

**1 YEAR**  
WARRANTY

# **Ω OMEGA™**

# **User's Guide**



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## **FMG490 SERIES**

## **Municipal/Industrial Magmeter**



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The **FMG490 Series** is a spool-type electromagnetic flowmeter for use in irrigation applications in 3" to 12" pipe. With no moving parts, these meters provide unobstructed flow and are resistant to wear from debris found in ground or surface water. Little maintenance is required because there are no bearings to wear out or propellers to stop turning. Minimal straight pipe requirements allow FMG490 meters to be used in piping configurations where there is little space between the meter and an elbow.

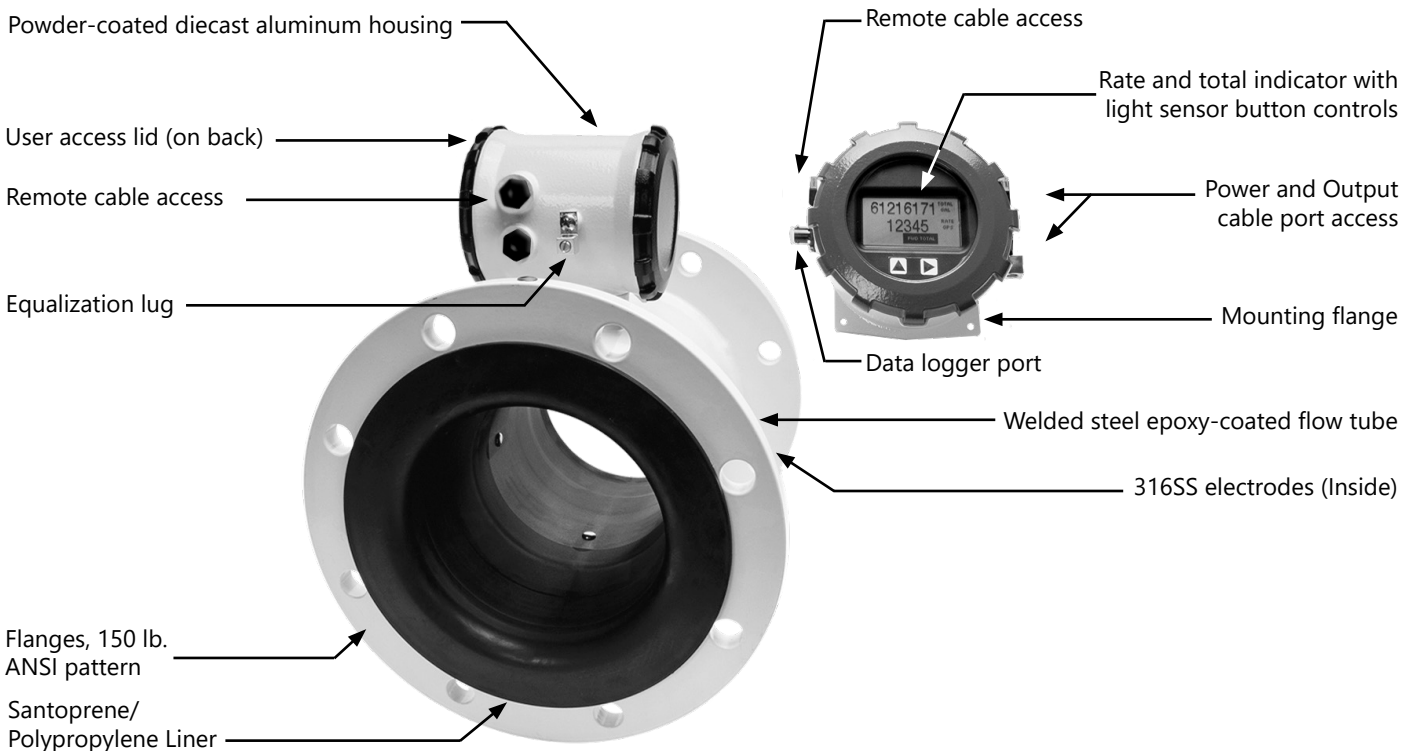
The display for the FMG490 is mounted remotely for ease of access. The FMG490 is available as either AC or DC powered, with battery backup. Both rate and total indication show on the remote mounted display. Bidirectional flow reading is standard with totals available in forward, reverse, net

flow, batch forward flow, and batch reverse flow. Batch totals can be reset. Built-in data logging is available as an option for secure flow logging.

Scaled pulse output is standard and one additional output can also be added, such as 4-20mA.

The FMG490 Series is CE certified and IP68 for burial, or applications where the meter may be under water for prolonged periods of time. All meters are provided with a security seal to protect against unauthorized access. The seal can be broken by an authorized agent to replace the battery pack or field install a power/output cable. The cable(s) are field installed.

