enter the Full value for when the input is 20 mA.



### Setting Up the Password (PR55)

To set up the password see page 73 for details.

*Note: The Main menu allows for setup of only one password (PR55 1).*

## Full Menu Display Functions & Messages

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

Display	Parameter	Action/Setting Description
SEtUP	Setup	Enter Setup menu
INPut	Input	Enter Input selection menu
mA	4-20 mA	Set meter for 4-20 mA input
VOLT	0-10 VDC	Set meter for ±10 VDC input
d-SCL	Dual-scale	Press Enter to select dual-scale display for some level applications (Select Yes or No)
UNITS	Units	Select the display units/tags
DEC Pt	Decimal point	Set decimal point
PV 1	PV1	PV1 decimal point (Level)
PV 2	PV2	PV2 decimal point (Level)
PRoG	Program	Enter the Program menu
SCL	Scale	Enter the Scale menu
SCL 1	Scale 1	Enter the Scale menu for PV1
INP 1	Input 1	Program input 1 value
DIS 1	Display 1	Program display 1 value
INP 2	Input 2	Program input 2 value
DIS 2	Display 2	Program display 2 value
SCL 2	Scale 2	Enter the Scale menu for PV2
CL	Calibrate	Enter the Calibration menu
INP 1	Input 1	Calibrate input 1 signal or program input 1 value
DIS 1	Display 1	Program display 1 value
INP 2	Input 2	Calibrate input 2 signal or program input 2 value (up to 32 points)
DIS 2	Display 2	Program display 2 value (up to 32 points)
Error	Error	Error, calibration not successful, check signal or programmed value
dSPLY	Display	Enter the Display menu

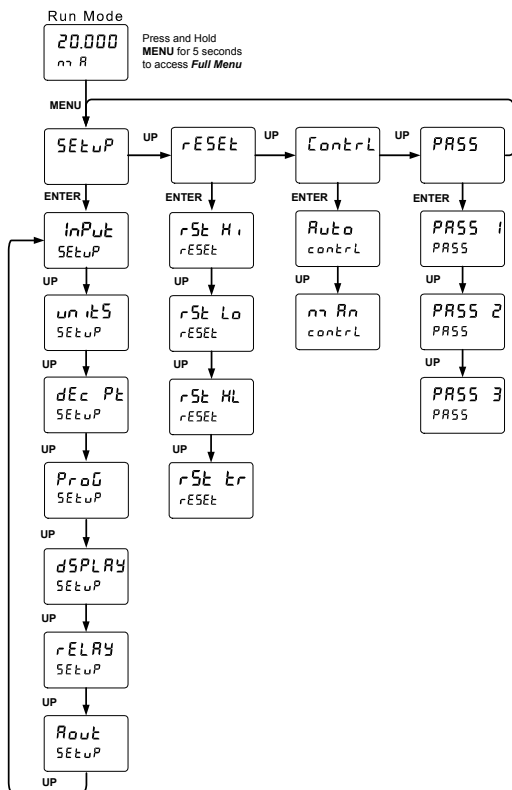
Display	Parameter	Action/Setting Description
b iG	<i>Big display</i>	Press Enter to assign the Main display parameter (default: PV)
L iELE	<i>Little display</i>	Press Enter to assign the small display parameter (default: engineering units)
d- iNtY	<i>Display intensity</i>	Set display intensity level from 1 to 8
rELAY	<i>Relay</i>	Enter the <i>Relay</i> menu
rLY 1	<i>Relay 1</i>	Relay 1 setup
Act 1	<i>Action 1</i>	Set relay 1 action
Auto	<i>Automatic</i>	Set relay for automatic reset
Auto-man	<i>Auto-manual</i>	Set relay for auto & manual reset any time
LATCH	<i>Latching</i>	Set relay for latching operation
Lt-Clr	<i>Latching-cleared</i>	Set relay for latching operation with manual reset only after alarm has cleared
ALtErn	<i>Alternate</i>	Set relay for pump alternation control
SAMP	<i>Sampling</i>	Set relay for sampling operation
OFF	<i>Off</i>	Disable relay and front panel status LED (Select Off to enable Interlock feature)
SEt 1	<i>Set 1</i>	Program set point 1
rSEt 1	<i>Reset 1</i>	Program reset point 1
rLY 2	<i>Relay 2</i>	Relays 2-8 setup <i>Note: Relays 5-8 are shown, only if expansion relay module is installed.</i>
FR iLSF	<i>Fail-safe</i>	Enter <i>Fail-safe</i> menu
FLS 1	<i>Fail-safe 1</i>	Set relay 1 fail-safe operation
on	<i>On</i>	Enable fail-safe operation
oFF	<i>Off</i>	Disable fail-safe operation
FLS 2	<i>Fail-safe 2</i>	Set relays 2-8 fail-safe operation
dELAY	<i>Delay</i>	Enter relay <i>Time Delay</i> menu
dLY 1	<i>Delay 1</i>	Enter relay 1 time delay setup
On 1	<i>On 1</i>	Set relay 1 On time delay
OFF 1	<i>Off 1</i>	Set relay 1 Off time delay
dLY 2	<i>Delay 2</i>	Enter relays 2-8 time delay setup

Display	Parameter	Action/Setting Description
brERH	Loop break	Set relay condition if loop break detected
Ignore E	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 <i>Analog output</i> scaling menu
d 1 1	Display 1	Program display 1 value
Out 1	Output 1	Program output 1 value (e.g. 4.000 mA)
d 1 2	Display 2	Program display 2 value
Out 2	Output 2	Program output 2 value (e.g. 20.000 mA)
rESEt	Reset	Press Enter to access the <i>Reset</i> menu
rSt H	Reset high	Press Enter to reset max display
rSt Lo	Reset low	Press Enter to reset min display
rSt HL	Reset high & low	Press Enter to reset max & min displays
rSt tr	Reset tare	Reset tare
ContRL	Control	Enter <i>Control</i> menu
Auto	Automatic	Press Enter to set meter for automatic operation
Man An	Manual	Press Enter to manually control relays or analog output operation
PASS	Password	Enter the <i>Password</i> menu
PASS 1	Password 1	Set or enter Password 1
PASS 2	Password 2	Set or enter Password 2
PASS 3	Password 3	Set or enter Password 3
unLoc	Unlocked	Program password to lock meter
Locd	Locked	Enter password to unlock meter
999999 -999999	Flashing	Over/under range condition

## Full Menu

The Full Menu features added functionality and settings allowing for a more customized setup and programming. It consists of the following functions: *Setup*, *Reset*, *Control*, and *Password*.

- Press and hold Menu button for 5 seconds to enter the full menu then press the Up button to scroll main menu.



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





## Setting the Input Signal ( *Input* )

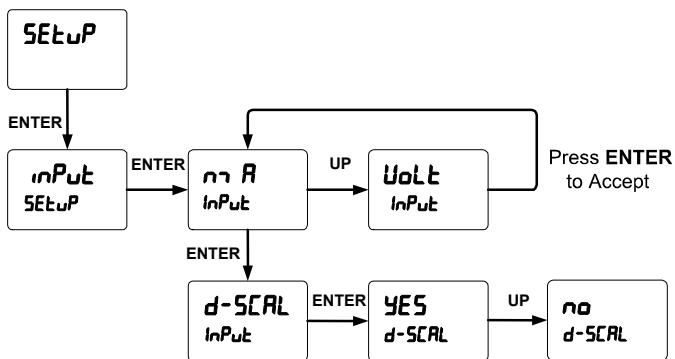
Enter the *Input* menu to set up the meter to display current (*mA*) or voltage (*Volt*) inputs. The default input is mA, and it does not need to be changed when using current inputs.

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  $\pm 10$  VDC signals.

## Dual-Scale

After selecting *mA* or *Volt* input, *d-SCAL* is displayed; press Enter to select “Yes” or “No”. Selecting “Yes” enables the dual-scale feature, which allows for the *SCALE* and *Units* menus to be used to scale the same input in two different scales for PV1 & PV2.



Set **d-SCAL** to **no** if both displays are to be used for anything other than PV1 & PV2.

## Setting Custom Units or Tags (unit 5)

Enter the input unit or custom tag that will be displayed if *d unit* is selected as the little display parameter. See the flow chart on page 51 to access the display menu to show the unit or tag on the lower display. The engineering units or custom legends can be set using the following 7-segment character set:

Display	Character
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	A
b	b
C	C
c	c
d	d
E	E
F	F
G	G
g	g
H	H
h	h
I	I
i	i
J	J

Display	Character
K	K
L	L
m	m
n	n
O	O
o	o
P	P
q	q
r	r
S	S
t	t
u	u
V	V
w	w
X	X
Y	Y
Z	Z
-	-
/	/
]	]
[	[
=	=
Degree(<)	Degree(<)
Space	Space

### Notes:

The letters "m" and "w" use two 7-segment LEDs each; when selected the characters to the right are shifted one position.

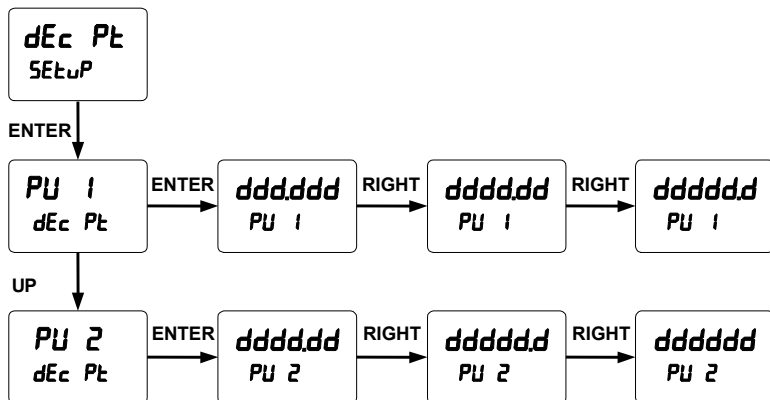
Press and hold Up button to auto-scroll the characters in the display.

## Setting the Decimal Point (*dEc Pt*)

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

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

If the dual-scale level feature is selected, the decimal point selections for PV1 & PV2 are enabled.



## Programming the Meter (Prog)

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

- The meter is factory calibrated prior to shipment to read in milliamps and volts depending on the input selection. The calibration equipment is certified to NIST standards.
- Use the *Scale* menu to scale the process input (e.g. 4-20 mA). A calibrated signal source is not needed to scale the meter.
- Use the *Calibrate* menu to apply a signal from a calibrator or a flowmeter.
- The LI55 is a single input meter with dual-scale capability.

