User's Guide

FMG-2000/2100 SERIES
Municipal/Industrial Magmeter

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GENERAL INFORMATION

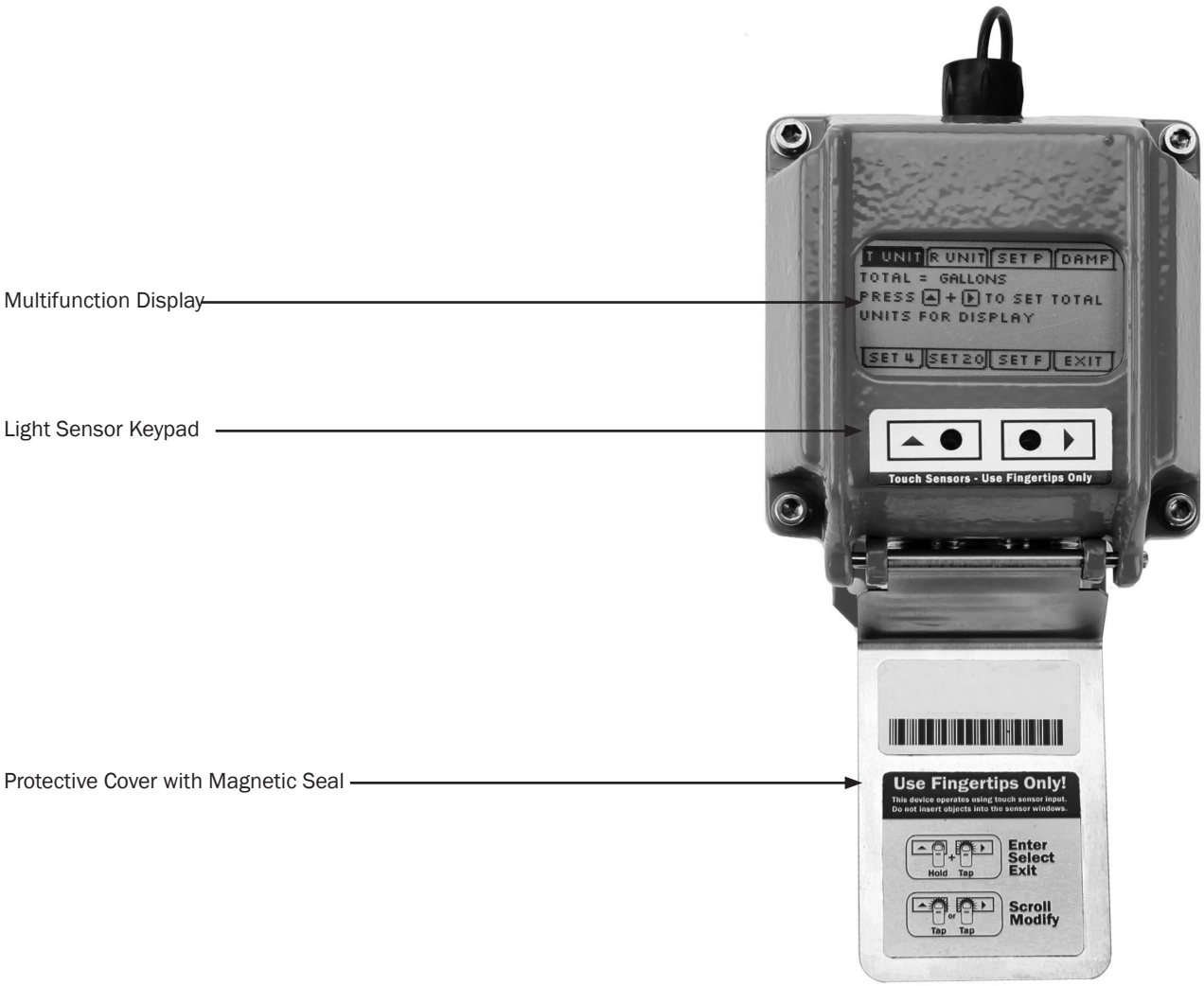
The **FMG2000/2100-Series** is the most economical flanged electromagnetic flowmeter on the market. It is used in 3" to 12" pipe in municipal or industrial water, wastewater, pump stations and packaged plant applications. The FMG2000/2100 have no moving parts with electrodes designed to discourage fouling. This magmeter requires much less frequent maintenance in applications where debris would impede mechanical meters. There is no rotor to stop turning or bearings to wear out. Minimal straight pipe requirements allow FMG2000/2100-Series meters to be used in piping configurations where there is little space between the meter and an elbow.

FMG2000/2100-Series meters are rated IP68 for applications where the meter may be under water up to a depth of 10 feet (3 meters) for prolonged periods of time.