**Features**



**No moving parts!**

Snap on faceplate cover and lanyard



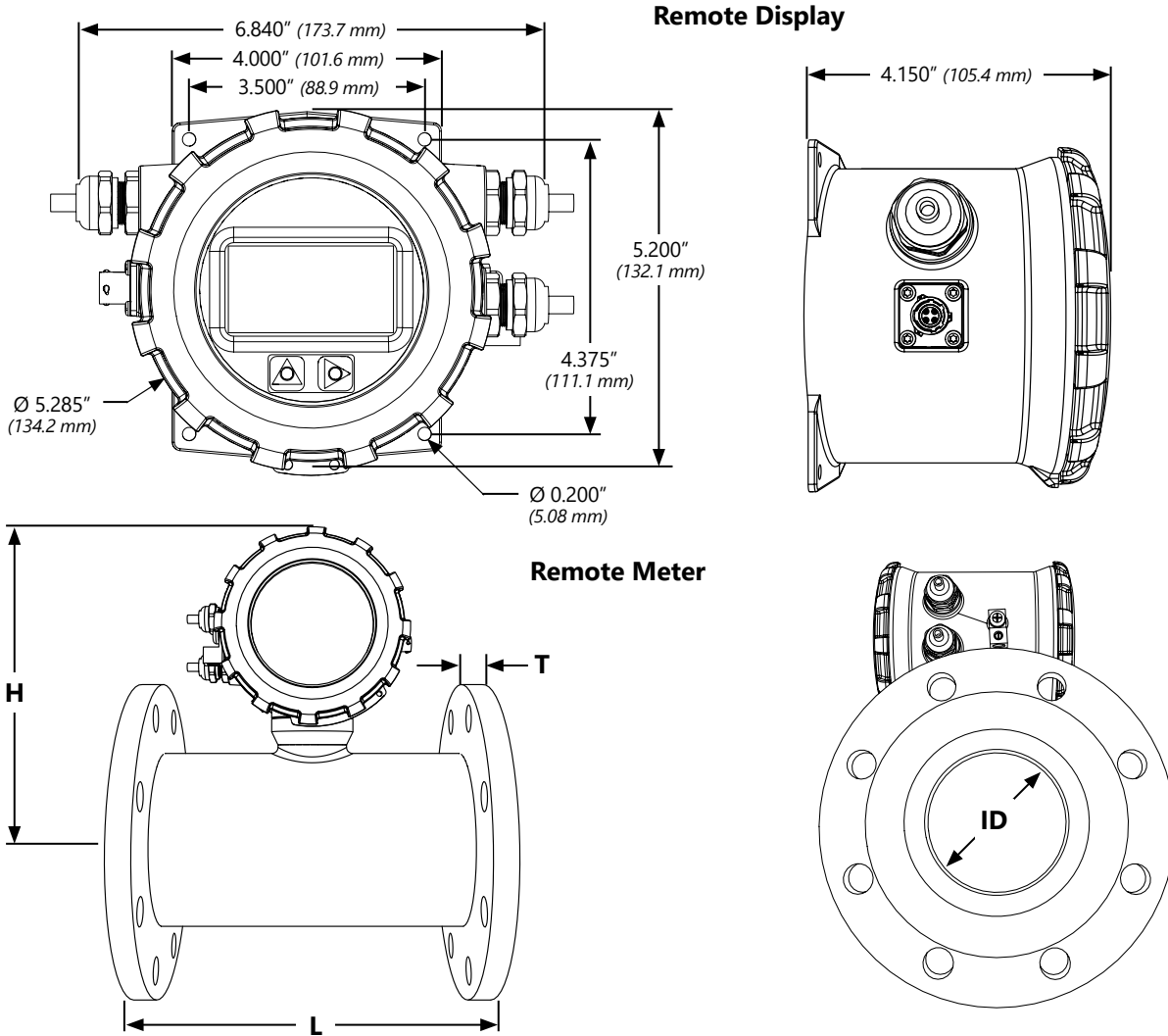
Specifications\*

<b>Pipe Sizes</b>	3", 4", 6", 8", 10", 12"						
<b>Flanges</b>	150 lb. ANSI Pattern						
<b>Pressure</b>	150 psi (10.3 bar) line pressure						
<b>Temperature Operating</b>	10° to 140° F (-12° to 60° C)						
<b>Storage</b>	-40° to 158° F (-40° to 70° C)						
<b>Accuracy</b>	±0.75% of reading on FMG480 and FMG490 (±1.0% FMG470), ±0.025% of full-scale flow from low flow cutoff to maximum flow rate of 10 m/sec						
<b>Low Flow Cutoff</b>	0.5% of maximum flow rate						
<b>Material</b>	<b>Body (3" only)</b>	Ductile cast iron, powder coated					
	<b>Body (4"-12")</b>	Welded steel, epoxy-coated					
	<b>Liner (3" only)</b>	Noryl®					
	<b>Liner (4"-12")</b>	Santoprene flange/Polypropylene liner body					
	<b>Electronics Housing</b>	Powder-coated diecast aluminum					
	<b>Electrodes</b>	316 stainless steel					
	<b>O-ring (3" only)</b>	EPDM					
<b>Display</b>	<b>Type</b>	128x64 dot-matrix LCD					
	<b>Digits</b>	5 Digit Rate			8 Digit Total		
	<b>Units</b>	Rate Volume Units		Rate Time Units	Total Volume Units		
	<i>Please Note: All FMG470 meters are factory set for gallons per minute (GPM) rate and acre feet total. If other units are required, they can be set in the field.</i>	Gallons	Million Gallons <sup>2</sup>	Second	Gallons	Barrels (42 gal)	Acre Feet
		Liters	Mega Liters <sup>2</sup>	Minute	Gallons x 10	Cubic Meters	Acre Inches
	Barrels(42 gal)	Imperial Gallons	Hour	Gallons x 100	Cubic Meters	Imperial Gallons	
	Cubic Feet	Million Imperial Gallons <sup>2</sup>	Day	Gallons x 1000	x 1000	Imperial Gallons x 1000	
	Cubic Meters			Million Gallons	Cubic Feet		
				Liters	Cubic Feet x 1000	Million Imperial Gallons	
				Kilo Liters	Second Foot Day	Gallons	
				Mega Liters	Million Cubic Feet	Fluid Ounces	
<b>Bidirectional</b>	Forward Total, Reverse Total, Net Total, Batch Forward Total, Batch Reverse Total (Batch totals can be reset)						
<b>Power</b>	<b>DC Power</b>	9-36 Vdc @ 250 mA max, 30 mA average					
	<b>Battery Backup</b> <i>(Not for use as primary power)</i>	DC powered units: Two lithium 3.6V 'D' batteries, replaceable. AC powered units: One 9V alkaline battery, replaceable.					
	<b>AC Power</b> <i>(FMG490 and FMG480 only)</i>	85-264Vac, 50/60Hz, 0.12A					
	<b>Battery</b> <i>(FMG470 only)</i>	One lithium 7.2V 'D' size battery pack, replaceable.					
<b>Scaled Pulse Output</b>	<b>Signal</b>	Current sinking pulse, isolated, 36 Vdc at 10 mA max					
	<b>Pulse Rates</b>	User-scalable from 0.1 to 99,999.9 volume units/pulse. Pulse width is one-half of pulse period with minimum pulse width of 2.5 ms, 200 pulses/sec max. For battery option meters, pulse width varies with frequency, 150 pulses/sec max.					
<b>Options</b>	<b>4-20mA Current Loop</b>	Isolated, passive, 24Vdc, 650 Ω maximum current loop					
<b>Cable</b>	<b>Power/Output Cable</b>	20ft (6m) standard length polyurethane jacketed cable—for power and outputs (lengths up to 200' available).					
	<b>Remote Display Cable</b> <i>(FMG490)</i>	20ft (6m) standard length polyurethane jacketed cable—for connection between meter and remote display (lengths up to 200' available).					
<b>Conductivity</b>	> 20 microSiemens/cm						
<b>Empty Pipe Detection</b>	Hardware/software, conductivity-based						
<b>Regulatory</b>	CE (EN 61326)						
<b>Environmental</b>	NEMA 6P, IP68 (10ft (3m) depth, continuously)						

\* Specifications subject to change.

<sup>2</sup> Rate Time Unit is available in Day only.

Dimensions



FMG490 Meter Size	L		H		T		ID		Shipping Weight	
	inch	mm	inch	mm	inch	mm	inch	mm	lbs	Kg
3"*	12.25	311	7.08	179.8	.68	17.25	2.6	66.04	40	18
4"	10.12	257	8.3	211	.62	15.7	3.12	79	43	19.5
6"	12.09	307	9.1	231	.69	17.5	5.05	128	59	27
8"	14.14	359	10.1	257	.69	17.5	6.44	164	78	35
10"	18.08	459	11.2	284	.69	17.5	8.61	219	135	61
12"	19.68	500	12.2	310	.81	20.6	10.55	268	175	79
<b>Flanges</b>	Standard ANSI 150 lb. drilling								Cable 1 lb.	

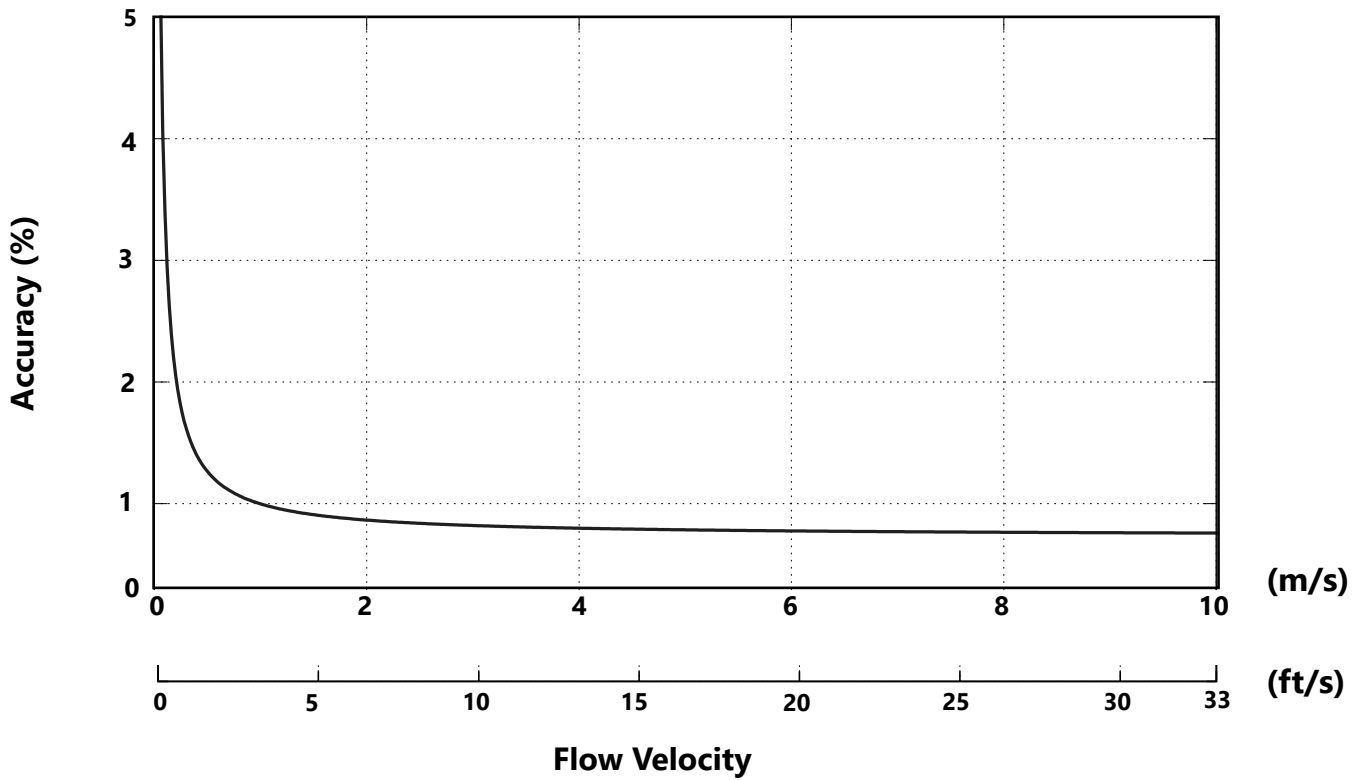
\*Add 8lbs (3.5kg) for remote display. 3" Only.

Note: 'L' dimension is total from liner face to liner face

Install security seals during installation if regulations require.