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

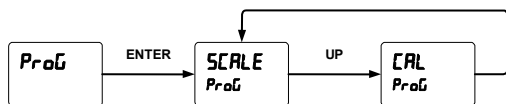
*Note: The **Scale** and **Calibrate** functions are exclusive of each other.*

*The meter uses the last function programmed. Only one of these methods can be employed at a time. The Scale and Calibrate functions can use up to 32 points (default is 2). The number of points should be set in the Advanced menu under the Multi-Point Linearization (**LnERr**) menu selection prior to scaling and calibration of the meter, see page 81 for details.*

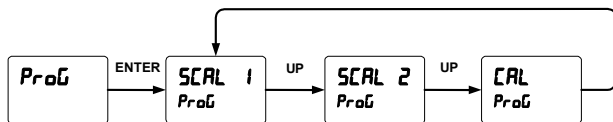
If the dual-scale level feature is selected in the *Setup* menu, the *Scale 1* and *Scale 2* menus are enabled for PV1 & PV2 respectively.

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

### Program Menu for Single Scale Process



### Program Menu for Dual-Scale Level Applications



Additional parameters, not needed for most applications, are programmed in the *Advanced Features* menu; see *Advanced Features Menu*, page 75.

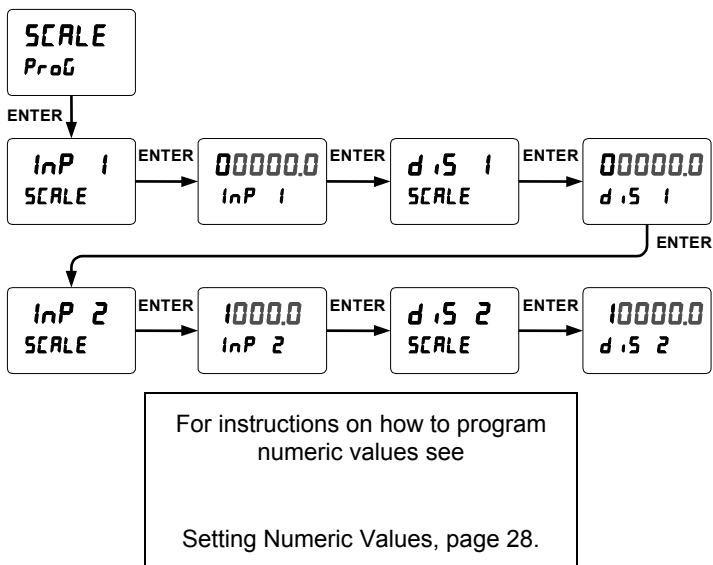
## Multi-Point Calibration & Scaling

The meter is set up at the factory for 2-point linear calibration. The number of points for multi-point calibration/scaling is set up in the *Advanced Features* menu. Up to 32 linearization points may be selected for PV1 and up to 8 linearization points may be selected for PV2. See page 81 for details.

### Scaling the Meter (SCALE)

The process input (4-20 mA,  $\pm 10$  VDC) can be scaled to display the process variable in engineering units.

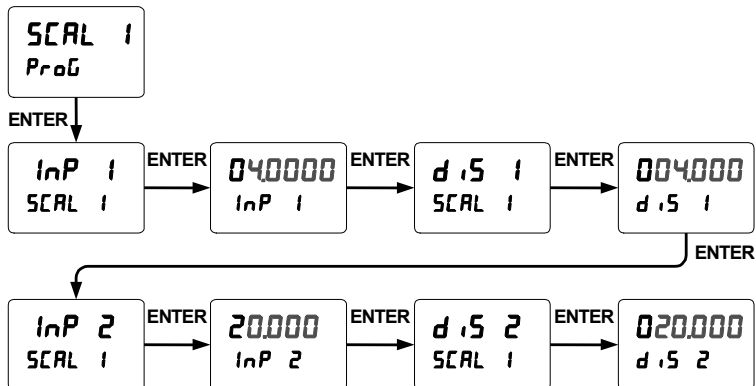
A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.



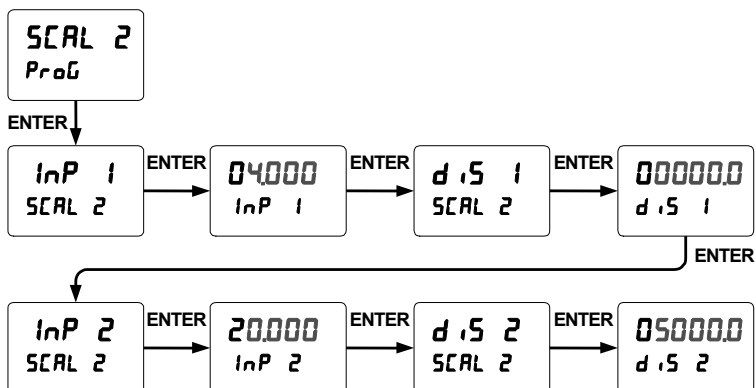
### Dual-Scale for Level Application

The analog input can be displayed in two different scales, by enabling the dual-scale feature (**d-SCAL**) in the *Setup-Input* menu, see page 41. To enable the dual-scale feature for some level applications you must select d-SCAL in the Input selection menu.

#### Scaling the Input for PV1 (SCAL 1)



#### Scaling the Input for PV2 (SCAL 2)



**Error Message (Error)**

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

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

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

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

**Minimum Input Span**

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

Input Range	Input 1 & Input 2 Span
4-20 mA	0.15 mA
±10 VDC	0.10 VDC

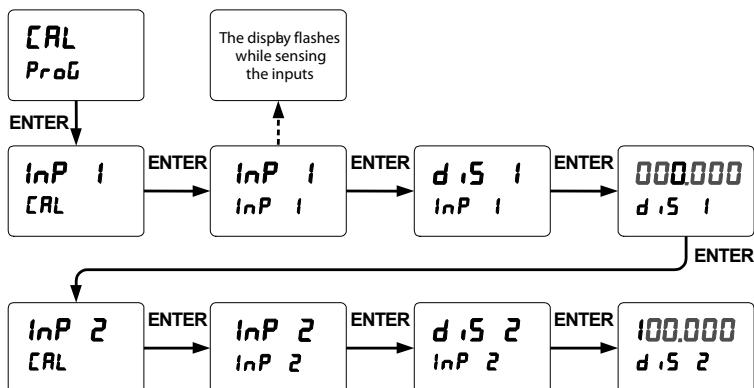


## Calibrating the Meter with External Source (CAL)

*Note: To scale the meter without a signal source refer to **Scaling the Meter (SCALE)**, page 46.*

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 Display Parameter & Intensity (d5PLR4)

The main display (b 1) can be programmed to display:

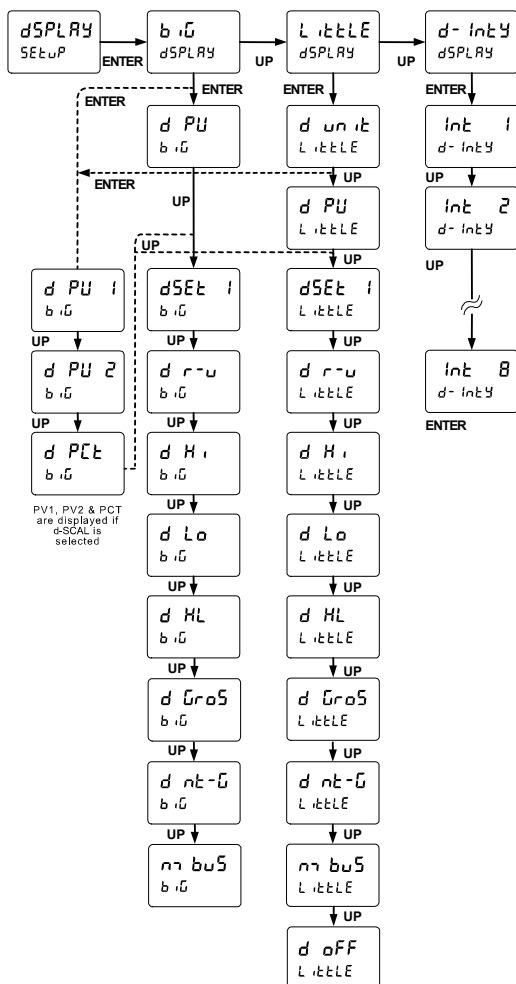
1. Process value 1 (PV1)
2. Process value 2 (PV2)
3. Percent of PV1 (PCT)
4. Relay set points
5. Max & min values
6. Display reading and units
7. Display gross
8. Toggle net & gross

The small display (L 1) can be programmed to display:

1. Unit
2. Process value 1 (PV1)
3. Process value 2 (PV2)
4. Percent of PV1 (PCT)
5. Relay set points
6. Max & min values
7. Engineering units or custom legends
8. Off (no display)
9. Toggle reading and units
10. Display gross
11. Toggle net/gross

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

## Display Setup Menu



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

## Setting the Relay Operation (rELAY)

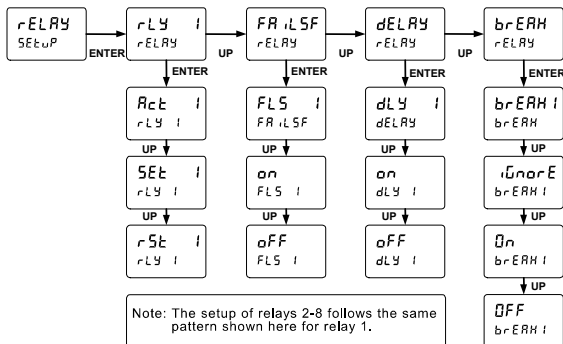
This menu is used to set up the operation of the relays.



