



Installation and Operating Instructions

Level Mate™ III Level Measurement and Control System



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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, 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.

Safety Information

Installation:

Designed for use within installation Category II Environments as defined in IEC664: 1980/PD6499: 1981 and UL 873. 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.

CE Conformity

DMC Series digital panel meters are in accordance to:

EN 50081-1: 1993

EN 50082-1: 1995

And comply with the basic directives:

89/336/EEC






93/68/EEC

73/23/EEC



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 0-150 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	< 1.0% Full Scale	±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

Level Mate™ III Level Measurement and Control System

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	Main display: 0.60" (15 mm) high, red LEDs Second display: 0.46" (12 mm) high, red LEDs 6 digits each (-99999 to 999999), with lead zero blanking
Display Intensity	Eight user selectable intensity levels
Display Update Rate	5/second (200 ms)
Overrange	Display flashes 999999
Underrange	Display flashes -99999
Programming Methods	Four front panel buttons, digital inputs, PC and multi-point linearization utility, 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 the F1–F3 function keys Pass 2: Allows use of the F1–F3 function keys and changing the set/reset points Pass 3: Restricts all programming and F1–F3 keys Note: Digital inputs are not password protected, except programming functions.

Specifications

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 external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse
Isolated Transmitter Power Supply	Terminals P+ & P-: 24 VDC \pm 5% @ 200 mA max (standard), (12/24 VDC powered models rated @ 100 mA max). 5 or 10 VDC @ 50 mA max, selectable with internal jumper J4.
Normal Mode Rejection	Greater than 60 dB at 50/60 Hz
Isolation	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
Overvoltage Category	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.
Environmental	Operating temperature range: -40 to 65°C Storage temperature range: -40 to 85°C Relative humidity: 0 to 90% non-condensing
Connections	Removable screw terminal blocks accept 12 to 22 AWG wire, RJ45 for external relays, digital I/O, and serial communication adapters.
Enclosure	1/8 DIN, high impact plastic, UL 94V-0, color: black
Mounting	1/8 DIN panel cutout required: 3.622" x 1.772" (92 mm x 45 mm) Two panel mounting bracket assemblies are provided.
Tightening Torque	Screw terminal connectors: 5 lb-in (0.56 Nm)
Overall Dimensions	4.68" x 2.45" x 5.64" (119 mm x 62 mm x 143 mm) (W x H x D)
Weight	9.5 oz (269 g)
Warranty	2 years parts & labor

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Process Input

Inputs	Field selectable: 0-20, 4-20 mA, ± 10 V (0-5, 1-5, 0-10 V)
Accuracy	$\pm 0.03\%$ of calibrated span ± 1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span
Temperature Drift	0.005% of calibrated span/ $^{\circ}$ C max from 0 to 65 $^{\circ}$ C ambient, 0.01% of calibrated span/ $^{\circ}$ C max from -40 to 0 $^{\circ}$ C ambient
Math Functions	Linear, square root, programmable exponent, or round horizontal tank volume calculation
Multi-Point Linearization	2 to 32 points
Programmable Exponent	1.0001 to 2.9999
Low-Flow Cutoff	0-999999 (0 disables cutoff function)
Decimal Point	Up to five decimal places or none: d.ddddd, d.dddd, d.ddd, d.dd, d.d, or ddddd
Calibration Range	Input Range: 4-20 Ma, ± 10 V Minimum Span Input 1 & Input 2: 0.15 mA, 0.10 V <i>An Error Message Will Appear If The Input 1 And Input 2 Signals Are Too Close Together.</i>
Input Impedance	Voltage ranges: greater than 1 MW Current ranges: 50 - 100 W (depending on resettable fuse impedance)
Input Overload	Current input protected by resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.

Relays

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

Level Mate™ III Level Measurement and Control System

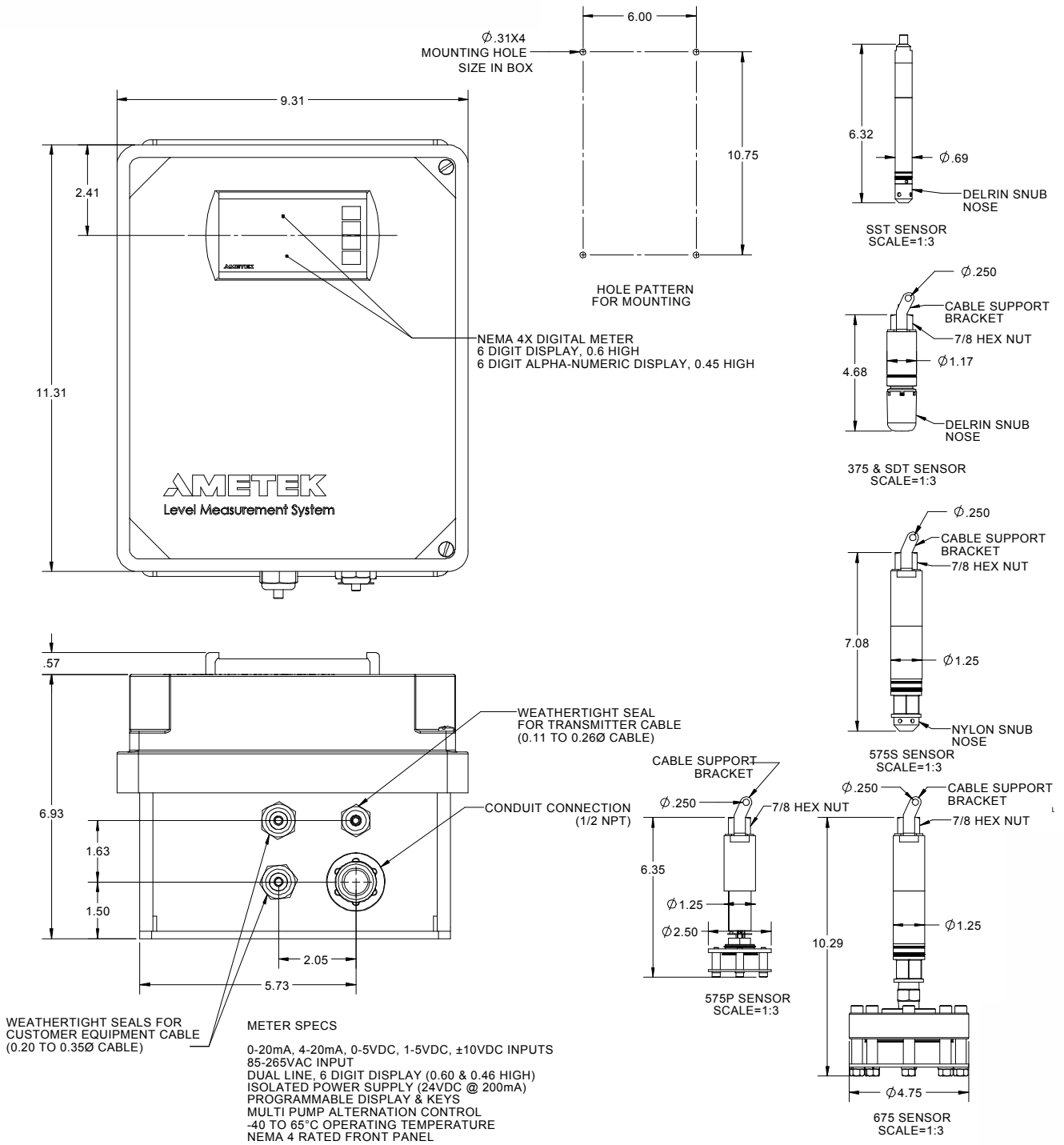
Isolated 4-20 mA Transmitter Output

Output Source	Process variable (PV), max, min, set points 1-4, or manual control mode		
Scaling Range	1.000 to 23.000 mA for any display range		
Calibration	Factory calibrated: 4.000 to 20.000 = 4-20 mA output		
Analog Out Programming	23.000 mA maximum for all parameters: Ovrange, underrange, max, min, and break		
Accuracy	± 0.1% of span ± 0.004 mA		
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 Note: Analog output drift is separate from input drift.		
Isolated Transmitter Power Supply	Terminals I+ & R: 24 VDC ± 5% @ 40 mA maximum; may be used to power the 4-20 mA output or other devices.		
External Loop Power Supply	35 VDC maximum		
Output Loop Resistance	Power supply	Minimum	Maximum
	24 VDC	10 Ohms	700 Ohms
	35 VDC (external)	100 Ohms	1200 Ohms