FMG490 Accuracy

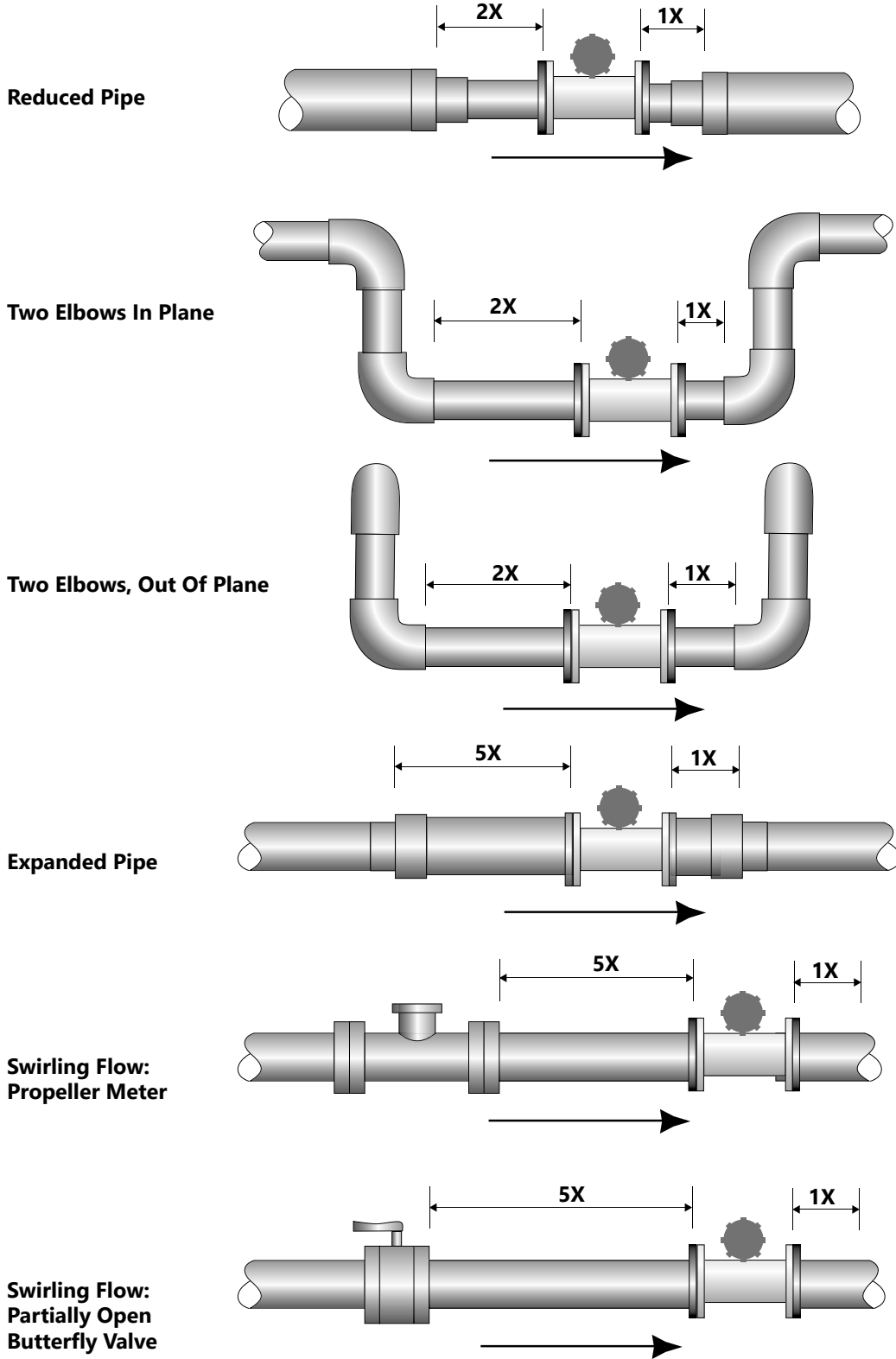


Flow Rate (3" - 12")

Pipe Size <i>(Inches in diameter)</i>	3"	4"	6"	8"	10"	12"
<b>Max Flow Rate</b> <i>(Gallons/Minute)</i>	723	1285	2891	5140	8031	11565
<b>Cut-off (min) Flow Rate</b> <i>(Gallons/Minute)</i>	3.62	6.43	14.46	25.70	40.15	57.82
<b>Max Flow Rate</b> <i>(Liters/Second)</i>	46	81	182	324	507	730
<b>Cut-off (min) Flow Rate</b> <i>(Liters/Second)</i>	0.23	0.41	0.91	1.62	2.54	3.65
<b>Max Flow Velocity</b> <i>(Meters/Second)</i>	10	10	10	10	10	10

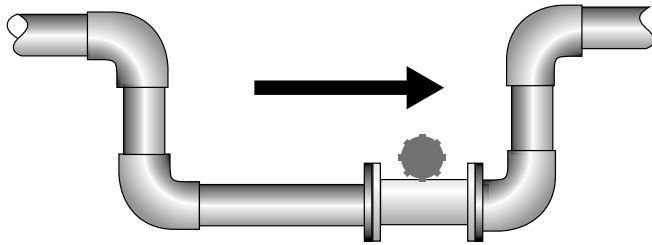
**Straight Pipe Recommendations** (*X = diameter*)

**NOTE:** These configurations are to be used as general guidelines and do not cover every possible installation. A combination of two or more obstructions will require additional straight pipe. If there is any concern about the length of pipe required for a specific application, please contact your local dealer.

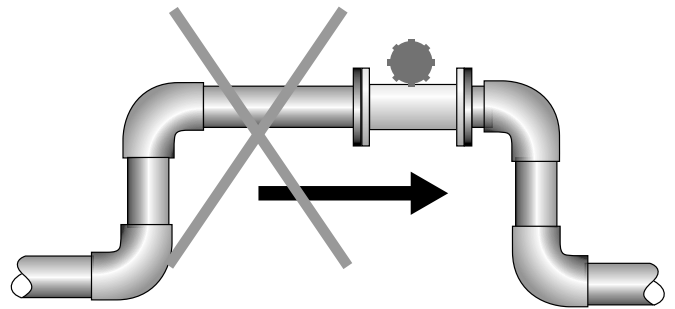




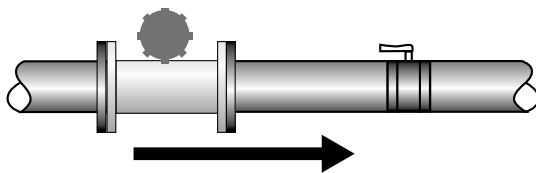
Full Pipe Recommendations



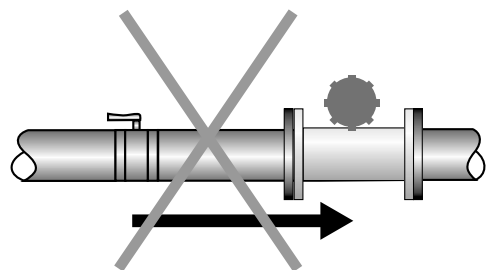
**Recommended:**  
Keep pipe full at meter for accuracy



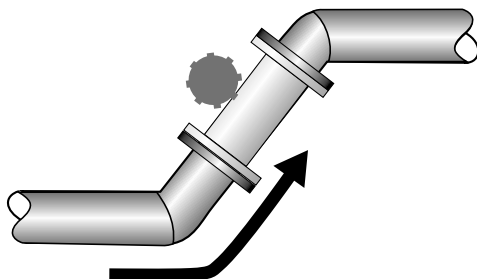
**Not Ideal:**  
Allows air pockets to form at meter



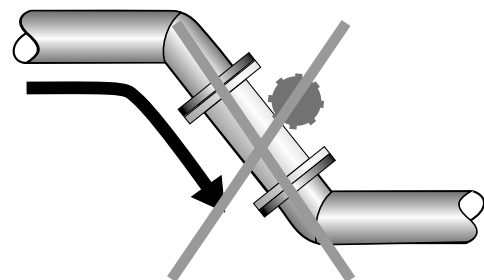
**Recommended:**  
Keeps pipe full at meter for accuracy



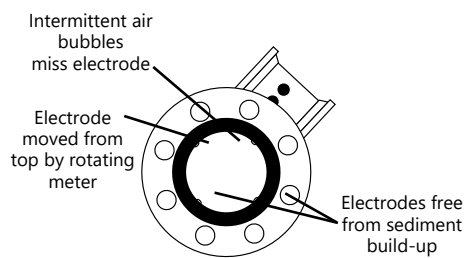
**Not Ideal:**  
Post-valve cavitation can create air pocket



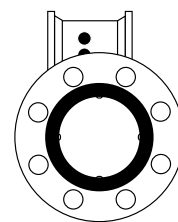
**Recommended:**  
Allows air to bleed off



**Not Ideal:**  
Air can be trapped



**Recommended:**  
Improved accuracy results from unimpeded electrodes



**Not Ideal:**  
Air bubbles and sediment on the electrodes can affect accuracy

**Positioning the Meter**



**CAUTION:** These flow sensors are not recommended where installation may expose the flow sensor to boiler pressure and temperature. Maximum recommended operating temperature is 130° F.

These meters can be installed horizontally, vertically (with upward flow), and in any radial position. **Using a check valve on the upstream side of the meter, and/or an air vent (vacuum relief valve) in the same, unobstructed run of pipe as the meter, is required in any installation where the meter may be exposed to suction when the system is not in normal operation. Suction can cause damage to the liner. Liner damage caused by suction, without the use of a check valve and/or air vent, may void the warranty.**

**Straight Pipe Recommendations.** The FMG490 requires straight pipe before and after the meter for best accuracy. However, the ability of electromagnetic meters to average the flow across the entire pipe allows for shorter straight pipe recommendations than most mechanical meters (see page 8).

**Full Pipe Recommendations.** To prevent false readings, this meter is designed to indicate 'EMPTY PIPE' if one or more electrodes is exposed. For highest accuracy, install the meter so that the pipe will be full when there is flow. If air bubbles may be present in the pipe or sludge accumulation is an issue, rotate the meter by one flange hole to position the control housing at a 45° angle (see diagrams on page 9).

**Fittings.** The meters have ANSI 150 lb. drilled flanges and will mate with any other ANSI 150 lb. flanges. See table on page 11 for flange bolt tightening torque specifications.

**Calibration.** The FMG490 meters are factory-calibrated and will not require any form of field calibration.

**Chemical Injection.** When an FMG490 meter is used in a chemical injection application, **the chemical injection point must be placed downstream of the magmeter OR far enough upstream for complete mixing to occur before the fluid reaches the meter.** When unmixed chemical alternates with water passing through the meter, the rapid changes in conductivity may cause sudden spikes and drops in the meter's reading, resulting in inaccurate measurement. The magmeter will restabilize, however, with a steady flow of fluid of uniform conductivity.