### Caution!

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

1. Relay action *[Available on full main menu only]*
  - a. Automatic reset only (non-latching) *[default]*
  - b. Automatic + manual reset at any time (non-latching)
  - c. Latching (manual reset only)
  - d. Latching with Clear (manual reset only after alarm condition has cleared)
  - e. Pump alternation control (automatic reset only)
  - f. Sampling (the relay is activated for a user-specified time)
  - g. Off (relay state controlled by Interlock feature)
2. Set point
3. Reset point
4. Fail-safe operation *[Available on full main menu only]*
  - a. On (enabled)
  - b. Off (disabled)
5. Time delay *[Available on full main menu only]*
  - 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) *[Available on full main menu only]*

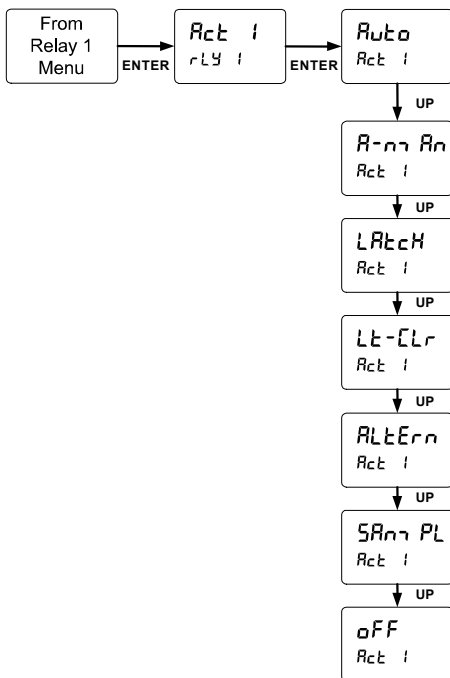


## Setting the Relay Action

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

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



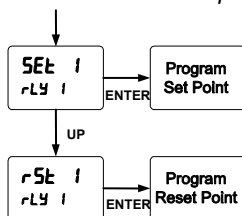
## Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

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

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



## Setting Fail-Safe Operation

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

## Programming Time Delay

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

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

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

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

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

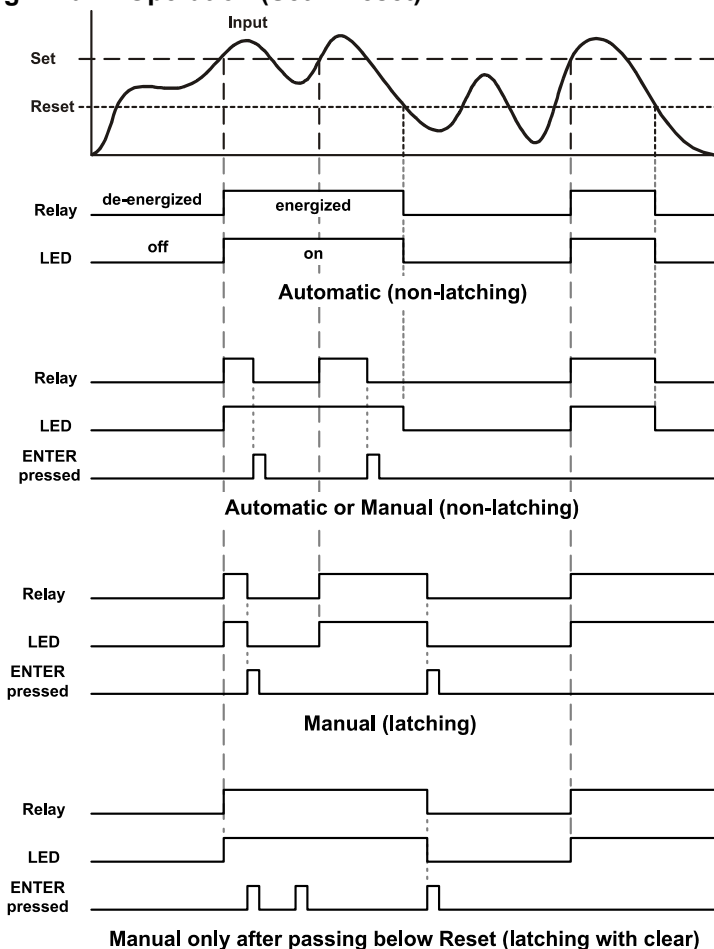
1. Turn *On* (Go to alarm condition)
2. Turn *Off* (Go to non-alarm condition)
3. Ignore (Processed as a low signal condition)

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

## Relay and Alarm Operation Diagrams

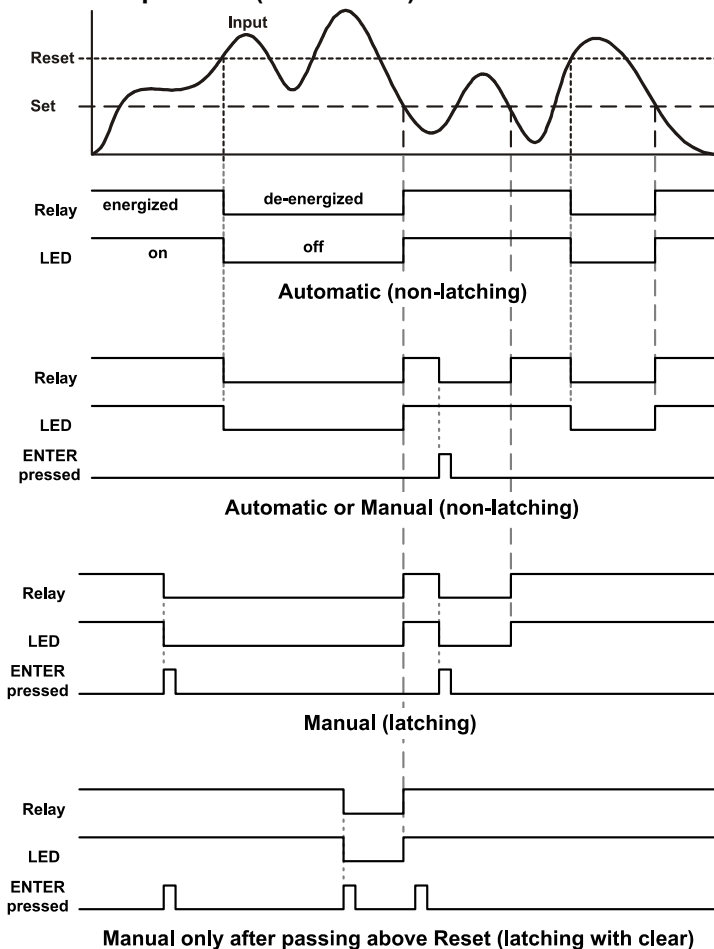
The following graphs illustrate the operation of the relays, status LEDs, and ENTER button.

### High Alarm Operation (Set > Reset)



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

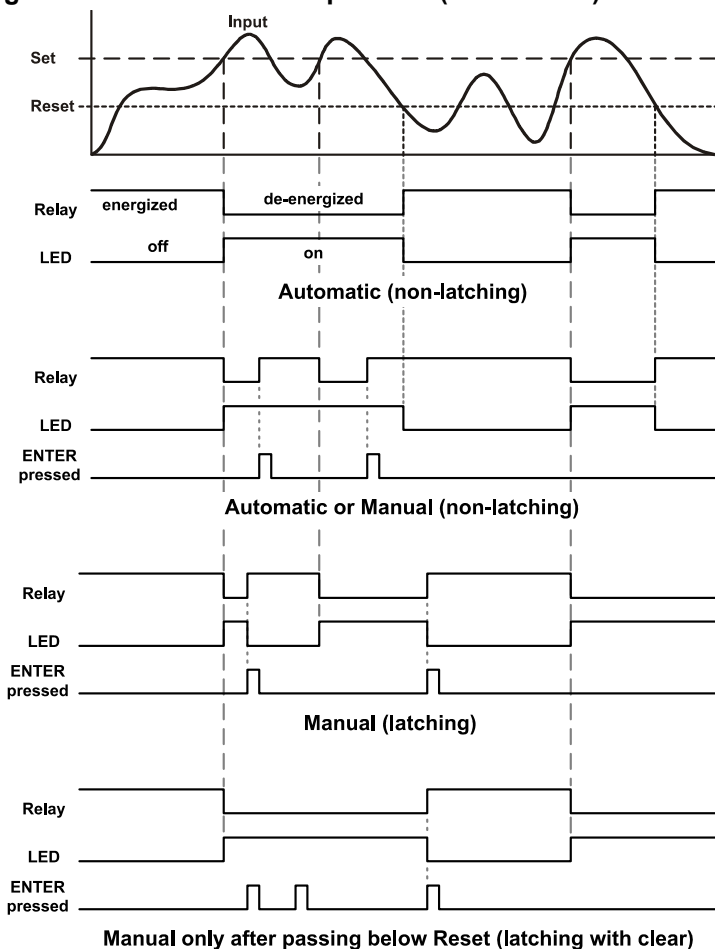
## Low Alarm Operation (Set < Reset)