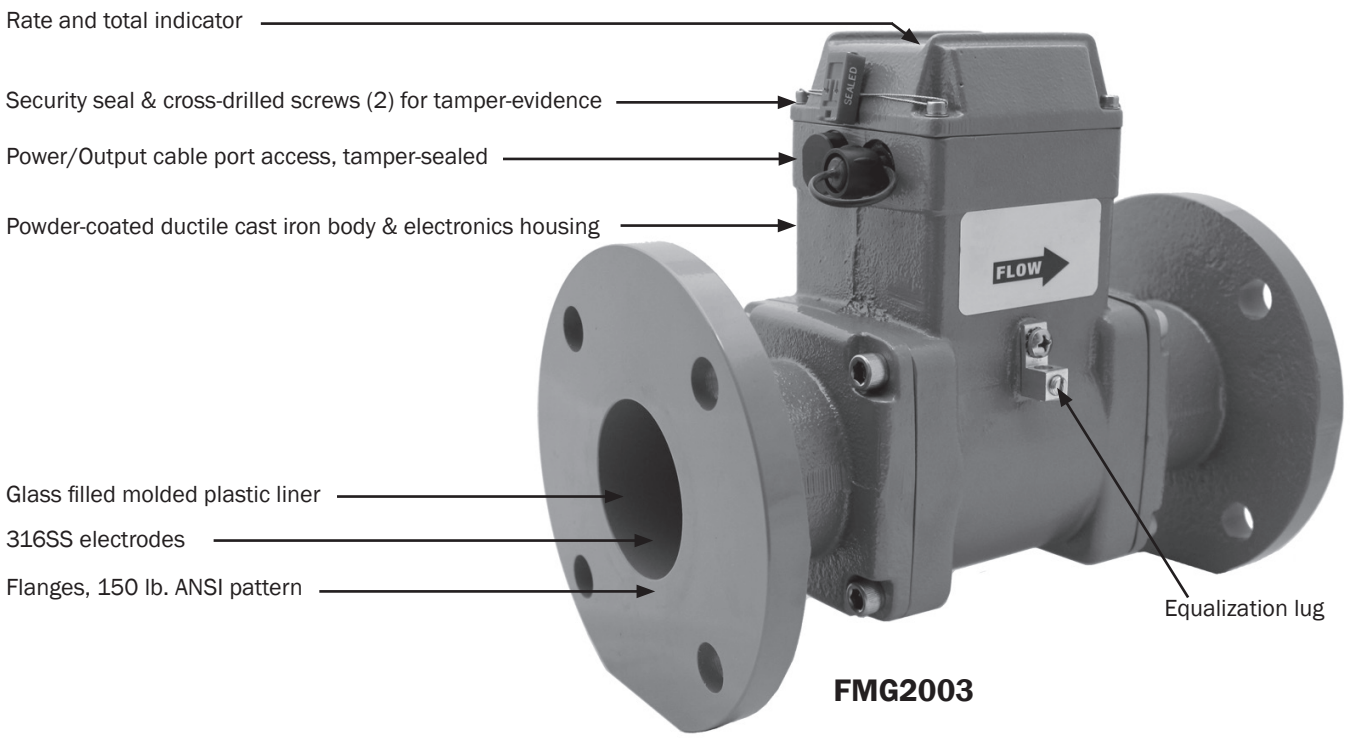
Rate and total indication are standard. Settings (units, pulse output, etc.) are user settable via front panel touch key pad.

The standard 20-foot (6 meter) cable also provides outputs for use with a variety of Omega and other displays and controls for remote reading, data logging and telemetry applications. 4-20mA passive current loop and high frequency outputs are optional. The FMG2100 remote display meter can be supplied with an optional internal AC power supply or can be externally powered with 9-36 Vdc at 30 mA.

