



LEVEL MATE III
Level Measurement and Control System
Installation and Operating Instructions





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Disclaimer

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



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



WARNING: Risk of electric shock or personal injury.



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

Limited Warranty

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

Registered Trademarks

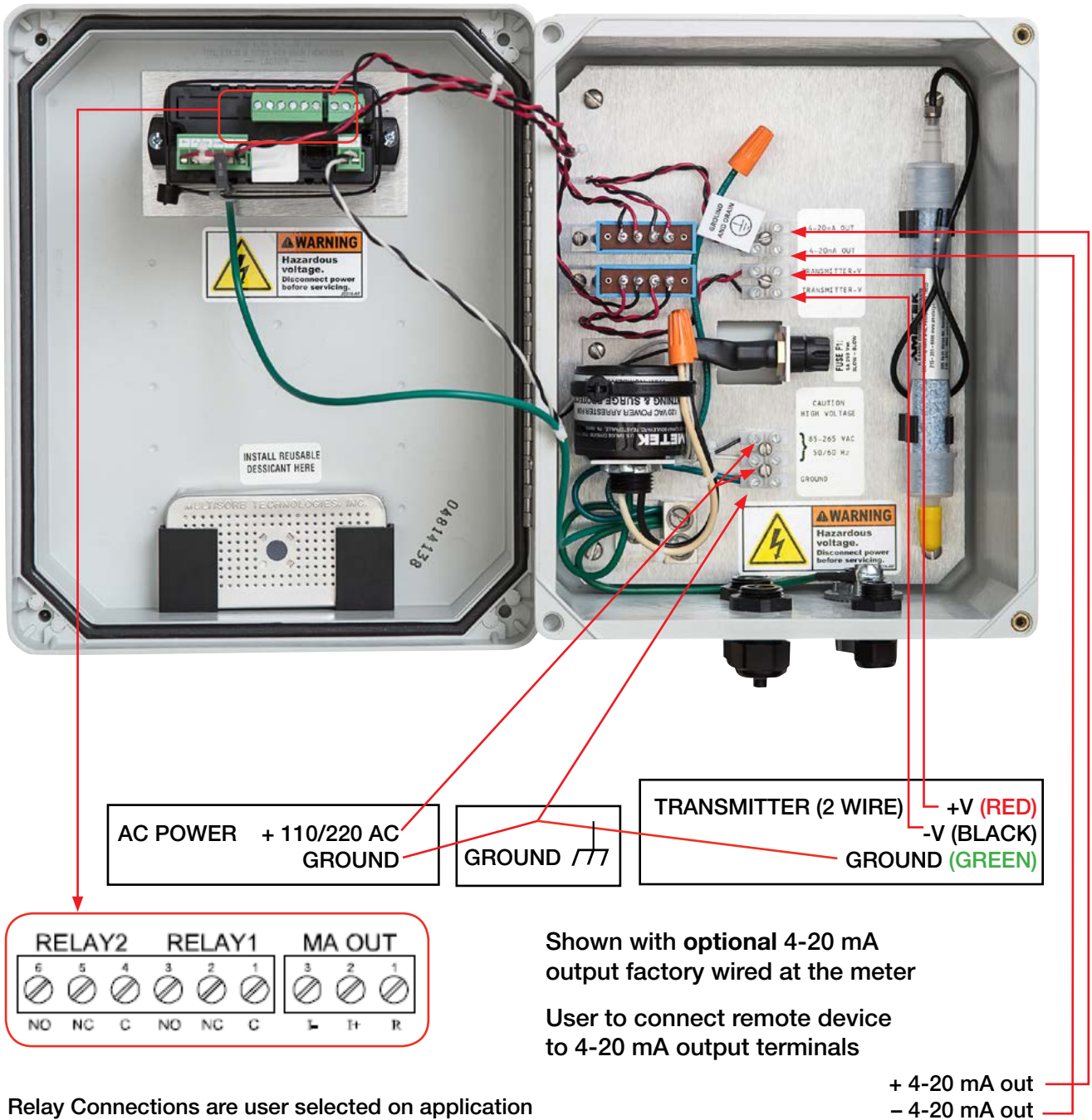
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User Quick Wiring Guide*

Shown are user required connections. All other connections and options are pre-wired in the LevelMate III system



* Quick Guide is only a supplement. Read the full instruction manual for safety in operation and compliance



Introduction

The Level Mate III Level Measurement System consists of an AMETEK Model DDMC Digital Meter Controller used with an AMETEK Submersible Transmitter to provide digital indication of liquid level.

Ametek's Submersible Level Transmitter is a solid state instrument designed for direct submergence in liquid for quick, accurate and reliable level measurements. The transmitter indicates the level of liquid by continuously measuring hydrostatic pressure via its sensing element, an ion implanted silicon chip consisting of a full Wheatstone bridge circuit used with a 316L stainless steel diaphragm to seal the element from corrosive fluids. It then transmits the level via a 4-20 mA output signal. All the electronics are mounted in a submersible 316 stainless steel housing protected by a removable snubnose threaded sensing port.

The electrical connection is a 3 wire, shielded, waterproof cable which is vented at the surface

end to reference atmospheric pressure. The stainless steel cable support provides extra stability for longer lengths of cable or for use with agitated liquids.






Model DDMC Meter Controller powers the transmitter with 24 VDC, displays the level and has two relays standard, each with adjustable Set and Reset Programming. The display provides a visual indication when setpoints are exceeded. Each setpoint actuates a Form C relay and can be programmed for NO (normally open) or NC (normally closed.) The relays provide on/off control of external control devices.

The optional analog output is adjustable over all or part of the display range via keypad setup. The analog output is proportional to the level measurement and can be used for external indicating, recording, and controlling; or with computing devices that accept analog signals.



Basic Sensor Specifications

See individual data sheets for more detail.

					
Model	375	575 / 575P	SST	SDT	675
Product Line	Submersible Level	Submersible Level	Submersible Level	Submersible Level	Submersible Level
Features	Low-cost, Reliable Level Measurement	Reliable Level Measurement	0.69" Diameter for Small Bore Applications	OEM Level Transducer With Optional Temperature Output	Shark Cage Design With Large Diaphragm
Ranges	0-6 psig thru 0-300 psig	0-6 psig thru 0-300 psig	0-6 psig thru 0-150 psig	0-1 thru 0-150 psig	0-6 psig thru 0-60 psig
	0-14 to 0-690 ft water	0-14 to 0-690 ft water	0-14 to 0-0.345 ft water	0-2.31 to 0-690 ft water	0-14 to 0-138 ft water
	0-4.2 to 0-211 meters water	0-4.2 to 0-211 meters water	0-4.2 to 0-105 meters water	0-0.7 to 0-211 meters water	0-4.2 to 0-0.42 meters water
Operating Temperature	-13° to 140° F (-25° to 60° C)	-25° to 180° F (-32° to 82° C)	-13° to 167° F (-15° to 75° C)	-13° to 140° F (-25° to 60° C)	-25° to 180° F (-32° to 82° C)
Compensated Temperature	-32° to 122° F (-0° to 50° C)	-23° to 130° F (-5° to 55° C)	-32° to 122° F (-0° to 50° C)	-13° to 140° F (-25° to 60° C)	-32° to 122° F (-0° to 50° C)
Sealed					
Differential					
Process Connection	1/4" NPT Male Snub Nose	1/2" NPT Nylon Snub Nose 1.39" Flush on 575P	9/16-18 Delrin Snub Nose	1/4" NPT Male Snub Nose	3.5" Diaphragm Protected by a 4.75" Cage
Wetted Parts	316L SS, Polyurethane, Viton	316L SS, Polyurethane, Viton Hastelloy C on 575P	316L SS	316L SS	316L SS Polyurethane, Viton
Input For mA Out	11-30 VDC	12-40 VDC	11-30 VDC	11-30 VDC	12-40 VDC
Output Volts				1-6 VDC, 1-5 VDC, 0.5-4.5 VDC, and 0-5 VDC	
Output Milliamps (mA)	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA
Housing	316 SS	316 SS	316 SS	316 SS	316 SS
Calibration	Fixed Range	Bench Adjustable	Fixed Range	Fixed Range	Bench Adjustable
Accuracy	±0.25% Full Scale BFSL	±0.25% Full Scale BFSL	±0.25% Full Scale BFSL	±0.20% Full Scale BFSL	±0.25% Full Scale BFSL
Electrical Connection	22 Gauge Polyurethane Shielded Cable up to 2500 Feet	20 Gauge Polyurethane Shielded Cable Up to 3000 Feet Optional 1/2" Conduit, Teflon Optional	22 Gauge Polyurethane Shielded Cable up to 5000 Feet	Polyurethane, Polyolefin, or Teflon Cable, EMI Protection and Conduit Adapter Optional	20 Gauge Polyurethane Shielded Cable Up to 3000 Feet Optional 1/2" Conduit, Teflon Optional
Agency Approvals and Standards					
Intrinsically Safe	General Purpose	CSA CL 1 DIV 1	General Purpose	General Purpose	CSA CL 1 DIV 1



Specifications

Except where noted all specifications apply to operation at +25° C
Level Mate III DDMC Digital Meter/Controller

Environmental

Warm up time 1min.; except T/C 5 min.
Operating Temperature -40°C to 65°C
Storage temperature -40°C to 85°C
Humidity 0 to 90% non-condensing

Mechanical

Housing: NEMA 4X Weathertight
Material: Fiberglass Reinforced Polyester with Transparent Polycarbonate Cover
Unit weight: 7.25 lbs. Max. (Does not include Transmitter & Cable)

General

Display	Upper display: 0.60" (15 mm) high, red LEDs Lower display: 0.46" (12 mm) high, red LEDs 6 digits each (-99999 to 999999), with lead zero blanking
Display Intensity	Eight user selectable intensity levels
Display Update Rate	5/second (200 ms)
Overrange	Display flashes <i>999999</i>
Underrange	Display flashes <i>-99999</i>
Display Assignment	The upper and lower displays may be assigned to PV1, PV2, PCT, d r-u, d gross, d nt-g, max/min, max & min, set points, units (lower display only), or Modbus input.
Programming Methods	Four front panel buttons, digital inputs, PC and DDMC Meter View software, Modbus registers, or cloning using Copy function.
Noise Filter	Programmable from 2 to 199 (0 will disable filter)
Filter Bypass	Programmable from 0.1 to 99.9% of calibrated span
Recalibration	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
Max/Min Display	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
Password	Three programmable passwords restrict modification of programmed settings. Pass 1: Allows use of function keys and digital inputs Pass 2: Allows use of function keys, digital inputs and editing set/reset points Pass 3: Restricts all programming, function keys, and digital inputs.
Power Options	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max or jumper selectable 12/24 VDC ±10%, 15 W max
Isolated Transmitter Power Supply	Terminals P+ & P-: 24 VDC ± 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.



Non-Volatile Memory	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
Power Options	85-265 VAC 50/60 Hz, 90-265 VDC, 20 W max or jumper selectable 12/24 VDC \pm 10%, 15 W max
Fuse*	Required fuse: UL Recognized, 5 A max, slow blow; 3AG *installed in Levelmate III Nema 4x Enclosure
Isolated Transmitter Power Supply	Terminals P+ & P-: 24 VDC \pm 5% @ 200 mA max (standard), (12/24 VDC powered models rated @ 100 mA max). 5 or 10 VDC @ 50 mA max, selectable with internal jumper J4.
Normal Mode Rejection	Greater than 60 dB at 50/60 Hz
Isolation	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
Overvoltage Category	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
Environmental	Operating temperature range: -40 to 65°C Storage temperature range: -40 to 85°C Relative humidity: 0 to 90% non-condensing
Connections	Removable screw terminal blocks accept 12 to 22 AWG wire, RJ45 for external relays, digital I/O, and serial communication adapters.
Enclosure	1/8 DIN, high impact plastic, UL 94V-0, color: black
Mounting	1/8 DIN panel cutout required: 3.622" x 1.772" (92 mm x 45 mm) Two panel mounting bracket assemblies are provided.
Tightening Torque	Screw terminal connectors: 5 lb-in (0.56 Nm)
Overall Dimensions	4.68" x 2.45" x 5.64" (119 mm x 62 mm x 143 mm) (W x H x D)
Weight	9.5 oz (269 g)
Warranty	2 years parts & labor



Process Input

Inputs	Field selectable: 0-20, 4-20 mA, 10 V (0-5, 1-5, 0-10 V), Modbus PV (Slave)						
Accuracy	±0.03% of calibrated span ±1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span						
Temperature Drift	0.005% of calibrated span/ C max from 0 to 65 C ambient, 0.01% of calibrated span/ C max from -40 to 0 C ambient						
Signal Input Conditioning	Linear, square root, programmable exponent, or round horizontal tank volume calculation						
Multi-Point Linearization	2 to 32 points for PV or PV1 2 to 8 points for PV2 (Dual-scale Level feature)						
Programmable Exponent	1.0001 to 2.9999						
Round H Tank	Diameter & Length: 999.999 inch or cm calculates volume in gallons or liters respectively.						
Low-Flow Cutoff	0-999999 (0 disables cutoff function)						
Decimal Point	Up to five decimal places or none: <i>d.ddddd, d.ddddd, d.ddd, d.dd, d.d, or d</i>						
Calibration Range	<table border="0"> <thead> <tr> <th>Input Range</th> <th>Minimum Span Input 1 & Input 2</th> </tr> </thead> <tbody> <tr> <td>4-20 mA</td> <td>0.15 mA</td> </tr> <tr> <td>10 V</td> <td>0.10 V</td> </tr> </tbody> </table> <p>An error message will appear if the input 1 and input 2 signals are too close together.</p>	Input Range	Minimum Span Input 1 & Input 2	4-20 mA	0.15 mA	10 V	0.10 V
Input Range	Minimum Span Input 1 & Input 2						
4-20 mA	0.15 mA						
10 V	0.10 V						
Input Impedance	Voltage ranges: greater than 500 k,Ω Current ranges: 50 - 100 Ω (depending on resettable fuse impedance)						
Input Overload	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.						
F4 Digital Input Contacts	3.3 VDC on contact. Connect normally open contacts across F4 to COM.						
F4 Digital Input Logic Levels	Logic High: 3 to 5 VDC Logic Low: 0 to 1.25 VDC						



Relays

Rating	2 or 4 SPDT (Form C) internal and/or 4 SPST (Form A) external; rated 3 A @ 30 VDC and 125/250 VAC resistive load; 1/14 HP (\approx 50 W) @ 125/250 VAC for inductive loads
Noise Suppression	Noise suppression is recommended for each relay contact switching inductive loads; see page 16 for details.
Deadband	0-100% of span, user programmable
High Or Low Alarm	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
Relay Operation	Automatic (non-latching) and/or manual reset Latching (requires manual) Pump alternation control (2 to 8 relays) Sampling (based on time) Off (disable unused relays and enable Interlock feature) Manual on/off control mode
Relay Reset	<u>User selectable via front panel buttons or digital inputs</u> 1. Automatic reset only (non-latching), when the input passes the reset point. 2. Automatic + manual reset at any time (non-latching) 3. Manual reset only, at any time (latching) 4. Manual reset only after alarm condition has cleared (latching) <i>Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.</i>
Time Delay	0 to 999.9 seconds, on & off relay time delays
Fail-Safe Operation	Programmable and independent for each relay. Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.
Auto Initialization	When power is applied to the meter, relays will reflect the state of the input to the meter.



Isolated 4-20 mA Transmitter Output

Output Source	Process variable (PV), max, min, set points 1-8, Modbus input, or manual control mode		
Scaling Range	1.000 to 23.000 mA for any display range Factory calibrated: 4.000 to 20.000 = 4-20 mA output		
Analog Out Programming	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break		
Accuracy	$\pm 0.1\%$ of span ± 0.004 mA		
Temperature Drift	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 Note: Analog output drift is separate from input drift.		
Isolated Power Supply	Terminals I+ & R: 24 VDC $\pm 10\%$. May be used to power the 4-20 mA output or other devices. Refer to Figure 3 on page 15 and Figure 16 on page 17. All models rated @ 40 mA max.		
External Loop Power Supply	35 VDC maximum		
Output Loop Resistance	Power supply	Minimum	Maximum
	24 VDC	10 Ω	700 Ω
	35 VDC (external)	100 Ω	1200 Ω

Modbus® RTU Serial Communications

Slave Id	1 – 247 (Meter address)
Baud Rate	300 – 19,200 bps
Transmit Time Delay	Programmable between 0 and 199 ms
Data	8 bit (1 start bit, 1 or 2 stop bits)
Parity	Even, Odd, or None with 1 or 2 stop bits
Byte-To-Byte Timeout	0.01 – 2.54 second
Turn Around Delay	Less than 2 ms (fixed)
<i>Note: Refer to the Modbus Register Tables located at www.ametekusg.com for details.</i>	



Compliance Information

The information and specifications below pertain to the meter/controller ONLY in the Level Mate III system