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

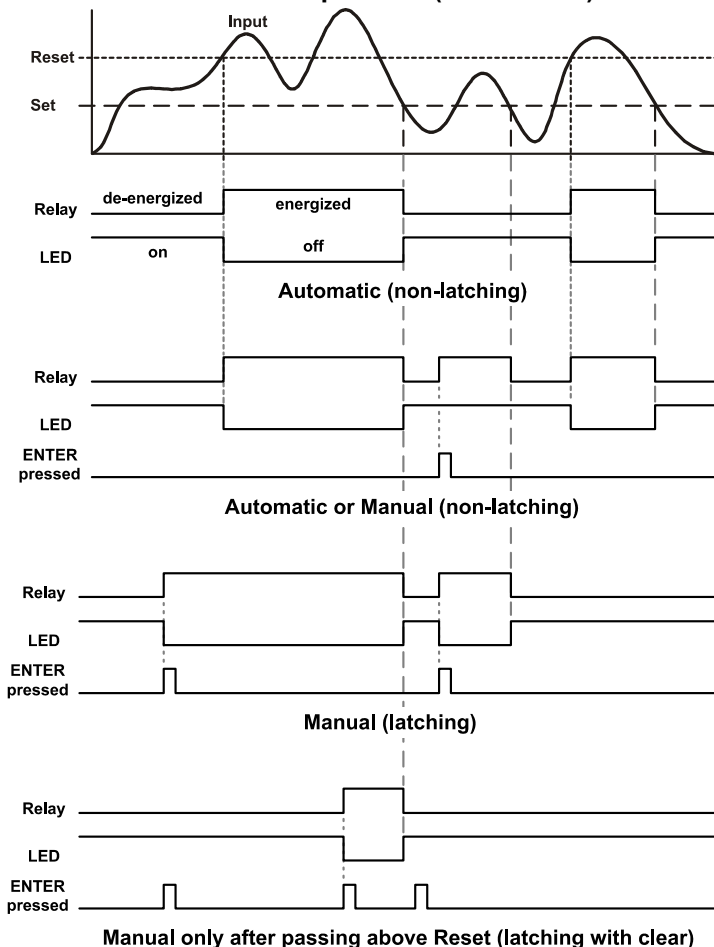


## High Alarm with Fail-Safe Operation (Set > Reset)



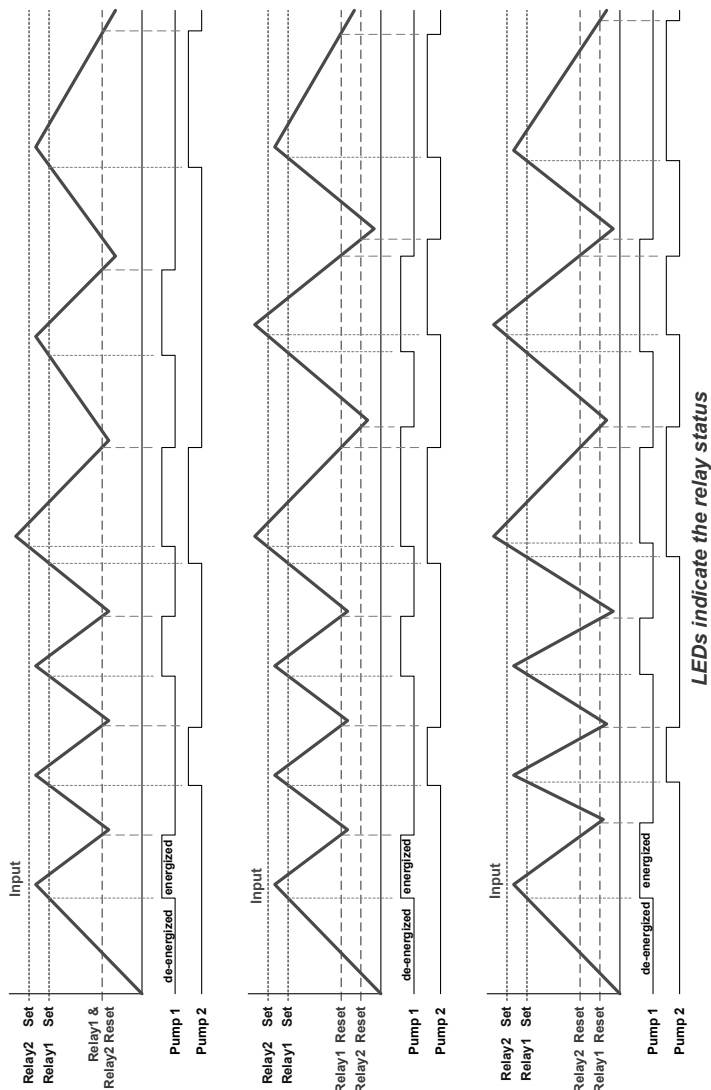
*Note: Relay coil is energized in non-alarm condition.  
In case of power failure, relay will go to alarm state.*

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

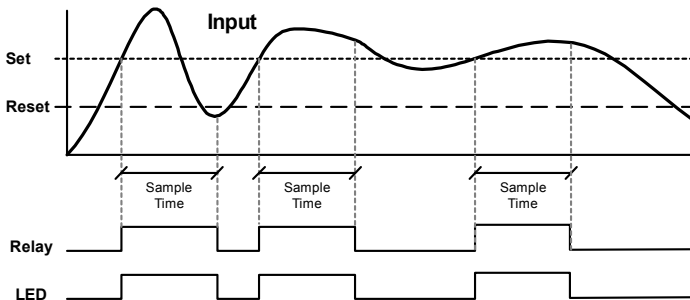


*Note: Relay coil is energized in non-alarm condition.  
In case of power failure, relay will go to alarm state.*

## Pump Alternation Control Operation



## Relay Sampling Operation

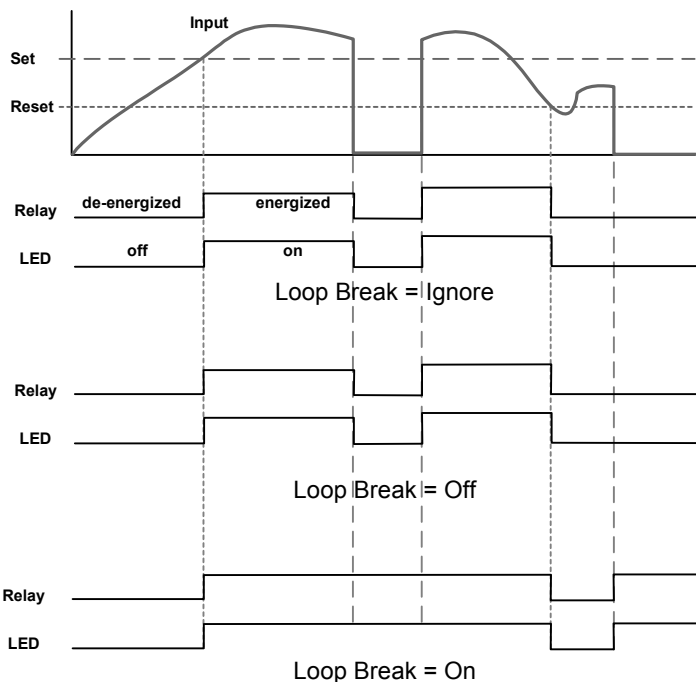


When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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

## Signal Loss or Loop Break Relay Operation

The following graph shows the loop break relay operation for a high alarm relay.

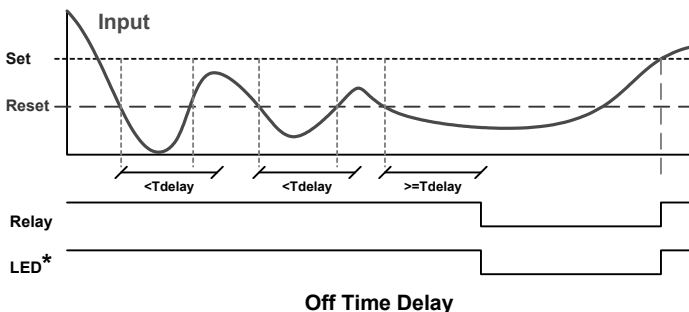
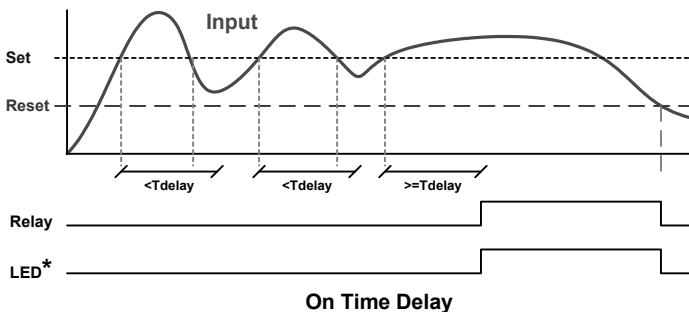


When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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

## Time Delay Operation

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



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

*Note: If “Automatic or Manual (A-m A0)” 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
1	Alarm 1
2	Alarm 2
3	Alarm 3
4	Alarm 4

LED	Status
5	Alarm 5
6	Alarm 6
7	Alarm 7
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: ENTER key):

### 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 (RULC)****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 (R-OR Rn)****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 (LRLC)****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 (L<sub>L</sub>-L<sub>R</sub>)

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:

1. Via the programmable front panel function keys F1-F3 (Default: ENTER key).
2. Remotely via a normally open pushbutton or active low signal wired across the F4 and COM terminals (see page 24).

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

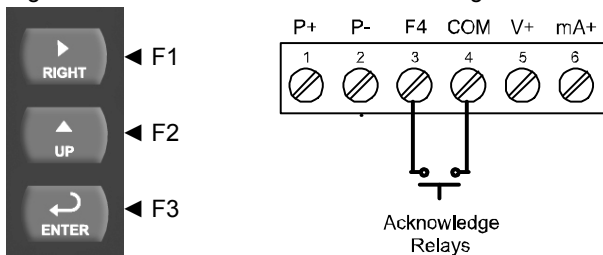


Figure 19. Acknowledge Relays w/Function Key or Digital Input

## 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.

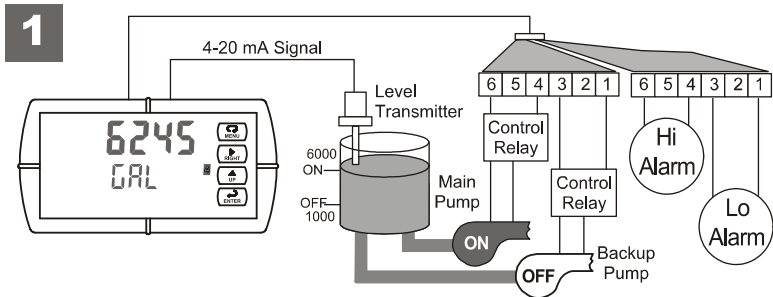
**Application #2: Pump Alternation Using Relays 3 & 4**

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.

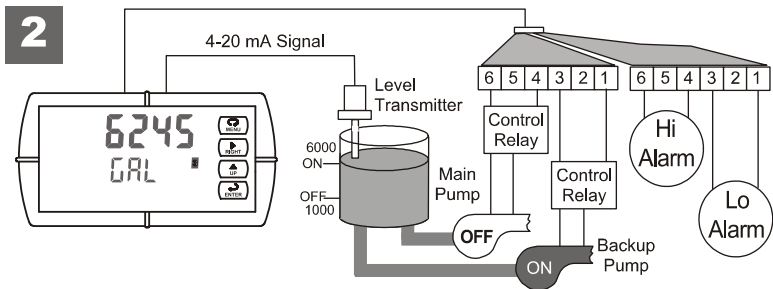
**Set and Reset Point Programming**

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

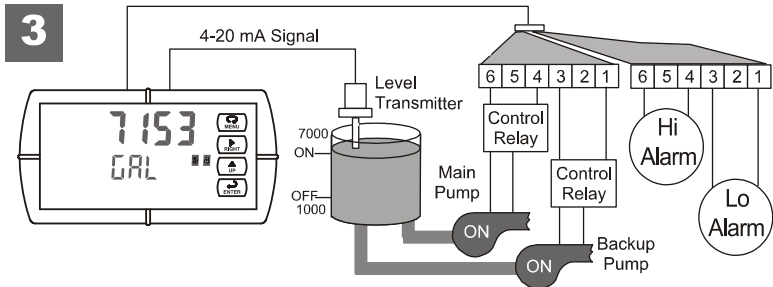
The following graphics provide a visual representation of a typical pump alternation application with high and low alarm monitoring:



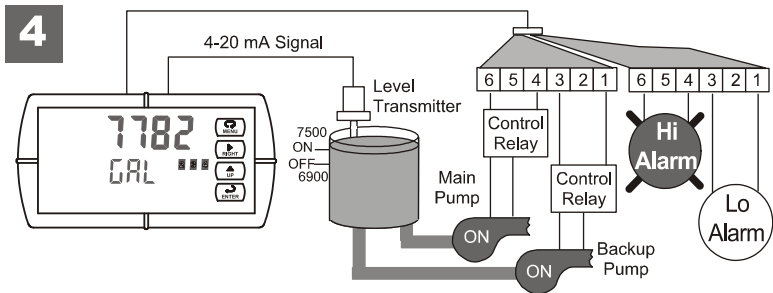
1. Relay #4 turns the main pump on at 6000 gallons and turns it off at 1000 gallons.