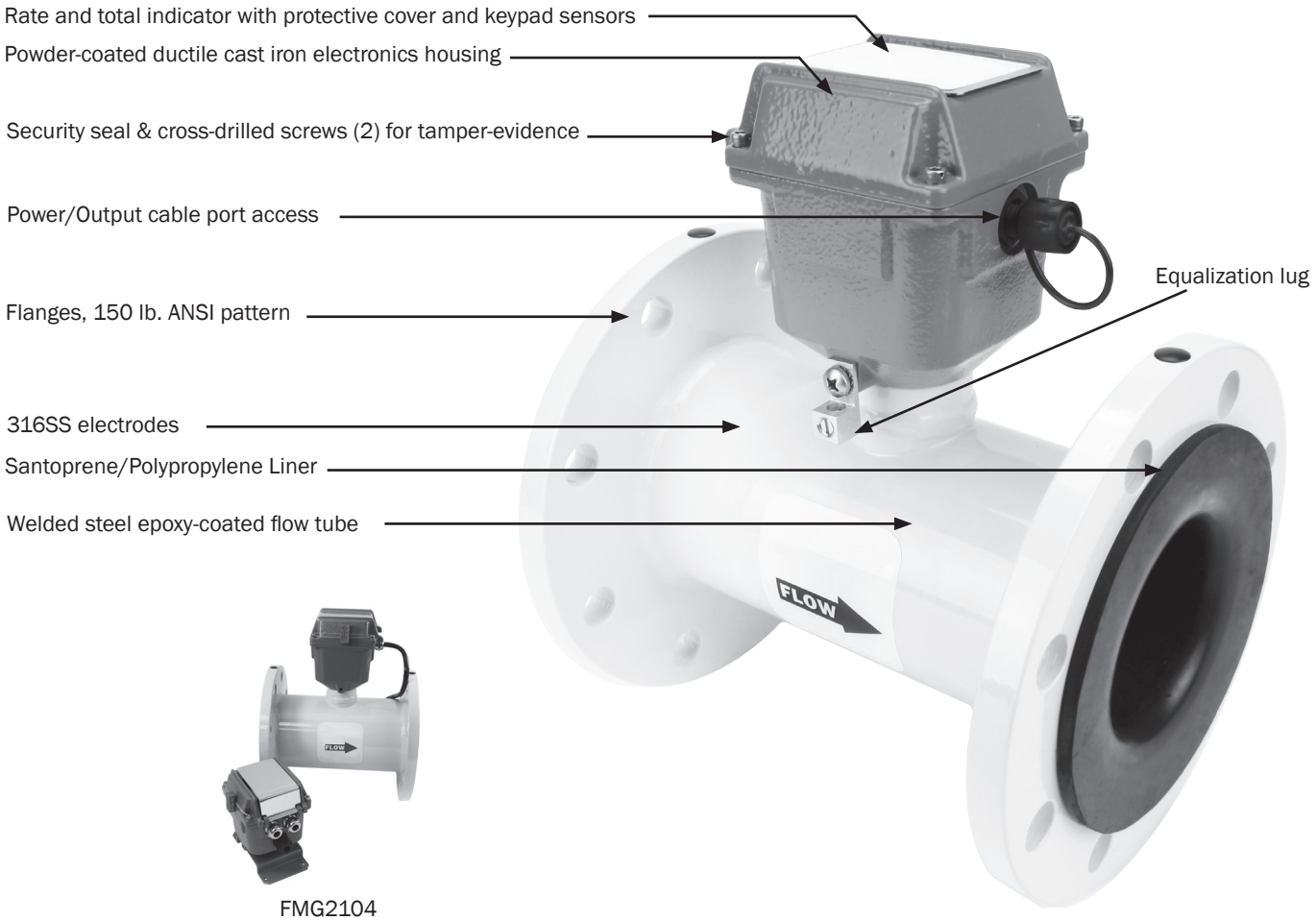
FEATURES



FEATURES Continued



FMG2003



FMG2104
(Remote indicator)

FMG2004

SPECIFICATIONS*

Pipe Sizes		3",4", 6", 8", 10",12"			
Flanges		150 lb. ANSI pattern			
Pressure		150 psi (10.3 bar) working pressure			
Temperature	**Operating**	10˚ to 130˚ F (-12˚ to 54˚ C)			
	Storage	-40˚ to 158˚ F (-40˚ to 70˚ C)			
Accuracy		+/- 1% of reading +/- 0.04% of full-scale flow from low flow cutoff to maximum flow rate of 10 m/sec			
Low Flow Cutoff		0.5% of maximum flow rate			
Materials	**Body (3" Only)**	Ductile cast iron, powder-coated w/epoxy powder			
	Body (4"-12")	Welded steel, epoxy-coated			
	Liner (3" Only)	PPO/PS Blend			
	Liner (4"-12")	Santoprene/Polypropylene			
	Electronics Housing	Ductile cast iron, powder-coated			
	Electrodes	316 stainless steel			
	O-ring (3" Only)	EPDM			
Display	**Type**	128x64 dot-matrix LCD			
	Digits	**5 Digit Rate**		**8 Digit Total**	
	Units	**Rate Volume Units**	**Rate Time Units**	**Total Volume Units**	
		Gallons Liters Cubic Feet Cubic Meters Million Gallons Mega Liters Imperial Gallons Million Imperial Gallons	Second Minute Hour Day	Gallons Gallons x 1000 Million Gallons Liters Liters x 1000 Mega Liters	Cubic Meters Cubic Meters x 1000 Cubic Feet Cubic Feet x 1000 Imperial Gallons Imperial Gallons x 1000 Million Imperial Gallons
Power	**DC Power**	9-36 Vdc @ 250 mA max, 30 mA average			
	AC Power[1]	85-264Vac, 50/60Hz, 0.12A			
Telemetry Output[2]		3.3V asynchronous receive and transmit (UART) signals, ASCII command-response protocol			
Pulse Frequency Output	**Signal**	Current sinking pulse, isolated, 36 Vdc at 10 mA max			
	Pulse Rates	User-settable volume units/pulse. Pulse width is one-half of pulse period, 200 pulses/sec max			
Options	**4-20mA Current Loop**	Isolated, passive, 6-36Vdc, +/- 0.1% of pulse/frequency output HART compliant[2]			
	Digital Output	Isolated, open collector, 36Vdc @ 10mA max., frequency output up to 10kHz			
Cable	**Control Cable**	Six-conductor water-blocked cable, polyurethane jacket, 20ft (6m) standard length for power, pulse frequency or optional outputs			
	Remote Display Cable (FMG2100)	30ft (9m) standard length (may be shortened). Additional cable can be ordered and attached with the use of a junction box up to 100ft (30m) total			
Conductivity		>20 microSiemens/cm			
Empty Pipe Detection		Hardware/software, conductivity-based			
Regulatory		CE (EN 61326) pending			
Environmental		IP68 to 10ft (3m) depth			