Safety

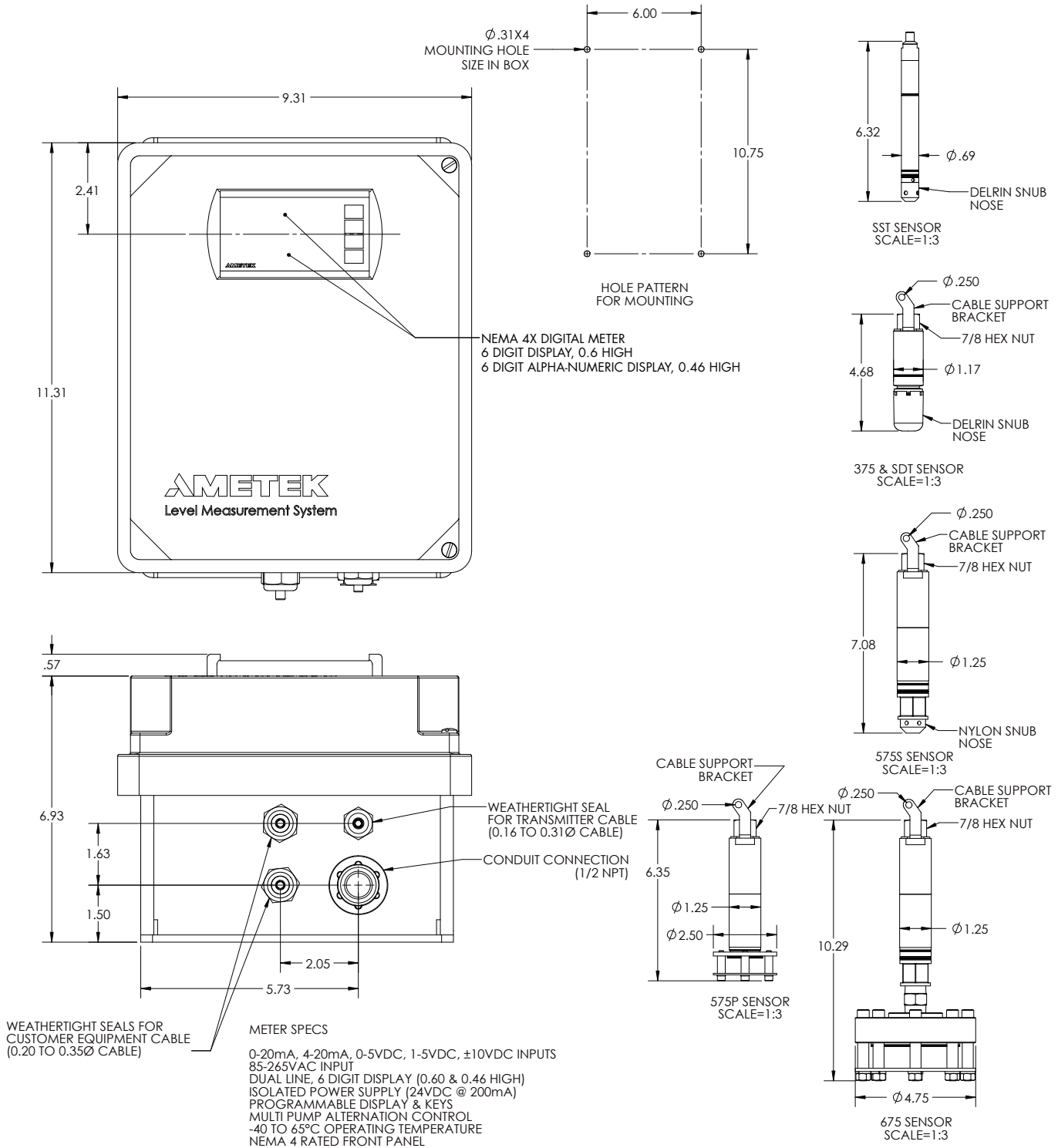
UL & c-UL Listed	USA & Canada UL 508 Industrial Control Equipment
UI File Number	E195093
Front Panel	UL Type 4X, NEMA 4X, IP65; panel gasket provided
Low Voltage Directive	EN 61010-1:2001 Safety requirements for measurement, control, and laboratory use

Electromagnetic Compatibility

EMISSIONS	EN 55022:2006/A1:2007
	Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
IMMUNITY	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



Outline Drawing





Ordering Information

Model Numbering:

Base Model LM

Sensor Type	Sensor Model Number	Display Range	
5	575SB0006RLS	0 to 13.8 ft (0 to 4.2m)	
	575SB0015RLS	0 to 34.6 ft (0 to 10.5m)	
	575SB0030RLS	0 to 69.2 ft (0 to 21.1m)	
	575SB0060RLS	0 to 138.4 ft (0 to 42.2m)	
	575SB0100RLS	0 to 230.7 ft (0 to 70.3m)	
	575SB0150RLS	0 to 346.0 ft (0 to 105.4m)	
	575SB0200RLS	0 to 461.3 ft (0 to 140.5m)	
	575SB0300RLS	0 to 692.0 ft (0 to 211.0m)	
	P	575PB0006RLS	0 to 13.8 ft (0 to 4.2m)
		575PB0015RLS	0 to 34.6 ft (0 to 10.5m)
575PB0030RLS		0 to 69.2 ft (0 to 21.1m)	
575PB0060RLS		0 to 138.4 ft (0 to 42.2m)	
575PB0100RLS		0 to 230.7 ft (0 to 70.3m)	
575PB0150RLS		0 to 346.0 ft (0 to 105.4m)	
575PB0200RLS		0 to 461.3 ft (0 to 140.5m)	
575PB0300RLS		0 to 692.0 ft (0 to 211.0m)	
6		675PB0006MLS	0 to 13.8 ft (0 to 4.2m)
		675PB0015MLS	0 to 34.6 ft (0 to 10.5m)
	675PB0030MLS	0 to 69.2 ft (0 to 21.1m)	
	3	375SB0006RLSV	0 to 13.8 ft (0 to 4.2m)
		375SB0015RLSV	0 to 34.6 ft (0 to 10.5m)
		375SB0030RLSV	0 to 69.2 ft (0 to 21.1m)
S	375SB0060RLSV	0 to 138.4 ft (0 to 42.2m)	
	375SB0100RLSV	0 to 230.7 ft (0 to 70.3m)	
	375SB0150RLSV	0 to 346.0 ft (0 to 105.4m)	
	375SB0200RLSV	0 to 461.3 ft (0 to 140.5m)	
	375SB0300RLSV	0 to 692.0 ft (0 to 211.0m)	
	D	SSTSB0006PLSV	0 to 13.8 ft (0 to 4.2m)
		SSTSB0015PLSV	0 to 34.6 ft (0 to 10.5m)
		SSTSB0030PLSV	0 to 69.2 ft (0 to 21.1m)
		SSTSB0060PLSV	0 to 138.4 ft (0 to 42.2m)
		SSTSB0100PLSV	0 to 230.7 ft (0 to 70.3m)
SSTSB0150PLSV		0 to 346.0 ft (0 to 105.4m)	
D	SDTSB0006RLSV	0 to 13.8 ft (0 to 4.2m)	
	SDTSB0015RLSV	0 to 34.6 ft (0 to 10.5m)	
	SDTSB0030RLSV	0 to 69.2 ft (0 to 21.1m)	
	SDTSB0060RLSV	0 to 138.4 ft (0 to 42.2m)	
	SDTSB0100RLSV	0 to 230.7 ft (0 to 70.3m)	
	SDTSB0150RLSV	0 to 346.0 ft (0 to 105.4m)	

Accessories	Part #
* Length of model 575 / 575P, standard, factory installed, non vent tube, polyurethane, waterproof cable (4 cond / 20 AWG)	K515076
* Length of model 675 / 375 / SST, standard, factory installed, vent tube, polyurethane, waterproof cable (3 cond / 22 AWG)	K515072
* Length of model SDT, standard, factory installed, non vented tube, polyurethane, waterproof cable (6 cond / 24 AWG)	K515136
Metal conduit connector for NEMA 4X weather-tight housing (0.11 to 0.26 cable Ø range)	K554149
Cable strain relief cord grip for NEMA 4X weather-tight housing (0.16 to 0.31 cable Ø range)	K554167
Cable strain relief cord grip for NEMA 4X weather-tight housing (0.20 to 0.35 cable Ø range)	K554148
Surge protector for excitation and signal lines between meter and transmitter	LMA912
Surge protector for 115 VAC line to the meter	LMA918
Surge protector for 230 VAC line to the meter	LMA919
USB serial communications adaptor kit (for programming meter and software download)	K516131
Reusable desiccant for Level Mate box	K234432
8" desiccant for transmitter with vented cable	K234436
4 relay expansion module (see DDMC manual for details)	K740366
Meter copy cable (see DDMC manual for details)	K516132
Stainless steel support	K515183

*Consult Factory for other sensor and cable options.

Meter output (other power & relay options available, consult factory)

- A 2 relays
- B 2 relays, 4-20mA output (specify output and calibrated range)
- C 4 relays

Surge Protection***

- 0 No DC surge protection
- 1 Surge protection for signal line between meter and transmitter (LM912)
- 2 Surge protection for signal line between meter and customer equipment (LM912)
- 3 Surge protection for signal line between meter and transmitter and meter and customer equipment (LM912 - 2 required)

AC Surge Protection***

- 0 No AC surge protection
- 1 115 VAC surge protection for input line to the meter (LM918)
- 2 230 VAC surge protection for input line to the meter (LM919)

LM 5 A 0 0

*** NOTE: surge protectors are wired into the NEMA 4X enclosure unless advised otherwise



Safety / Installation



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.

This instrument is designed to prevent accidental shock to the operator when properly used. However, no design can insure the safety of an instrument improperly installed or used negligently. Read this manual carefully and completely before operating the instrument. Failure to read this manual in its entirety could result in damage to the instrument or injury to the operator.

To avoid possible shock hazard install in a grounded enclosure, prevent live parts being touched and ground the sensor sheath and housing. Follow wiring diagrams and local regulations.

Installations where failure of this equipment may cause personal injury, property loss, equipment damage or financial loss, backup failsafe protection must be employed.

Configuration:

All functions are front key selectable, it is the responsibility of the installing engineer to ensure that the configuration is safe. Use the program lock (via password function) to protect critical functions from tampering.

Unpacking and Inspection

The Level Mate III is calibrated with a specific Submersible Transmitter.

The Transmitter Model Number is identified on label located inside the NEMA enclosure

The meter should be used with the transmitter with which it was calibrated.

Unpack the meter, transmitter and cable from the shipping container and inspect for physical damage.

Operational Checkout

Before installing the Level Mate III Transmitter, make sure the system is operating by doing a bench check.



WARNING: Do not connect any wires while AC Power input is applied.

Connect AC power to the meter. Apply power and allow a five-minute warm-up.

With no pressure applied to the transmitter, the meter should display zero (or for “drawdown” the reading corresponding to the depth below ground level that the transmitter will be when installed.)



CAUTION: Do not simulate an increase in pressure by applying mechanical force to the sensing diaphragm of the transmitter. Excessive force will result in damage to or destruction of the transmitter.

When pressure is applied to the transmitter, the display should increase (or decrease if setup for “drawdown”) and return to the original reading when pressure is removed.

The Transmitter can be pressurized by lowering it into water or by applying air pressure from a calibration device. To apply air pressure unscrew the snub-nose and replace it with a 1/2 “ NPT pressure fitting.



Level Mate III Transmitter

The Level Mate III Transmitter can be suspended in a well or tank supported by its attached shielded electrical cable or optional stainless steel support cable. Ensure that the opening in the well or tank cover is large enough for possible future removal of the transmitter.

Additional support can be provided when the transmitter is being used under circumstances of excess stress, such as, when submerged in agitated water or when suspended with electrical cable longer than 300 ft. The cable support feature on the transmitter provides this extra strain relief. (See figure 3) (not available on SST).

Level Mate III Meter/Controller

The meter/controller in the NEMA 4X housing can be mounted on a flat panel or wall. Prepare a standard 1/8 DIN Panel cutout 3.622" x 1.772 (92 mm x 45 mm). Refer to DDMC meter manual for more detail.

Signal Noise Isolation

The meter should not be mounted close to high current switching relays or in an enclosure containing such relays.

Low voltage wiring (transmitter signal wires and analog output wires) should be separated from high voltage wiring (115, 230 & 440 VAC) and should be shielded.

Surge Protection

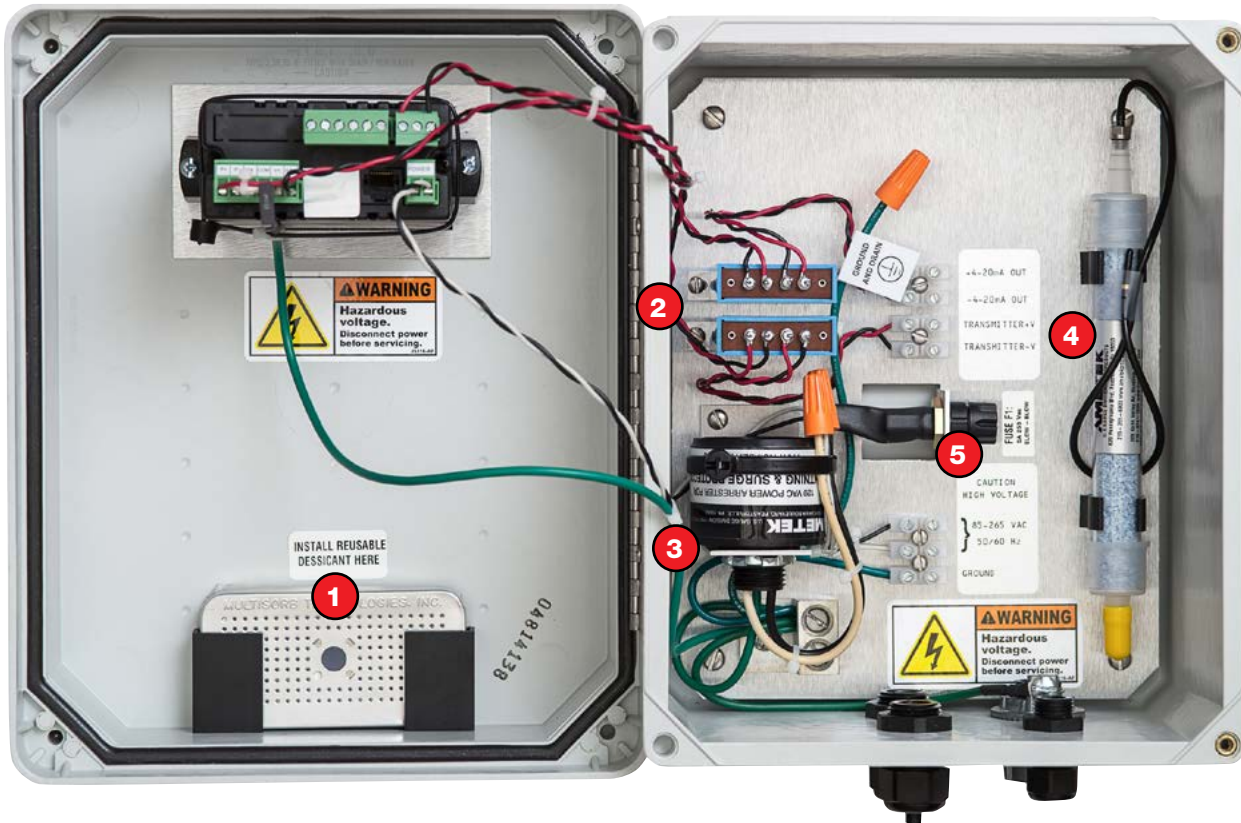
Surge protectors are available as an option item (see "parts & accessories" in the back of this manual) and are strongly recommended to protect from secondary surges and lightning on outdoor installations. Install in accordance with the applicable drawing that is supplied with the surge protector and the following instructions:

Lightning protection devices should be placed as close to the meter or transmitter as possible and wired in accordance with Local Electrical Codes in an approved watertight enclosure.

If the distance between the meter and transmitter, or meter and recorder is less than 100 ft. only one protector per line is needed.

Use No. 8 AWG ground wire or better from protector.

Keep ground wire less than one foot long and tie to a suitable ground rod or metal frame ground. Surge capability is only as good as the grounding method. All ground connections must be installed.



INSIDE VIEW

ACCESSORIES/OPTIONS

Inside view of the Level Mate III enclosure showing factory wiring of the meter as well as AC power and sensor connection terminals.

- 1** Standard reusable canister desiccant Part# K234432 (initial desiccant supplied)
- 2** Optional DC lightning and surge protectors Part# LMA912 (protection for excitation and signal lines between meter and transmitter)
- 3** Optional AC lightning and surge protectors Part# LMA918 115 VAC, Part# LMA919 230 VAC (protection for power line to the meter)
- 4** Disposable 8" in-line cartridge desiccant (for use with sensors using a separate vent tube). Initial desiccant supplied - Part# K234436 (full assembly with tubing and hardware)
Replacement CARTRIDGE ONLY Part# K234446 (requires some assembly of parts from original full assembly)
- 5** 5 AMP 250 VAC 3AG slo blow fuse



Configuration for 12 or 24 VDC Power Option

Warning!

Do not exceed voltage rating of the selected configuration.

Meters equipped with the 12/24 VDC power option are shipped from the factory ready to operate from 24 VDC. To configure the meter for 12 VDC power:

1. Remove all the connectors.
2. Unscrew the back cover.
3. Slide the back cover about 1 inch.
4. Configure the J9 jumper, located behind the power connector, for 12 V as shown below.

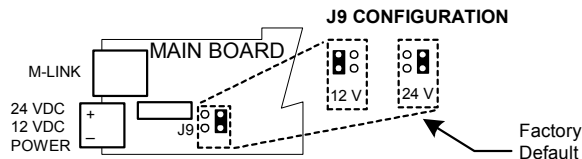


Figure 1.

Jumper Configuration for 12/24 VDC Power

Transmitter Supply Voltage Selection (P+, P-)

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

If the transmitter requires 5 or 10 VDC excitation, the internal

jumper J4 must be configured accordingly.

To access the voltage selection jumper:

1. Remove all the 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.

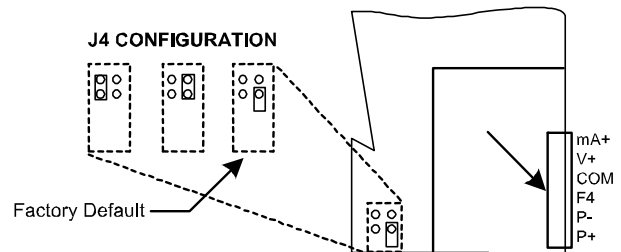


Figure 2. Transmitter Supply Voltage Selection

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 AMETEK's expansion modules, cables, or meters to the RJ45 M-LINK connector. Otherwise damage will occur to the equipment and the meter.

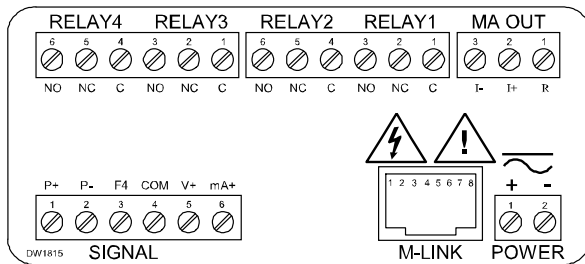
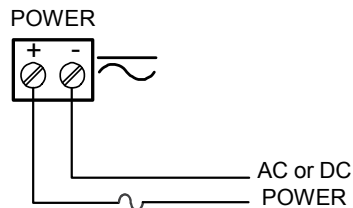


Figure 3. Connector Labeling for Fully Loaded DDMC

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 3 above. 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 3 AG Slow Blow
installed in Level Mate III Nema 4X Enclosure

Figure 4. Power Connections

Signal Connections

Signal connections are made to a five-terminal connector labeled SIGNAL on Figure 3. The COM (common) terminal is the return for the 4-20 mA and the +_ 10 V input signals.

Current and Voltage Connections

The following figures show examples of current and voltage connections. There are no switches or jumpers to set up for current and voltage inputs. Setup and programming is performed through the front panel buttons.