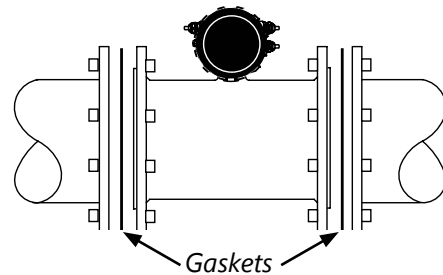
**CAUTION:** In chemical injection applications, install chemical injection point downstream of magmeter, or far enough upstream to allow complete mixing of fluids.

**Installing Gaskets**

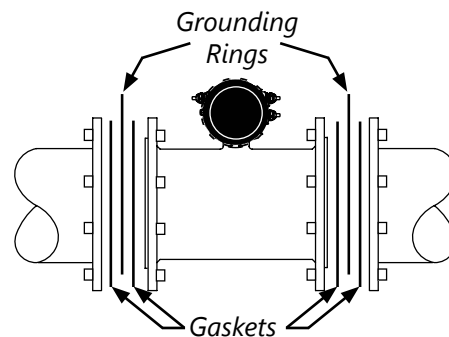


**GASKETS**  
Gaskets are required at all junctions.

1. Be sure all mating surfaces are smooth and free of debris.
2. Install provided gaskets, or equivalent, on each end of meter as shown in diagrams below. If using grounding rings, install one gasket on each side of the grounding ring.
3. **Failure to install gaskets will void warranty.**



Installation without grounding rings

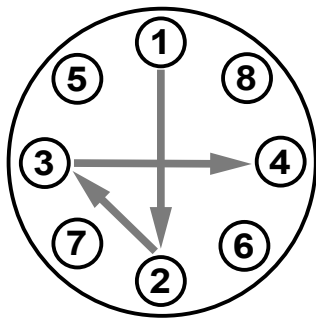


Installation with grounding rings

**Tightening Flange Bolts**

NOTE: Mating pipe flanges must be ANSI 150# full face (FF) and/or raised face (RT).

1. Tighten flange bolts in an alternating pattern.
  - Tighten left flange bolt-1 to 20% recommended torque.
  - Tighten right flange bolt-1 to 20% of recommended torque.
  - Repeat steps a and b for each bolt in an alternating order, such as shown at right, tightening to 40%, then 60%, then 80%, and then 100%.
2. Test for leaks.
3. If needed, tighten further in 10% increments until leaking stops. **DO NOT over-tighten. Over-tightening can cause serious damage to the flow meter.**
4. Recheck after 24 hours, adjusting if needed.



*Suggested Tightening Sequence*



**Caution:** Improper tightening sequence can cause serious damage to the flow meter.

- Do not tighten one side at a time.
- Do not tighten each bolt completely at one time.

**SUGGESTED FLANGE BOLT TORQUE**

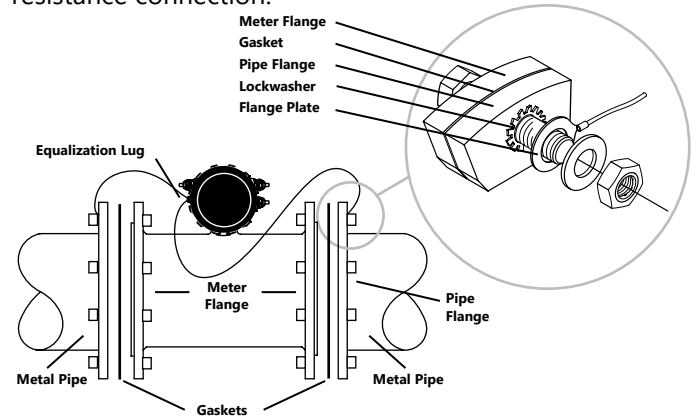
Pipe Size	Santoprene Liner	
	ft-lb	Nm
3"	25	34
4"	20	27
6"	42	57
8"	65	88
10"	73	99
12"	97	132

**Equalization and Grounding**

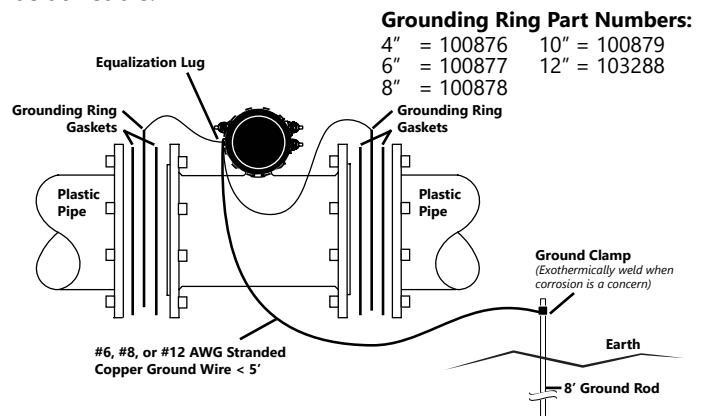


**WARNING: ELECTRICAL SHOCK HAZARD**  
When the FMG490 is installed in a plastic piping system, or when externally powered, the piping system must be grounded to meet national and local electrical safety codes. Failure to do so can result in electrocution.

**Metal Pipe Installations.** To equalize the electrical potential of the fluid, the FMG490 meter, and the surrounding pipe, secure the flange plates (factory-installed on the equalization wire) to both pipe flanges at one of the bolt holes, as shown below. Be sure the lock washer fits between the pipe flange and the flange plate. For the best electrical bonding, remove rust and paint to expose clean, bare metal where the equalization flange plate lock washer contacts the pipe flange. Connection must be inspected periodically for corrosion to maintain the necessary low resistance connection.



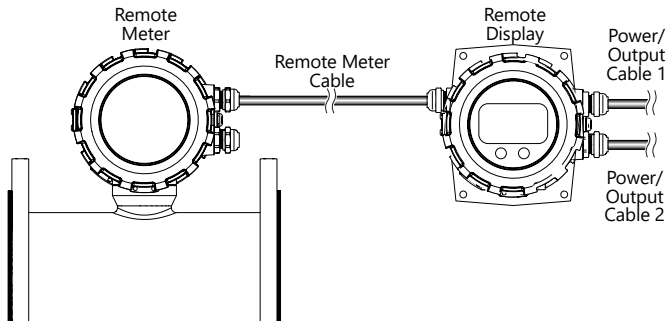
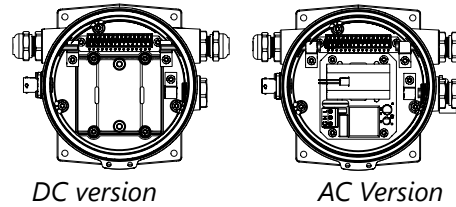
**Plastic Pipe and Electronically Noisy Installations.** When the FMG490 is installed in plastic pipe or in an electrically noisy system (near a VFD etc.), grounding rings are recommended. As shown in the diagram below, the equalization wires should be solidly connected to the grounding ring tabs instead of the flange bolts as in metal piping installations. Where lightning is a threat, or in severe electrical environments, an optional connection to a nearby equipment ground or ground rod may be advisable.



**General Cable Information**

For the FMG490, a cable needs to be installed from the terminal block on the remote display interface board to the 15 pin connector inside the remote display. This cable is referred to as the remote meter cable. There are four wires in the cable: +REM PWR, - REM PWR, B, and A. There are an additional 2 cable ports that can be used for power (DC or AC) and any outputs that are installed on the meter such as scaled pulse, 4-20mA, HART, and Modbus®. (See Sample Control Cable Wiring Diagrams and Control Cable Wiring Table.)

The display is available in either DC or AC versions.



If the meter is configured with AC power, one of the additional Power/Output cable ports must be reserved for AC power only. We do not recommend combining AC power signals with any of the meter outputs in a single cable. If the meter is configured for DC power, you may have one or two cables, depending on configuration. (See Cable Wiring Diagrams.)

**Cable Gland Opening and Sealing**



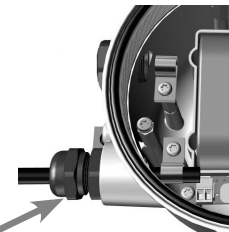
**WARNING:** Improper sealing of glands or cables will invalidate any warranty. If plugs or cable glands are removed, reinstall using Teflon pipe sealant, or tape, to ensure maximum moisture protection.



Remove plug & o-ring. Insert cable gland/strain relief. Feed cable through cable gland.



Clamp cable with strain relief clips. Attach drain wire lug to bracket post.



**CRITICAL!**  
Torque cable gland sealing nut to 22 in-lbs.

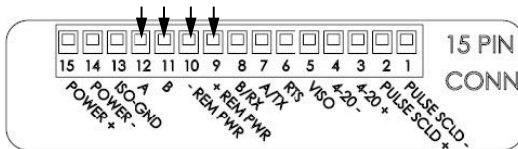
**Cable Installation**

**Remote Display Wiring**

1. On the remote display, unscrew the display lid and remove it.
2. Remove the 3 screws holding the display assembly and remove it from the meter exposing the internal 15 pin connector. Be sure to **NOT** undo any connections to the display assembly as you remove it.