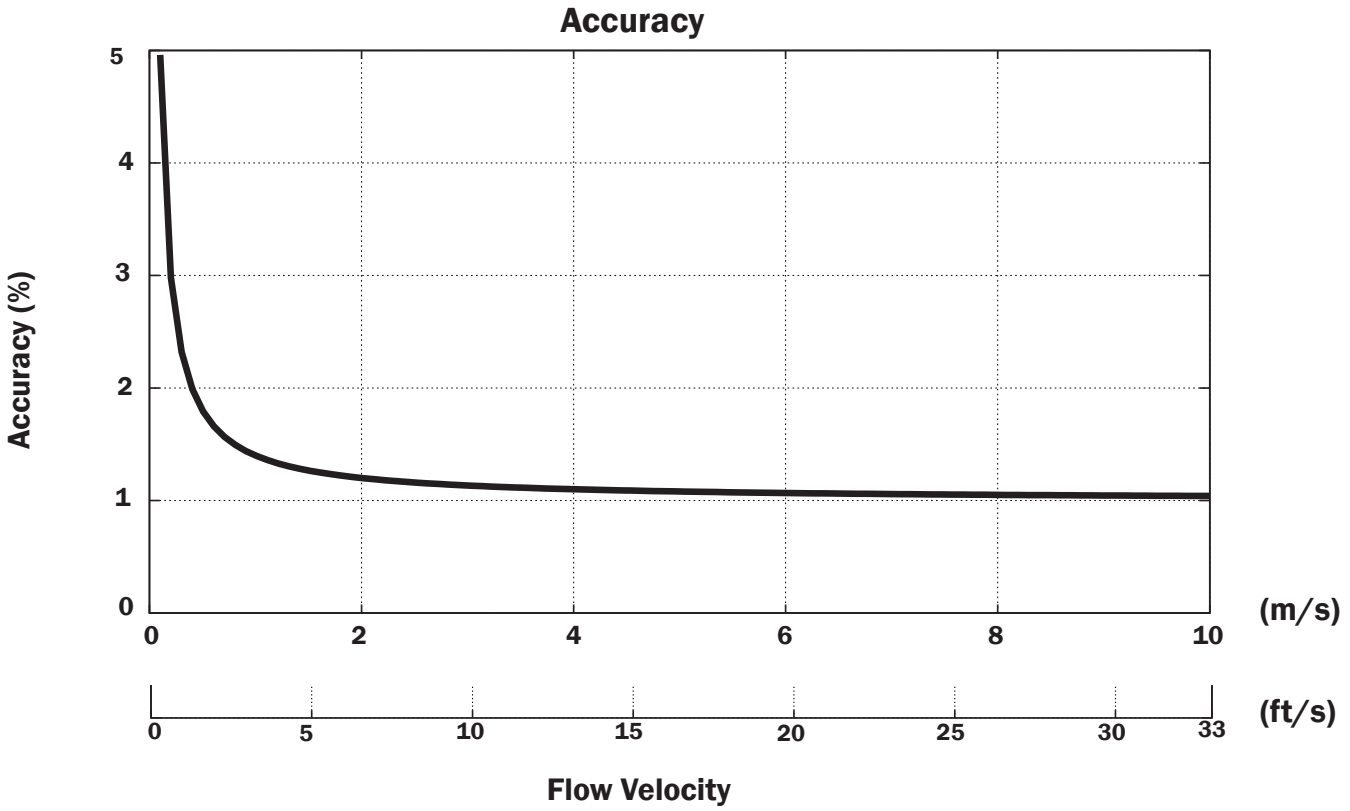
**Specifications subject to change. Please consult our website for the most current data.*

[1] FMG2000 only, FMG2001 requires external AC power supply

[2]Available in 2014

FLOW RANGE (3” - 12”)

Pipe Size (Inches in diameter)	3”	4”	6”	8”	10”	12”
Max Flow Velocity (Meters/Second)	10	10	10	10	10	10
Max Flow Rate (Gallons/Minute)	723	1285	2891	5140	8031	11565
Max Flow Rate (Liters/Second)	46	81	182	324	507	730
Turn Down Flow Rate (Gallons/Minute)	3.62	6.43	14.46	25.70	40.15	57.82
Turn Down Flow Rate (Liters/Second)	0.23	0.41	0.91	1.62	2.54	3.65