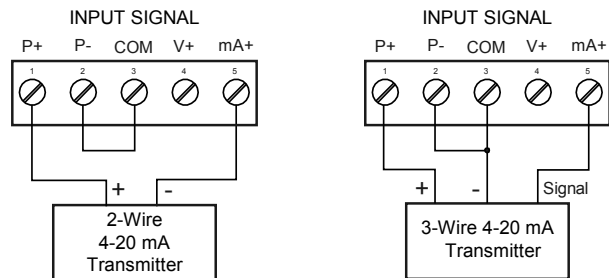


Figure 5. Transmitters Powered by Internal Supply

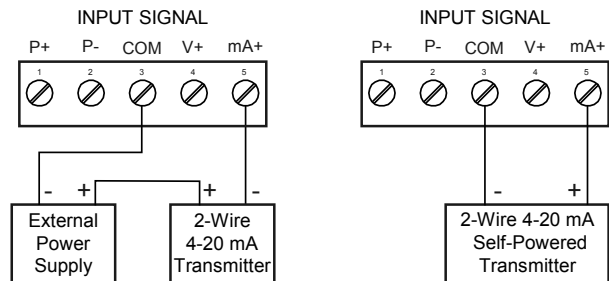


Figure 6. Transmitters Powered by External Supply or Self-Powered

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.

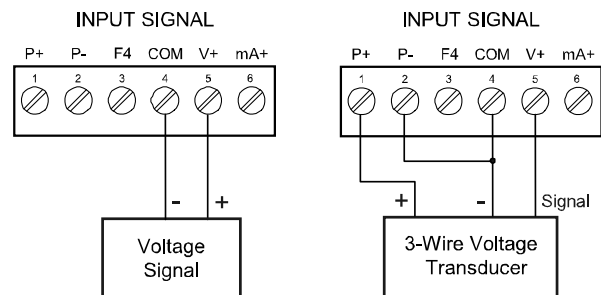


Figure 7. Voltage Input Connections

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



Modbus RTU Serial Communications

Serial communications connection is made to an RJ45 connector labeled M-LINK on Figure 3. For interfacing to the DDMC, use the K516131 for USB. The same port is used for interfacing with all expansion modules (e.g. external relays, digital I/O).

Use the K516132 meter copy cable for meter-to-meter interfacing for cloning purposes (i.e. copying settings from one meter to other meters).

Relay Connections

Relay connections are made to two six-terminal connectors labeled RELAY1 – RELAY4 on Figure 3. 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.

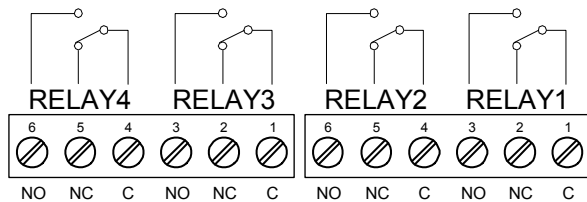


Figure 8. Relay Connections

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.

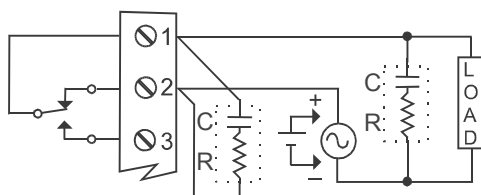


Figure 9. AC and DC Loads Protection

Choose R and C as follows:

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

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

Notes:

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

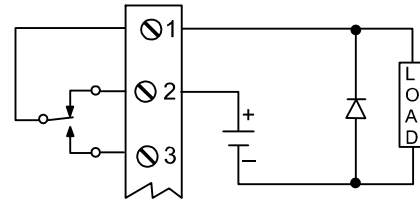


Figure 10. Low Voltage DC Loads Protection

Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

RC Networks Available from AMETEK

RC networks are available from AMETEK and should be applied to each relay contact switching an inductive load.

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.

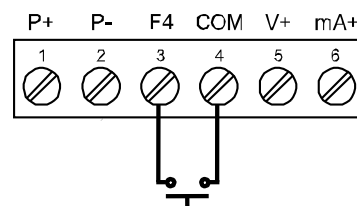


Figure 11. Digital Input Connections



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.

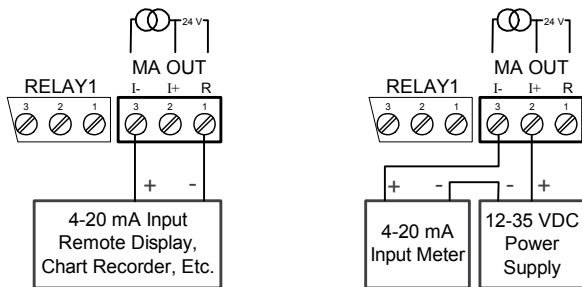


Figure 12. 4-20 mA Output Connections

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 & Digital I/O Connections

External Relays & Digital I/O Connections
The relay expansion module K740366 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.

Note: The jumper located between the RJ45 connectors of the K740366 must be removed on the second digital I/O module in order for the system to recognize it as module #2.



WARNING: Do not connect or disconnect the expansion modules with the power on!

More detailed instructions are provided with each optional expansion module.

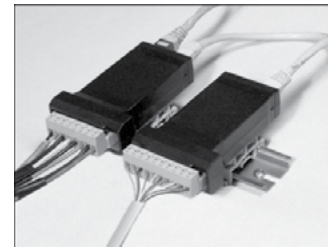


Figure 13. Expansion Modules & DIN Rail Mounting Kit

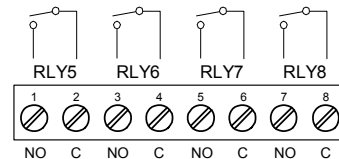


Figure 14. External Relays Module Connections

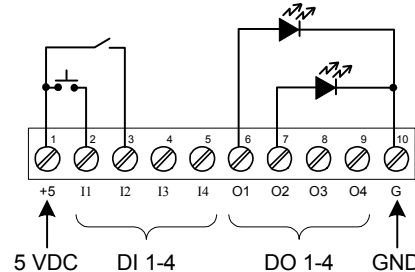


Figure 15. Digital I/O Module Connections

Interlock Relay Feature

As the name implies, the interlock relay feature reassigns one, or more, alarm/control relays for use as interlock relay(s). Interlock contact(s) are wired to digital input(s) and trigger the interlock relay. This feature is enabled by configuring the relay, and relative digital input(s) (see page 63). In one example, dry interlock contacts are connected in series to one digital input which will be used to force on (energize) the assigned interlock power relay when all interlock contacts are closed (safe). The interlock relay front panel LED flashes when locked out. The interlock relay would be wired in-series with the load (N/O contact). See below.

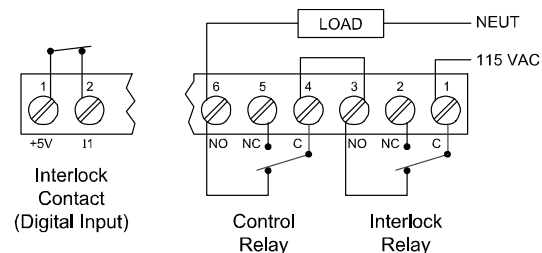


Figure 16. Interlock Connections



Wiring Diagram with Lightning Protection Options

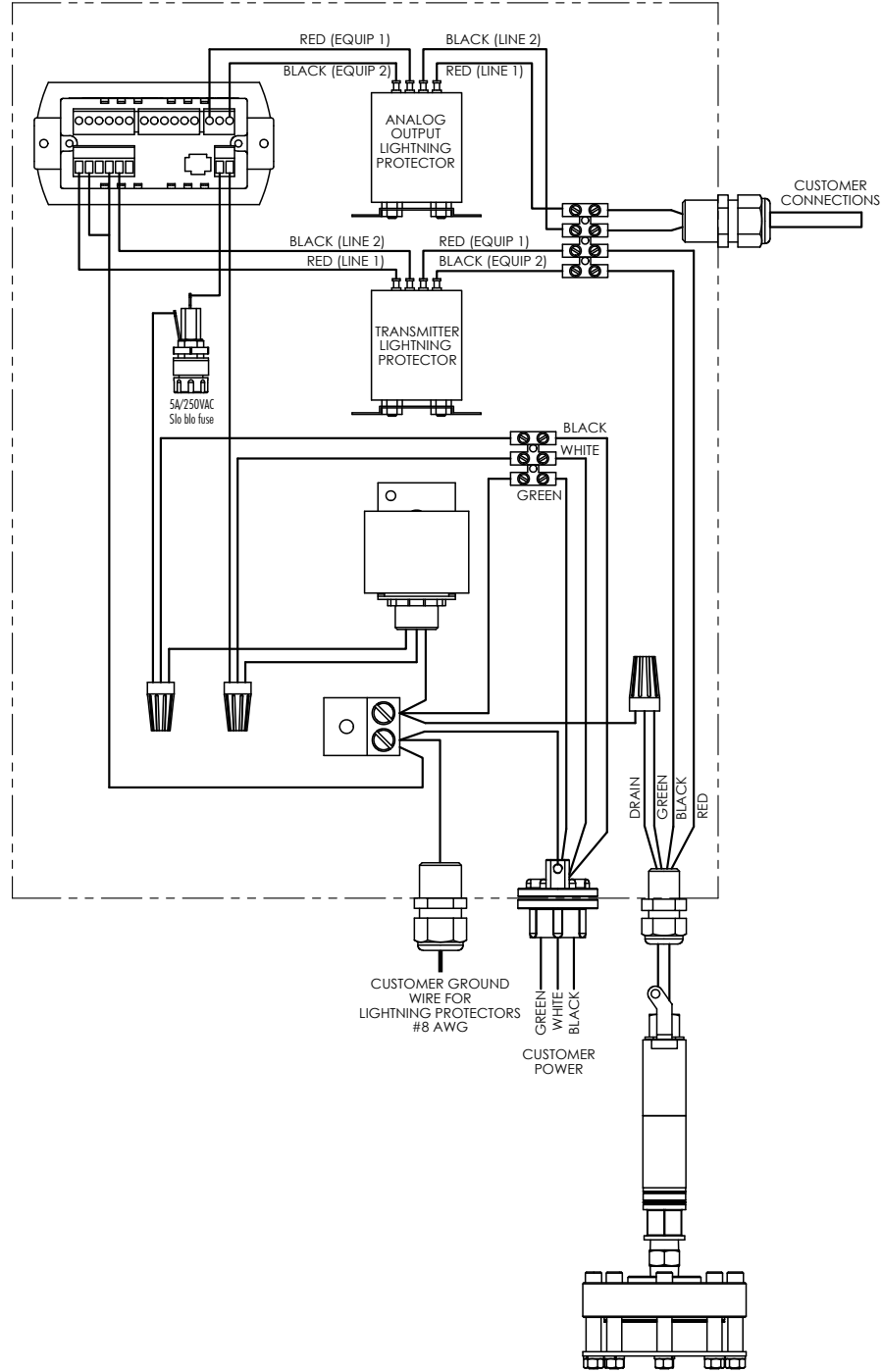


Figure 17. Wiring with Lightning Protection Options



Wiring Diagram without Lightning Protection Options

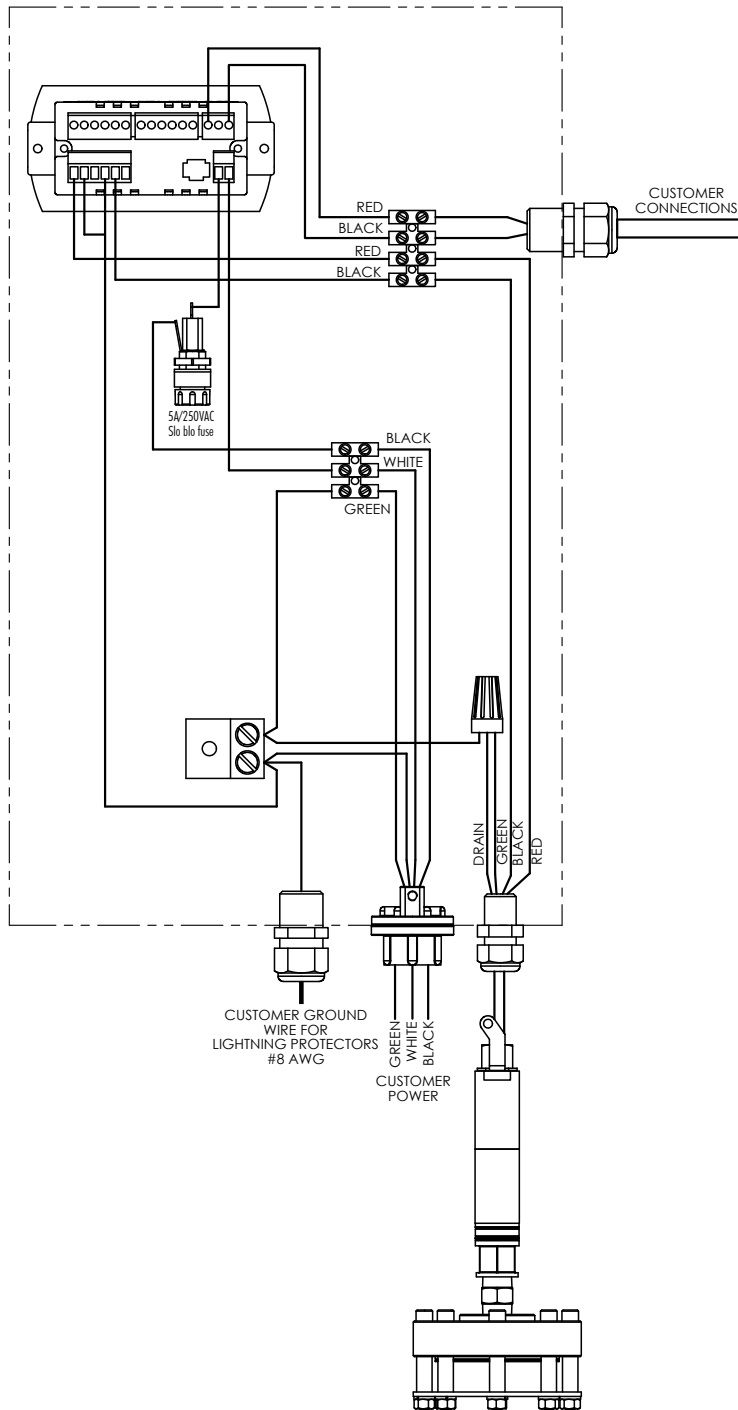


Figure 18. Wiring with no Lightning Protection Options



OPTIONAL FACTORY OR CUSTOMER SUPPLIED AND INSTALLED
SUPPORT CABLE WITH TIES AT REGULAR INTERVALS

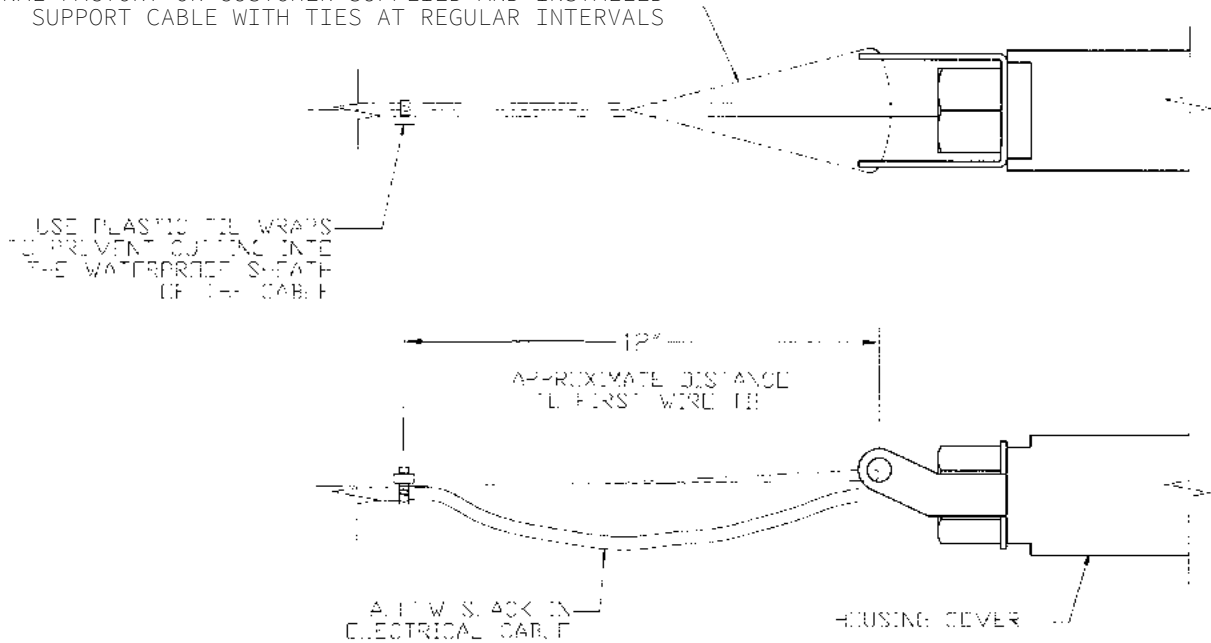


Figure 19. Model 575 Transmitter with Cable Support



CAUTION: The cable grommet is specially installed by factory-trained personnel to assure watertightness. Any adjustment or removal of the grommet may destroy the watertight feature thus exposing the transmitter to water causing an electrical short and transmitter failure. Any adjustment or removal of the cable grommet voids the warranty.



CAUTION: The waterproof cable should not be kinked or nicked, which would also allow water to seep into the cable and short out the transmitter. The surface end of the cable should not be sealed since it references the transmitter to atmospheric pressure.



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.

Front Panel Buttons and Status LED Indicators



Button Symbol	Description
	Menu
	Right arrow/F1
	Up arrow/F2
	Enter/F3

Note:
F4 is a digital input. Alarms 5-8 are enabled when relay expansion module is installed.

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

Note:
LEDs for relays in manual mode flash with the "M" LED every 10 seconds. "M" flashing by itself indicates Aout – manual control is used.