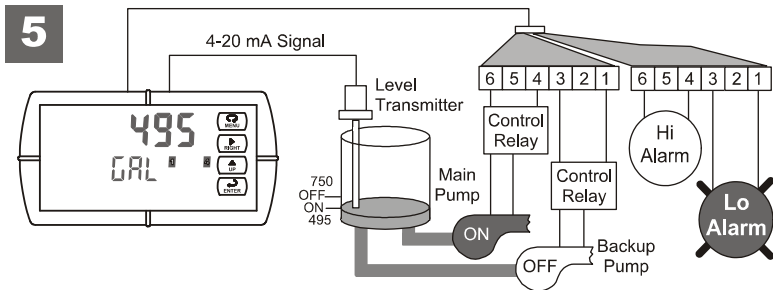
2. With the Pump Alternation feature activated, the next time the level reaches 6000 gallons, relay #3 transfers and starts the backup pump.



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



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

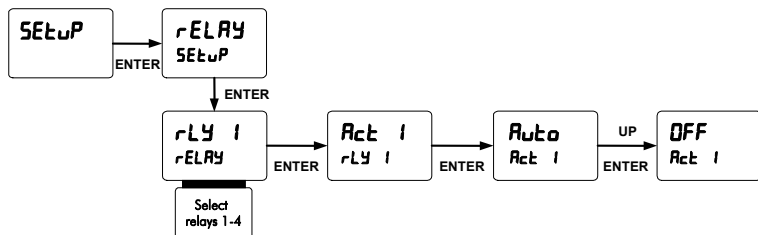


5. Relay #1 trips the Low Level Alarm at 495 gallons and resets at 750 gallons.

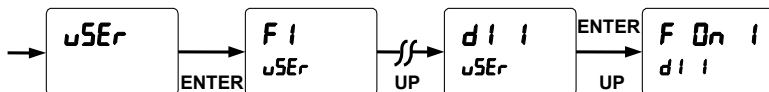
## Setting Up the Interlock Relay (Force On) Feature

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

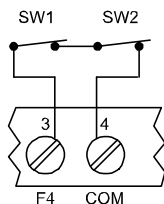
1. Access the *Setup – Relay – Action* menu and set the action to off.



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



3. Connect a switch or dry contact between the F4 and the COM terminal.



Interlock Contact  
(F4 Digital Input)

### Interlock Relay Operation Example

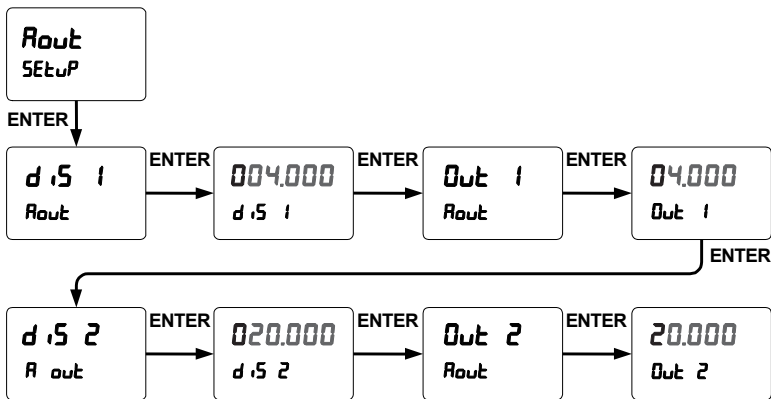
Relay 1 is configured to energize (the front panel LED is off) when SW1 or SW2 switches (above) are closed. If either of the contacts set in series with the digital input open, the corresponding front panel LED flashes indicating this condition. The processes being controlled by the interlock relay will stop, and will re-start only after the interlock relay is re-activated by the digital input (switches).

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

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

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

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



For instructions on how to program  
numeric values see

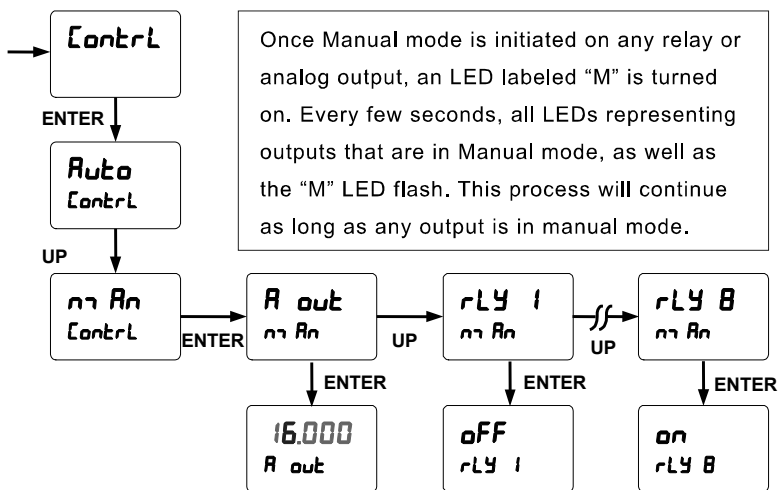
Setting Numeric Values, page 28.

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

## Control Menu (ContrL)

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





## Setting Up the Password (PASS)

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

Pass 1: Allows use of function keys and digital input

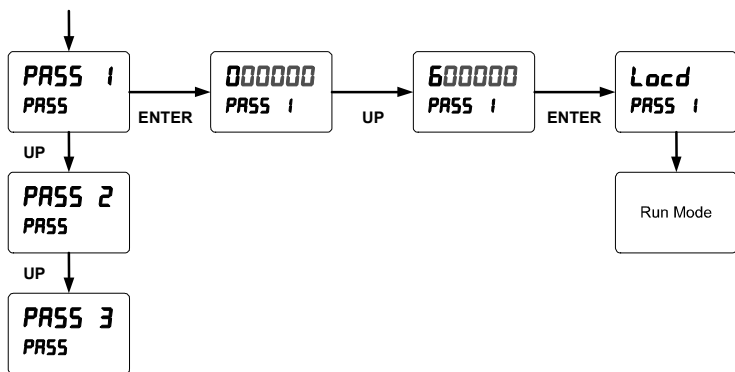
Pass 2: Allows use of function keys, digital input and editing set/reset points

Pass 3: Restricts all programming, function keys, and digital input.

## Protecting or Locking the Meter

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

For instructions on how to program numeric values see page 28.



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

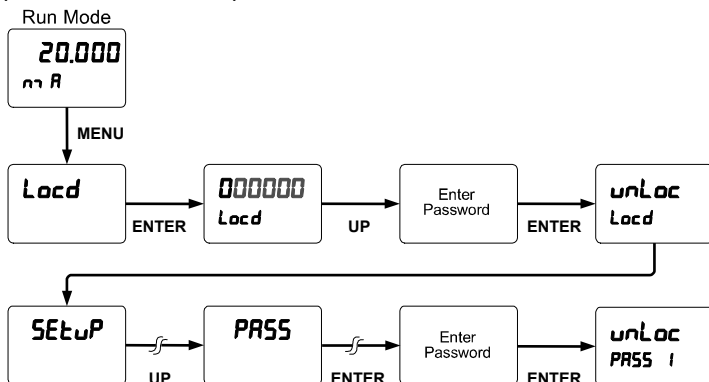
Model:	
Serial Number:	
Password 1:	__ __ __ __ __ __
Password 2:	__ __ __ __ __ __
Password 3:	__ __ __ __ __ __

## Making Changes to a Password Protected Meter

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

## Disabling Password Protection

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



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

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

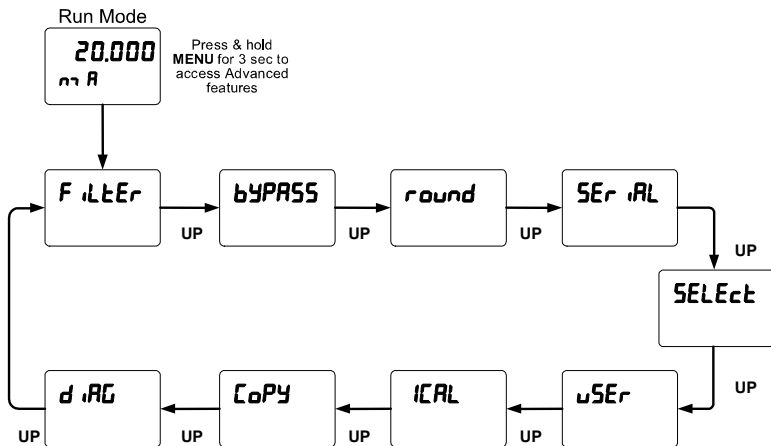
### Did you forget the password?

The password may be disabled by entering a master password once. If you are authorized to make changes, enter the master password 508655 to unlock the meter.