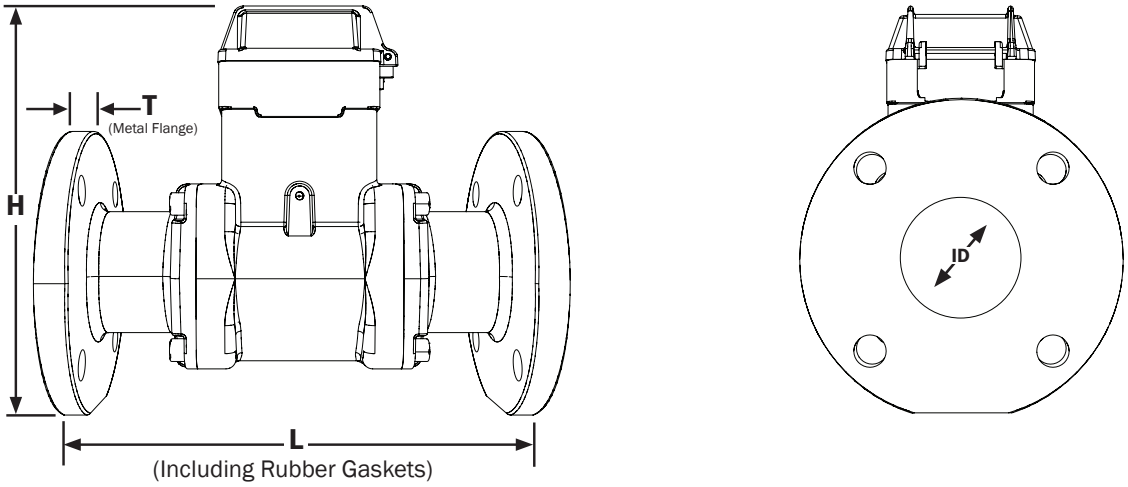


Dimensions

Meter Size	L		H		T		ID		Shipping Weight	
	inch	mm	inch	mm	inch	mm	inch	mm	pounds	Kg
3”	12.0	305	6.80	173	.68	17.3	2.60	66.04	41	19
4”	10.24	260	8.12	206	.62	20.9	3.12	79.25	35	16
6”	12.27	312	9.22	234	.69	23.3	5.05	128.27	50	23
8”	14.24	362	10.22	260	.69	23.3	6.44	163.58	72	33
10”	18.18	462	11.22	285	.69	23.3	8.61	218.69	128	58
12”	19.68	500	12.28	312	.81	20.6	10.55	267.97	170	78
Flanges	Standard ANSI 150 lb. drilling								Cable 1 lb.	

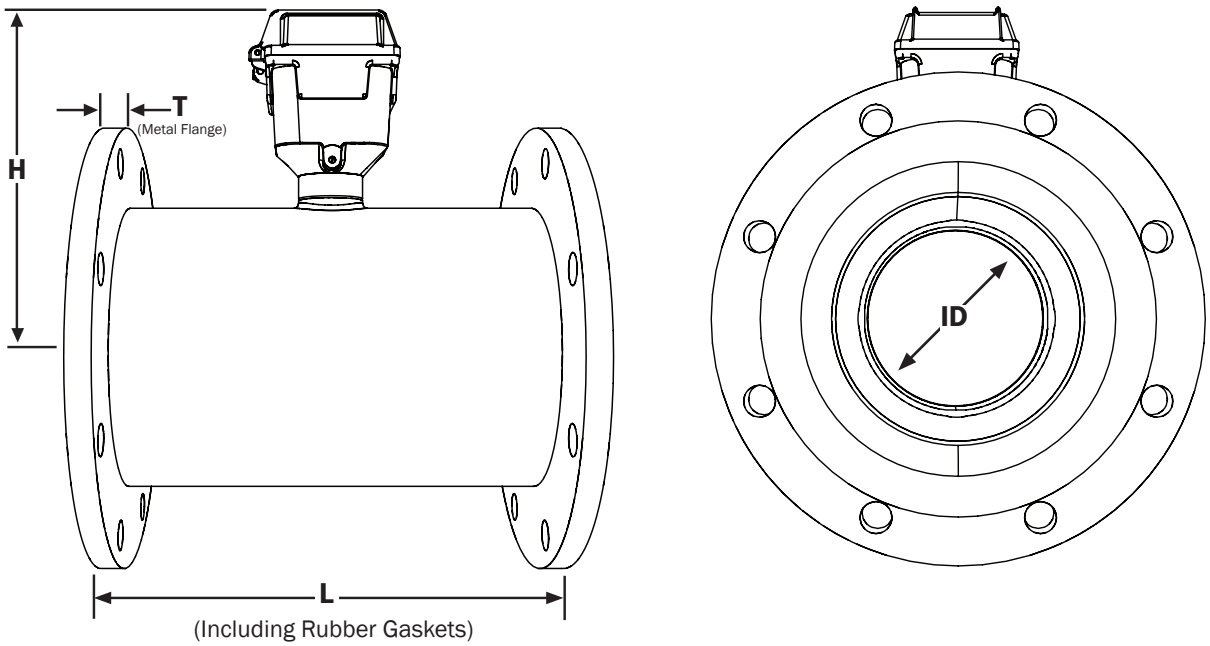
DIMENSIONS

FMG2003 Shown



FMG2100 Remote Shown

FMG2004-2012 Shown



INSTALLATION

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

Positioning the Meter. These meters can be installed horizontally, vertically, 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. As with most flow meters, the FMG2000/2100 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 7).

Full Pipe Recommendations. All magmeters require a method for determining that the pipe is empty, to prevent false reading. 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 8).

Fittings. The FMG2000/2100 flanges have standard ANSI 150 lb. drilling pattern and mate with any other ANSI 150 lb. flange.