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



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
<i>SEtUP</i>	Setup	Enter Setup menu
<i>INPUt</i>	Input	Enter Input selection menu
<i>mA</i>	4-20 mA	Set meter for 4-20 mA input
<i>VoLt</i>	0-10 VDC	Set meter for 10 VDC input
<i>d-SCAL</i>	Dual-scale Press	Enter to select dual-scale display for some level applications (Select Yes or No)
<i>unItS</i>	Units	Select the display units/tags
<i>dEc Pt</i>	Decimal point	Set decimal point
<i>PV 1</i>	PV1	PV1 decimal point (Level)
<i>PV 2</i>	PV2	PV2 decimal point (Level)
<i>PrOG</i>	Program	Enter the Program menu
<i>SCALE</i>	Scale	Enter the Scale menu
<i>SCAL 1</i>	Scale 1	Enter the Scale menu for PV1
<i>SCAL 2</i>	Scale 2	Enter the Scale menu for PV2
<i>CAL</i>	Calibrate	Enter the Calibration menu
<i>INP 1</i>	Input 1	Calibrate input 1 signal or program input 1 value
<i>diS 1</i>	Display 1	Program display 1 value
<i>INP 2</i>	Input 2	Calibrate input 2 signal or program input 2 value (up to 32 points)
<i>diS 2</i>	Display 2	Program display 2 value (up to 32 points)
<i>Error</i>	Error	Error, calibration not successful, check signal or programmed value
<i>dSPLAY</i>	Display	Enter the Display menu
<i>biG</i>	Upper display	Press Enter to assign the Upper display parameter (default: PV)
<i>LI tLE</i>	Lower display	Press Enter to assign the lower display parameter (default: engineering units)
<i>d-INtY</i>	Display intensity	Set display intensity level from 1 to 8
<i>rELAY</i>	Relay	Enter the Relay menu
<i>rLY 1</i>	Relay 1	Relay 1 setup
<i>Act 1</i>	Action 1	Set relay 1 action
<i>Auto</i>	Automatic	Set relay for automatic reset
<i>Auto-man</i>	Auto-manual	Set relay for automatic & manual reset any time
<i>LATCH</i>	Latching	Set relay for latching operation
<i>Lt-CLR</i>	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared
<i>ALtErn</i>	Alternate	Set relay for pump alternation control
<i>SAMPL</i>	Sampling	Set relay for sampling operation

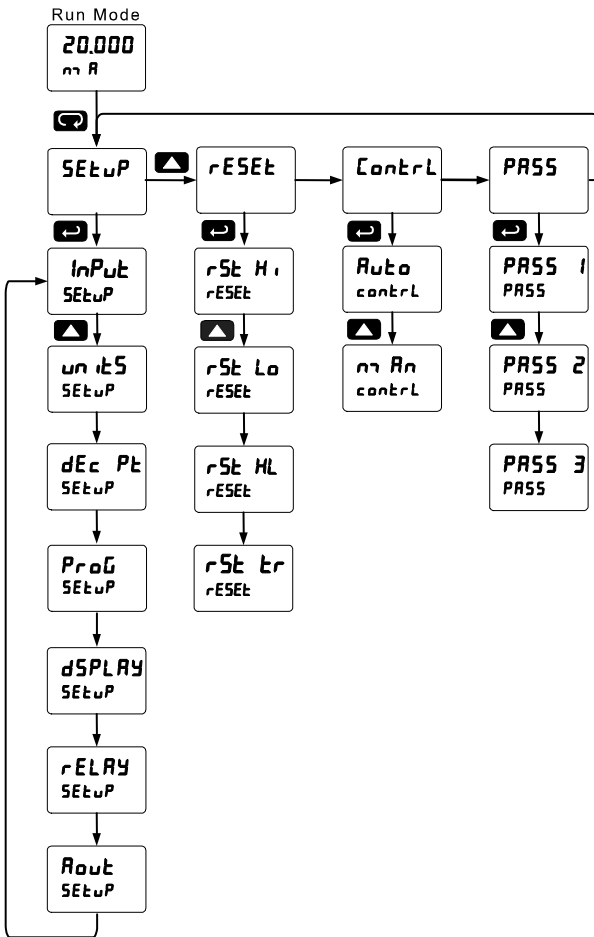


OFF	Off	Disable relay and front panel status LED (Select Off to enable Interlock feature)
SEt 1	Set 1	Program set point 1
rSE 1	Reset 1	Program reset point 1
rLY 2	Relay 2	Relays 2-8 setup <i>Note: Relays 5-8 are shown, only if expansion relay module is installed.</i>
FAi LSF	Fail-safe	Enter Fail-safe menu
FLS 1	Fail-safe 1	Set relay 1 fail-safe operation
on	On	Enable fail-safe operation
oFF	Off	Disable fail-safe operation
FLS 2	Fail-safe 2	Set relays 2-8 fail-safe operation
dELAY	Delay	Enter relay Time Delay menu
dLY 1	Delay 1	Enter relay 1 time delay setup
On 1	On 1	Set relay 1 On time delay
OFF 1	Off 1	Set relay 1 Off time delay
dLY 2	Delay 2	Enter relays 2-8 time delay setup
brEAH	Loop break	Set relay condition if loop break detected
I gnorE	Ignore	Ignore loop break condition (Processed as a low signal condition)
On	On	Relay goes to alarm condition when loop break is detected
OFF	Off	Relay goes to non-alarm condition when loop break is detected
Route	Analog output	Enter the Analog output scaling menu
di S 1	Display 1	Program display 1 value
Out 1	Output 1	Program output 1 value (e.g. 4.000 mA)
di S 2	Display 2	Program display 2 value
Out 2	Output 2	Program output 2 value (e.g. 20.000 mA)
rESEt	Reset	Press Enter to access the Reset menu
rSE HI	Reset high	Press Enter to reset max display
rSE Lo	Reset low	Press Enter to reset min display
rSE HL	Reset high & low	Press Enter to reset max & min displays
rSE tr	Reset tare	Reset tare
ContRl	Control	Enter Control menu
Auto	Automatic	Press Enter to set meter for automatic operation
man	Manual	Press Enter to manually control relays or analog output operation
PASS	Password	Enter the Password menu
PASS 1	Password 1	Set or enter Password 1
PASS 2	Password 2	Set or enter Password 2
PASS 3	Password 3	Set or enter Password 3
unLoc	Unlocked	Program password to lock meter
Locd	Locked	Enter password to unlock meter
999999- 99999	Flashing	Over/under range condition



Main Menu

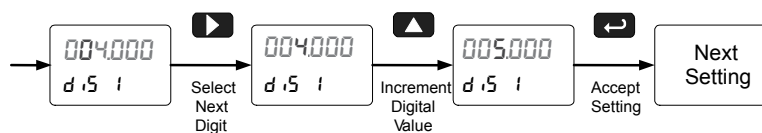
The main menu consists of the most commonly used functions: Setup, Reset, Control, and Password.



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

Setting Numeric Values

- The numeric values are set using the Right and Up arrow buttons. Press Right arrow to select next digit and Up arrow to increment digit value.
- The digit being changed is displayed brighter than the rest.
- Press and hold up arrow to auto-increment the display value.
- Press the Enter button, at any time, to accept a setting or Menu button to exit without saving changes.



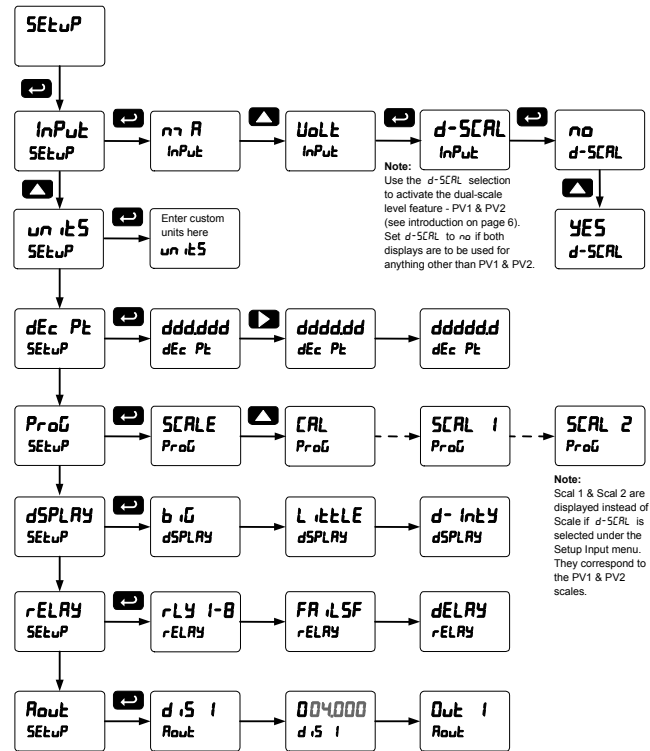


Setting Up the Meter (SEtUP)

The *Setup* menu is used to select:

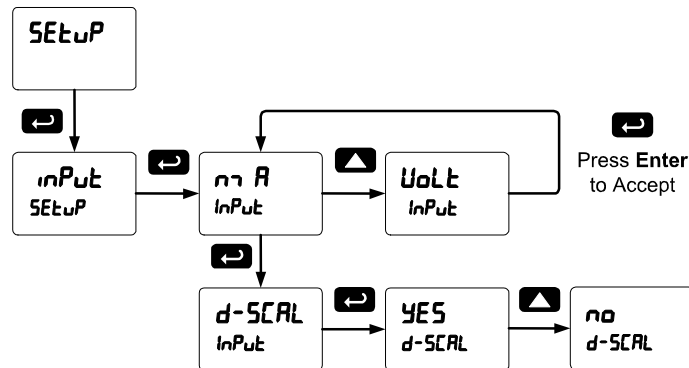
1. Input signal the meter will accept
2. Dual-scale feature for some level applications
3. Select the display units/tags
4. Decimal point position
5. Programming Menu
6. Display parameter and intensity
7. Relay operation
8. 4-20 mA analog output scaling

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



Setting the Input Signal (InPUt)

- Enter the *Input* menu to set up the meter to display current (*mA*) or voltage (*Volt*) inputs.
- The current input is capable of accepting any signal from 0 to 20 mA. Select current input to accept 0-20 mA or 4-20 mA signals.
- The voltage input is capable of accepting any signal from -10 to +10 VDC. Select voltage input to accept 0-5, 1-5, 0-10, or ±10 VDC signals.
- 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 (*SCALE*) and Units (*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 the Input Units or Custom Tags (units)

Enter the input unit or custom tag that will be displayed if d unit is selected as the lower display parameter. See the flow chart on page 44 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

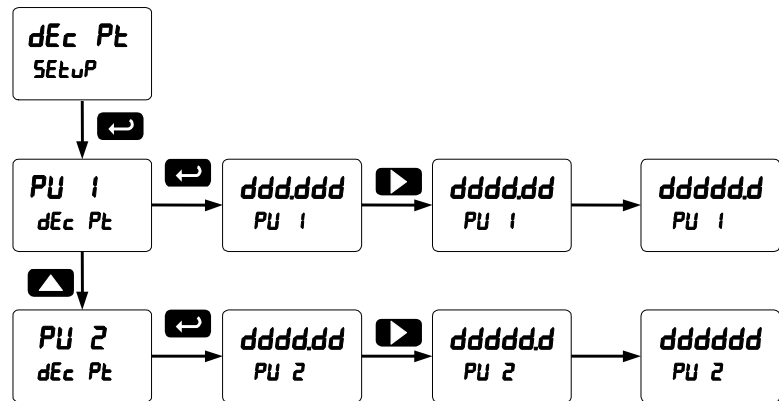
Display	Character
K	K
L	L
m	m
n	n
O	O
o	o
P	P
q	q
r	r
S	S
t	t
u	u
V	V
w	w
X	X
Y	Y
Z	Z
-	-
/	/
[]
]	[
=	=
°	Degree(<)
	Space

Notes: Degree symbol represented by (<) if programming with DDMC Meter View. The letters “m” and “w” use two 7-segment LEDs each; when selected the characters to the right are shifted one position. Press and hold up arrow to auto-scroll the characters in the display.



Setting the Decimal Point (dEc Pt)

- The decimal point may be set with up to five decimal places or with no decimal point at all.
- Pressing the Right arrow moves the decimal point one place to the right until no decimal point is displayed, and then it moves to the leftmost position. Pressing the Up arrow moves the decimal point one place to the left.
- If the dual-scale level feature is selected, the decimal point selections for PV1 & PV2 are enabled.



Programming the Meter (ProG)

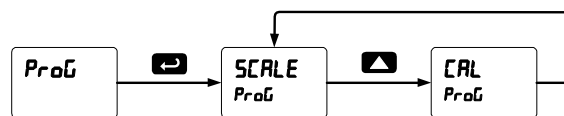
It is very important to read the following information, before proceeding to program the meter:

- 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 DDMC is a single input meter with dual-scale capability. The Program menu contains the Scale and the Calibrate menus.

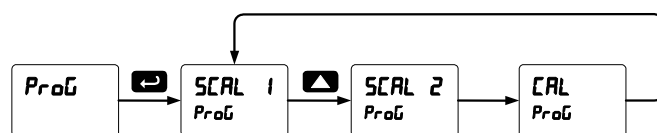
Note: The Scale and Calibrate functions are exclusive of each other. The meter uses the last function programmed. Only one of these methods can be employed at a time. The Scale and Calibrate functions can use up to 32 points (default is 2). The number of points should be set in the Advanced menu under the Multi-Point Linearization (Linear) menu selection prior to scaling and calibration of the meter, see page 75 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 68.



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 75 for details.

DDMC Meter View Software

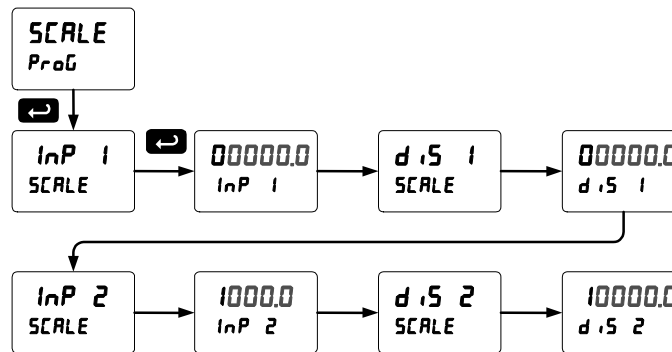
The meter can also be programmed using the PC-based DDMC Meter View software available for free download at www.ametekusg.com.

Data logging for one meter at a time is available with DDMC Meter View software. More advanced data acquisition may be accomplished by using any Modbus RTU compliant software.

In order to program the meter using a computer, the meter must be connected using a USB serial adapter, see ORDERING INFORMATION on page 7 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.



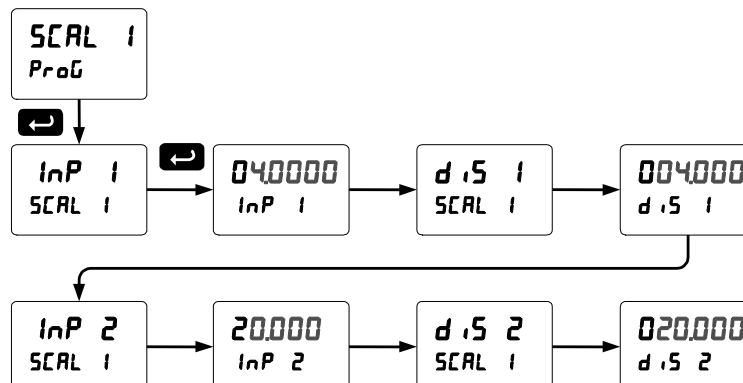
For instructions on how to program numeric values see *Setting Numeric Values*, page 33.

Dual-Scale for Level Application

The analog input can be displayed in two different scales, by enabling the dual-scale feature (*d-SCALE*) in the Setup-Input menu, see page 34.

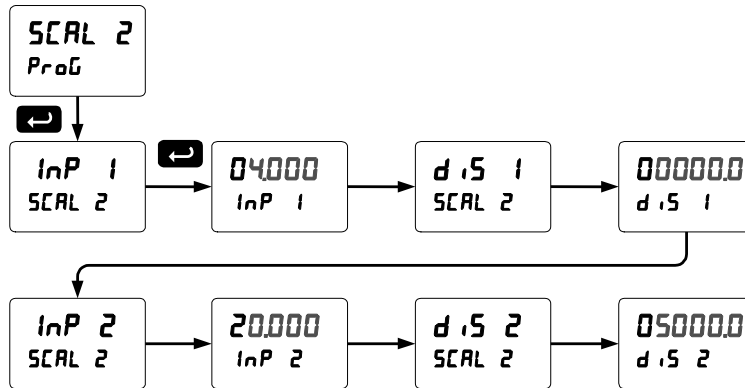
To enable the dual-scale feature for some level applications you must select d-SCAL in the Input selection menu.

Scaling the Input for PV1 (*SCALE 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

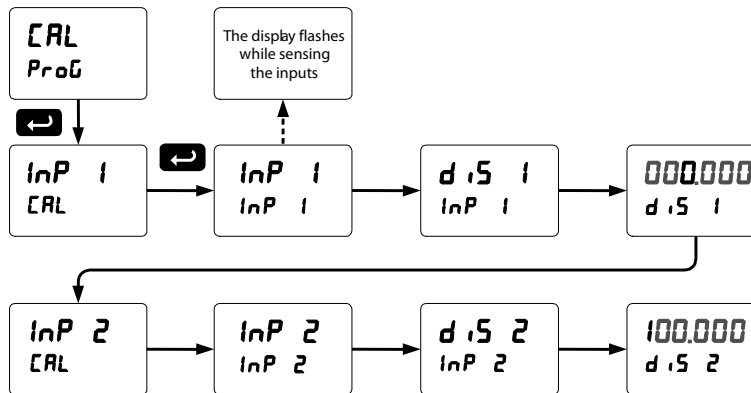


Calibrating the Meter with External Source (CAL)

Note: To scale the meter without a signal source refer to Scaling the Meter (SCALE), page 39.

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

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



Warm up the meter for at least 15 minutes before performing calibration to ensure specified accuracy.