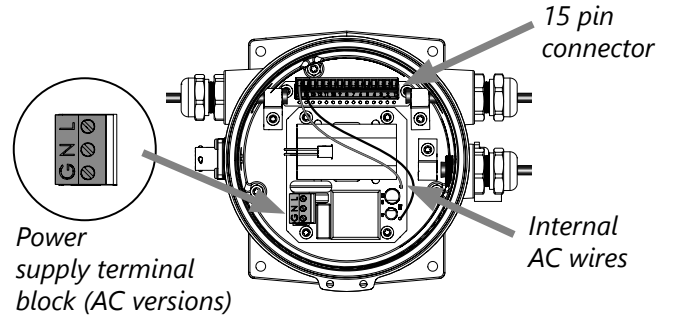


3. Remove the 15 pin screw connector from the bag.
4. Remove the plug and o-ring from the cable port(s) where you want to insert the cable(s).
5. Install cable gland(s) using Teflon pipe sealant, or tape, and insert cable end(s).
6. Strip cable jacket and conductors and install the wires into the screw connector in their respective locations (+Rem Pwr (red), - Rem Pwr (black), B (orange), and A (blue)).



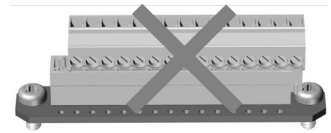
7. At this point, install any other options using the Power/Output cable(s) through the Power /Output cable port(s), and securely screw them into the screw connector in their respective locations. (See Cable Wiring Table for details.)
8. If using AC power version continue here. If not, then skip to step 13. If AC then take the red and black wires coming out of the AC supply board and install in POWER+ and POWER- (red wire to pin 15, black wire to pin 14).
9. When the AC power supply board is installed, 85-264 VAC power is supplied via a user-supplied 3 conductor power cord having local regulatory agency approval. If installed outdoors or less than 33ft. (10m) from a utility power service entrance, AC power should be supplied via a properly-grounded surge suppression device.

10. Remove the plug and o-ring from the AC cable port.
11. Install cable gland and insert cable end.
12. Strip cable jacket and conductors and install 3 conductor power cable and wire to Line (L), Neutral (N) and ground (G) positions on power supply terminal block.

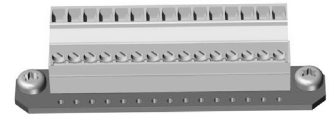


13. Plug the 15 pin screw connector into its socket. **Be sure all pins align properly and that the connector has not slipped to one side.**

*Improper alignment*

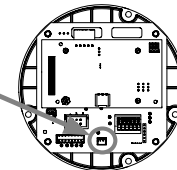


*Proper alignment*



14. Plug the backup battery cable into the back of the display assembly. (Standard backup batteries are two 3.6V "D" lithium cells. For the AC option, the backup battery is one 9V alkaline cell.)

*Backup battery connection*



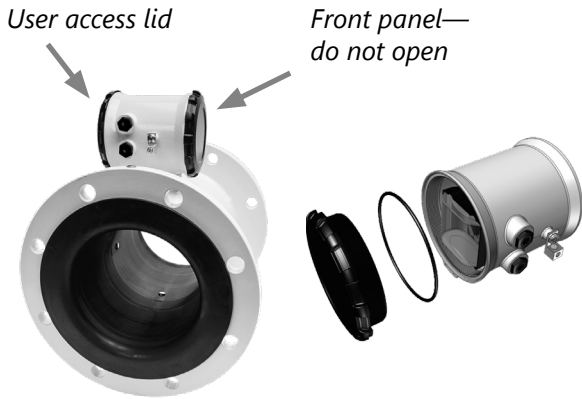
**WARNING: BACKUP BATTERIES ARE NOT INTENDED AS A PRIMARY POWER SOURCE OF A MAINS (DC or AC) CONFIGURED METER.**

15. Secure the cables inside the internal strain relief clips and tighten the cable gland sealing nuts securely (torque strain relief/sealing gland dome nut to 22 in-lbs). A loose nut could cause moisture ingress and compromise the meter head's IP68 rating, voiding the warranty.
16. Remount the display assembly, being careful to not pinch any wires, and install the display assembly screws.
17. Reinstall the display lid, being sure to avoid cross-threading the lid.

**Cable Installation**

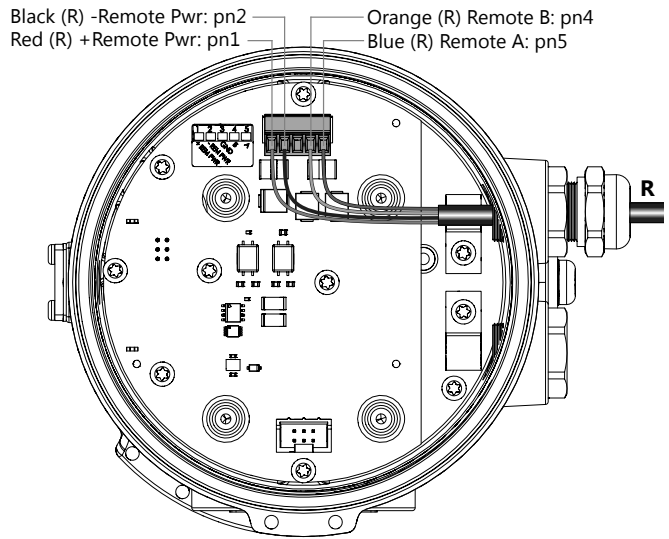
**Remote Meter Wiring**

1. On the remote meter, unscrew the user access lid and remove it.

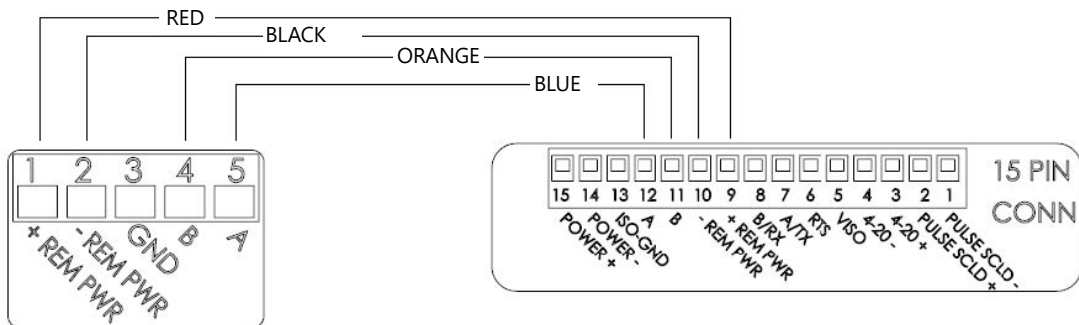


2. Remove the 5 pin screw connector from its socket.
3. Remove the plug and o-ring from the cable port.
4. Install cable gland and insert cable end.
5. Strip cable jacket and conductors and install the wires into the 5 pin screw connector in their respective locations (+Rem Pwr (red), - Rem Pwr (black), B (orange), and A (blue)).

6. Secure the remote sensor cable inside the internal strain relief clip and tighten the cable gland sealing nut securely (torque strain relief/sealing gland dome nut to 22 in-lbs.). A loose nut could cause moisture ingress and compromise the meter head's IP68 rating; voiding the warranty. Plug the 5 pin screw connector into its socket.
7. Reinstall the user access lid. Be sure to avoid cross-threading the lid and to not pinch any wires with the lid.



**Remote Meter**

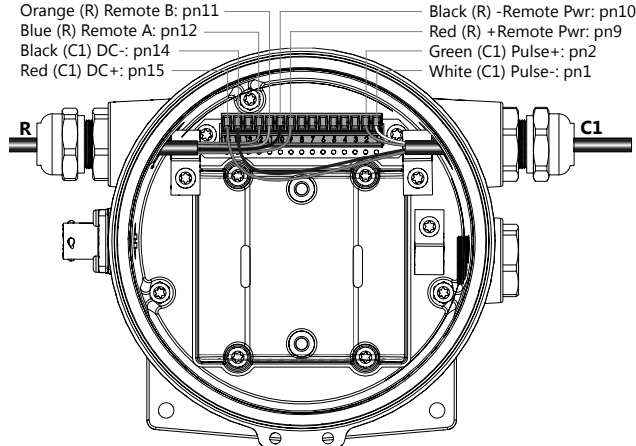


*Remote meter*

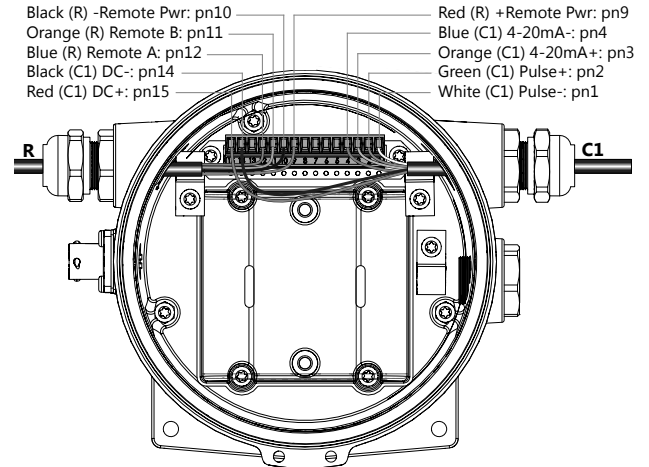
*15 pin connector in remote display*

**Wiring Diagrams (Remote Display)**

Remove the 3 screws holding the display assembly and remove it from the meter. Remove the 15 pin screw connector from its bag. Install the wires through the cable glands into the 15 pin screw connector in their respective locations. Plug the 15 pin screw connector into its socket. (C1 = power/output cable 1, C2 = power/output cable 2, R = remote cable)