Serial Communications

Meter Address	1 - 247
Baud Rate	300 – 19,200 bps
Transmit Time Delay	Programmable between 0 and 199 ms or transmitter always on for RS-422 communication
Data	8 bit (1 start bit, 1 stop bit)
Parity	None
Turn Around Delay	Less than 2 ms (fixed)

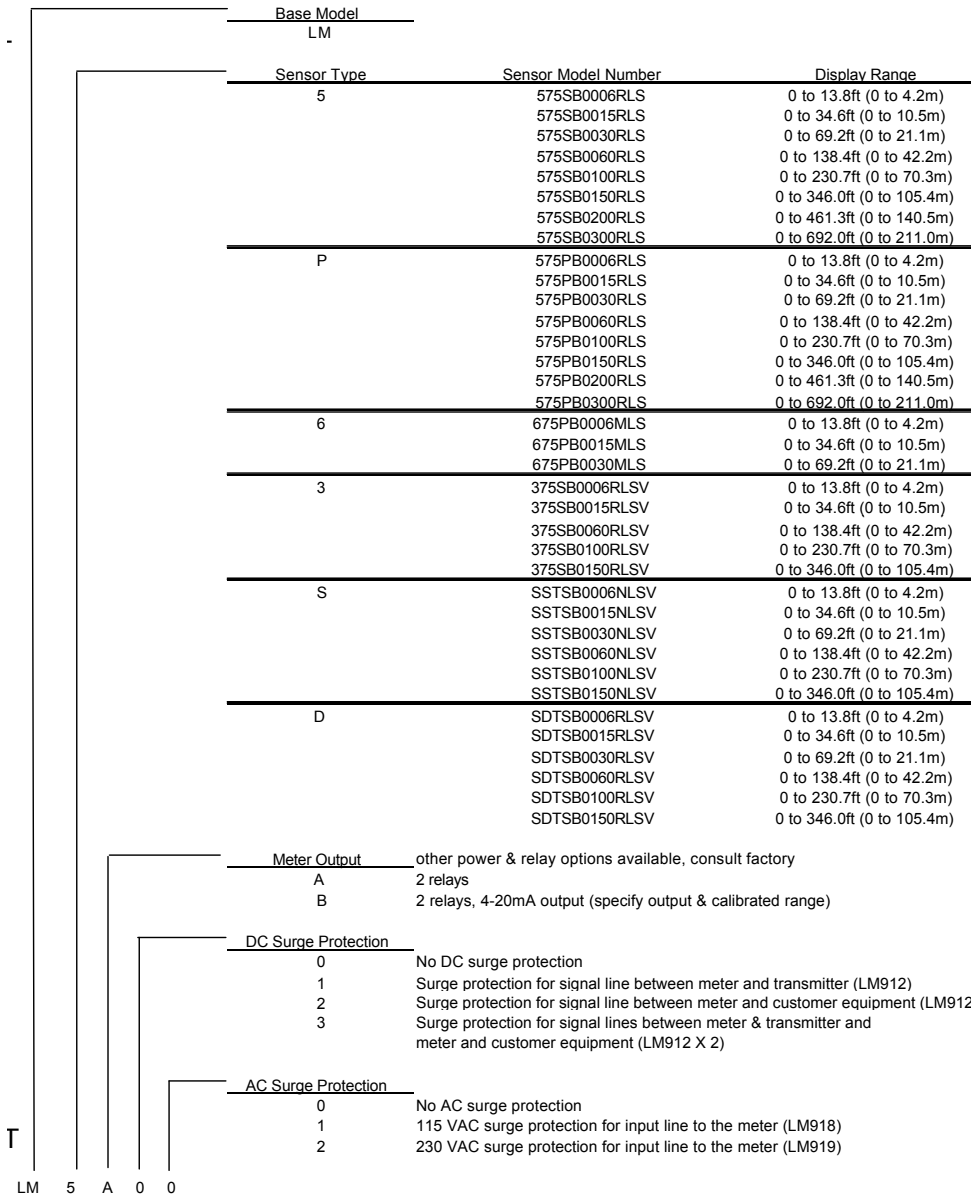
Outline Drawing



Level Mate™ III Level Measurement and Control System

Ordering Information

Model Code



Accessories	Part Number
* Length of model 575 / 575P, standard, factory installed, non vent tube, polyurethane, waterproof cable (4 cond / 22AWG)	K515076
* Length of model 675 / 375 / SST, standard, factory installed, vent tube, polyurethane, waterproof cable (3 cond / 22AWG)	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 weathertight housing (0.11 to 0.26 cable Ø range)	K554149
Cable strain relief cord grip for NEMA 4X weathertight housing (0.16 to 0.31 cable Ø range)	K554167
Cable strain relief cord grip for NEMA 4X weathertight housing (0.20 to 0.35 cable Ø range)	K554148
Surge protector for excitation & 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 & 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

* Consult factory for other cable options

Installation

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

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only by its attached shielded electrical 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.


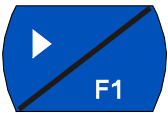


If the distance between the meter and transmitter, or meter and recorder is less than 100 ft. only one protector per line is needed.

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.

Front Panel Buttons and Status LED Indicators



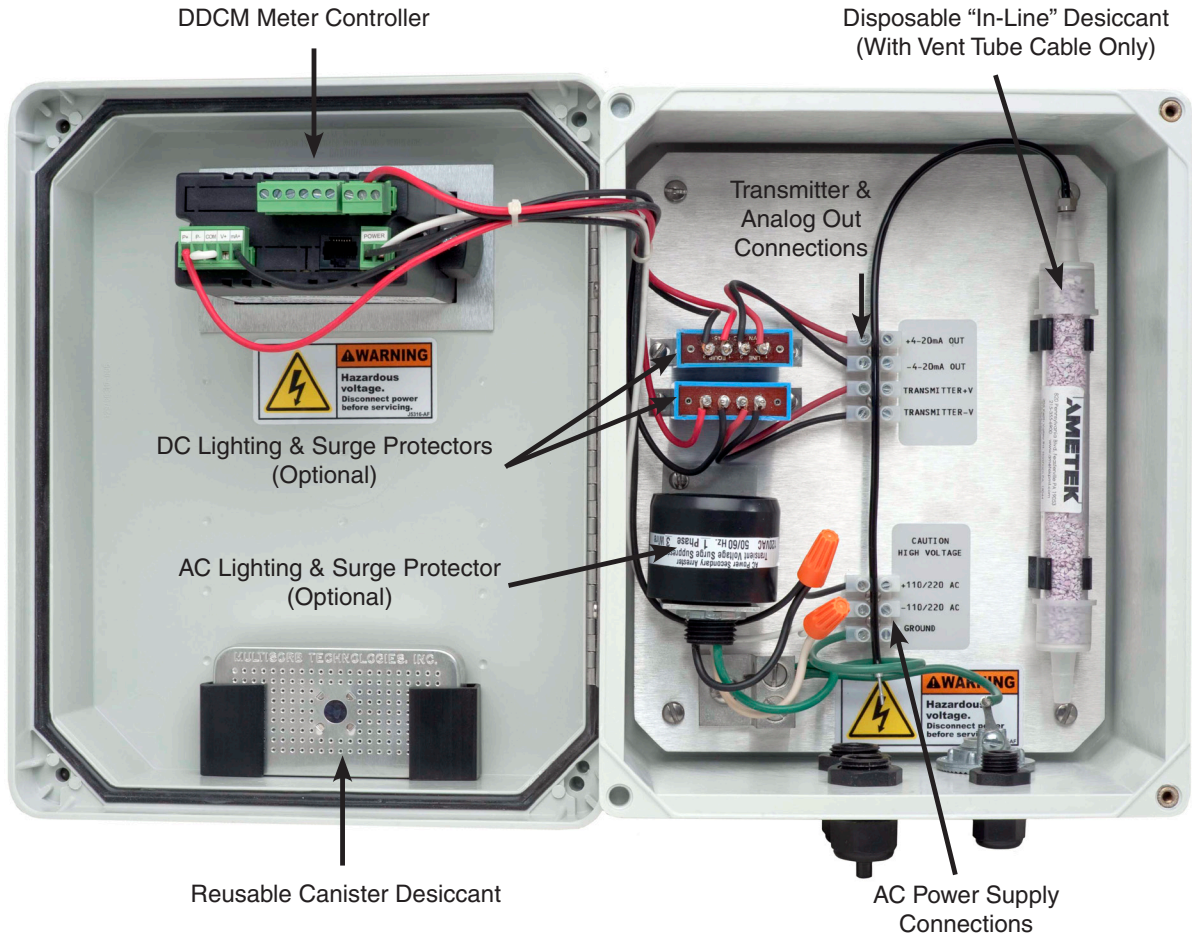
Button Symbol	Description
	Menu
	Right arrow/F1
	Up arrow/F2
	Enter/F3