Setting the Display Parameter & Intensity (dSPRAY)

The Upper display (dIS) can be programmed to display:

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

The Lower display (dILE) can be programmed to display:

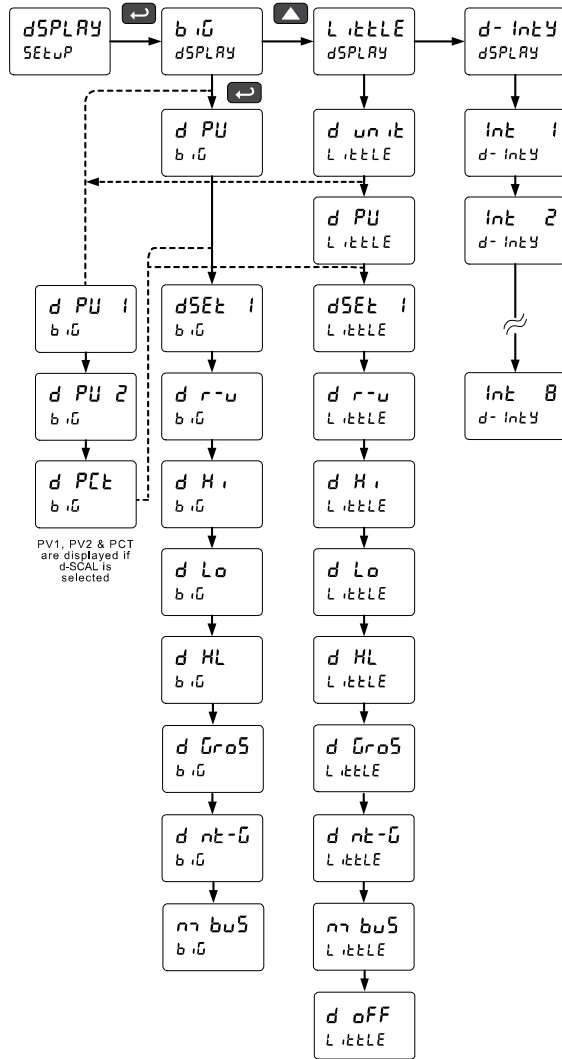
1. Unit
2. Process value 1 (PV1)
3. Process value 2 (PV2)
4. Percent of PV1 (PCT)
5. Relay set points
6. Max & min values
7. Engineering units or custom legends
8. Modbus input
9. Off (no display)
10. Toggle reading and units
11. Display gross
12. Toggle net/gross

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



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 arrow to reach the Program menu and complete the scaling or calibration of the meter.



Setting the Relay Operation (rELAY)

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

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

- Automatic reset only (non-latching)
- Automatic + manual reset at any time (non-latching)
- Latching (manual reset only)
- Latching with Clear (manual reset only after alarm condition has cleared)
- Pump alternation control (automatic reset only)
- Sampling (the relay is activated for a user-specified time)
- Off (relay state controlled by Interlock feature)

2. Set point

3. Reset point

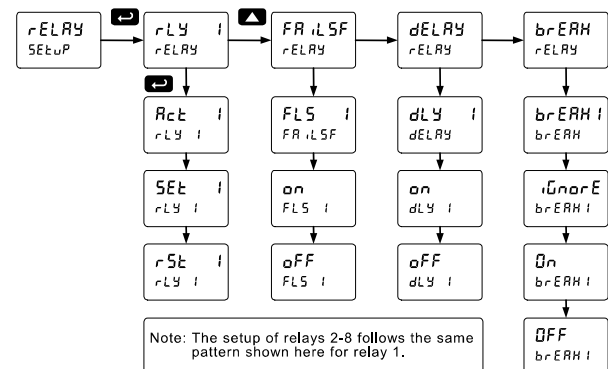
4. Fail-safe operation

- On (enabled)
- Off (disabled)

5. Time delay

- On delay (0-999.9 seconds)
- Off delay (0-999.9 seconds)

6. Relay action for loss (break) of 4-20 mA input (ignore, on, off)



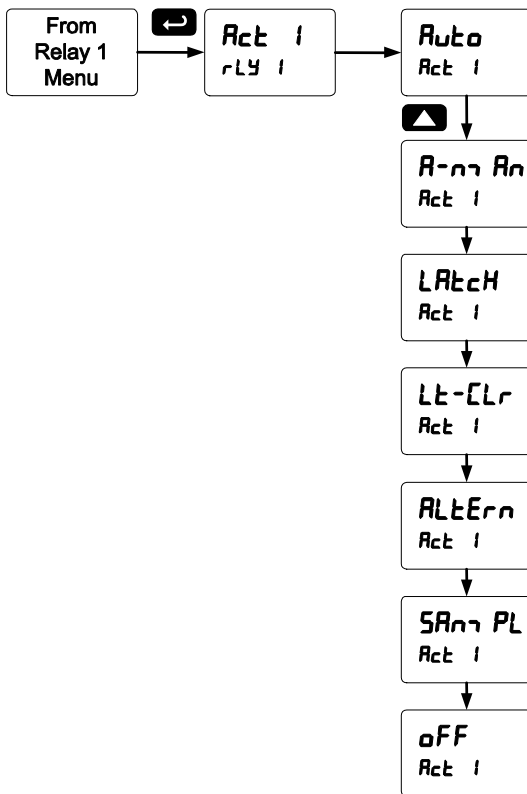


Setting the Relay Action

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

1. Automatic reset (non-latching)
2. Automatic + manual reset at any time (non-latching)
3. Latching (manual reset only, at any time)
4. Latching with Clear (manual reset only after alarm condition has cleared)
5. 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.



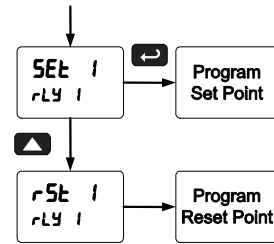
Programming Set and Reset Points

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)

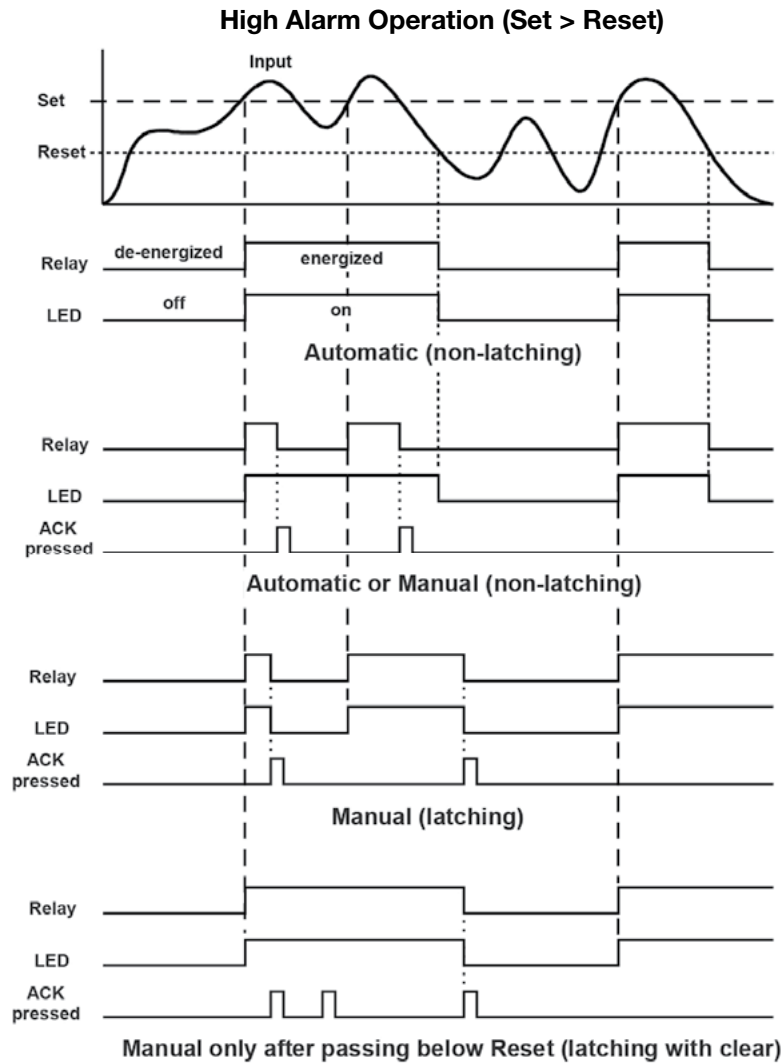
The loop break feature is associated with the 4-20 mA input. Each relay may be programmed to go to one of the following conditions when the meter detects the loss of the input signal (i.e. < 0.005 mA):

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

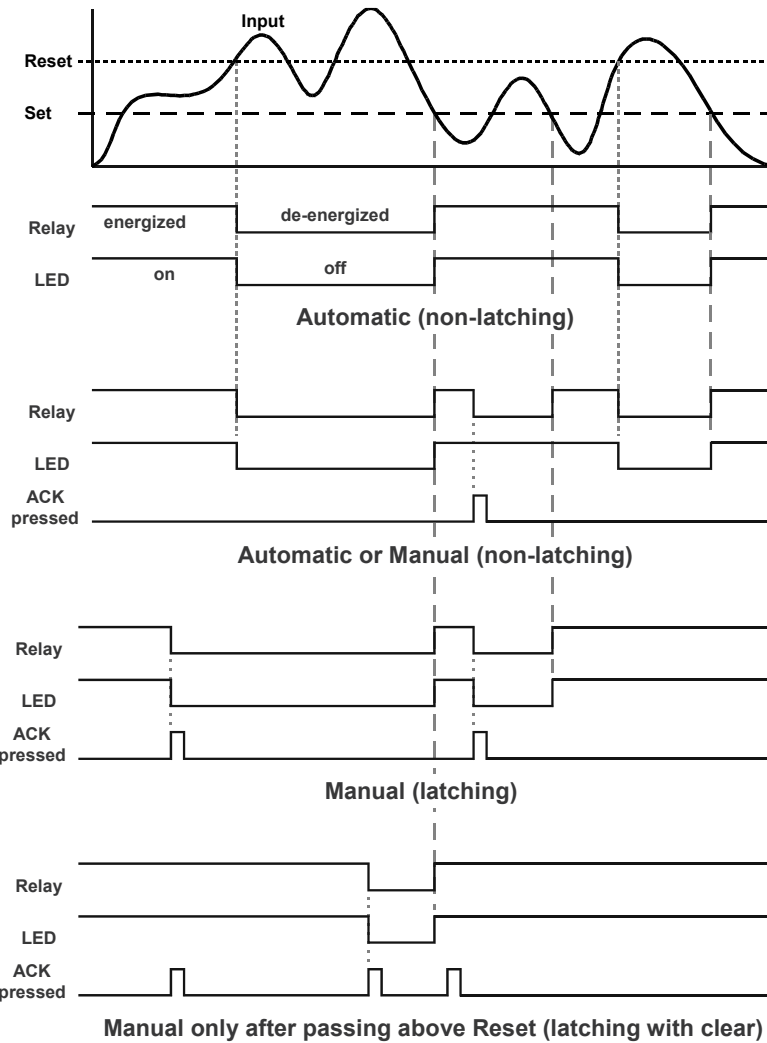
The following graphs illustrate the operation of the relays, status LEDs, and ACK button.



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



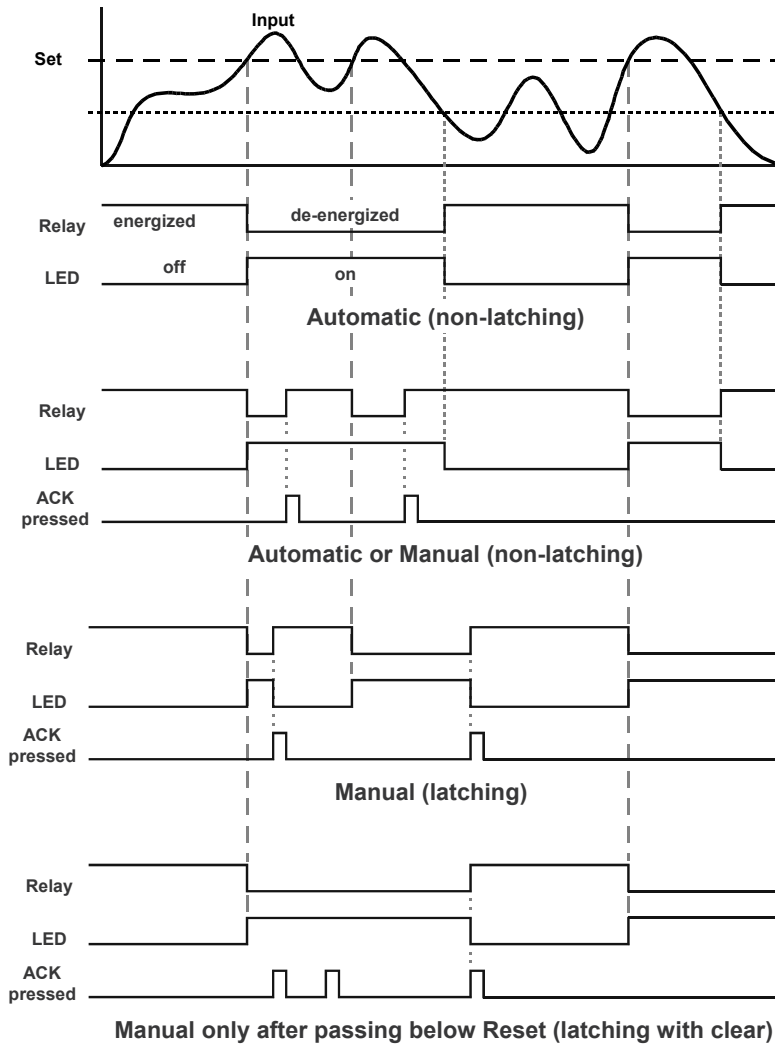
Low Alarm Operation (Set < Reset)



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



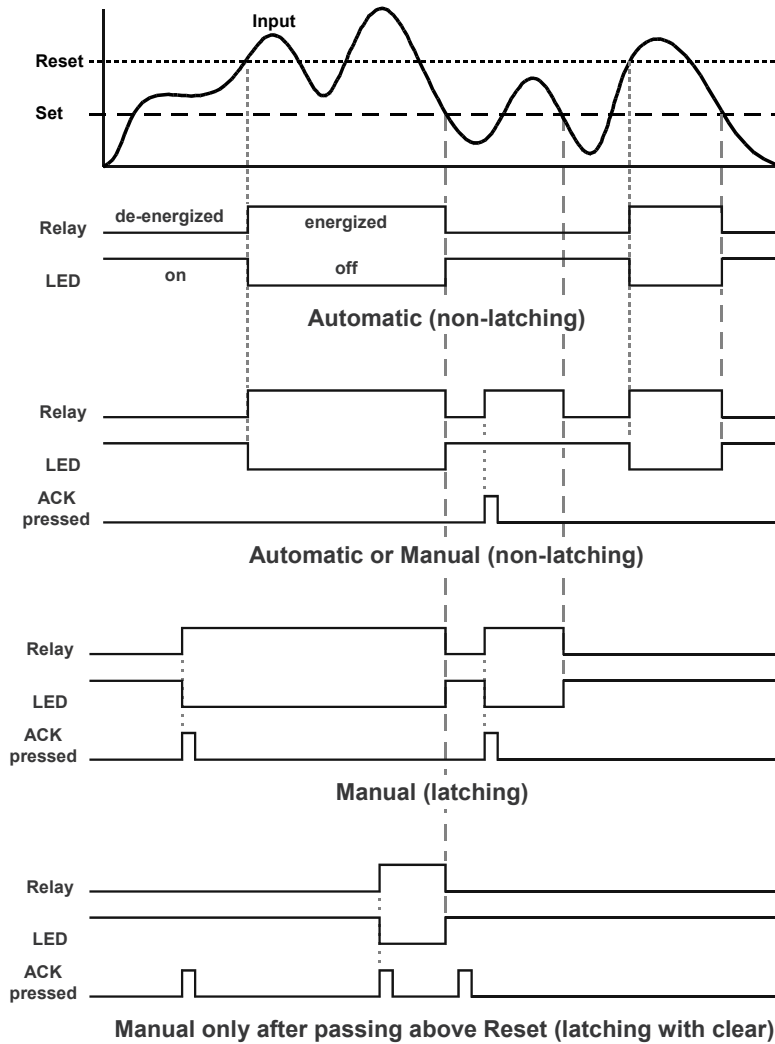
High Alarm with Fail-Safe Operation (Set > Reset)



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



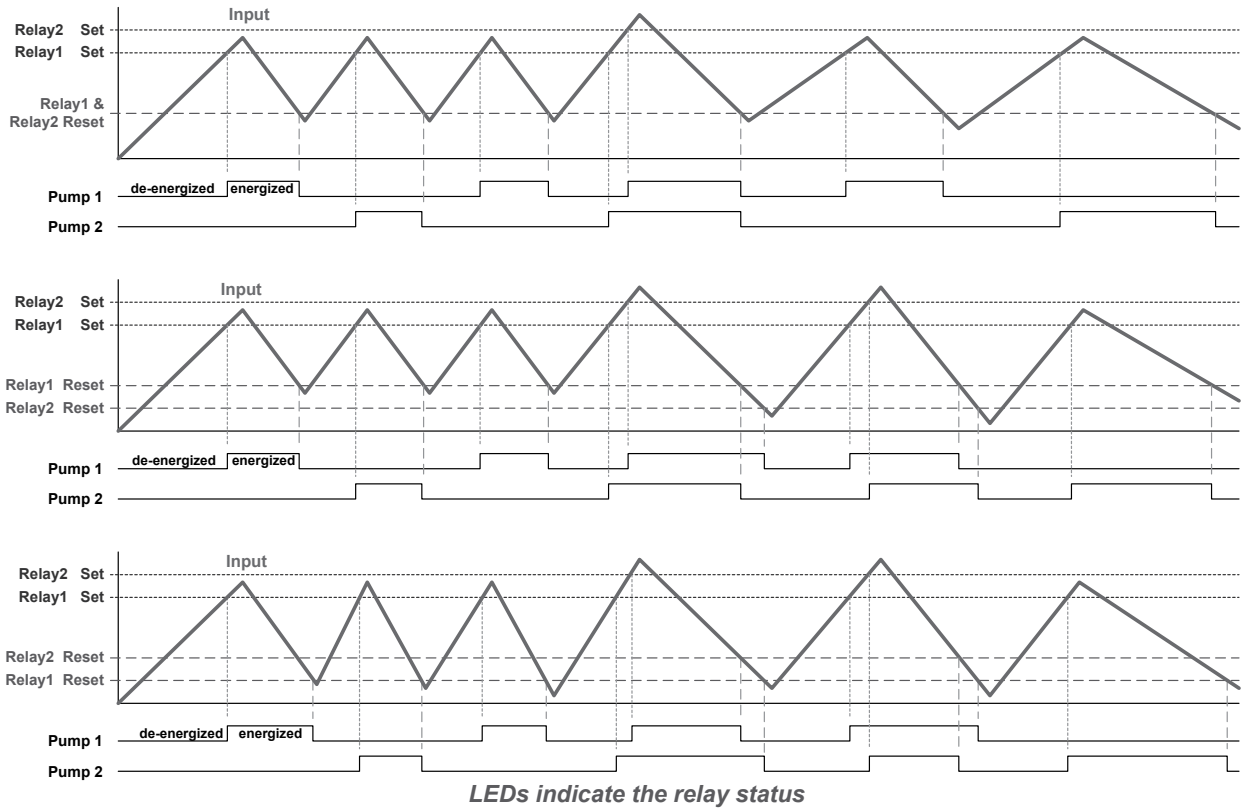
Low Alarm with Fail-Safe Operation (Set < Reset)



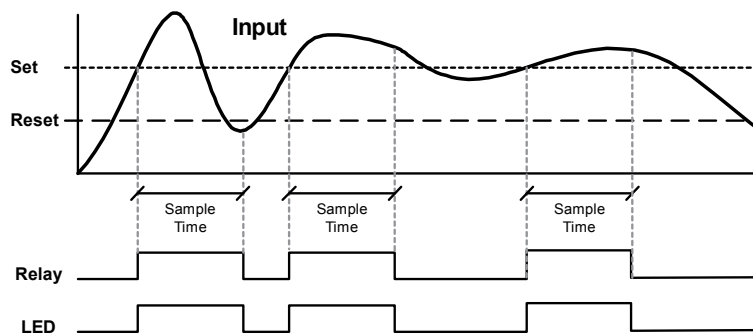
Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.