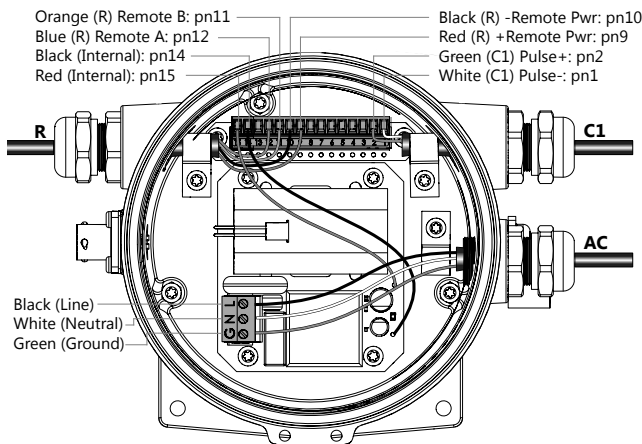


**DC Power with Pulse (D5N/D6N)**

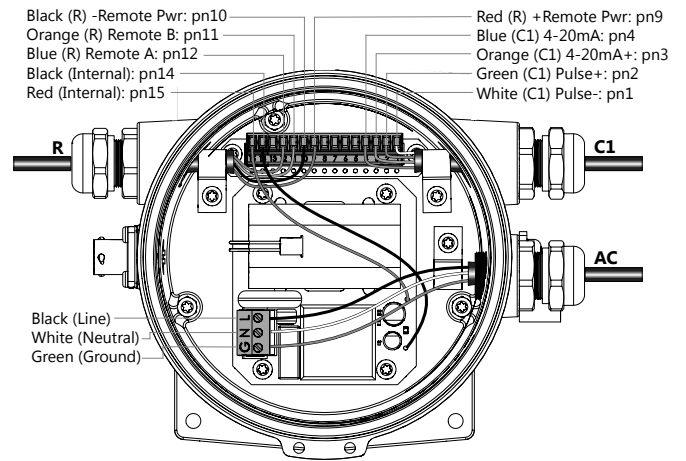


**DC Power with Pulse and 4-20mA (D5I/D6I)**

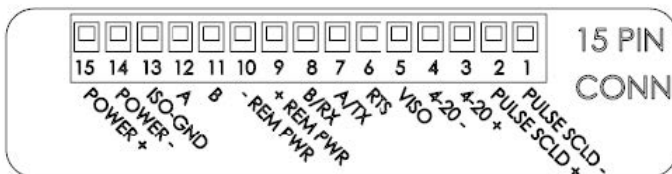
Remove the 3 screws holding the display assembly and remove it from the meter. Remove the 15 pin screw connector from its bag. Install the wires through the cable glands into the 15 pin screw connector in their respective locations. Plug the 15 pin screw connector into its socket. (C1 = power/output cable, R = remote cable, AC = AC power cable)



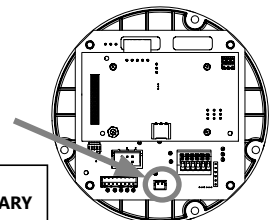
**AC Power with Pulse (A5N/A6N)**



**AC Power with Pulse and 4-20mA (A5I/A6I)**



Plug the backup battery cable into the back of the display assembly.



**WARNING: BACKUP BATTERIES ARE NOT INTENDED AS A PRIMARY POWER SOURCE OF A MAINS (DC or AC) CONFIGURED METER.**

Cable Wiring Table

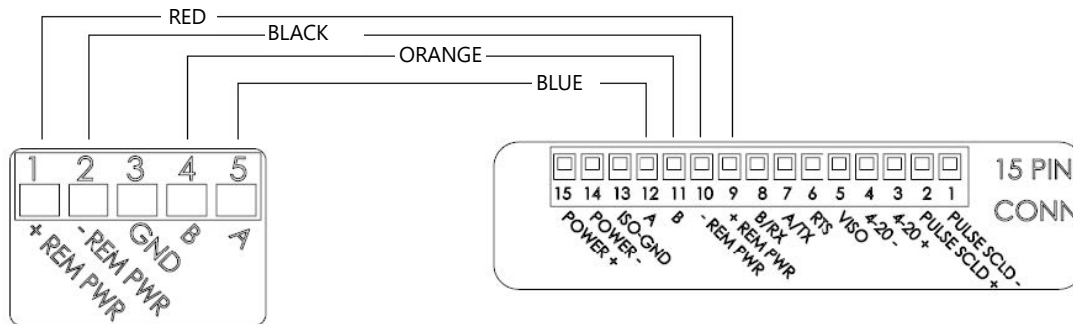
PIN	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
O ID	PWR+	PWR-	ISO-GND	A	B	-REM PWR	+REM PWR	B/RX	A/TX	RTS	VISO	4-20 -	4-20 +	PULSE SCLD+	PULSE SCLD-
D5N/D6N	RED C1	BLACK C1		BLUE R	ORNG R	BLACK R	RED R							GREEN C1	WHITE C1
D5L/D6L	RED C1	BLACK C1		BLUE R	ORNG R	BLACK R	RED R					BLUE C1	ORNG C1	GREEN C1	WHITE C1
A5N/A6N	RED INT	BLACK INT		BLUE R	ORNG R	BLACK R	RED R							GREEN C1	WHITE C1
A5L/A6L	RED INT	BLACK INT		BLUE R	ORNG R	BLACK R	RED R					BLUE C1	ORNG C1	GREEN C1	WHITE C1

(C1 = power/output cable 1 C2 = power/output cable 2 R = remote cable INT = Internal AC power wires)

Option IDs

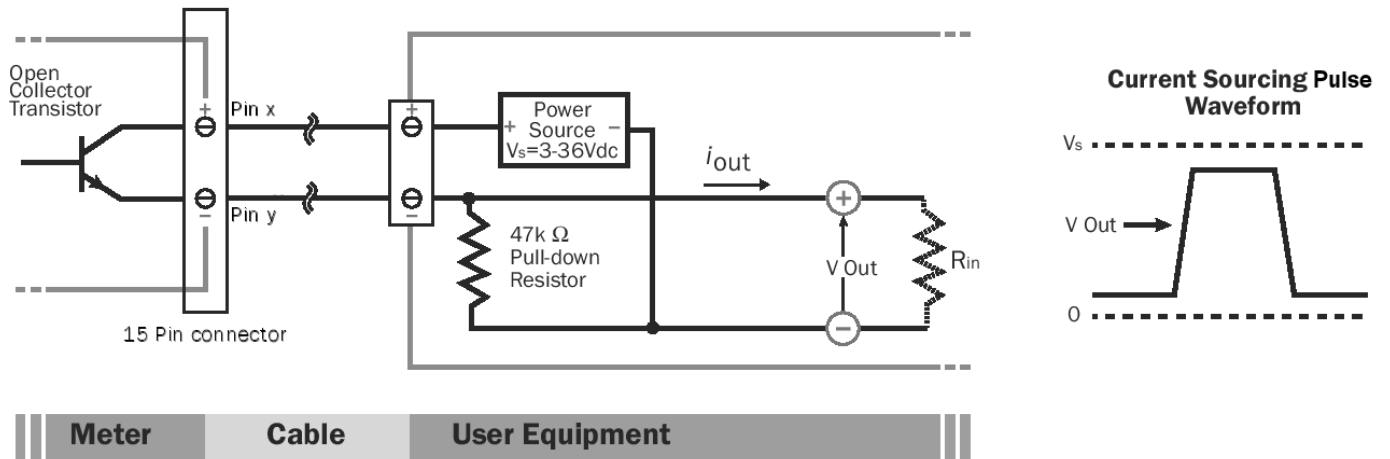
**O ID**      **POWER SOURCE / OUTPUT(S)**  
**D5N/D6N** = DC POWER / PULSE SCALED  
**D5L/D6L** = DC POWER / PULSE SCALED AND 4-20mA

**O ID**      **POWER SOURCE / OUTPUT(S)**  
**A5N/A6N** = AC POWER / PULSE SCALED  
**A5L/A6L** = AC POWER / PULSE SCALED AND 4-20mA