LED	Status
1-4	Alarm 1 – 4 indicator

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

Level Mate™ III Level Measurement and Control System

Level Mate III Enclosure Internal Component View



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

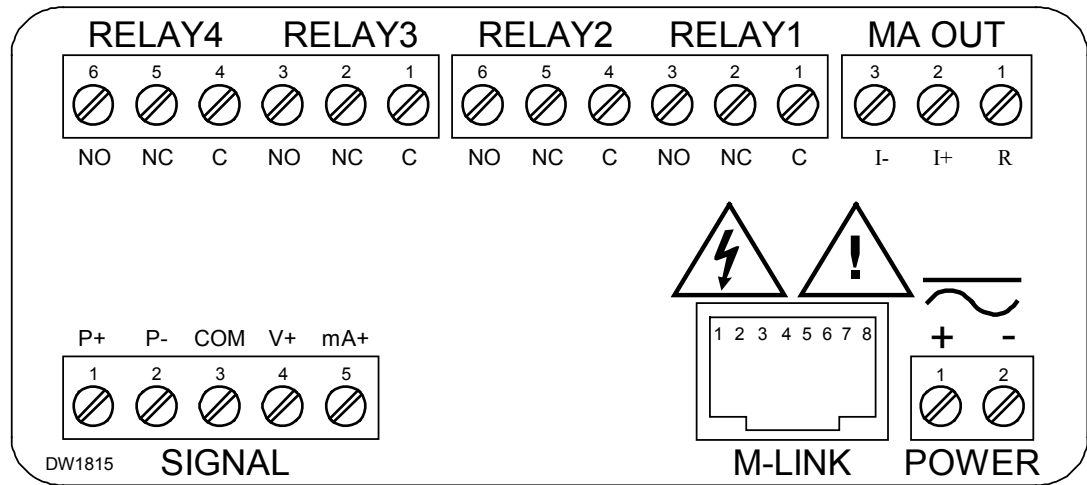
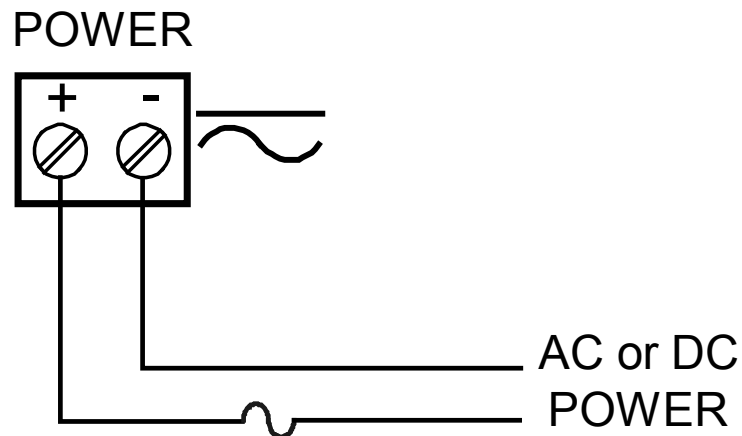


Figure 5. Connector Labeling for Fully Loaded Meter

Power Connections

Power connections are made to a two-terminal connector labeled POWER on Figure 5. The meter will operate regardless of DC polarity connection. The + and - symbols are only a suggested wiring convention.



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

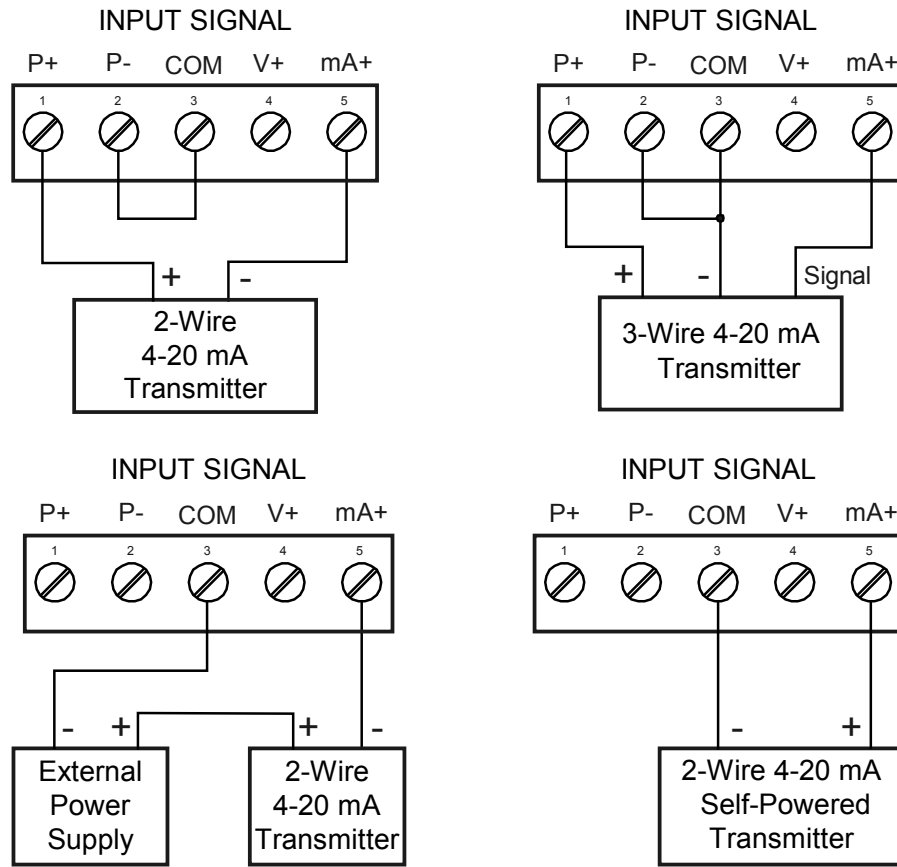
Figure 6. Power Connections

Signal Connections

Signal connections are made to a five-terminal connector labeled SIGNAL on Figure 5. 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.



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.

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.