Pump Alternation Control Operation



Relay Sampling Operation



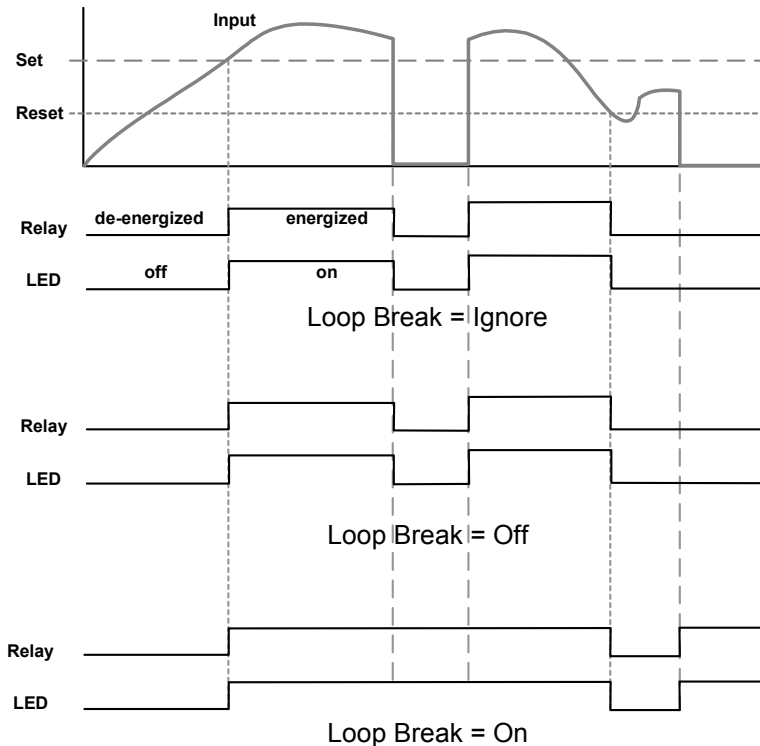
When the signal crosses the set point, the relay trips and the sample time starts. After the sample time has elapsed, the relay resets. The cycle repeats every time the set point is crossed, going up for high alarms and going down for low alarms.

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



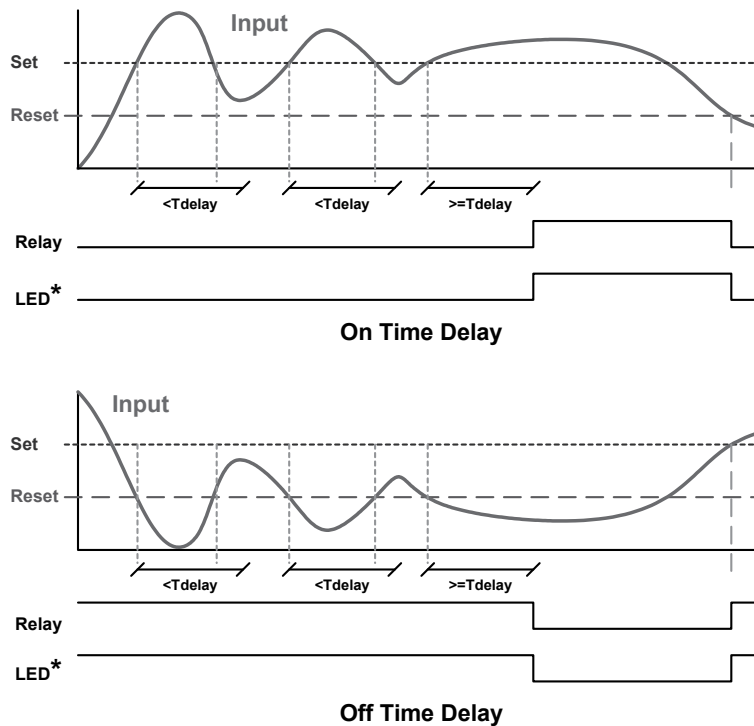
When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

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-mAn)" reset mode is selected, the LED follows the reset point and not the relay state when the relay is acknowledged.

Relay Operation Details

Overview

The relay capabilities of the meter expand its usefulness beyond simple indication to provide users with alarm and control functions. These capabilities include front panel alarm status LEDs as well as either 2 or 4 optional internal relays and/or 4 external relays expansion module. Typical applications include high or low temperature, level, pressure or flow alarms, control applications such as simple on/off pump control, and pump alternation control for up to 8 pumps. There are four basic ways the relays can be used:

1. High or Low Alarms with Latching or Non-Latching Relays
2. Simple On/Off Control with 100% Adjustable Deadband
3. Sampling (Based on Time)
4. Pump Alternation Control for up to 8 Pumps



Relays Auto Initialization

When power is applied to the meter, the front panel LEDs and alarm relays will reflect the state of the input to the meter. The following table indicates how the alarm LEDs and relays will react on power-up based on the set and reset points:

Alarm #	HI or LO Alarm	Set Point	Reset Point	Power-Up Reading	Relay & LED
1	HI	1000	500	499	Off
2	LO	700	900	499	On
3	LO	250	400	499	Off
4	HI	450	200	499	On

Fail-Safe Operation

The following table indicates how the relays behave based on the fail-safe selection for each relay:

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

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

Front Panel LEDs

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

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

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

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

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



Latching and Non-Latching Relay Operation

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

Relay terminology for following tables

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

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



WARNING: In latching relay mode, latched relays will reset (unlatch) when power is cycled.

Non-Latching Relay (Auto)

Automatic reset only

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

In this application, the meter is set up for automatic reset (non-latching relay). Acknowledging the alarm while it is still present has no effect on either the LED or the relay. When the alarm finally goes away, the relay automatically resets and the LED also goes off.

Non-Latching Relay (Auto-Reset)

Automatic + manual reset at any time

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

In this application, the meter is set up for automatic and manual reset at any time (non-latching relay). The LED and the relay automatically reset when the meter returns to the normal condition. The next time an alarm occurs, the operator acknowledges the alarm manually while the alarm condition still exists. This causes the relay to reset, but the LED stays on until the meter returns to the normal condition.

Latching Relay (LATCH)

Manual reset at 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 (LATCH-CLR)

Manual reset only after alarm condition has cleared

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

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



Acknowledging Relays

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

1. Via the programmable front panel function keys F1-F3 (Default: F3 assigned to ACK).
2. Remotely via a normally open pushbutton wired across one of the digital inputs and the +5 V terminals on the digital I/O modules, or using the F4 digital input, which is triggered with a contact closure to COM, or with an active low signal (see page 24).

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

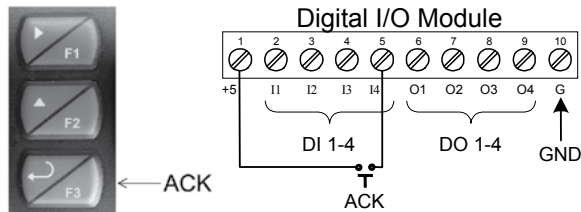


Figure 21. Acknowledge Relays w/Function Key or Digital Input

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.



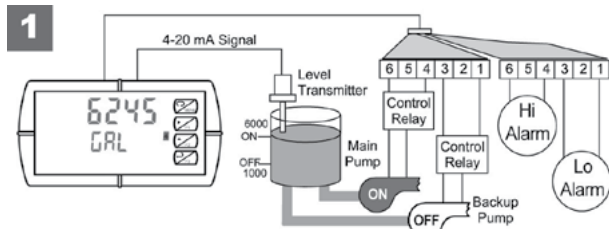
Application #2: Pump Alternation Using Relays 3 & 4

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.

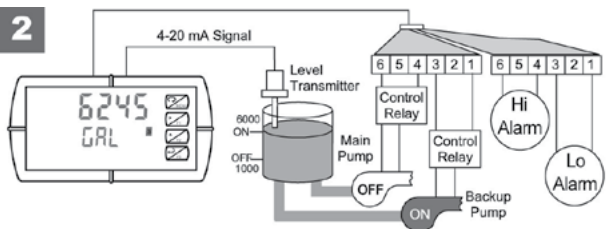
Set and Reset Point Programming

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

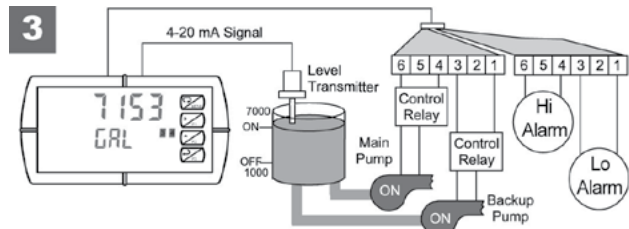
The following graphics provide a visual representation of a typical pump alternation application with high and low alarm monitoring:



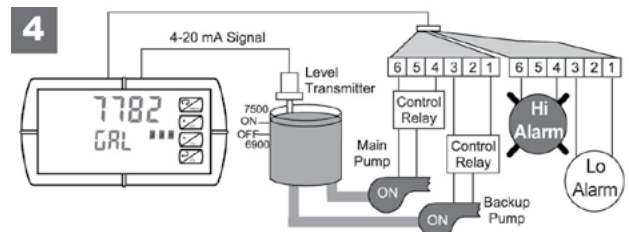
1. Relay #4 turns the main pump on at 6000 gallons and turns it off at 1000 gallons.



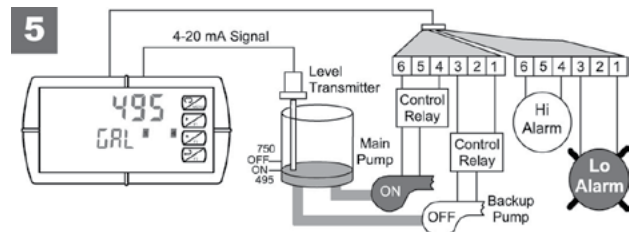
2. With the Pump Alternation feature activated, the next time the level reaches 6000 gallons, relay #3 transfers and starts the backup pump.



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.



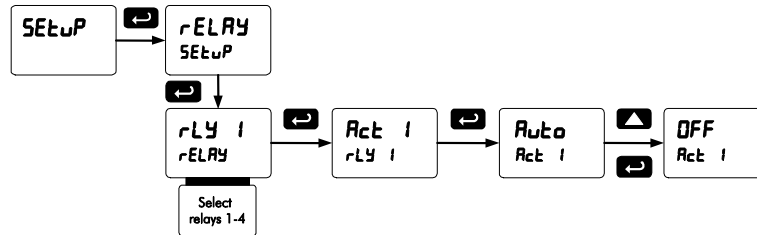
5. Relay #1 trips the Low Level Alarm at 495 gallons and resets at 750 gallons.



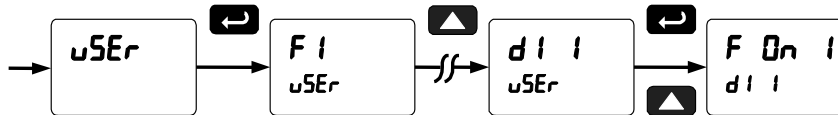
Setting Up the Interlock Relay (Force On) Feature

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

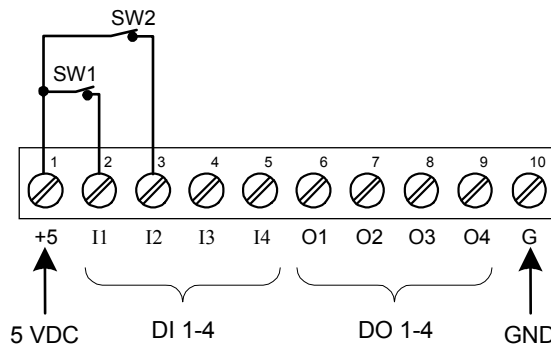
1. Access the Setup – Relay – Action menu and set the action to off.



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



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



Interlock Relay Operation Example

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

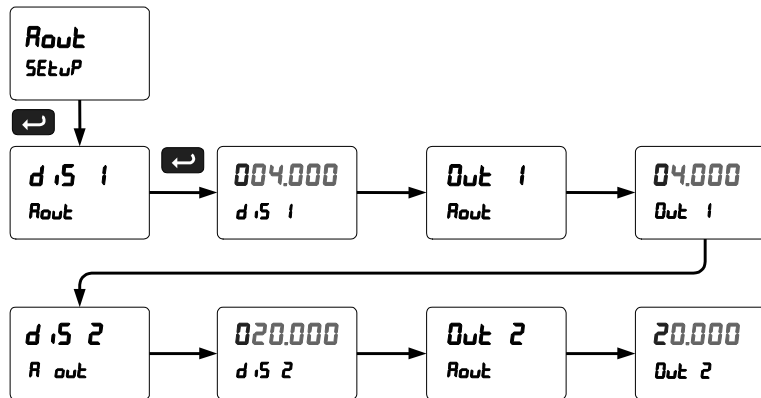
Note: If multiple digital inputs are assigned to the same relay, then the corresponding logic is (AND) – i.e. both switches must be closed to trip the relay.



Scaling the 4-20 mA Analog Output (R_{out})

The 4-20 mA analog output can be scaled to provide a 4-20 mA signal for any display range selected. No equipment is needed to scale the analog output; simply program the display values to the corresponding mA output signal.

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



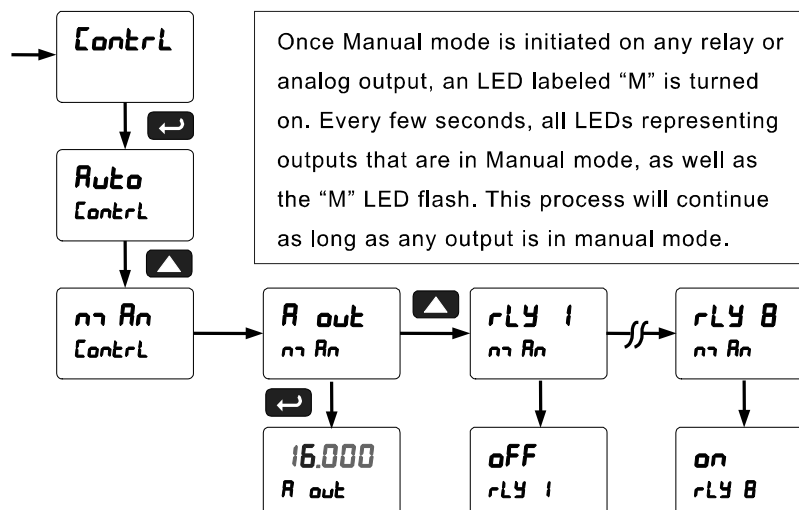
For instructions on how to program numeric values see *Setting Numeric Values*, page 33.

Reset Menu ($rESEt$)

The Reset menu is used to reset the maximum or minimum reading (peak or valley) reached by the process; both may be reset at the same time by selecting “reset high & low” (rst HL). The tare value used to zero the display may be reset by selecting “reset tare” (rst tr).

Control Menu ($Contrl$)

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





Setting Up the Password (*PASS*)

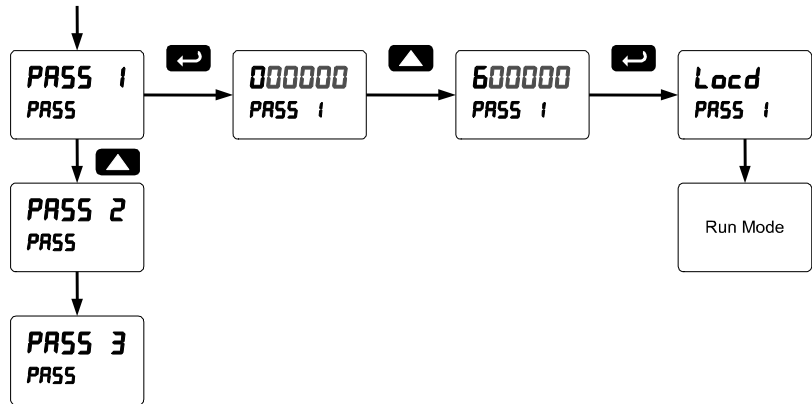
The Password menu is used for programming three levels of security to prevent unauthorized changes to the programmed parameter settings.

- Pass 1: Allows use of function keys and digital inputs
- Pass 2: Allows use of function keys, digital inputs and editing set/reset points
- Pass 3: Restricts all programming, function keys, and digital inputs.