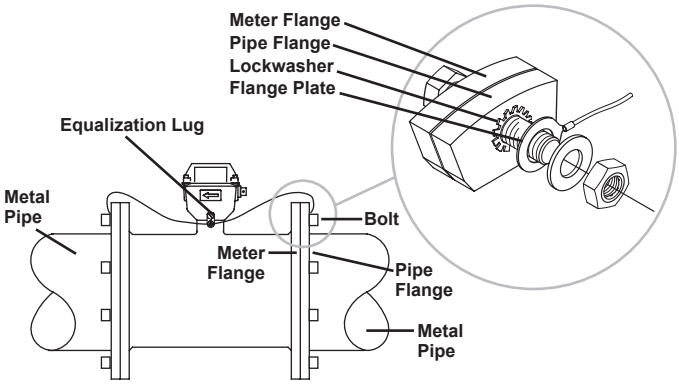
Calibration. The FMG2000/2100 is factory-calibrated and will not require any form of field calibration.

Chemical Injection. When any magmeter, by any manufacturer, 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.

EQUALIZATION AND GROUNDING

Metal Pipe Installations. To equalize the electrical potential of the fluid, the iMAG 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 lockwasher 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 equlization flange plate lockwasher contacts the pipe flange. Connection must be inspected periodically for corrosion to maintain the necessary low resistance connection.

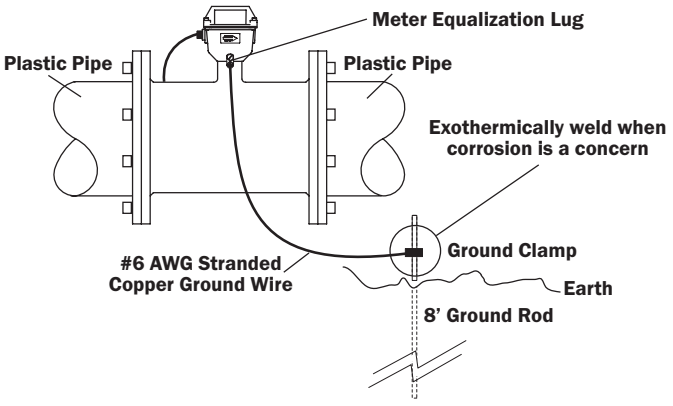


Equalization Diagram

Run wire from equalization lug to both pipe flanges; secure flange plates under bolt heads as shown.

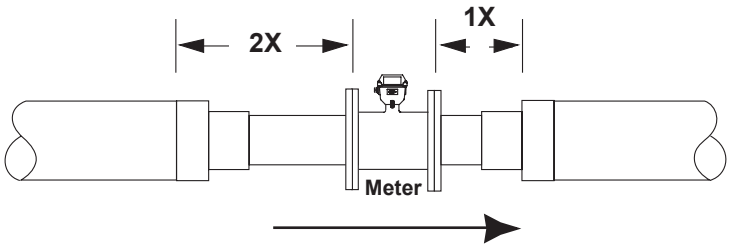
WARNING: ELECTRICAL SHOCK HAZARD When the meter is externally AC powered the piping system must be grounded to meet national and local electrical safety codes. Failure to do so can result in electrical shock and/or burn.

Plastic Pipe Installations. When the FMG2000/2100 is installed in a plastic piping system, it is not necessary to use the equalization straps, but very important to ground the meter to avoid electrical shock hazard and electrostatic interference with meter function. If the rate display is unstable, grounding rings may be necessary.

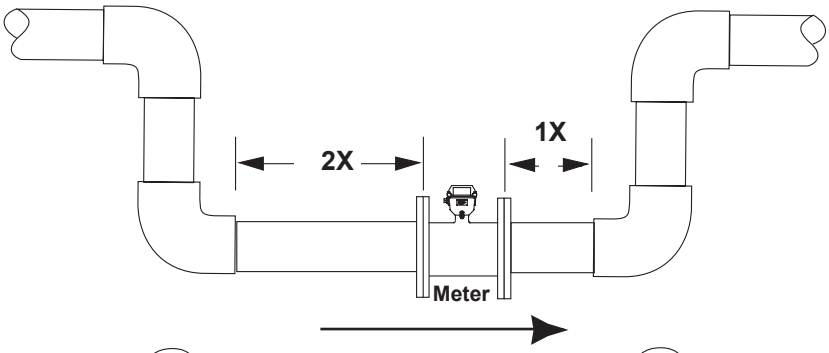


(X = diameter)