## 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 5 seconds to enter the full main menu. From Setup, press and hold the Menu button for 3 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
<i>F ILT Er</i>	<i>Filter</i>	Set noise filter value
<i>bYPASS</i>	<i>Bypass</i>	Set filter bypass value
<i>rOund</i>	<i>Round</i>	Set the rounding value for display variables
<i>SERIAL</i>	<i>Serial</i>	Set serial communication parameters
<i>SLAVE ID</i>	<i>Slave ID</i>	Set slave ID or meter address
<i>bAUD</i>	<i>Baud rate</i>	Select baud rate
<i>Tr DELAY</i>	<i>Transmit delay</i>	Set transmit delay for serial communication
<i>PARITY</i>	<i>Parity</i>	Select parity Even, Odd, or None with 1 or 2 stop bits
<i>Time byte</i>	<i>Time byte</i>	Set byte-to-byte timeout
<i>SELECT</i>	<i>Select</i>	Enter the Select menu (function, cutoff, out)
<i>FUNCTION</i>	<i>Signal input conditioning</i>	Select linear, square root, programmable exponent, or round horizontal tank function
<i>LINEAR</i>	<i>Linear</i>	Set meter for linear function and select number of linearization points
<i>PV 1</i>	<i>PV1</i>	Select PV1 number of linearization points
<i>PV 2</i>	<i>PV2</i>	Select PV2 number of linearization points
<i>no PTS</i>	<i>Number of points</i>	Set PV1 for 2 to 32-point linearization Set PV2 for 2 to 8-point linearization
<i>SQUARE</i>	<i>Square root</i>	Set meter for square root extraction
<i>PROG E</i>	<i>Programmable exponent</i>	Set meter for programmable exponent and enter exponent value
<i>rhE</i>	<i>Round horizontal tank</i>	Set meter for round horizontal tank volume calculation
<i>inch</i>	<i>Dimension</i>	Calculate volume in gallons
<i>litr</i>	<i>Dimension</i>	Calculate volume in liters
<i>diameter</i>	<i>Diameter</i>	Enter the tank's diameter in inches
<i>LENGTH</i>	<i>Length</i>	Enter the tank's length in inches
<i>CUTOFF</i>	<i>Cutoff</i>	Set low-flow cutoff
<i>ANALOG Pr</i>	<i>Analog output programming</i>	Program analog output parameters

Display	Parameter	Action/Setting
Source	Source	Select source for the 4-20 mA output
OverRange	Overrange	Program mA output for display overrange
UnderRange	Underrange	Program mA output for display underrange
Break	Break	Set input break condition operation
Max RH	Maximum	Program maximum mA output allowed
Min RL	Minimum	Program minimum mA output allowed
Cal	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
4 mA	4 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
20 mA	20 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
User I/O	User I/O	Assign function keys and digital I/O
F1	F1 function key	Assign F1 function key (Right button)
F2	F2 function key	Assign F2 function key (Up button)
F3	F3 function key	Assign F3 function key (Enter button)
F4	F4 function	Assign F4 function (digital input)
Internal Cal	Internal source calibration	Enter internal source calibration (used for scaling the meter without a signal source)
Current Cal	Current calibration	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
Current Low	Current low	Calibrate low current input (e.g. 4 mA)
Current High	Current high	Calibrate high current input (e.g. 20 mA)
Voltage Cal	Voltage calibration	Calibrate voltage input
Voltage Low	Voltage low	Calibrate low voltage input (e.g. 0 V)
Voltage High	Voltage high	Calibrate high voltage input (e.g. 10 V)
Copy	Copy	Enter copy function
Send	Send	Send meter settings to another meter
Done	Done	Copy function completed
Diag	Diagnostics	Display parameter settings
Input	Input	Input selection

Display	Parameter	Action/Setting
units	<i>Units</i>	Select the display units/tags
Filter	<i>Filter</i>	Filter value
bypass	<i>Bypass</i>	Bypass value
round	<i>Round</i>	Round value
Function	<i>Function</i>	Function selected
SCALE	<i>Scale</i>	Scaling parameter
Cutoff	<i>Cutoff</i>	Cutoff value
display	<i>Display</i>	Display assignments
relays	<i>Relays</i>	Relay settings
Route	<i>Analog output</i>	Analog output scaling
RoutePr	<i>Analog output programming</i>	Analog output programming
Serial	<i>Serial</i>	Serial communication settings
LED test	<i>LED test</i>	Test all LEDs
Info	<i>Information</i>	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.

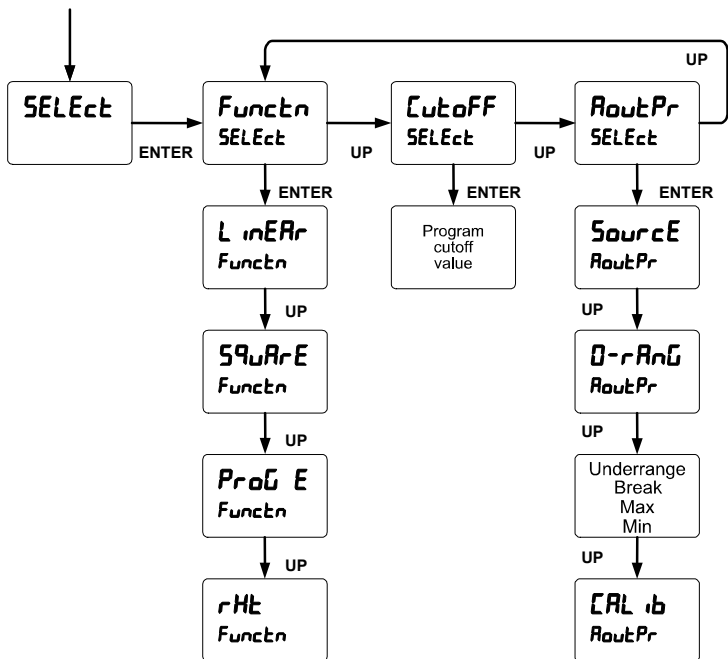
### Rounding Feature (*round*)

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

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

## Select Menu (SELEct)

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



## Signal Input Conditioning (Functn)

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

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



**Square Root Linearization (SQUR E)**

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

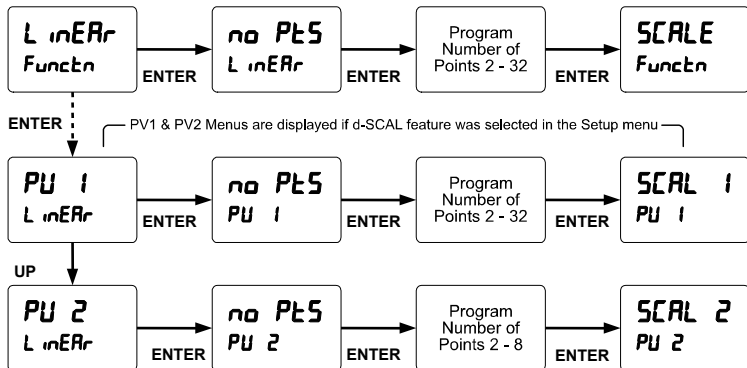
**Programmable Exponent Linearization (PROG E)**

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 (LINEAR)**

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

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

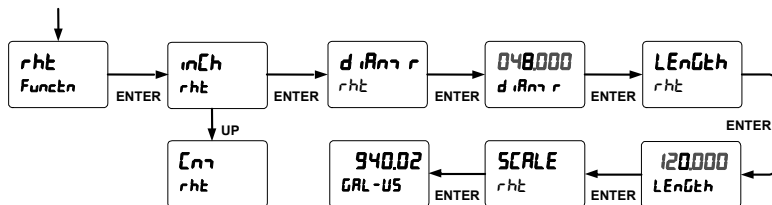


### Round Horizontal Tank Linearization (rHt)

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. Select units, inches or cm for the tank dimensions. Enter the diameter and the length in inches and the results are calculated automatically in US gallons.

The meter can be scaled to display the volume in any engineering unit.



*Note: After Scale is displayed continue pressing the Enter button until the meter completes the scaling of the input and display values.*

### Changing the Volume from Gallons to Liters

In the above graphic, entering the 48" for the diameter and 120" for the length of the round horizontal tank, the meter automatically calculates that the volume of the tank is 940.02 gallons.

1. Convert gallons to liters  
 1 US gallon = 3.7854 L  
 940.02 gal = 3558.4 L
2. Go to the *Setup* menu and change the decimal point to 1 decimal.
3. Go to the *Program – Scale* menu and press Enter until *d .5 2* is shown on the main display.
4. Press Enter and change the display 2 value to 3558.4.
5. The meter is now displaying the volume in liters.

*Note: The display can be scaled to display the volume in any engineering units.*

## 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.

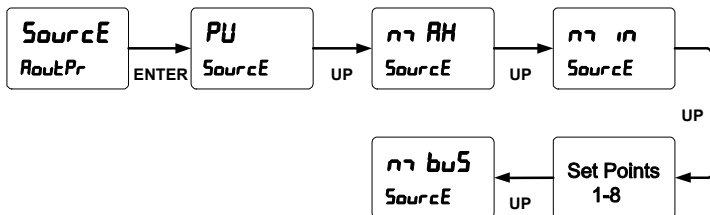
## Analog Output Programming (AnalogPr)

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

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

## Analog Output Source

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

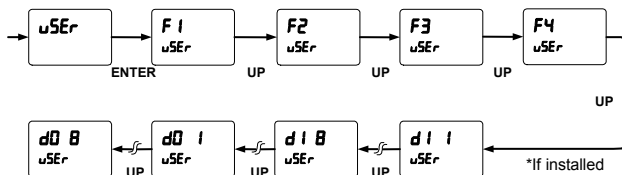


## Analog Output Calibration

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

## Programmable Function Keys User Menu (uSEr)

The *User* menu allows the user to assign the front panel function keys F1 (RIGHT), F2 (UP), and F3 (ENTER), and the digital input F4, to access most of the menus or to activate functions immediately (e.g. Reset max & min). F4 is a digital input on the signal input connector.



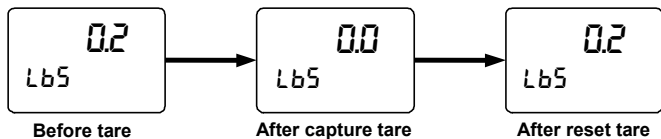
### Function Keys & Digital I/O Available Settings

Display	Description	Display	Description
r5t HL	Reset max & min	Control	Control Menu
tRrE	Capture tare	d,SRbL	Disable function key
r5t tr	Reset tare	RcH	Acknowledge relays
rELRY	Relay menu	rESEt	Reset Menu
SEt i	Set point 1 - 8	r5t Hi	Reset max
rLY d	Disable all relays	r5t Lo	Reset min
rLY E	Enable all relays	r Enu	Menu button
o HoLd	Relays & output hold	r iHt	Right button
d HoLd	Display hold	uP	Up button
b i Hi	Max on big display	EntEr	Enter button
b i Lo	Min on big display	ALn 1	Alarm 1 – 8
b i HL	Max/min big display	F On 1	Force relay 1 on
L i Hi	Max on little display	F On 2	Force relay 2 on
L i Lo	Min on little display	F On 3	Force relay 3 on
L i HL	Max/min little display	F On 4	Force relay 4 on

## Tare (LRrE)

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

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



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

## Internal Source Calibration ( $I_{RL}$ )

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

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

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

### Notes:

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

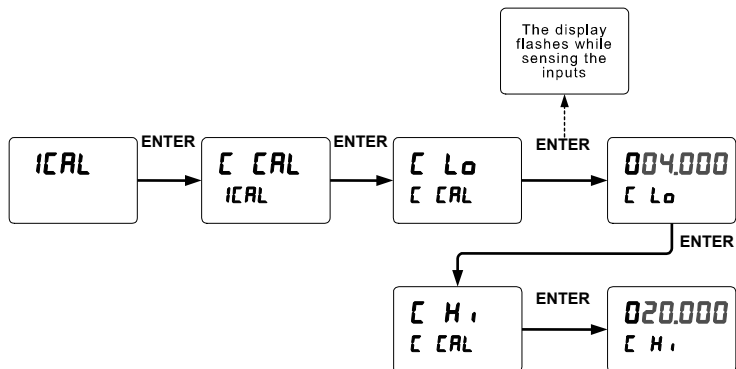
The *Internal calibration* menu is part of the *Advanced Features* menu.