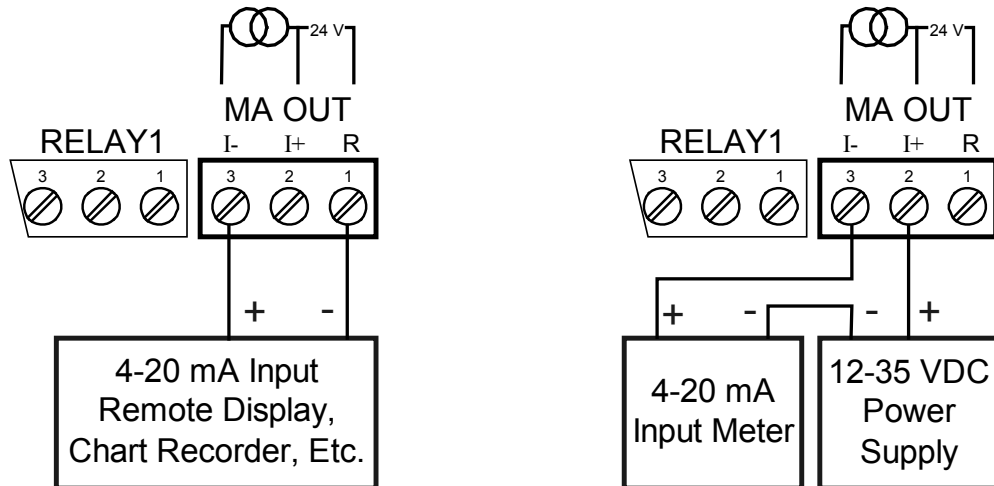


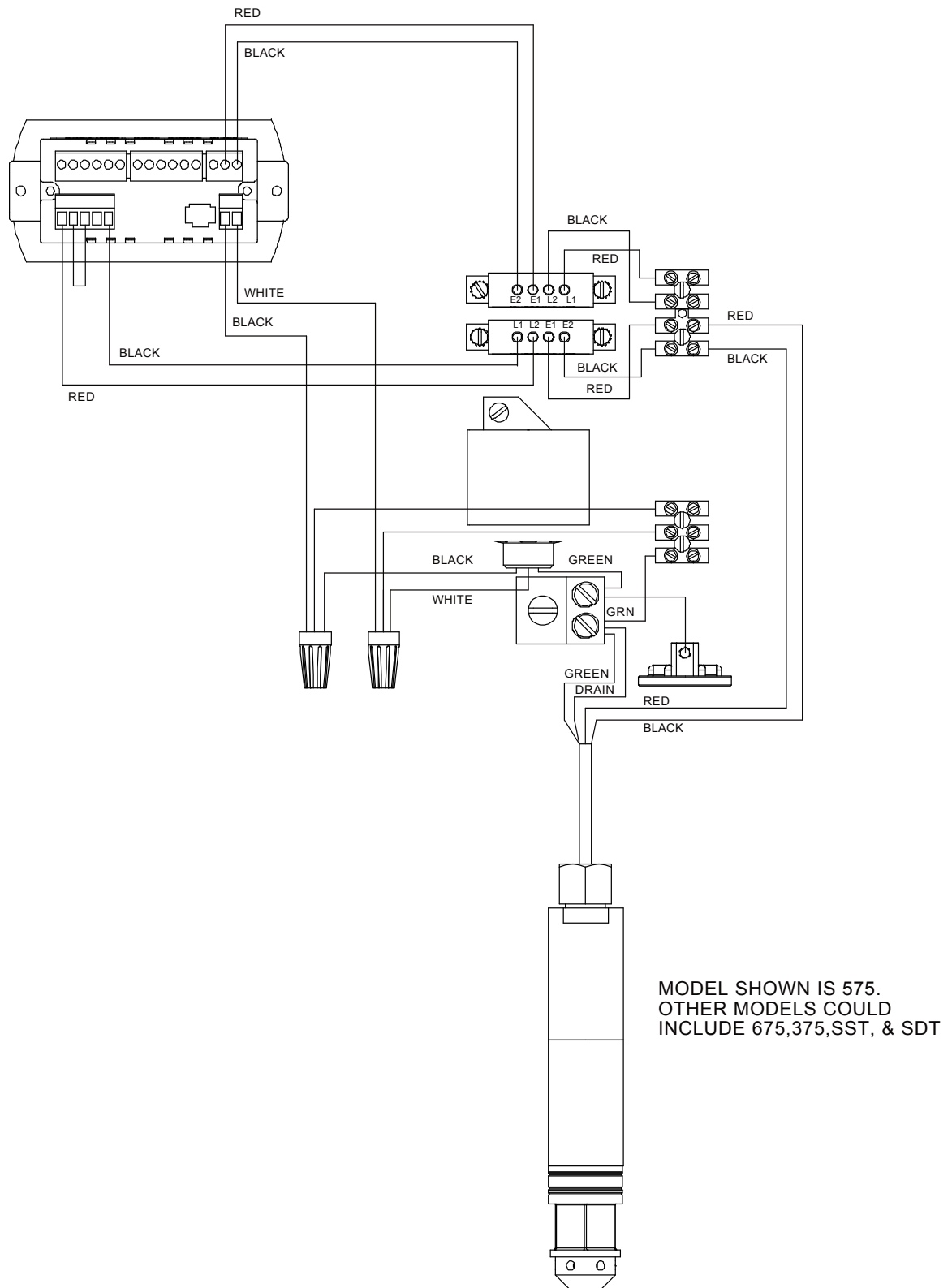
Figure 13. 4-20 mA Output Connections

Analog Output Transmitter Power Supply

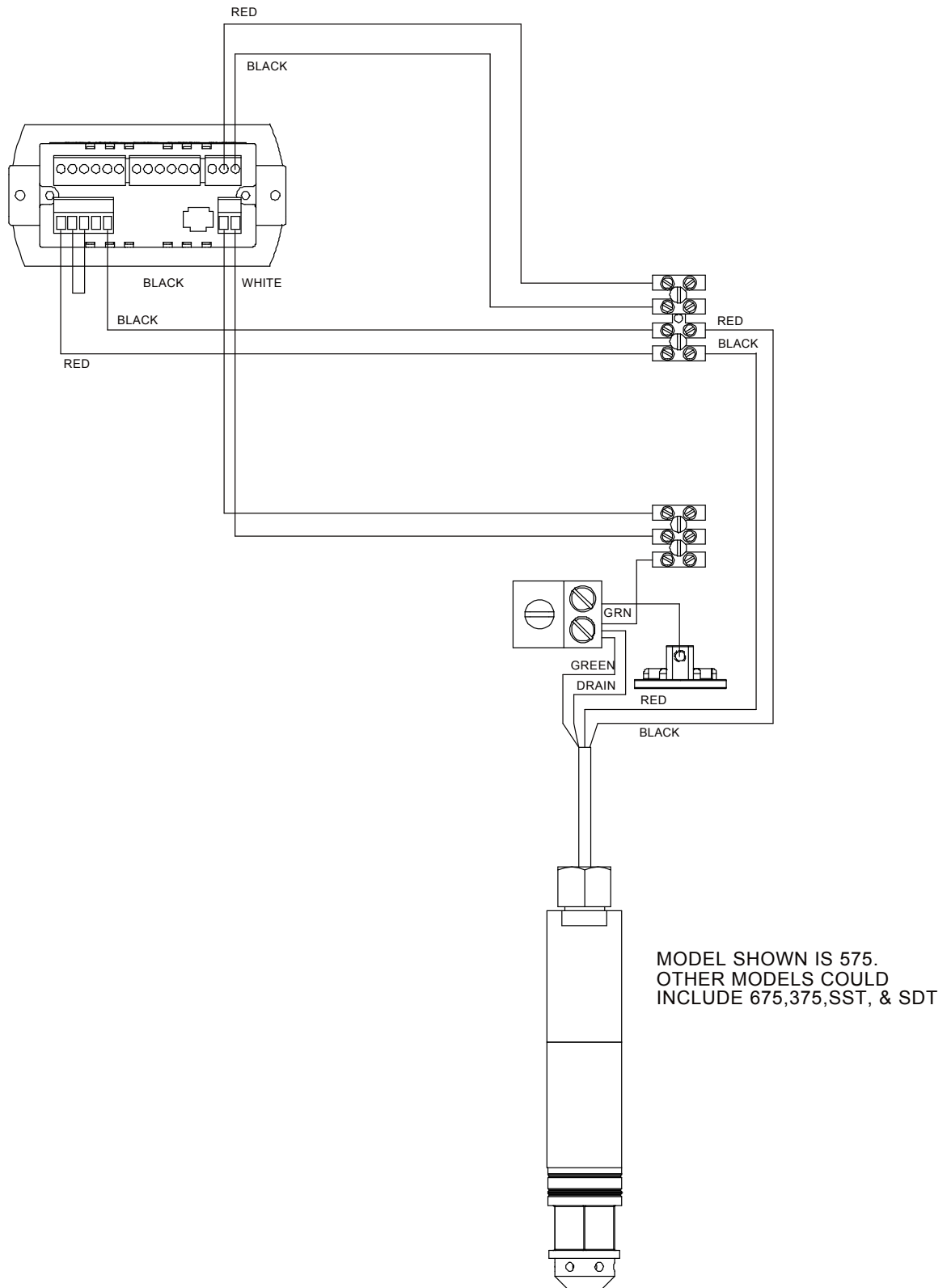
The internal 24 VDC power supply powering the analog output may be used to power other devices, if the analog output is not used. The I+ terminal is the +24 V and the R terminal is the return. This power supply is capable of sourcing up to 40 mA.