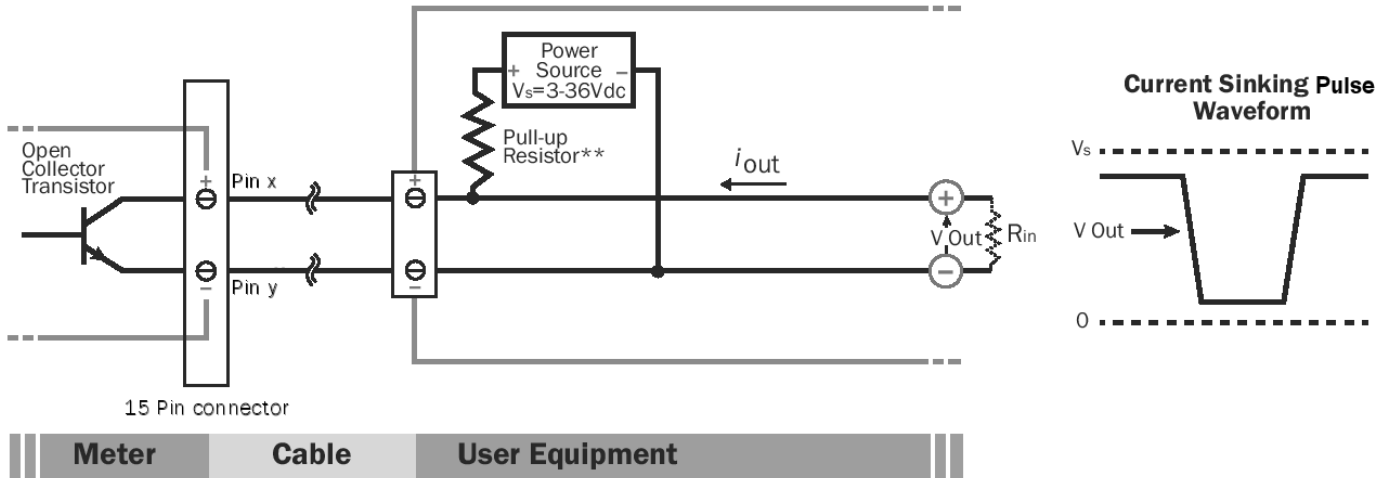




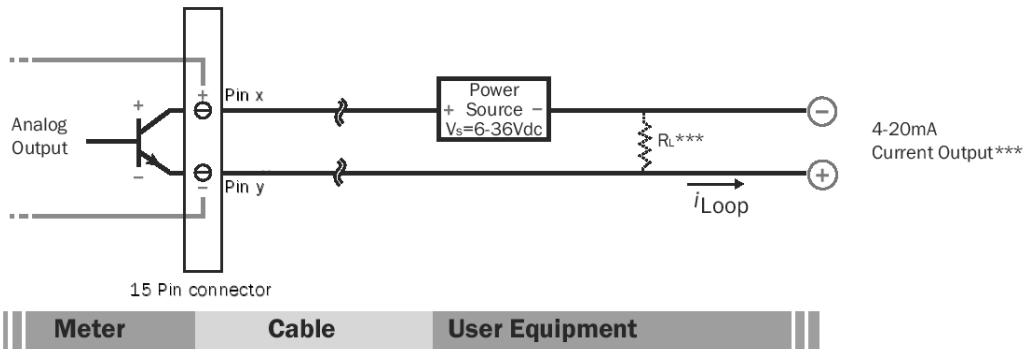
**Pulse or Digital Output Application - Sourcing Mode (Recommended for  $R_{in} < 30k\Omega$ )**



**Pulse or Digital Output Application - Sinking Mode (Recommended for  $R_{in} > 30k\Omega$ )**



**Analog (4-20mA Current Loop) Output Application**



\*\* Minimum resistor value is  $(100 \times V_s)$  ohms. Higher resistances maybe used depending on frequency and cable length. Longer cables and high frequencies require lower resistance.

\*\*\* Resistor  $R_L$  converts 4-20mA current to voltage for voltage input only devices.

**Cable Shield.** In general, the cable shield and its bare drain wire should be left unconnected at the user equipment end of the cable to minimize “ground loop” problems.

**Pulse Output Configuration.** A pulse output is standard on all models. Since this is an isolated output, the external equipment must include a DC power source to regenerate the pulse from the open-collector output (transistor equivalent of a contact closure). A pull-up or pull-down resistor may be needed if not included in the user equipment as shown in the diagrams. Both the power source and resistor may be supplied internally in some types of control and monitoring devices. If not, as for most PLC discrete input modules, they must be added externally at the module input terminals. The pulse output rate in volume units/pulse can be set by the user via the SETP tab on the meter’s setup menus.

Because the pulse output of an FMG490 meter is set by the user, care must be taken to assure the output pulses do not exceed the maximum frequency of the meter while also ensuring a reasonable resolution.

**K-factor:** Remember that SETP is expressed in units totaled per output pulse (G/P if using gallons) while K-factors are expressed in pulses per gallon (P/G.) To determine K-factor from SETP, divide 1 by SETP (if SETP is expressed in gallons.) Conversely, 1 divided by the K-factor equals SETP

FMG490 meters that were initially configured as battery powered units have a maximum output frequency of 150 Hz. Those that were initially configured as powered units have a maximum output frequency of 200 Hz.

Because all pulse outputs (SETP) are configured in (rate) units totaled per pulse, all sizes of meters can be configured with the same SETP values

For example, if your rate is chosen as gallons per minute (GPM) the table below applies. If your rate is different, simply use your rate label in place of (GPM.) The numerical values will remain the same.

**Pulse Units.** The units of measure of SETP are independently selectable and are not tied to rate or total. Upon change of the SETP unit, the pulse output may take up to 10 seconds, or the duration of one pulse (whichever is longer) to take effect.

**If Pulse Output is Inconsistent.** The PDAMP filter may need to be increased.

**Pulse Width Timing.** The unit and value of SETP must be chosen to keep the duration between meter pulse outputs to less than 500 seconds.

SETP	Flow Rate at 1 Hz (GPM)	Flow Rate at 200 Hz (GPM) Powered Meters	Flow Rate at 150 Hz (GPM) Battery Powered Meters
0.1	6	1200	900
0.2	12	2400	1800
0.3	18	3600	2700
0.4	24	4800	3600
0.5	30	6000	4500
0.6	36	7200	5400
0.7	42	8400	6300
0.8	48	9600	7200
0.9	54	10800	8100
1.0	60	12000	9000

*Lower frequency output pulses (1 pulse for some particular number of gallons) can also be set.*

Any output frequency can be determined by:

$$\text{Rate (units/minute)} \div \text{SETP (units/pulse)} = \text{pulse/minute}$$

$$\text{Hz} = \text{pulse/minute} \div 60 \text{ seconds / minutes}$$

**Analog Output (4-20mA) Configuration.** *(Not available on battery only units.)* Since the meter’s analog output is isolated and passive, loop power must be supplied externally as shown previously. (In addition, an external resistor R<sub>L</sub> will be needed to convert the loop current to voltage for voltage-only input devices.) The meter’s loop transmitter minimum voltage drop is 6Vdc (8Vdc with HART) which, with wiring resistance and loop power supply voltage, will determine the maximum resistance for R<sub>L</sub>. The flow rates corresponding to 4 and 20mA can be set by the user via the SET 4 and SET20 tabs on the meter’s setup menus.

### Changing Flow Meter Settings

#### Home Screen and General Navigation

The HOME Screen displays flow volume, direction of the flow total and flow RATE along with status conditions such as Empty Pipe. Two buttons below the LCD display are used to access menu screens for viewing and changing meter setup parameters.



**These two buttons are light sensors which can detect when a finger is covering them and activate upon release.** Only three button touch actions are needed to control navigation through the menus, settings changes and back to the home screen.

**HORIZONTAL SCROLLING:**

Tap right button to scroll horizontally through menu tabs or move horizontally within a tab dialog when applicable.



**SELECT:**

Tap left button to change a highlighted item within a tab dialog.



**ENTER/EXIT:**

Hold left button while tapping right button once to enter or exit a tab dialog or to navigate between the HOME and other menu screens.



#### Changing Total Direction/Resetting Batch Totalizers

On the Main screen, hold right button and tap left button 5 times to scroll through the total direction options. Release right button to select a total direction.



Once BATCH FORWARD or BATCH REVERSE is selected, tap right button four times to reset batch totalizer.

#### Entering Menu System

To enter the Menu System perform the hold and tap sequence. The Passcode entry screen will display. The default passcode is 000000. If a different passcode has previously been set, use the up and right buttons to enter that passcode. In either case, hold and tap again to move into the menu system. (If you enter the wrong passcode, hold and tap again to return to the previous screen. See page 21 for information on how to change a passcode.)



#### Making Selections

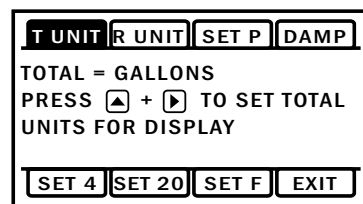
Once in the Menu System, move from tab to tab by tapping the right button. (See the next page for details on the various available tabs.)



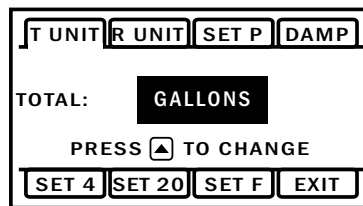
**Select the parameter.** In the screen for the highlighted tab you will see the current parameter value for that tab. Tapping the right button, move to the tab for the parameter you want to change.



In this example, the first line indicates that the current unit for the TOTAL is GALLONS. The next two lines tell you what to do next.



If you would like to change the TOTAL units, just perform the hold and tap sequence to bring up a screen to change the setting.



**Select a new setting.** Select the new setting by scrolling through a list of selections as in the screen illustration below by tapping the left button to find a different TOTAL unit.



**Accept changes.** To accept any changes you have made, perform the hold and tap sequence.



**When finished making changes.** When you are finished making changes, move to the EXIT tab using the right button.



To return to the HOME screen, perform the hold and tap sequence.