1. Press and hold the Menu button for 5 seconds to enter the full main menu. From Setup, press and hold the Menu button for 3 seconds to access the advanced features of the meter.
2. Press the Up button to scroll to the *Internal calibration* menu (  $I_{RL}$  ) and press Enter.
3. The meter displays either current calibration (  $I_{RL}$  ) or voltage calibration (  $V_{RL}$  ), 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 (  $I_{L0}$  ). 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 leftmost digit brighter than the rest. The bright digit is the active digit that can be changed by pressing the Up button. Press the Right button to move to the next digit.
6. Set the display value to correspond to the input signal being calibrated, typically 4.000 mA.

- The display moves to the *high* input calibration (C H ). Apply the high input signal and press Enter.
- Set the display for the high input calibration, in the same way as it was set for the low input calibration, typically 20.000 mA.



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

**Tips:**

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

**Error Message (Error)**

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

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

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

**Minimum Input Span**

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

Input Range	Input 1 & Input 2 Span
4-20 mA	0.15 mA
±10 VDC	0.10 VDC

**Meter Copy Function (COPY)**

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

**Warning!**

***Only the LI56-1000 meter copy cable must be used for meter-to-meter interfacing. The LI56-1000 is a special eight-conductor flat cable with two wires swapped.***  
***Using standard CAT5 or other cable will cause damage to both meters.***

**Copy Function Requirements**

*To successfully copy settings from one meter to another, both meters must have the same software version and baud rate settings. See *Determining Software Version*, page 92, for instructions.*



## Meter Copy or Cloning Instructions

**Caution!**

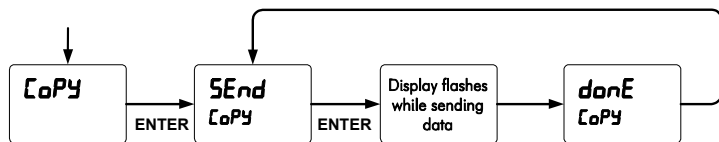
*Do not connect the two meters to the same signal source while cloning. Internal calibration may be affected.*

1. Connect two meters using a LI56-1000 meter copy cable.

**Warning!**

***Using standard CAT5 or other cable will cause damage to both meters. Use LI56-1000 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* on page 75.
5. Scroll to the *Copy* function using the Up button then press Enter.
6. The meter displays the message *SEnd CoPY*. Press Enter, the display flashes while sending data. The message *donE CoPY* 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,  $\pm 10$  V) and displaying these signals in engineering units from -99999 to 999999 (e.g. a 4-20 mA signal could be displayed as -50.000 to 50.000).

The 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 for engineering units, custom legend, or set point indication.

The analog input can be scaled to display the process in two different scales; for example: with *d-SCAL* enabled, the main display could indicate level in feet and the second display could indicate the volume in gallons.

## 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 <i>User</i> menu
	Press to display max/min readings or other parameter/function assigned through the <i>User</i> menu
	Press to acknowledge relays or other parameters/function assigned through the <i>User</i> 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 RIGHT, UP, and ENTER.

## F4 Operation

A digital input, F4, is standard on the meter. This digital input is programmed identically to function keys F1, F2, and F3. The input is triggered with a contact closure to COM, or with an active low signal. During operation, F4 operates according to the way it has been programmed in the *Advanced Features – User* menu.

## Maximum/Minimum Readings

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

1. Display briefly by assigning to the RIGHT, UP, or ENTER buttons or to the digital input in the *User* menu.
2. Display continuously by assigning either display to max/min through the *Display* menu.

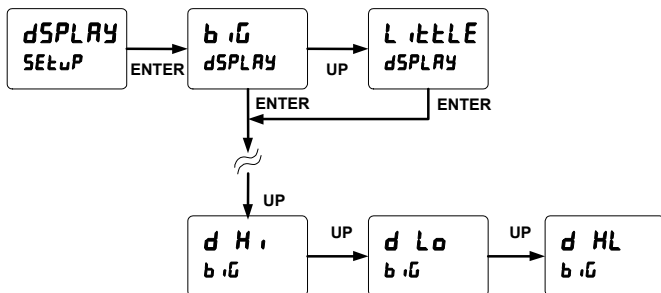
Any of the RIGHT, UP, or ENTER buttons or the digital input can be programmed to reset the max & min readings. The meters are set at the factory to display the max reading by pressing the Up button and to use the Right button to access the *Reset* menu.

### To display max reading using function key with factory defaults:

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

### To display max/min readings continuously:

Assign either display to Max (d H i), Min (d L o), 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 iRG)

The *Diagnostics* menu is located in the *Advanced Features* menu, to access *Diagnostics* menu see *Advanced Features Menu*, page 75.

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 76.

### Determining Software Version

To determine the software version of a meter:

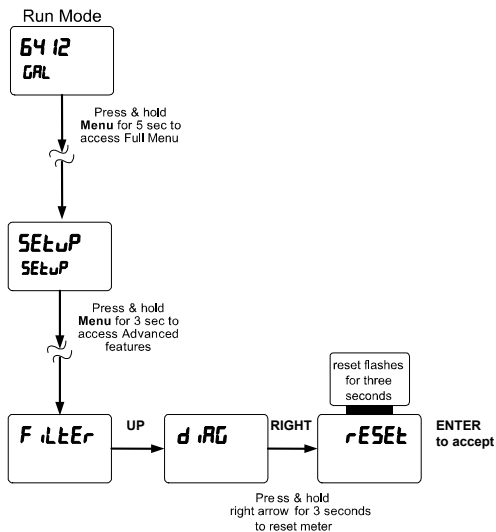
1. Go to the *Diagnostics* menu (d iRG) and press Enter button.
2. Press Up button and scroll to Information menu ( i n F a).
3. Press Enter to access the software number (5Ft) and version (UER) information. Write down the information as it is displayed. Continue pressing Enter until all the information is displayed.
4. The meter returns to Run Mode after displaying all the settings.

## Reset Meter to Factory Defaults

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

### Instructions to load factory defaults:

1. Press and hold MENU for 5 seconds to access the *Full Menu*
2. From Setup, press and hold MENU for 3 seconds to access the *Advanced Features Menu*
3. Press Up button to go to *Diagnostics* menu
4. Press and hold Right button for three seconds, press Enter when display flashes *rESEt*.  
Note: If Enter is not pressed within three seconds, the display returns to the *Diagnostics* menu.
5. The meter goes through an initialization sequence (similar as on power-up), and loads the factory default settings.



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

## Factory Defaults & User Settings

The following table shows the factory setting for most of the programmable parameters on the meter. 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	<i>INPUL</i>	4-20 mA	
Dual-scale feature	<i>d-SCALE</i>	No (Single scale)	
Filter	<i>FILTEr</i>	70	
Bypass	<i>BYPASS</i>	0.2	
Function	<i>FUNCTiON</i>	Linear	
Number of points	<i>no Pts</i>	2	
Programming	<i>PROG</i>	Scale	
Input 1	<i>INP 1</i>	4.000 mA	
Display 1	<i>d IS 1</i>	4.000	
Input 2	<i>INP 2</i>	20.000 mA	
Display 2	<i>d IS 2</i>	20.000	
Decimal point	<i>dddd</i>	3 places	
Cutoff value	<i>CUTOFF</i>	0.000 (disabled)	
Display assignment	<i>DISPLAY</i>		
Big display (Main)	<i>b IG</i>	PV: Process variable	
Little display (Small)	<i>L iLE</i>	Eng unit default= mA	
Display intensity	<i>d-INTY</i>	8	
Relay 1 action	<i>Act 1</i>	Automatic	
Relay 1 set point	<i>SEt 1</i>	1.000	
Relay 1 reset point	<i>rSEt 1</i>	0.500	
Relay 2 action	<i>Act 2</i>	Automatic	
Relay 2 set point	<i>SEt 2</i>	2.000	
Relay 2 reset point	<i>rSEt 2</i>	1.500	
Relay 3 action	<i>Act 3</i>	Automatic	
Relay 3 set point	<i>SEt 3</i>	3.000	

Parameter	Display	Default Setting	User Setting
Relay 3 reset point	<i>rSt 3</i>	2.500	
Relay 4 action	<i>Act 4</i>	Automatic	
Relay 4 set point	<i>SEt 4</i>	4.000	
Relay 4 reset point	<i>rSt 4</i>	3.500	
Fail-safe relay 1	<i>FLS 1</i>	Off	
Fail-safe relay 2	<i>FLS 2</i>	Off	
Fail-safe relay 3	<i>FLS 3</i>	Off	
Fail-safe relay 4	<i>FLS 4</i>	Off	
On delay relay 1	<i>On 1</i>	0.0 sec	
Off delay relay 1	<i>OFF 1</i>	0.0 sec	
On delay relay 2	<i>On 2</i>	0.0 sec	
Off delay relay 2	<i>OFF 2</i>	0.0 sec	
On delay relay 3	<i>On 3</i>	0.0 sec	
Off delay relay 3	<i>OFF 3</i>	0.0 sec	
On delay relay 4	<i>On 4</i>	0.0 sec	
Off delay relay 4	<i>OFF 4</i>	0.0 sec	
Loop break relay 1	<i>Ignore</i>	Ignore	
Loop break relay 2	<i>Ignore</i>	Ignore	
Loop break relay 3	<i>Ignore</i>	Ignore	
Loop break relay 4	<i>Ignore</i>	Ignore	
Display 1 analog out	<i>dIs 1</i>	4.000	
Output 1 value	<i>Out 1</i>	4.000 mA	
Display 2 analog out	<i>dIs 2</i>	20.000	
Output 2 value	<i>Out 2</i>	20.000 mA	
Source analog output	<i>Source</i>	Process Variable	
Overrange output	<i>OverRange</i>	21.000 mA	
Underrange output	<i>UnderRange</i>	3.000 mA	
Loop break output	<i>brERH</i>	1.000 mA	
Maximum output	<i>max RH</i>	23.000 mA	