Protecting or Locking the Meter

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

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



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

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

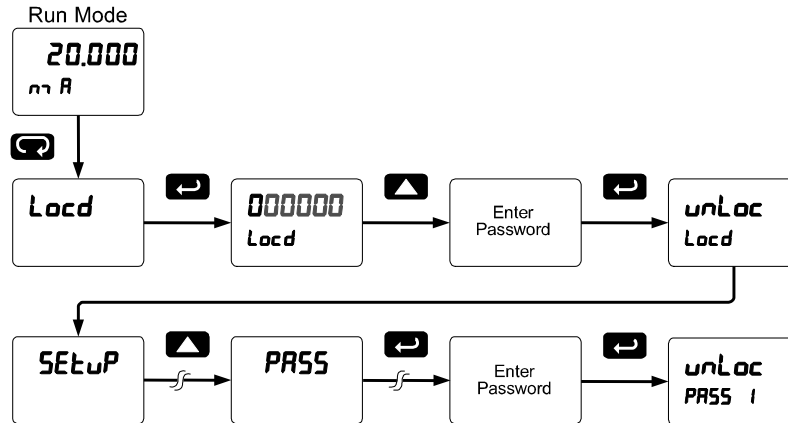
Making Changes to a Password Protected Meter

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



Disabling Password Protection

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



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

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

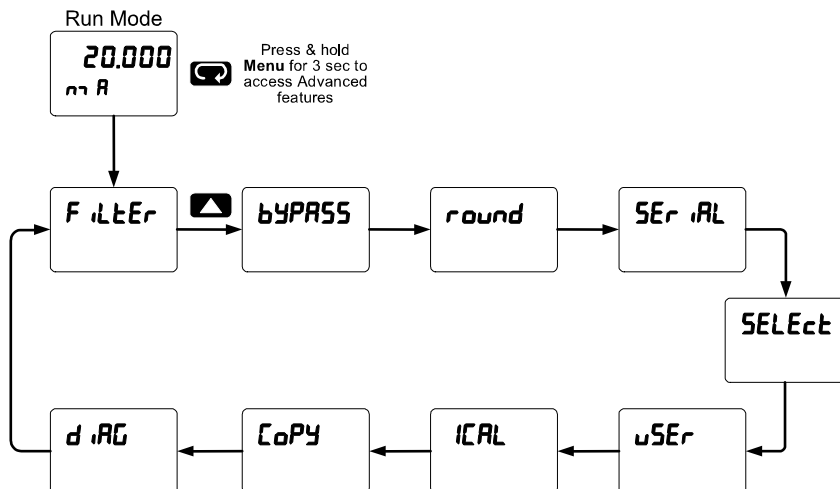
DID YOU FORGET THE PASSWORD?

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

Advanced Features Menu

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

Press and hold the Menu button for three seconds to access the advanced features of the meter.





Advanced Features Menu & Display Messages

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

Display	Parameter	Action/Setting Description
<i>FILTEr</i>	Filter	Set noise filter value
<i>bYPASS</i>	Bypass	Set filter bypass value
<i>round</i>	Round	Set the rounding value for display variables
<i>SERIAL</i>	Serial	Set serial communication parameters
<i>SLAVE Id</i>	Slave ID	Set slave ID or meter address
<i>baud</i>	Baud rate	Select baud rate
<i>Tr dLY</i>	Transmit delay	Set transmit delay for serial communication
<i>PARITy</i>	Parity	Select parity Even, Odd, or None with 1 or 2 stop bits
<i>t-bytE</i>	Time byte	Set byte-to-byte timeout
<i>SELEct</i>	Select Enter the	Select menu (function, cutoff, out)
<i>Functn</i>	Signal input conditioning	Select linear, square root, programmable exponent, or round horizontal tank function
<i>LI nEAR</i>	Linear	Set meter for linear function and select number of linearization points
<i>PV 1</i>	PV1	Select PV1 number of linearization points
<i>PV 2</i>	PV2	Select PV2 number of linearization points
<i>no Pts</i>	Number of points	Set PV1 for 2 to 32-point linearization Set PV2 for 2 to 8-point linearization
<i>SqURrE</i>	Square root	Set meter for square root extraction
<i>Prog E</i>	Programmable exponent	Set meter for programmable exponent and enter exponent value
<i>rhE</i>	Round horizontal tank	Set meter for round horizontal tank volume calculation
<i>inch</i>	Dimension	Calculate volume in gallons
<i>litr</i>	Dimension	Calculate volume in liters
<i>di AMr</i>	Diameter	Enter the tank's diameter in inches
<i>LEnGth</i>	Length	Enter the tank's length in inches
<i>CutoFF</i>	Cutoff	Set low-flow cutoff
<i>OutPr</i>	Analog output programming	Program analog output parameters
<i>Source</i>	Source	Select source for the 4-20 mA output
<i>OverRng</i>	Overrange	Program mA output for display overrange
<i>UnderRng</i>	Underrange	Program mA output for display underrange
<i>brEAK</i>	Break	Set input break condition operation
<i>max</i>	Maximum	Program maximum mA output allowed
<i>min</i>	Minimum	Program minimum mA output allowed
<i>CALib</i>	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)



Display	Parameter	Action/Setting Description
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	User I/O	Assign function keys and digital I/O
F1	F1 function key	Assign F1 function key
F2	F2 function key	Assign F2 function key
F3	F3 function key	Assign F3 function key
F4	F4 function	Assign F4 function (digital input)
dI 1	Digital input 1	Assign digital input 1 – 8, if expansion modules are connected
dO 1	Digital output 1	Assign digital output 1 – 8, if expansion modules are connected
I CAL	Internal source calibration	Enter internal source calibration (used for scaling the meter without a signal source)
C CAL	Current calibration	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
C Lo	Current low	Calibrate low current input (e.g. 4 mA)
C HI	Current high	Calibrate high current input (e.g. 20 mA)
V CAL	Voltage calibration	Calibrate voltage input
V Lo	Voltage low	Calibrate low voltage input (e.g. 0 V)
V HI	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
DI AG	Diagnostics	Display parameter settings
INPut	Input	Input selection
unItS	Units	Select the display units/tags
FI LTER	Filter	Filter value
bYPASS	Bypass	Bypass value
Round	Round	Round value
Functn	Function	Function selected
SCALE	Scale	Scaling parameter
CuTtoFF	Cutoff	Cutoff value
dSPLaY	Display	Display assignments
rELAY	Relays	Relay settings
RoUt	Analog output	Analog output scaling
RoUtPr	Analog output programming	Analog output programming
SErI aL	Serial	Serial communication settings
LEd t	LED test	Test all LEDs
INFo	Information	Display software and S/N information



Noise Filter (*FILTEr*)

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

Noise Filter Bypass (*bYPASS*)

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

Rounding Feature (*round*)

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

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

Modbus RTU Serial Communications (*SErIAL*)

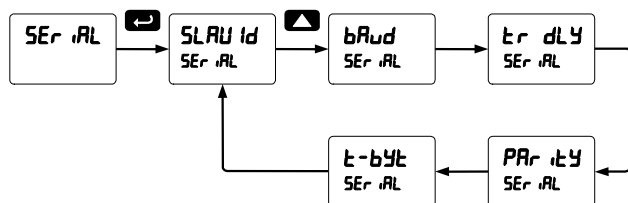
The meter is equipped with serial communications capability as a standard feature using Modbus RTU Serial Communication Protocol.

To communicate with a computer or other data terminal equipment, a USB adapter option is required; see Ordering Information on page 7 for details.



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

Note: Refer to the Modbus Register Tables located at www.ametekusg.com for details.



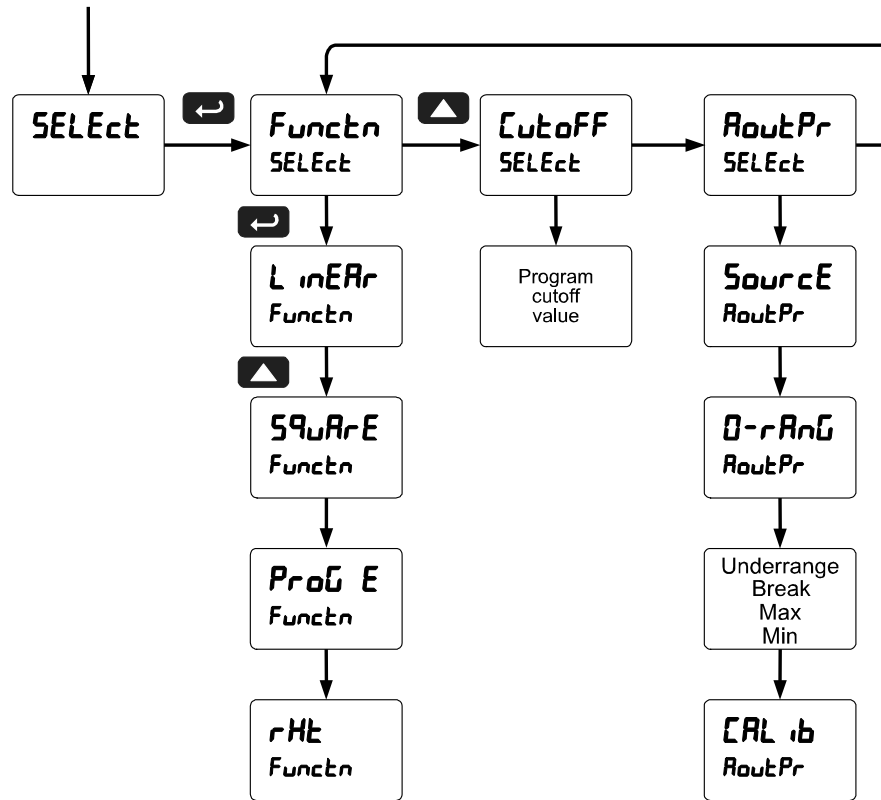
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) may be programmed between 1 and 247. The transmit delay may be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop bits.

The DDMC can also be connected to another DDMC with a special K516132 cable, allowing the user to copy all the settings from one meter to another, using the Copy function.



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 (*SQUARrE*)

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*)

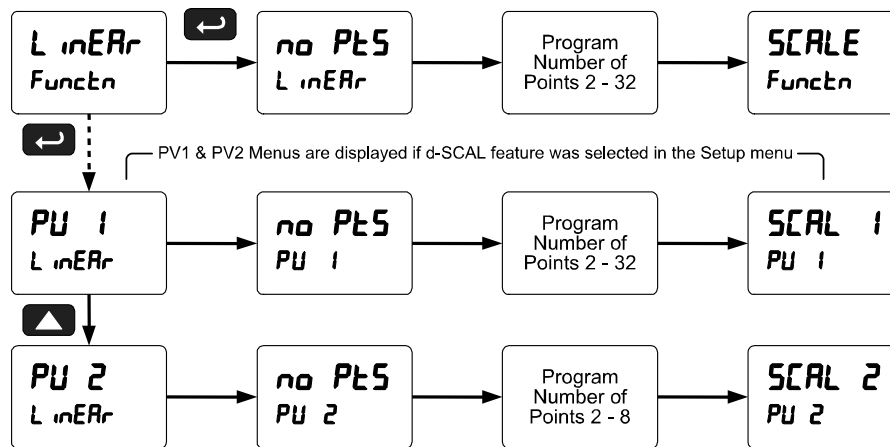
The programmable exponent can be used to linearize the signal from level transmitters in open-channel flow applications using weirs and flumes.



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.

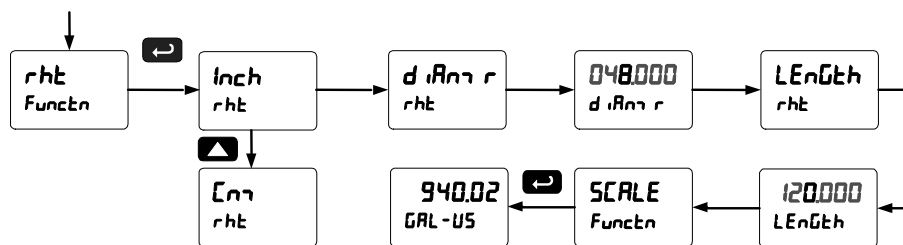


Round Horizontal Tank Linearization (RHET)

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 dis 2 is shown on the upper 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 (CutoffF)

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.

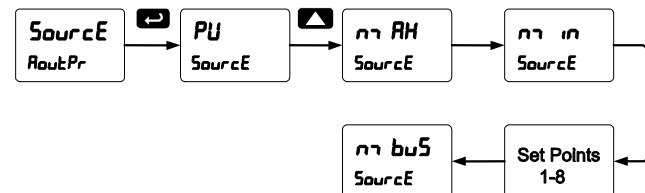
Analog Output Programming (RoutPr)

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

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

Analog Output Source

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



Analog Output Calibration

To perform the analog output calibration it is recommended to use a milliamp meter with a resolution of at least 0.1 μ 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, F2, and F3, the digital input F4, and up to eight additional digital inputs 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. Up to eight digital outputs can be assigned to a number of actions and functions executed by the meter (e.g. Alarms, relay acknowledgement, etc.).

Function Keys & Digital I/O Available Settings

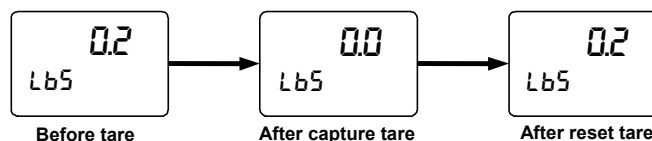
Display	Description	Display	Description
rSt HL	Reset max & min	ContrL	Control Menu
tAR-E	Capture tare	diSAbL	Disable function key
rSt tr	Reset tare	AcH	Acknowledge relays
rELAY	Relay menu	rESEt	Reset Menu
SEt 1	Set point 1 - 8	rSt HI	Reset max
rLY d	Disable all relays	rSt Lo	Reset min
rLY E	Enable all relays	mEnu	Menu button
o HoLd	Relays & output hold	RI Ght	Right arrow button/F1
d HoLd	Display Hold	uP	Up arrow button/F2
bl G HI	Max on Upper display	EntEr	Enter button/F3
bl G Lo	Min on Upper display	ALm 1	Alarm 1 – 8
bl G HL	Max/min Upper display	F On 1	Force relay 1 on
LI t HI	Max on lower display	F On 2	Force relay 2 on
LI t Lo	Min on lower display	F On 3	Force relay 3 on
LI t HL	Max/min lower display	F On 4	Force relay 4 on

Tare (tAR-E)

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 (ICAL)

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

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

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

Notes:

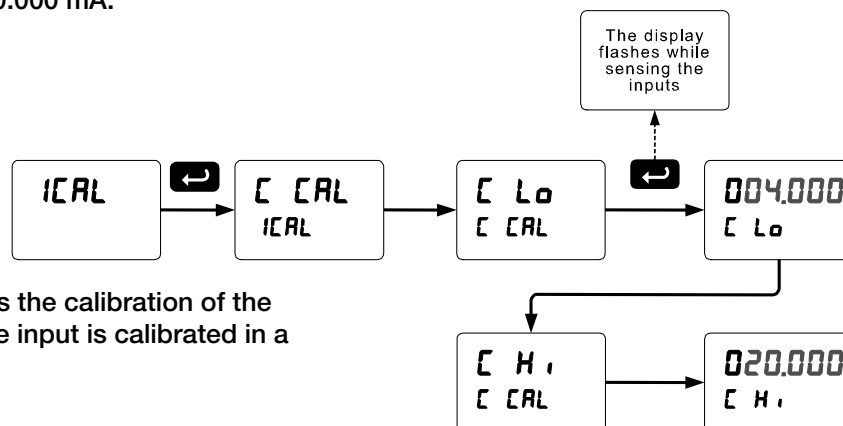
1. If meter is in operation and it is intended to accept only one input type (e.g. 4-20 mA), recalibration of other input is not necessary.
2. Allow the meter to warm up for at least 15 minutes before performing the internal source calibration procedure.

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

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

Example of Internal Calibration for current input:

4. The meter displays low input current message (C lo). Apply the low input signal and press Enter. The display flashes for a moment while the meter is accepting the low input signal.
5. After the display stops flashing, a number is displayed with the leftmost digit brighter than the rest. The bright digit is the active digit that can be changed by pressing the Up arrow button. Press the Right arrow button to move to the next digit.
6. Set the display value to correspond to the input signal being calibrated, typically 4.000 mA
7. The display moves to the high input calibration (C Hi). Apply the high input signal and press Enter.
8. Set the display for the high input calibration, in the same way as it was set for the low input calibration, typically 20.000 mA.



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 K516132 meter copy cable must be used for meter-to-meter interfacing.

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 59, for 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 K516132 meter copy cable.



WARNING: Using standard CAT5 or other cable will cause damage to both meters. Use K516132 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 48.
5. Scroll to the Copy function using the Up arrow button then press Enter.
6. The meter displays the message Send. Press Enter, the display flashes while sending data. The message done is displayed when copying is completed.
7. The Clone meter displays the message *COPY REC* while being programmed then the message done when copying is completed. The meter initializes and returns to Run Mode using the same settings as the Master.
8. If meter to be cloned does not respond to the data being sent, refer to *Copy Function Requirements* above.



METER OPERATION

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

The dual-line display can be customized by the user to operate in such a way as to satisfy a specific application. Typically the upper display is used for the process variable; while the lower 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 upper display could indicate level in feet and the lower display could indicate the volume in gallons.

Additionally the meter can be set up to display the analog input on the upper display and the Modbus input on the lower display. The relays and analog output can be programmed to operate from the Modbus PV input.

Front Panel Buttons Operation

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

Function Keys Operation

During operation, the programmable function keys operate according to the way they have been programmed in the *Advanced Features – User menu*.

The table above shows the factory default settings for F1, F2, and F3.

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 momentary:

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

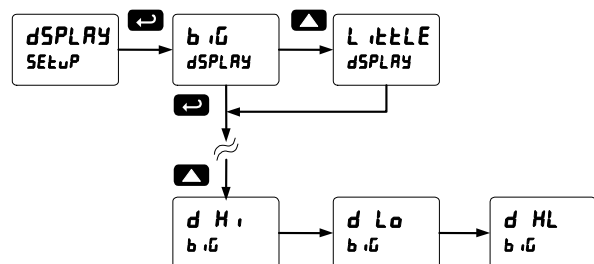
Any of the F1-F3 function keys (buttons) and the digital inputs can be programmed to reset the max & min readings. The meters are set at the factory to display the max reading by pressing the Up arrow/F2 button and to use the Right arrow/F1 button to access the Reset menu.

To display max reading using function key with factory defaults:

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

To display max/min readings continuously:

Assign either display to Max (d HI), Min (d LO), or toggle between Max and Min (d HL) every 10 seconds.





Level Mate III Input Type & Display Scaling

I	II	III	IV	VI	VII
LEVEL MATE III	TRANSMITTER	INPUT TYPE 4-20 mA	INCHES OF WATER	FEET OF WATER	METERS OF WATER
LM5	575SB0006RLS	Read LO	00.0	0.00	.000
		Read HI	166.4	13.86	4.226
LM5	575SB0015RLS	Read LO	00.0	0.00	0.00
		Read HI	415.9	34.66	10.56
LM5	575SB0030RLS	Read LO	00.0	0.00	0.00
		Read HI	831.9	69.32	21.13
LM5	575SB0060RLS	Read LO		00.0	0.00
		Read HI		138.6	42.26
LM5	575SB0100RLS	Read LO		00.0	0.00
		Read HI		231.1	70.43
LM5	575SB0150RLS	Read LO		00.0	00.0
		Read HI		346.6	105.6
LM5	575SB0200RLS	Read LO		00.0	00.0
		Read HI		462.2	140.9
LM5	575SB0300RLS	Read LO		00.0	00.0
		Read HI		693.2	211.3

- I Level Mate III model number.
*Note: 575 used in this example, but displays are the same for all sensors as applicable
- II Transmitter used.
- III The input type to be selected is 4-20 mA.
- IV Decimal point location and display reading entered for inches of water level measurements.
- VI Decimal point location and display reading entered for feet of water level measurements.
- VII Decimal point location and display reading entered for meters of water level measurements.