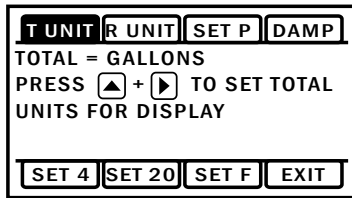
**Standard Menu Options**

Note: Available options will depend on specific meter configuration. Not all options are available on all meters.

**Options not ordered with your meter will not appear on the meter menu.**

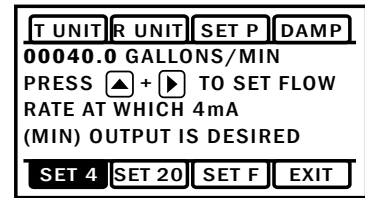
**T UNIT**

View or change TOTAL volume units



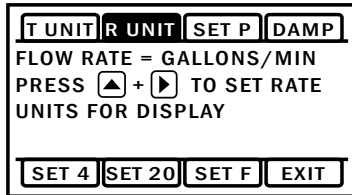
**SET 4**

View or change flow rate corresponding to 4mA.



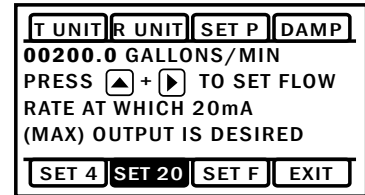
**R UNIT**

View or change flow RATE units



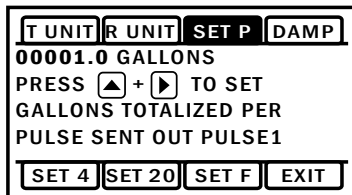
**SET 20**

View or change flow rate corresponding to 20mA.



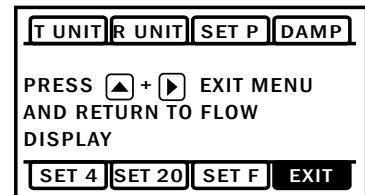
**SET P**

View or change pulse output scaling



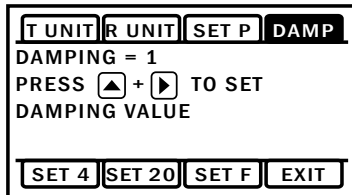
**EXIT**

Return to HOME SCREEN or enter SUBMENU



**DAMP**

View or change # of samples for rolling average.

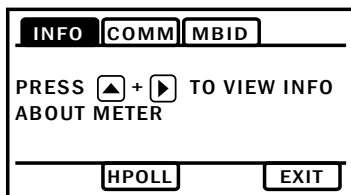


**Special SUBMENU for Further Options**

The EXIT tab in the MAIN MENU has a second function. If, instead of using the hold and tap sequence to return to the HOME screen, you tap five times, you will be redirected to a SUBMENU screen from which you can access several more options.

Navigation in this SUBMENU is the same as for the MAIN MENU. Whenever you wish, go to the EXIT tab in the SUBMENU and perform the hold and tap sequence to return to the MAIN MENU.

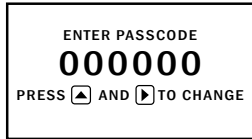
- INFO: Meter model number, serial number, and firmware version.
- COMM: Modbus® baud rate and parity. (Not available on battery only units.)
- MBID: Modbus® address (Not available on battery only units.)
- HPOLL: HART Address (Not available on battery only units.)
- EXIT: Return to MAIN MENU.



*Sub-Menu*

**To Change a Passcode and Decimal Places**

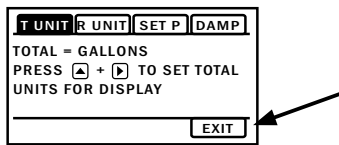
The FMG490 has a passcode system for restricting access to the menus. The meter comes from the factory with the passcode set to 000000. When a user attempts to enter the menu system (see details on page 20), the passcode entry screen will be displayed.



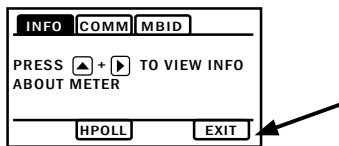
The default passcode is 000000. If a different passcode has previously been set, then the user must enter that passcode at this time. After entering the passcode, or leaving it at 000000 if using the default passcode, the user does the tap and hold sequence to move into the menu system.

**To change the passcode**, you must use the THIRD MENU screen. Access the THIRD MENU screen as follows:

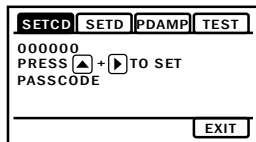
- Enter the main menu system, as described above.



- On the main menu, tab over to the EXIT tab and tap the [UP] five times. A SUBMENU screen will display.



- On the SUBMENU screen tab over to the EXIT tab and tap the [UP] five times. The THIRD MENU screen will display.



- To set the passcode, hold and tap and then use the [UP] and [RIGHT] to enter the new code.
- Hold and tap again to return to the THIRD MENU screen
- Tab to EXIT, and then hold and tap to return to the SUBMENU.

**To change the number of decimal places in the total**

- To set the decimal point, hold and tap on SETD and then use the [RIGHT] to move the decimal point.
- Hold and tap again to return to the THIRD MENU screen.
- Tab to EXIT, and then hold and tap to return to the SUBMENU.

**PDAMP**

PDAMP is used to view or change the number of samples for rolling average of pulse output.

**TEST**

TEST allows the user to initiate a fully functional, artificial flow rate for the purpose of testing other connected equipment. When TEST is applied, all features of the meter will function at the stated flow rate (in gallons per second).

For TEST to function, the meter must be filled (not EMPTY PIPE).

To enter a value into the TEST feature, navigate to the TEST tab and enter a flow rate value in the VAL screen (in gallons per second only,) then [RIGHT] to the VAL box and [UP] to the ON screen. This will initiate the TEST feature. The next [UP] would bring you to the OFF screen, but you can 'hold and tap' the arrows to return you to the sub menu while the feature operates.

**After use, the TEST feature must be turned OFF.** If the TEST feature is not turned OFF, the stated static flow rate (in gallons per second) will be shown any time the meter is full or in a flowing condition. Flow values recorded by the meter while the TEST feature is operating are permanently recorded in the displayed TOTAL. It may be useful to note that these values are only written to permanent memory every 15 minutes and cycling all power within this 15 minute time frame will return the meter to its previous total.

**Power Indicators**

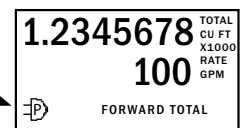
A power indicator is displayed in the lower left of the main display window.

Any meter powered from an external power source will display a power plug icon when running on external power. If the connection to external power is lost, the meter will switch to the backup battery and the power icon will switch to a battery symbol.

**OK** on the battery indicator means battery voltage is above 6.4 volts.

**LO** on the battery indicator means the battery is low and should be replaced soon.

- Being powered by external DC or AC
- Being powered by battery - voltage is sufficient
- Being powered by battery - voltage is low



If display reads, 'BATT END' replace battery immediately.

## Troubleshooting

Problem	Probable Causes	Things to try...
Blank Display	Faulty wiring from power source to meter  Backup battery has not been plugged in Dead backup battery	Check for incorrect wiring. Measure voltage with DMM where red and black wires connect to terminal block TB1 on back side of display. Verify correct polarity and confirm that voltage is steady and between 9Vdc and 32Vdc  Plug in the battery Replace battery
Flow rate reading fluctuates excessively when flow is unchanging	Excessively turbulent or unsteady flow due to partially closed valves or other flow obstructions  Pipe not full  Pulsing flow due to combining multiple upstream flow sources  Insufficient mixing of upstream chemicals  Low fluid conductivity < 20 $\mu$ S/cm  Noisy electrical environment  Defective or noisy AC switching power supply	Eliminate or minimize causes of flow disturbances or increase meter damping  Provide back pressure or other means to ensure pipe is filled  Move connection point further upstream  Move chemical injection downstream from meter  Replace with different type of meter  Improve grounding at meter and nearby potentially noisy electrical equipment. Increase distance between meter and electrical noise sources.  Replace power supply
Flow Rate appears correct but pulse/ frequency output is low, erratic or absent	Wiring incorrect  External device input impedance too low  Cable too long	Compare wiring with appropriate wiring recommendations  Use sourcing rather than sinking interface connection  Reduce interface pull-up resistance
Flow Rate appears correct but pulse/frequency output is erratic and/or too high	Electrical noise sources interfering with pulse frequency signal  Wrong type of cable  Grounding problem	Isolate, remove or reduce noise sources. Move meter control cable away from noise sources. Increase pulse damp setting (PDAMP)  Use only twisted pair cable and ensure both signal wires are on same twisted pair  Improve or try different grounding method

## Error Messages

Under certain conditions an error message may be displayed.

Message	Description	Notes
INIT	Initialization is occurring during power up.	
EMPTY PIPE	Fluid is not detected between the sensing electrodes.	Loop output = 22.8mA
LO in battery icon	Battery is getting low, replace soon. Meter still functions.	Above 6.4V, OK appears in icon
BATT END	Battery is very low (approx. 6.1V). Totalizer stops updating.	Loop output = 4mA
LOW VOLT	Incoming external power is very low and backup battery is dead or not connected	Loop output = 4mA
COIL FAIL	Coil current too high or too low (short or open).	Loop output = 22.8mA
COMM FAIL	Communication between transmitter and sensor board fails.	Loop output = 22.8mA
OVER RANGE	Rate exceeds number of digits that can be displayed. Adjust units.	Loop output = 4mA

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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