Parameter	Display	Default Setting	User Setting
Minimum output	<i>07 00</i>	1.000 mA	
Slave ID (Address)	<i>SLAV id</i>	247	
Baud rate	<i>bAud</i>	9600	
Transmit delay	<i>tr dLY</i>	50 ms	
Parity	<i>PAR itY</i>	Even	
Byte-to-byte timeout	<i>t-byt</i>	010 (0.1 sec)	
RIGHT	<i>F 1</i>	Reset max & min	
UP	<i>F 2</i>	Big display: Max (Hi)	
ENTER	<i>F 3</i>	Acknowledge relays	
F4 function	<i>F 4</i>	Acknowledge relays	
Password 1	<i>PASS 1</i>	000000 (unlocked)	
Password 2	<i>PASS 2</i>	000000 (unlocked)	
Password 3	<i>PASS 3</i>	000000 (unlocked)	



## Troubleshooting Tips

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

*Note: Certain sequences of events can cause unexpected results. To solve these issues, it is best to start fresh from factory defaults and map changes ahead of time, rather than at random.*

## Alphabetical List of Display Functions & Messages

Display	Parameter	Action/Setting Description
20 mA R	20 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
4 mA R	4 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
999999 -999999	Flashing display	Overrange condition Underrange condition
RcH	Acknowledge	Acknowledge relays
Rc1 i	Action 1	Set relay 1 action
R1 R i	Alarm 1	Assign digital output to Alarm 1-8
RLEr n	Alternate	Set relay for pump alternation control
R-n R n	Auto-manual	Set relay for automatic & manual reset
Rout	Analog output	Enter the <i>Analog output</i> scaling menu
RoutPr	Analog output programming	Enter analog output programming
Ruto	Automatic	Press Enter to set automatic operation
bRud	Baud rate	Select baud rate
b i	Big display	Press Enter to assign the main display parameter (default: PV)
b i H i	Max on big display	Assign digital input to display max on the main display
b i HL	Max/min big display	Assign digital input to toggle max/min on the main display
b i Lo	Min on big display	Assign digital input to display min on the main display
brERH	Loop break	Set relay condition if loop break detected
bYPASS	Bypass	Set filter bypass value
[ [RL	Current calibration	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
[ H i	Current high	Calibrate high current input (e.g. 20 mA)
[ Lo	Current low	Calibrate low current input (e.g. 4 mA)
tArE	Capture tare	Capture tare

Display	Parameter	Action/Setting Description
[RL	Calibrate	Enter the <i>Calibration</i> menu
[RL ib	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
[ontrol	Control	Enter <i>Control</i> menu to turn relays on/off, set analog output manually, or return meter to automatic operation
[OPY	Copy	Enter copy function
[utoff	Cutoff	Set low-flow cutoff
d GROSS	Display gross	Select to display the gross
d net-G	Display net/gross	Select to display the net/gross
d H i	Display high	Select to display the max
d HL	Display H&L	Select to display the max & min toggling
d HoLd	Display hold	Display hold
d Lo	Display low	Select to display the min
d Pct	Display PCT	Select to display percent of PV1 (dual-scale display)
d PV	Display PV	Select to display PV
d PV 1	Display PV1	Select to display PV1 (dual-scale display)
d PV 2	Display PV2	Select to display PV2 (dual-scale display)
d r-u	Display r-u	Select to display reading and units
d units	Display units	Select to display engineering units or label
dEc Pt	Decimal point	Set decimal point
dELAY	Delay	Enter relay <i>Time Delay</i> menu
d RG	Diagnostics	Display parameter settings
d DIA r	Diameter	Enter the tank's diameter in inches
d- IntY	Display intensity	Set display intensity level from 1 to 8
d 1	Display 1	Program display 1 value
d 2	Display 2	Program display 2 value (up to 32 points)
d ISAbL	Disable	Disable function key
dLY 1	Delay 1	Enter relay 1 time delay setup (1-8)

Display	Parameter	Action/Setting Description
<i>donE</i>	<i>Done</i>	Copy function completed
<i>d-SCAL</i>	<i>Dual-scale</i>	Enter <i>d-SCAL</i> menu and select <i>Yes</i> for dual-scale display or <i>No</i> for single scale display
<i>dSEt 1</i>	<i>Display set 1</i>	Select to display set point 1 (1-8)
<i>dSPLY</i>	<i>Display</i>	Enter the <i>Display</i> menu
<i>Enr PLY</i>	<i>Empty</i>	Enter value at 4 mA
<i>EntEr</i>	<i>Enter button</i>	Assign digital input to Enter button
<i>Error</i>	<i>Error</i>	Error, calibration not successful, check signal or programmed value
<i>F On 1</i>	<i>Force On 1</i>	Force relay 1 on using digital input
<i>F 1</i>	<i>F1 function key</i>	Assign F1 function key (Right button)
<i>F2</i>	<i>F2 function key</i>	Assign F2 function key (Up button)
<i>F3</i>	<i>F3 function key</i>	Assign F3 function key (Enter button)
<i>F4</i>	<i>F4 function</i>	Assign F4 function (digital input)
<i>FR iLSF</i>	<i>Fail-safe</i>	Enter <i>Fail-safe</i> menu
<i>F iLEr</i>	<i>Filter</i>	Set noise filter value
<i>FLS 1</i>	<i>Fail-safe 1</i>	Set relay 1 fail-safe operation (1-8)
<i>ForcE</i>	<i>Force</i>	Force analog output value for loop break
<i>FuLL</i>	<i>Full</i>	Enter value at 20 mA
<i>FuncEn</i>	<i>Signal input conditioner</i>	Select linear, square root, programmable exponent, or round horizontal tank function
<i>iCAL</i>	<i>Internal source calibration</i>	Enter internal source calibration (used for scaling the meter without a signal source)
<i>iGnorE</i>	<i>Ignore</i>	Ignore loop break condition
<i>Info</i>	<i>Information</i>	Display software and S/N information
<i>inP 1</i>	<i>Input 1</i>	Calibrate input 1 signal or program input 1 value
<i>inP 2</i>	<i>Input 2</i>	Calibrate input 2 signal or program input 2 value (up to 32 points)
<i>inPULt</i>	<i>Input</i>	Enter <i>Input</i> selection menu
<i>LRECH</i>	<i>Latching</i>	Set relay for latching operation

Display	Parameter	Action/Setting Description
LED t	LED test	Test all LEDs
LEnGth	Length	Enter the tank's length in inches
Linear	Linear	Set meter for linear function and select number of linearization points
Max on little display	Max on little display	Assign digital input to display max on the small display
Max/min little display	Max/min little display	Assign digital input to toggle max/min on the small display
Min on little display	Min on little display	Assign digital input to display min on the small display
Little display	Little display	Press Enter to assign the small display parameter (default: engineering units)
Locked	Locked	Enter password to unlock meter
Latching-cleared	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared
4-20 mA	4-20 mA	Set meter for 4-20 mA input
Manual	Manual	Press Enter to manually control relays or analog output operation
Maximum	Maximum	Program maximum mA output allowed
Modbus	Modbus	N/A
Menu button	Menu button	Assign digital input to Menu button
Minimum	Minimum	Program minimum mA output allowed
Number of points	Number of points	Set meter for 2 to 32-point linearization
Relays output hold	Relays output hold	Assign digital input to hold all relays state hold
Off	Off	Disable relay and front panel status LED, turn relays off, program off time delay
Off 1	Off 1	Set relay 1 Off time delay (1-8)
On	On	Enable fail-safe operation, turn relays on, program on time delay
On 1	On 1	Set relay 1 On time delay (1-8)
Overrange	Overrange	Program mA output for display overrange

Display	Parameter	Action/Setting Description
Out 1	Output 1	Program output 1 value (e.g. 4.000 mA)
Out 2	Output 2	Program output 2 value (e.g. 20.000 mA)
PASS	Password	Enter the <i>Password</i> menu
PASS 1	Password 1	Set or enter Password 1 (Allows use of the F1–F3 function keys)
PASS 2	Password 2	Set or enter Password 2 (Allows use of the F1–F3 function keys and changing the set/reset points)
PASS 3	Password 3	Set or enter Password 3 (Restricts all programming & F1–F3 keys)
Prog	Program	Enter the <i>Program</i> menu
Prog E	Programmable exponent	Set meter for programmable exponent and enter exponent value
RELAY	Relay	Enter the <i>Relay</i> menu
RESET	Reset	Press Enter to access the <i>Reset</i> menu
rht	Round horizontal tank	Set meter for round horizontal tank volume calculation
r rht	Right button	Assign digital input to Right button
RLY 1	Relay 1	Relay 1 setup (1-8)
RLY d	Disable relay	Assign digital input to disable all relays
RLY E	Enable relay	Assign digital input to enable all relays
round	Round	Select rounding values for PV display
rSt 1	Reset 1	Program reset point 1 (1-8)
rSt H	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 tr	Reset tare	Reset tare
SAMPL PL	Sampling	Set relay for sampling operation
SCALE 1	Scale 1	Enter the <i>Scale 1</i> menu for PV1
SCALE 2	Scale 2	Enter the <i>Scale 2</i> menu for PV2

Display	Parameter	Action/Setting Description
SCALE	Scale	Enter the <i>Scale</i> menu
SELEct	Select	Enter Select menu (function, cutoff, output programming)
SEnd	Send	Send meter settings to another meter
SErIAL	Serial	Set serial communication parameters
SEt 1	Set 1	Program set point 1 (1-8)
SEtUP	Setup	Enter <i>Setup</i> menu
SLAVE ID	Slave ID	Set Slave ID or meter address
SOURCE	Source	Select source for the 4-20 mA output
SQRrE	Square root	Set meter for square root extraction
TARE	Capture tare	Capture tare
Tr dLY	Transmit delay	Set transmit delay for serial communication
unItS	Units	Select the display units/tags
unLoc	Unlocked	Program password to lock meter
uP	Up button	Assign digital input to Up button
u-rAnG	Underrange	Program mA output for display underrange
uSEr	User I/O	Assign function keys and digital I/O
V CAL	Voltage calibration	Calibrate voltage input
V Hi	Voltage high	Calibrate high voltage input (e.g. 10 V)
V Lo	Voltage low	Calibrate low voltage input (e.g. 0 V)
VOLT	0-10 VDC	Set meter for $\pm 10$ VDC input

***For complete product documentation, video training, and technical support, go to [www.flowline.com](http://www.flowline.com).***

***For phone support, call 562-598-3015 from 8am to 5pm PST, Mon - Fri.***

***(Please have the Part and Serial number available.)***

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Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service in accordance with instructions furnished by Flowline for a period, which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products. Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products or components, which Flowline's examination determines to its satisfaction to be defective in material or workmanship within the warranty period. Flowline must be notified pursuant to the instructions below of any claim under this warranty within thirty (30) days of any claimed lack of conformity of the product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original warranty period.

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