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Wiring Diagram with Lightning Protector Options



Wiring Diagram without Lightning Protector Options



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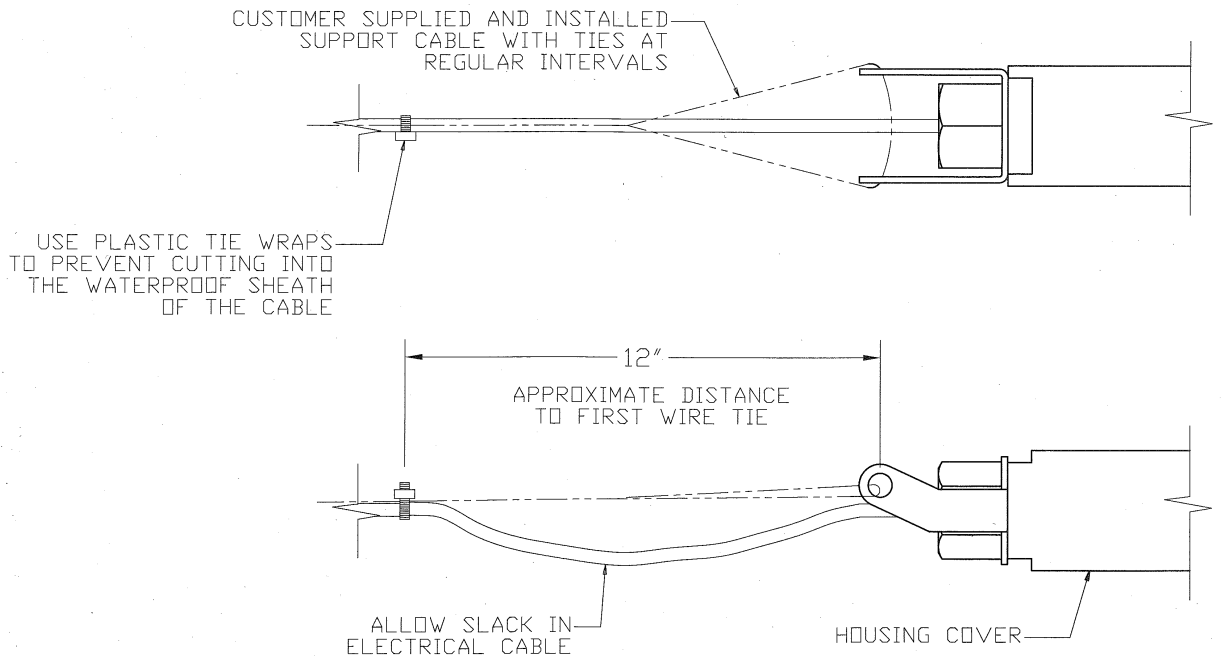


FIGURE 3 – MODEL 575 TRANSMITTER WITH CABLE SUPPORT



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.

Display Functions & Messages

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

Display	Parameter	Action/Setting Description
reset	<i>Reset</i>	Press Enter to access the <i>Reset</i> menu
Rst Hi	<i>Reset high</i>	Press Enter to reset max display
Rst Lo	<i>Reset low</i>	Press Enter to reset min display
Rst HL	<i>Reset high & low</i>	Press Enter to reset max & min displays
Contrl	<i>Control</i>	Enter <i>Control</i> menu
Auto	<i>Automatic</i>	Press Enter to set meter for automatic operation
mAn	<i>Manual</i>	Press Enter to manually control relays or analog output operation
setup	<i>Setup</i>	Enter <i>Setup</i> menu
input	<i>Input</i>	Enter <i>Input</i> selection menu
mA	<i>4-20 mA</i>	Set meter for 4-20 mA input
volt	<i>0-10 VDC</i>	Set meter for ± 10 VDC input
Dec pt	<i>Decimal point</i>	Set decimal point
dsplay	<i>Display</i>	Enter the <i>Display</i> menu
big	<i>Big display</i>	Press Enter to assign the Main display parameter (default: PV)
Little	<i>Little display</i>	Press Enter to assign the small display parameter (default: engineering units)
d-Inty	<i>Display intensity</i>	Set display intensity level from 1 to 8
RELaY	<i>Relay</i>	Enter the <i>Relay</i> menu
RLY 1	<i>Relay 1</i>	Relay 1 setup
Act 1	<i>Action 1</i>	Set relay 1 action
Auto	<i>Automatic</i>	Set relay for automatic reset
A-man	<i>Auto-manual</i>	Set relay for automatic & manual reset any time
LatCH	<i>Latching</i>	Set relay for latching operation
Lt-CLr	<i>Latching-cleared</i>	Set relay for latching operation with manual reset only after alarm condition has cleared
Altern	<i>Alternate</i>	Set relay for pump alternation control

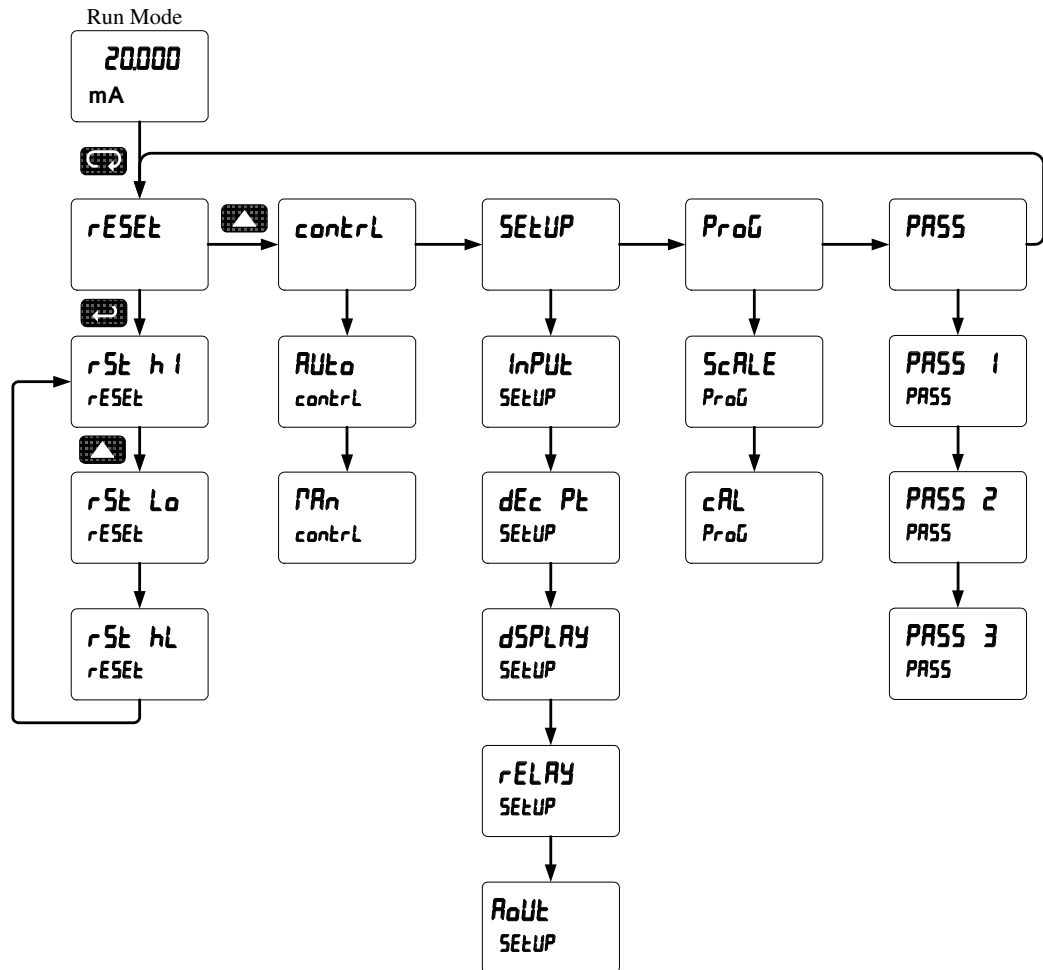
Display Functions & Messages (Continued)

Display	Parameter	Action/Setting Description
Sampl	<i>Sampling</i>	Set relay for sampling operation
OFF	<i>Off</i>	Disable relay and front panel status LED
Set 1	<i>Set 1</i>	Program set point 1
RSt 1	<i>Reset 1</i>	Program reset point 1
RLY 2	<i>Relay 2</i>	Relays 2-4 setup
FaiLSF	<i>Fail-safe</i>	Enter <i>Fail-safe</i> menu
FLS 1	<i>Fail-safe 1</i>	Set relay 1 fail-safe operation
on	<i>On</i>	Enable fail-safe operation
FLS 2	<i>Fail-safe 2</i>	Set relays 2-8 fail-safe operation
DeLAY	<i>Delay</i>	Enter relay <i>Time Delay</i> menu
DLY 1	<i>Delay 1</i>	Enter relay 1 time delay setup
On 1	<i>On 1</i>	Set relay 1 On time delay
OFF 1	<i>Off 1</i>	Set relay 1 Off time delay
DLY 2	<i>Delay 2</i>	Enter relays 2-8 time delay setup
break	Loop break	Set relay condition if loop break detected
ignore	<i>Ignore</i>	Ignore loop break condition (Processed as a low signal condition)
On	<i>On</i>	Relay goes to alarm condition when loop break is detected
Off	<i>Off</i>	Relay goes to non-alarm condition when loop break is detected
Aout	<i>Analog output</i>	Enter the <i>Analog output</i> scaling menu
Dis 1	<i>Display 1</i>	Program display 1 value
Out 1	<i>Output 1</i>	Program output 1 value (e.g. 4.000 mA)
Dis 2	<i>Display 2</i>	Program display 2 value
Out 2	<i>Output 2</i>	Program output 2 value (e.g. 20.000 mA)
prog	<i>Program</i>	Enter the <i>Program</i> menu
SCALE	<i>Scale</i>	Enter the <i>Scale</i> menu
Cal	<i>Calibrate</i>	Enter the <i>Calibration</i> menu
Inp 1	<i>Input 1</i>	Calibrate input 1 signal or program input 1 value
Dis 1	<i>Display 1</i>	Program display 1 value
Inp 2	<i>Input 2</i>	Calibrate input 2 signal or program input 2 value (up to 32 points)
Dis 2	<i>Display 2</i>	Program display 2 value (up to 32 points)
Error	<i>Error</i>	Error, calibration not successful, check signal or programmed value
pass	<i>Password</i>	Enter the <i>Password</i> menu
Pass 1	<i>Password 1</i>	Set or enter Password 1
Pass 2	<i>Password 2</i>	Set or enter Password 2
Pass 3	<i>Password 3</i>	Set or enter Password 3
unloc	<i>Unlocked</i>	Program password to lock meter
locd	<i>Locked</i>	Enter password to unlock meter
999999	<i>Flashing</i>	Overrange condition
-999999	<i>display</i>	Underrange condition