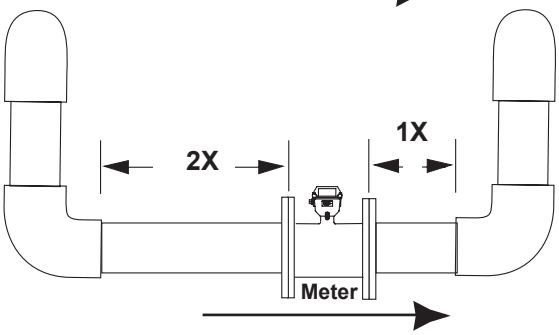
Reduced Pipe



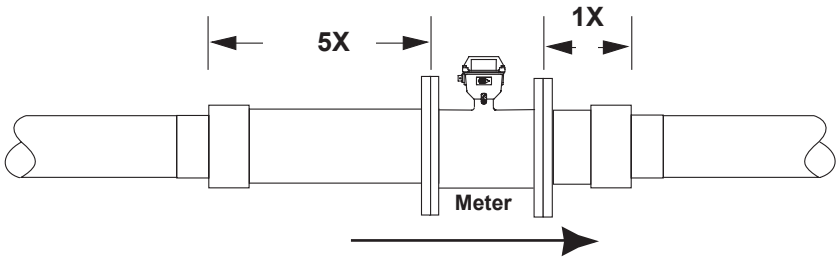
Two Elbows In Plane



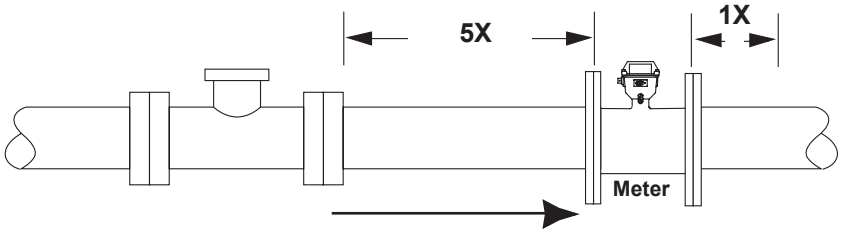
Two Elbows, Out Of Plane



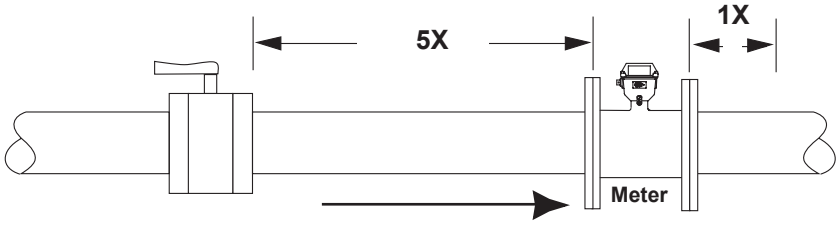
Expanded Pipe



Swirling Flow
Propeller Meter

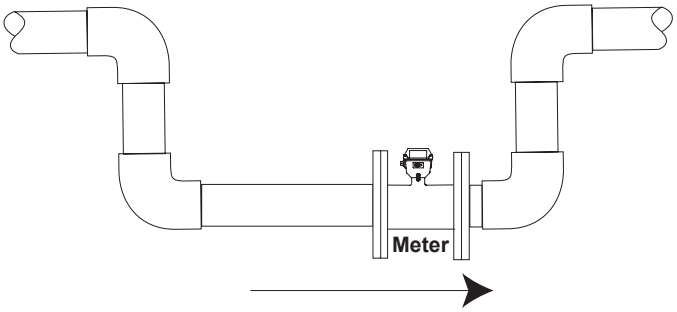


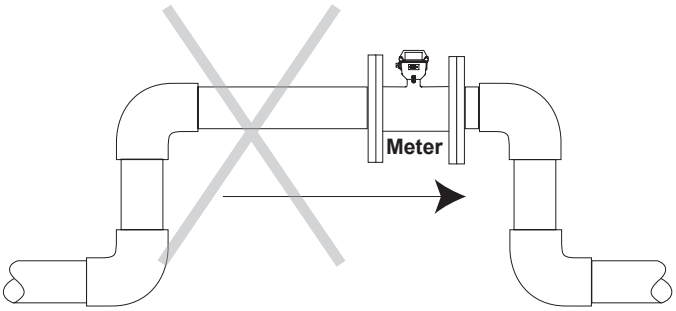
Swirling Flow
Partially Open
Butterfly Valve



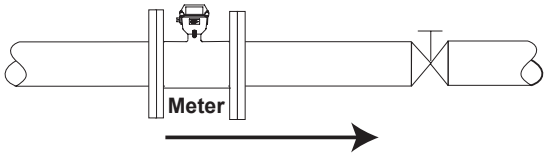
FULL PIPE RECOMMENDATIONS

Recommended:
Keep pipe full at meter for accuracy

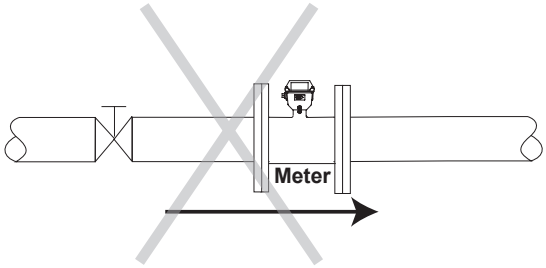




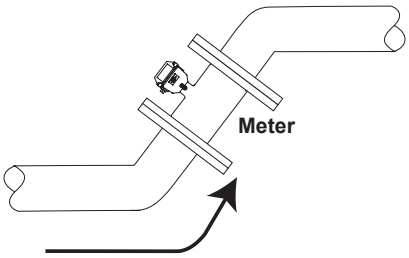
Not Ideal:
Allows air pockets to form at meter



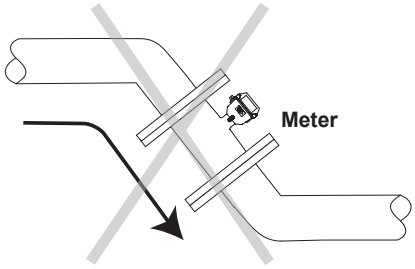
Recommended:
Keeps pipe full at meter for accuracy