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 (dI AG)

The Diagnostics menu is located in the *Advanced Features* menu, to access Diagnostics menu see *Advanced Features Menu*, page 47.

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 48.

Determining Software Version

To determine the software version of a meter:

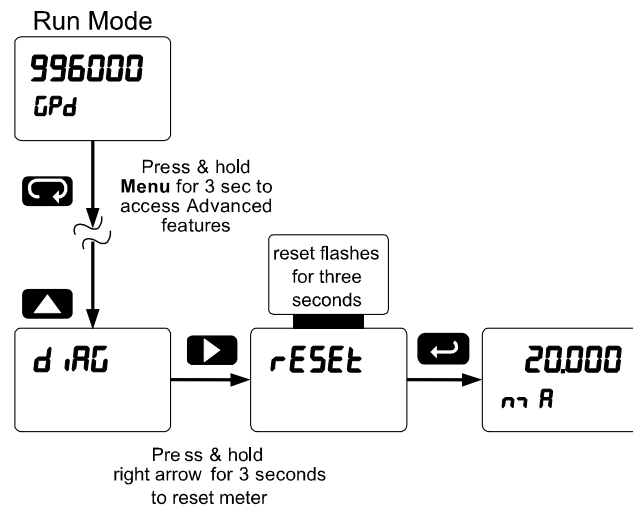
1. Go to the *Diagnostics* menu (dI AG) and press Enter button.
2. Press Up arrow button and scroll to Information menu (I nF o).
3. Press Enter to access the software number (SFT) and version (UER) information. Write down the information as it is displayed. Continue pressing Enter until all the information is displayed.
4. The meter returns to Run Mode after displaying all the settings.

Reset Meter to Factory Defaults

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

Instructions to load factory defaults:

1. Enter the Advanced Features menu. See *Advanced Features Menu*, page 47.
2. Press Up arrow to go to Diagnostics menu
3. Press and hold Right arrow for three seconds, press Enter when display flashes reset. *Note: If Enter is not pressed within three seconds, the display returns to the Diagnostics menu.*
4. The meter goes through an initialization sequence (similar as on power-up), and loads the factory default settings.



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>INPuT</i>	4-20 mA	
Dual-scale feature	<i>d-SCAL</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>DIS 1</i>	4.000	
Input 2	<i>INP 2</i>	20.000 mA	
Display 2	<i>DIS 2</i>	20.000	
Decimal point	<i>dd.ddd</i>	3 places	
Cutoff value	<i>CuTtOFF</i>	0.000 (disabled)	
Display assignment	<i>dSPLAY</i>		
Upper display	<i>blG</i>	PV: Process variable	
Lower display	<i>LI ttle</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	
Relay 3 reset point	<i>rSEt 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>rSEt 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>ORng</i>	21.000 mA
Underrange output	<i>URng</i>	3.000 mA
Loop break output	<i>brEAK</i>	1.000 mA
Maximum output	<i>max</i>	23.000 mA
Minimum output	<i>min</i>	1.000 mA
Slave ID (Address)	<i>SLAVE id</i>	247
Baud rate	<i>baud</i>	9600
Transmit delay	<i>tr dLY</i>	50 ms
Parity	<i>PARiTY</i>	Even
Byte-to-byte timeout	<i>t-byt</i>	010 (0.1 sec)
F1 function key	<i>F1</i>	Reset max & min
F2 function key	<i>F2</i>	Upper display: Max (Hi)
F3 function key	<i>F3</i>	Acknowledge relays
F4 function	<i>F4</i>	Acknowledge relays
Digital input 1	<i>di 1</i>	Menu
Digital input 2	<i>di 2</i>	Right arrow
Digital input 3	<i>di 3</i>	Up arrow
Digital input 4	<i>di 4</i>	Enter
Digital output 1	<i>do 1</i>	Alarm 1
Digital output 2	<i>do 2</i>	Alarm 2
Digital output 3	<i>do 3</i>	Alarm 3
Digital output 4	<i>do 4</i>	Alarm 4
Password 1	<i>PASS 1</i>	000000 (unlocked)
Password 2	<i>PASS 2</i>	000000 (unlocked)
Password 3	<i>PASS 3</i>	000000 (unlocked)



Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power connector
Not able to change setup or programming, Locd is displayed	Meter is password-protected, enter correct six-digit password to unlock
Meter displays error message during calibration (Error)	Check: 1. Signal connections 2. Input selected in Setup menu 3. Minimum input span requirements
Meter displays 1. 999999 2. -99999	Check: 1. Input selected in Setup menu 2. Corresponding signal at Signal connector
Display is unstable	Check: 1. Input signal stability and value 2. Display scaling vs. input signal 3. Filter and bypass values (increase)
Display response is too slow	Check filter and bypass values
Display reading is not accurate	Check: 1. Signal input conditioner selected: Linear, square root, etc. 2. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check: 1. Display assignment, it might be displaying max, min, or set point.
Display alternates between 1. Hi and a number 2. Lo and a number	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: 1. Fail-safe in Setup menu 2. Wiring of relay contacts
Relay and status LED do not respond to signal	Check: 1. Relay action in Setup menu 2. Set and reset points
Flashing relay status LEDs	Relays in manual control mode or relay interlock switches opened.
Meter not communicating with application programs	Check: 1. Serial adapter and cable 2. Serial settings 3. Meter address and baud rate
If the display locks up or the meter does not respond at all	Cycle the power to reboot the microprocessor.
Other symptoms not described above	Call Technical Support for assistance.

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	20 mA output	Enter mA output value read by milliamp meter with at least 0.001 mA resolution
4 mA	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
AcH	Acknowledge	Acknowledge relays
Act 1	Action 1	Set relay 1 action
ALm 1	Alarm 1	Assign digital output to Alarm 1-8
ALtErn	Alternate	Set relay for pump alternation control
A-mAn	Auto-manual	Set relay for automatic & manual reset
AOuT	Analog output	Enter the Analog output scaling menu
AOuTPr	Analog output programming	Enter analog output programming
Auto	Automatic	Press Enter to set automatic operation
BAud	Baud rate	Select baud rate
bl G	Upper display	Press Enter to assign the upper display parameter (default: PV)
bl G HI	Max on Upper display	Assign digital input to display max on the upper display
bl G HL	Max/min Upper display	Assign digital input to toggle max/min on the upper display
bl G Lo	Min on Upper display	Assign digital input to display min on the upper display
brEAK	Loop break	Set relay condition if loop break detected
bYPASS	Bypass	Set filter bypass value
C CAL	Current calibration	Calibrate 4-20 mA current input (internal reference source used for scaling the input)
C HI	Current high	Calibrate high current input (e.g. 20 mA)
C Lo	Current low	Calibrate low current input (e.g. 4 mA)
TArE	Capture tare	Capture tare
CAL	Calibrate	Enter the Calibration menu
CALi b	Calibrate	Calibrate 4-20 mA output (internal reference source used for scaling the output)
ConTrL	Control	Enter Control menu to turn relays on/off, set analog output manually, or return meter to automatic operation
CoPY	Copy	Enter copy function
CuTOff	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 HI	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



Display	Parameter	Action/Setting Description
<i>d Lo</i>	Display low	Select to display the min
<i>d Pct</i>	Display PCT	Select to display percent of PV1 (dual-scale display)
<i>d PV</i>	Display PV	Select to display PV
<i>d PV1</i>	Display PV1	Select to display PV1 (dual-scale display)
<i>d PV2</i>	Display PV2	Select to display PV2 (dual-scale display)
<i>d r-u</i>	Display r-u	Select to display reading and units
<i>d unit</i>	Display units	Select to display engineering units or label
<i>dEc Pt</i>	Decimal point	Set decimal point
<i>dELAY</i>	Delay	Enter relay Time Delay menu
<i>di 1</i>	Digital input 1	Assign digital input 1-8, if expansion modules are connected
<i>di AG</i>	Diagnostics	Display parameter settings
<i>di Srrr</i>	Diameter	Enter the tank's diameter in inches
<i>d-intY</i>	Display intensity	Set display intensity level from 1 to 8
<i>di S 1</i>	Display 1	Program display 1 value
<i>di S 2</i>	Display 2	Program display 2 value (up to 32 points)
<i>di SsbL</i>	Disable	Disable function key
<i>dLY 1</i>	Delay 1	Enter relay 1 time delay setup (1-8)
<i>do 1</i>	Digital output 1	Assign digital output 1 – 8, if expansion modules are connected
<i>donE</i>	Done	Copy function completed
<i>d-SCAL</i>	Dual-scale	Enter d-SCAL menu and select Yes for dualscale display or No for single scale display
<i>dSEt 1</i>	Display set 1	Select to display set point 1 (1-8)
<i>dSPRAY</i>	Display	Enter the Display menu
<i>EntEr</i>	Enter button	Assign digital input to Enter button/F3
<i>Error</i>	Error	Error, calibration not successful, check signal or programmed value
<i>F On 1</i>	Force On 1	Force relay 1 on using digital input (1-8)
<i>F 1</i>	F1 function key	Assign F1 function key
<i>F2</i>	F2 function key	Assign F2 function key
<i>F3</i>	F3 function key	Assign F3 function key
<i>F4</i>	F4 function	Assign F4 function (digital input)
<i>FAI LSF</i>	Fail-safe	Enter Fail-safe menu
<i>FI LtEr</i>	Filter	Set noise filter value
<i>FLS 1</i>	Fail-safe 1	Set relay 1 fail-safe operation (1-8)
<i>ForcE</i>	Force	Force analog output value for loop break
<i>FuncTn</i>	Signal input conditioner	Select linear, square root, programmable exponent, or round horizontal tank function
<i>ICAL</i>	Internal source calibration	Enter internal source calibration (used for scaling the meter without a signal source)
<i>I gnorE</i>	Ignore	Ignore loop break condition
<i>InfO</i>	Information	Display software and S/N information



Display	Parameter	Action/Setting Description
<i>INP 1</i>	Input 1	Calibrate input 1 signal or program input 1 value
<i>INP 2</i>	Input 2	Calibrate input 2 signal or program input 2 value (up to 32 points)
<i>INPut</i>	Input	Enter Input selection menu
<i>LRtCH</i>	Latching	Set relay for latching operation
<i>LEd t</i>	LED test	Test all LEDs
<i>LEnGth</i>	Length	Enter the tank's length in inches
<i>Li nEARr</i>	Linear	Set meter for linear function and select number of linearization points
<i>LI t HI</i>	Max on lower display	Assign digital input to display max on the lower display
<i>LI t HL</i>	Max/min lower display	Assign digital input to toggle max/min on the lower display
<i>LI t Lo</i>	Min on lower display	Assign digital input to display min on the lower display
<i>LI t tLE</i>	Lower display	Press Enter to assign the lower display parameter (default: engineering units)
<i>Locd</i>	Locked	Enter password to unlock meter
<i>Lt-CLr</i>	Latching-cleared	Set relay for latching operation with manual reset only after alarm condition has cleared
<i>mA</i>	4-20 mA	Set meter for 4-20 mA input
<i>mAn</i>	Manual	Press Enter to manually control relays or analog output operation
<i>mAH</i>	Maximum	Program maximum mA output allowed
<i>mBUS</i>	Modbus	Select to display Modbus input or to assign Modbus input as the analog output source
<i>mEnu</i>	Menu button	Assign digital input to Menu button
<i>mIn</i>	Minimum	Program minimum mA output allowed
<i>no Pts</i>	Number of points	Set meter for 2 to 32-point linearization
<i>o HoLd</i>	Relays output hold	Assign digital input to hold all relays state
<i>OFF</i>	Off	Disable relay and front panel status LED, turn relays off, program off time delay
<i>OFF 1</i>	Off 1	Set relay 1 Off time delay (1-8)
<i>On</i>	On	Enable fail-safe operation, turn relays on, program on time delay
<i>On 1</i>	On 1	Set relay 1 On time delay (1-8)
<i>o-rAnG</i>	Overrange	Program mA output for display overrange
<i>Out 1</i>	Output 1	Program output 1 value (e.g. 4.000 mA)
<i>Out 2</i>	Output 2	Program output 2 value (e.g. 20.000 mA)
<i>PASS</i>	Password	Enter the Password menu
<i>PASS 1</i>	Password 1	Set or enter Password 1 (Allows use of the F1-F3 function keys)
<i>PASS 2</i>	Password 2	Set or enter Password 2 (Allows use of the F1-F3 function keys and changing the set/reset points)
<i>PASS 3</i>	Password 3	Set or enter Password 3 (Restricts all programming & F1-F3 keys)



Display	Parameter	Action/Setting Description
<i>PrOG</i>	Program	Enter the Program menu
<i>PrOG E</i>	Programmable exponent	Set meter for programmable exponent and enter exponent value
<i>rELAY</i>	Relay	Enter the Relay menu
<i>rESEt</i>	Reset	Press Enter to access the Reset menu
<i>rht</i>	Round horizontal tank	Set meter for round horizontal tank volume calculation
<i>rIght</i>	Right arrow	Assign digital input to Right arrow button/F1
<i>rLY 1</i>	Relay 1	Relay 1 setup (1-8)
<i>rLY d</i>	Disable relay	Assign digital input to disable all relays
<i>rLY E</i>	Enable relay	Assign digital input to enable all relays
<i>round</i>	Round	Select rounding values for PV display
<i>rSt 1</i>	Reset 1	Program reset point 1 (1-8)
<i>rSt HI</i>	Reset high	Press Enter to reset max display
<i>rSt HL</i>	Reset high & low	Press Enter to reset max & min displays
<i>rSt Lo</i>	Reset low	Press Enter to reset min display
<i>rSt tr</i>	Reset tare	Reset tare
<i>SAmPL</i>	Sampling	Set relay for sampling operation
<i>SCAL 1</i>	Scale 1	Enter the Scale 1 menu for PV1
<i>SCAL 2</i>	Scale 2	Enter the Scale 2 menu for PV2
<i>SCALE</i>	Scale	Enter the Scale menu
<i>SELEct</i>	Select	Enter Select menu (function, cutoff, output programming)
<i>SEnd</i>	Send	Send meter settings to another meter
<i>SErIAL</i>	Serial	Set serial communication parameters
<i>SEt 1</i>	Set 1	Program set point 1 (1-8)
<i>SEtUP</i>	Setup	Enter Setup menu
<i>SLAUId</i>	Slave ID	Set Slave ID or meter address
<i>Source</i>	Source	Select source for the 4-20 mA output
<i>SqUArE</i>	Square root	Set meter for square root extraction
<i>tArE</i>	Capture tare	Capture tare
<i>tr dLY</i>	Transmit delay	Set transmit delay for serial communication
<i>unItS</i>	Units	Select the display units/tags
<i>unLoc</i>	Unlocked	Program password to lock meter
<i>uP</i>	Up arrow	Assign digital input to Up arrow button/F2
<i>u-rRnG</i>	Underrange	Program mA output for display underrange
<i>uSEr</i>	User I/O	Assign function keys and digital I/O
<i>U CAL</i>	Voltage calibration	Calibrate voltage input
<i>U HI</i>	Voltage high	Calibrate high voltage input (e.g. 10 V)
<i>U Lo</i>	Voltage low	Calibrate low voltage input (e.g. 0 V)
<i>UoLEt</i>	0-10 VDC	Set meter for ±10 VDC input



Parts and Accessories

K223001	Seal plug for K554127 strain relief
K234432	Reusable canister desiccant (for nema enclosure)
K234436	Spare disposable (in-line) desiccant (for vent tube)
K234446	Replacement cartridge only, requires some assembly of parts from original assembly
K515183	Stainless support cable
K516131	RS 232 Serial adapter kit
K516132	Meter Copy cable
K542050	Meter with 2 relays only
K542053	Meter with relays and 4-20 MA analog output
K554148	Cable strain relief cord grip for NEMA 4X weathertight housing 0.20 in. to 0.35 in.
K554149	Metal conduit connector for NEMA 4X weathertight housing ½ inch NPT
K554167	Cable strain relief cord grip for NEMA 4X weathertight housing 0.11 in. to 0.26 in.
K740366	4 relay expansion module
LMA912	Lightning and surge protector for excitation and signal lines to the milliamp transmitter or meter analog output lines to other instruments
LMA918	Lightning and surge protector for 115 VAC input line to the meter
LMA919	Lightning and surge protector for 230 VAC input line to the meter
Submersible Sensor	Transmitter with cable for LM system. See model number with standard cable lengths on ordering information.

Additional Meter Options

See meter manual DDMC for other options such as serial communication, expansion modules and software for configuring, monitoring and data logging the meter from a PC.



Warranty Policy

Ametek [“Seller”] warrants these products for a period of two years from the date of shipment that all products manufactured by the seller are free from defects of material and workmanship when used within the service, range, and purpose for which they were manufactured. Seller will, at its option, repair, replace, or refund the purchase price of parts found by Seller to be defective in material or workmanship provided that written notice of such defect requesting instructions for repair, replacement, or refund is received by Seller at the address below within the warranty period and provided that any instructions thereafter given by Seller are complied with.

This warranty shall not apply (i) to the performance of any system of which Seller's products are a component part, (ii) to deterioration by corrosion or any cause of failure other than defect of material or workmanship, or (iii) to any of Seller's products or parts thereof which have been tampered with or altered or repaired by anyone except Seller or someone authorized by Seller, or subjected to misuse, neglect, abuse or improper use or misapplication such as breakage by negligence, accident, vandalism, the elements, shock, vibration, or exposure to any other service, range, or environment of greater severity than that for which the products were designed.

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This warranty does not extend to anyone other than the original Buyer from the Seller.



FACTORY SERVICE / UNIT RETURN

Factory service is available by contacting the Customer Service Department. Supply the following information:

- 1) Instrument Model Number and Serial Number as shown on the Instrument Data Tag.
- 2) Description of problem being experienced.
- 3) Description and location of the installation.

For service: (215) 355-6900 TEL
(215) 354-1804 FAX

PARTS / ORDERING

When ordering replacement parts, supply the following information:

- 1) Part description and part number.
- 2) Quantity of each item required.
- 3) Shipping instructions and address.

Mail, Telephone, Fax or Email Orders to:

AMETEK U.S. GAUGE, PMT PRODUCTS

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215-354-1802 FAX

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