Main Menu

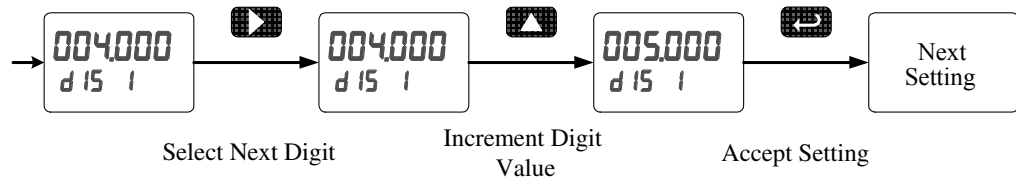
The main menu consists of the most commonly used functions: Reset, Control, Setup, Program, and Password.

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



Setting Numeric Values

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



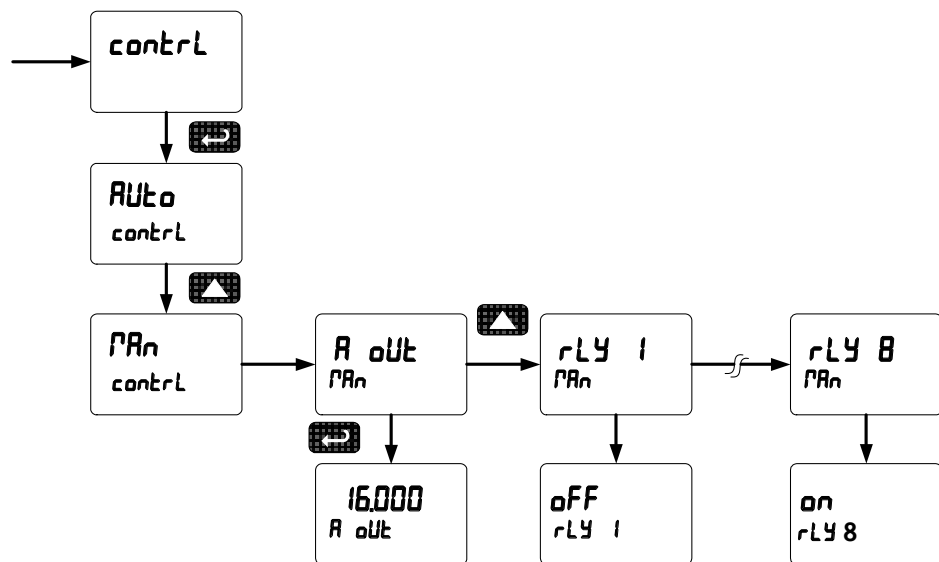
Note: The decimal point is set in the Setup-decimal point menu.

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).

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.

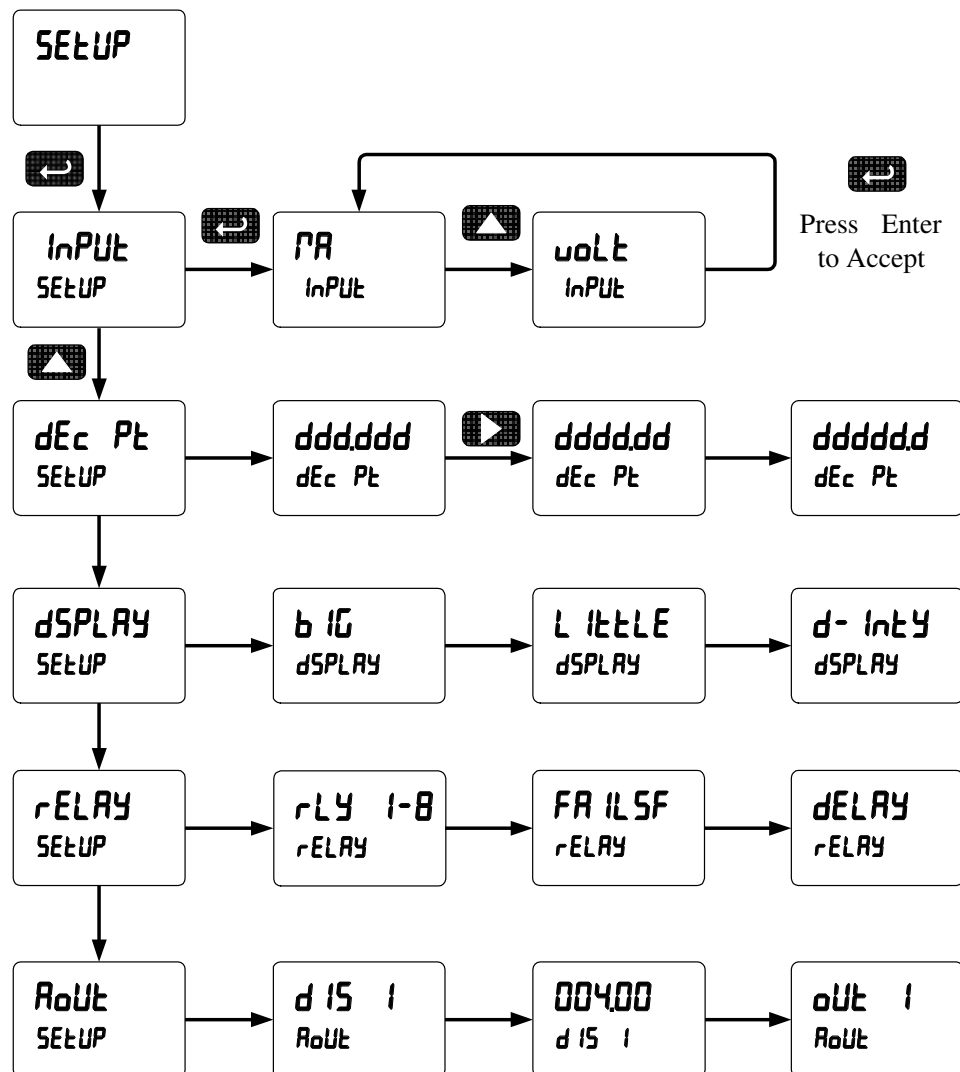


Setting Up the Meter (SETUP)

The Setup menu is used to select:

1. Input signal the meter will accept
2. Decimal point position
3. Display parameter and intensity
4. Relay operation
5. 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.



Level Mate™ III Level Measurement and Control System

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.

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.

Setting the Display Parameter & Intensity (*dSPlAY*)

The main display (Big) can be programmed to display:

1. Process value
2. Relay set points
3. Max & min values

The small display (Little) can be programmed to display:

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

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

Character Set for Engineering Units Display (d unit)

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

```
0 123456789AbccdEFG9hh i jKl  
nopPqrStUvXyZ-/_:[ ]=^`@
```

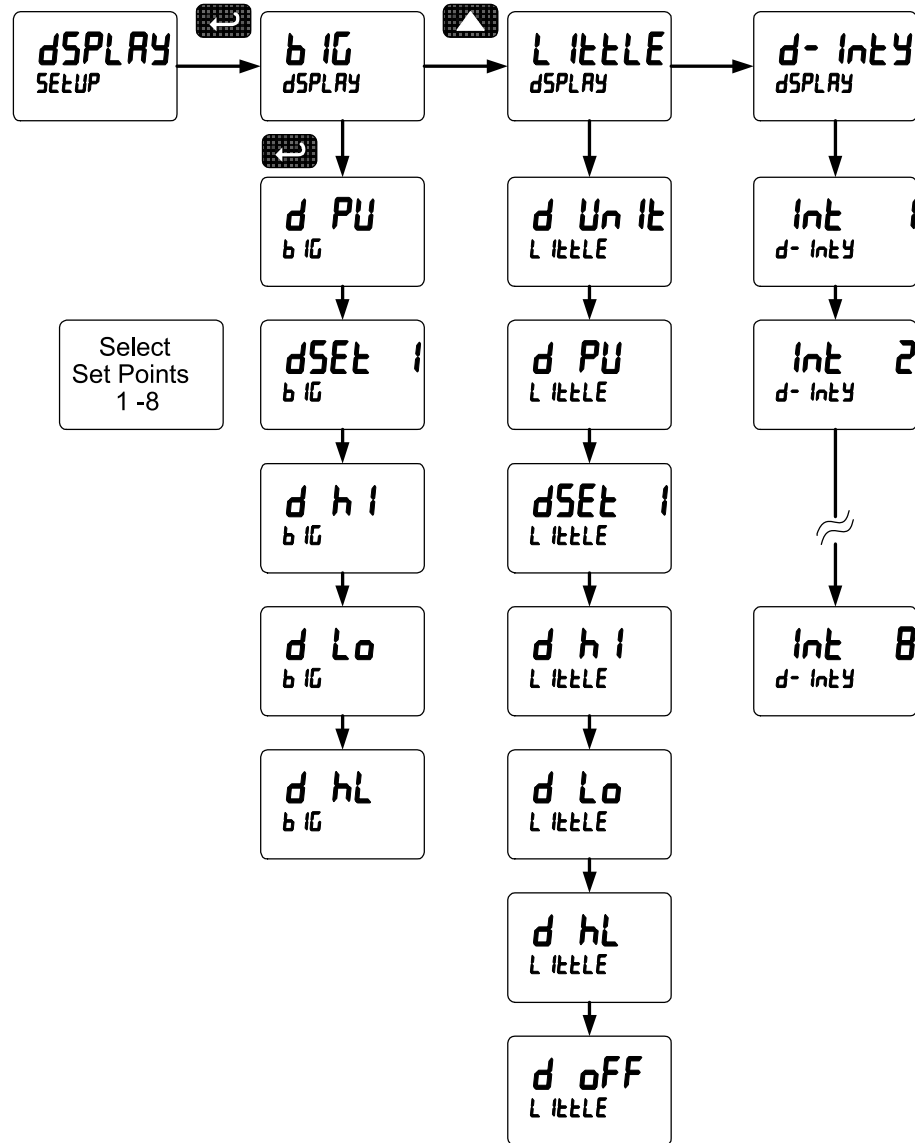
To create the letter “m” use the characters “h” followed by “i” to get “hi”.

To create the letter “w” use the characters “u” followed by “j” to get “uj”.

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

Display Setup Menu

- Press the Up arrow to change selection
- Press Enter to accept setting
- Press Menu to exit programming



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.

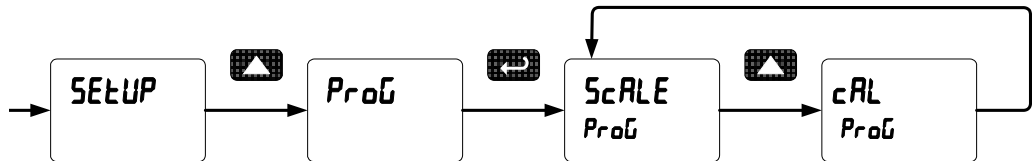
Programming the Meter (Prog)

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

The Program menu contains the Scale and the Calibrate menus.

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



Additional parameters, not needed for most applications, are programmed in the Advanced Features menu.

Multi-Point Calibration & Scaling

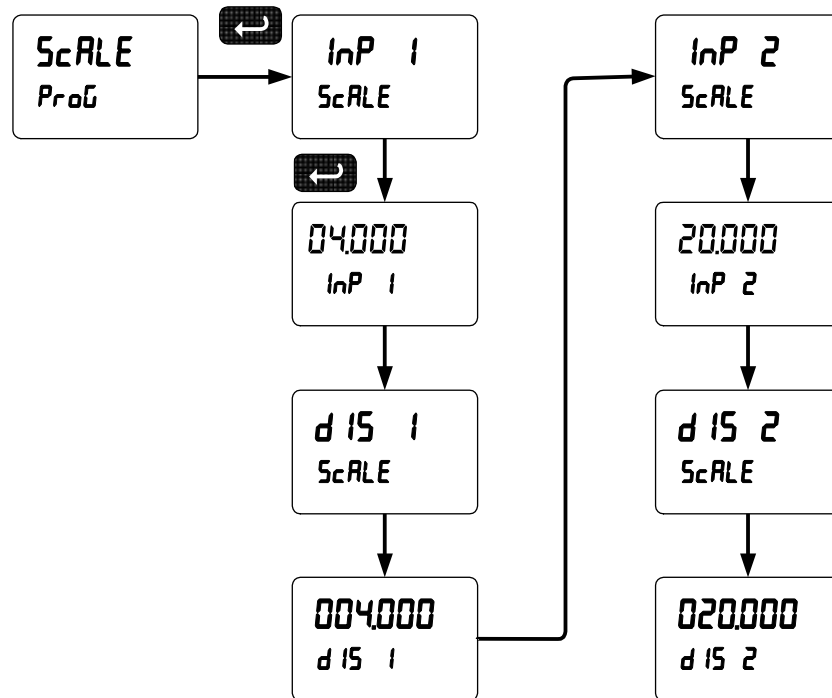
The meter is set up at the factory for 2-point linear calibration. The number of points for multi-point calibration/scaling is set up in the Advanced Features menu. Up to 32 linearization points may be selected.

In order to program the meter using a computer, the meter must be connected using an RS-232 or RS-485 serial adapter.

Scaling the Meter (SCALE)

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

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



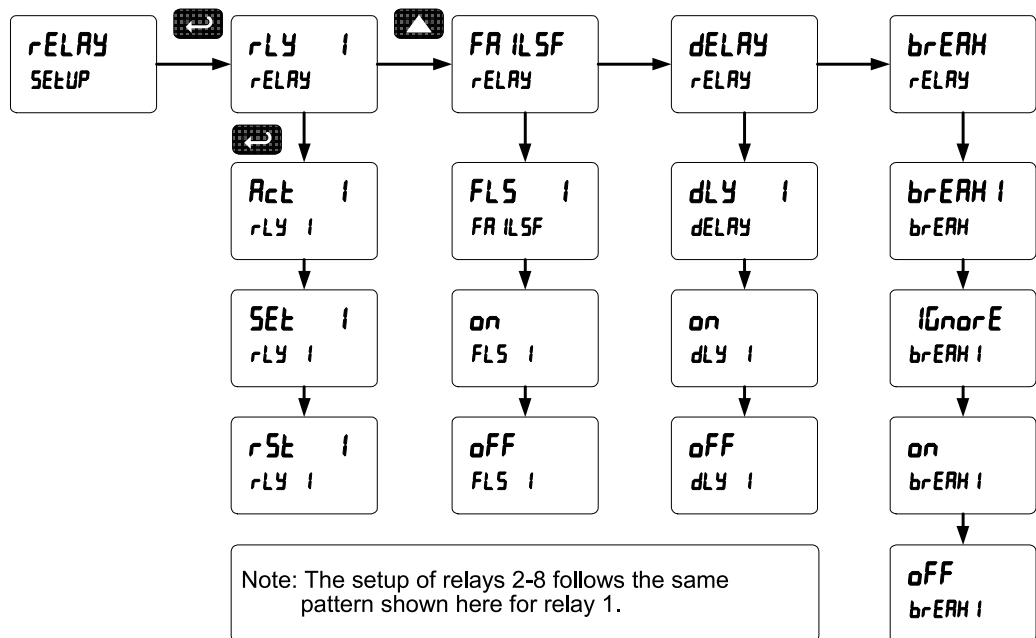
Setting the Relay Operation (rELAY)

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



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

1. Relay action
 - a. Automatic reset only (non-latching)
 - b. Automatic + manual reset at any time (non-latching)
 - c. Latching (manual reset only)
 - d. Latching with Clear (manual reset only after alarm condition has cleared)
 - e. Pump alternation control (automatic reset only)
 - f. Sampling (the relay is activated for a user-specified time)
 - g. Off (relay and status LED disabled)
2. Set point
3. Reset point
4. Fail-safe operation
 - a. On (enabled)
 - b. Off (disabled)
5. Time delay
 - a. On delay (0-999.9 seconds)
 - b. Off delay (0-999.9 seconds)
6. Relay action for loss (break) of 4-20 mA input (ignore, on, off)

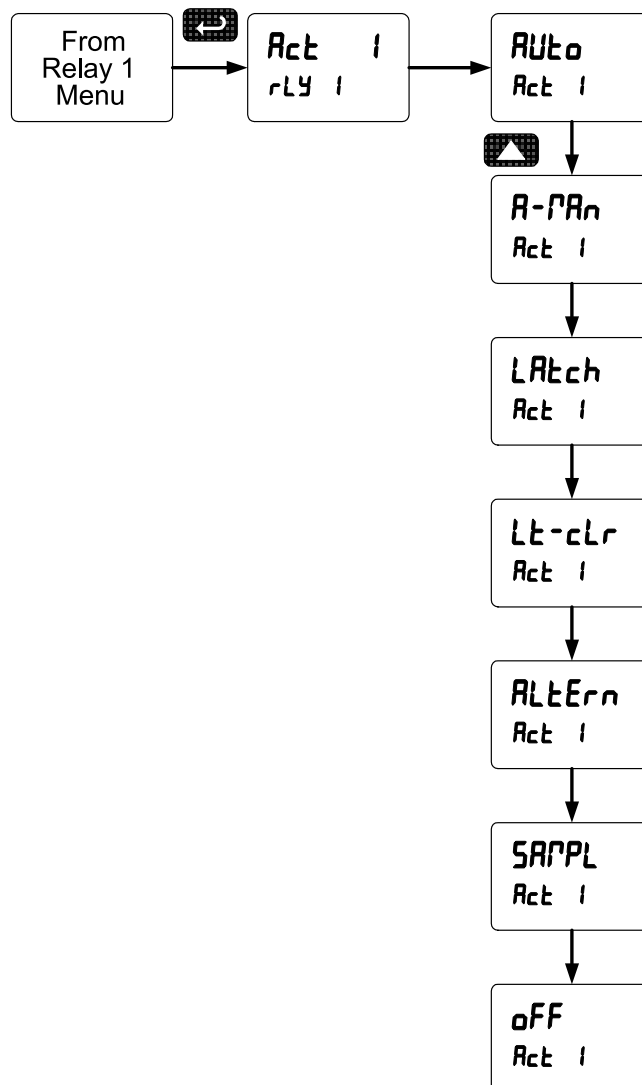


Setting the Relay Action

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

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

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



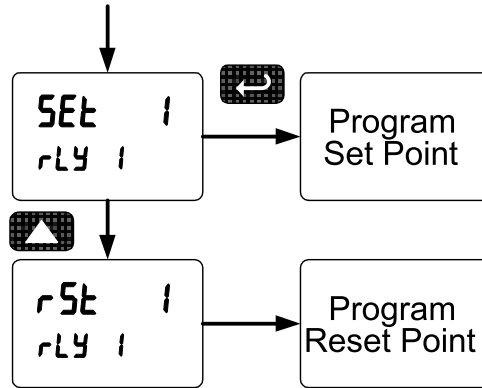
Programming Set and Reset Points

High alarm indication: program set point above reset point.

Low alarm indication: program set point below reset point.

The deadband is determined by the difference between set and reset points.

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



Setting Fail-Safe Operation

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

Programming Time Delay

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

The On time delay is associated with the set point.

The Off time delay is associated with the reset point.

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

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

1. Turn On (Go to alarm condition)
2. Turn Off (Go to non-alarm condition)
3. Ignore (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 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. 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 4 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 4 Pumps

Relays Auto Initialization

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

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

Fail-Safe Operation

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



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

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

Front Panel LEDs

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

LED	Status
1	Alarm 1
2	Alarm 2
3	Alarm 3
4	Alarm 4

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

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

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

Latching and Non-Latching Relay Operation

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

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 + Manual)

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 (Auto + Manual)

Manual reset any time

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

In this application, the meter is set up for manual reset at any time. Acknowledging the alarm even if the alarm condition is still present resets the relay and turns off the LED.

Latching Relay (Lk-clr)

Manual reset only after alarm condition has cleared

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

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

Acknowledging Relays

There are two ways to acknowledge relays programmed for manual reset: via the programmable front panel function keys F1-F3 (Default: F3 assigned to ACK). When the ACK button or the assigned digital input is closed, all relays programmed for manual reset are acknowledged.

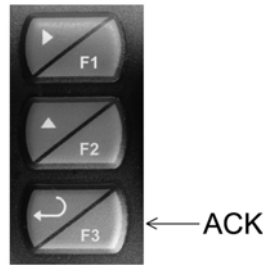


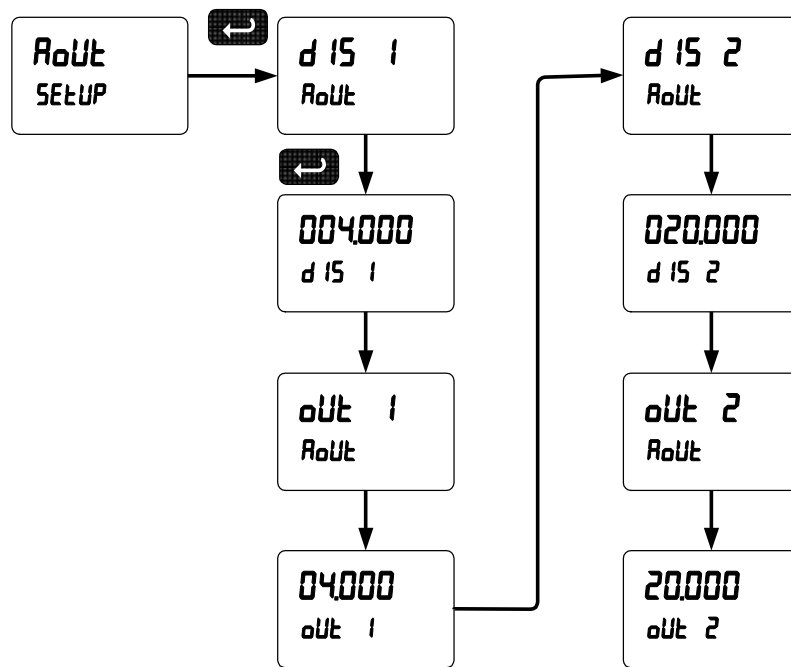
Figure 14. Acknowledge Relays w/Function Key

Scaling the 4-20 mA Analog Output (RoUt)

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

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

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



For instructions on how to program numeric values see Setting Numeric Values.

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 Chart

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 (<i>Error</i>)	Check: 1. Signal connections 2. Input selected in Setup menu 3. Minimum input span requirements
Meter displays 999999 -999999	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. Math function selected: Linear, square root, etc. 2. Scaling or calibration
Display does not respond to input changes, reading a fixed number	Check: 1. Display assignment, it might be displaying max, min, or set point.
Display alternates between h i and a number L o and a number	Press Menu to exit max/min display readings.
Relay operation is reversed	Check: Fail-safe in Setup menu Wiring of relay contacts
Relay and status LED do not respond to signal	Check: Relay action in Setup menu Set and reset points
Meter not communicating with application programs	Check: 1. Serial adapter and cable 2. Serial settings 3. Meter address and baud rate
If the display locks up or the meter does not respond at all	Cycle the power to reboot the microprocessor.
Other symptoms not described above	Call Technical Support for assistance.

Level Mate™ III Level Measurement and Control System

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)
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.

SELLER MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF FITNESS OR OF MERCHANTABILITY WITH RESPECT TO ITS PRODUCTS, OR ANY PART THEREOF, OTHER THAN AS EXPRESSLY SET FORTH ABOVE. NOR SHALL SELLER HAVE INCURRED ANY OTHER OBLIGATIONS OR LIABILITIES OR BE LIABLE FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHARGES, OR ANY OTHER LOSSES INCURRED IN CONNECTION WITH THE PURCHASE, INSTALLATION, REPAIR, OR OPERATION OF ITS PRODUCTS (INCLUDING ANY PARTS REPAIRED OR REPLACED.)

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

Service

Factory Service

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) 354-1802 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 or Fax Orders to:

AMETEK Drexelbrook

205 Keith Valley Road, Horsham, PA 19044

U.S. and Canada: 1-800-553-9092

24-Hour Service: 1-800-527-6297

International: +1 215-674-1234

Fax: +1 215-674-2731

E-mail: drexelbrook.info@ametek.com

Website: www.drexelbrook.com

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