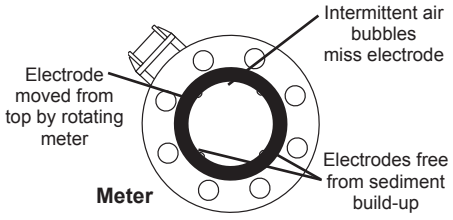
Not Ideal:
Post-valve cavitation can create air pocket



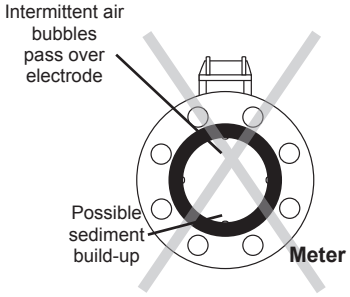
Recommended:
Allows air to bleed off



Not Ideal:
Air can be trapped



Recommended:
Improved accuracy results from unimpeded electrodes

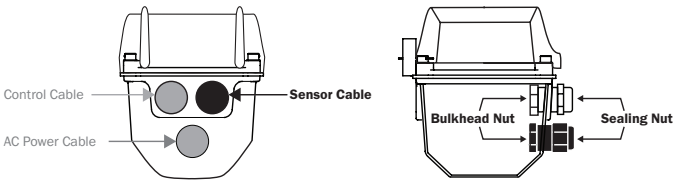


Not Ideal:
Air bubbles and sediment on the electrodes can affect accuracy

REMOTE SENSOR CABLE INSTALLATION (FMG2100 ONLY)

The standard 30 foot cable connecting the FMG2100 sensor body to the remote display head is shipped with the cable disconnected at the display end. To connect during installation:

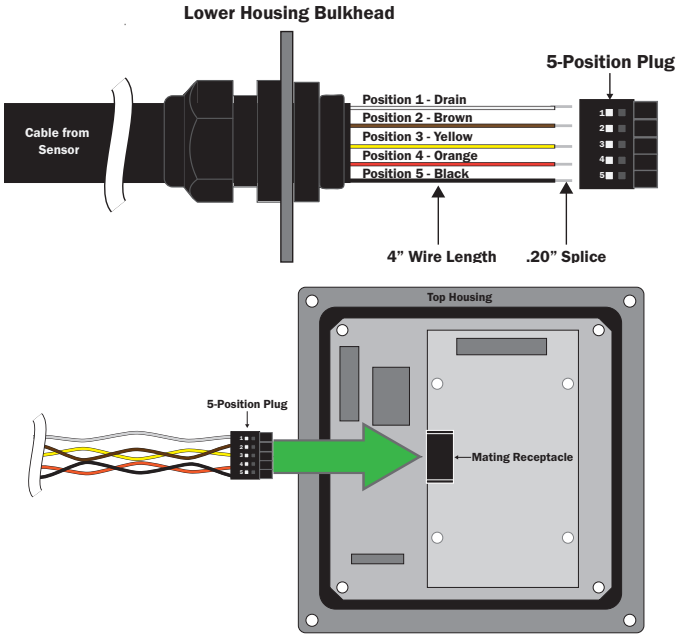
1. Remove the four cap screws securing the top housing to the lower housing and swing the top open to expose the internal wiring (see photo.)
2. Remove the sensor cable hole plug and discard.
3. After removing the cable gland bulkhead nut, insert the 5-postion plug and cable gland threaded bushing into the open hole. (see drawing.) Do not loosen the cable jacket sealing nut.



4. Install the bulkhead nut back onto the cable gland threads inside the housing and tighten securely. A loose nut could cause moisture ingress and compromise the meter head's IP68 rating, voiding the warranty.
5. Insert the five-position plug into the mating receptacle on the small circuit board attached to the larger main display circuit board.
6. Close the top cover and replace the four cap screws, securing tightly to reseal the housing against moisture ingress.

Shortening the Sensor Cable. The sensor cable may be shortened by cutting the cable at the display head end. Under no circumstances should the cable gland at the sensor body end be removed as this will compromise the IP68 moisture ingress protection causing meter failure and voiding the warranty. To shorten the cable follow the steps below:

1. Before cutting, loosen the cable gland sealing nut and slide the gland back past where the cable will be cut.
2. After cutting, remove the jacket and outer braid shield and cut and strip conductors to the dimensions shown in the drawing (right). Tinning the bare wire ends is recommended when possible for easier reinsertion into the 5-position plug.
3. Insert a small jeweler's screwdriver or pick into the slot next to the black wire on the 5-position plug and pull the wire out. Then insert the black wire from the shortened cable into the same position as the wire just removed. Repeat this step, one wire at a time, for all five positions.
4. Remove the sensor cable hole plug and discard.
5. After removing the cable gland bulkhead nut, insert the plug and cable gland bushing through the open hole. Install the nut back onto the cable gland threads inside the housing and tighten securely. A loose nut could cause moisture ingress and compromise the meter head's IP68 rating, voiding the warranty.
6. Slide the cable outward through the loosened cable gland until the jacket just protrudes past the cable gland bulkhead threads.
7. Retighten the gland sealing nut until cable cannot be pushed in by hand and then tighten an additional full turn. Pull on cable to assure sufficient tightness.
8. Insert the five-position plug into the mating receptacle on the small circuit board attached to the larger main display circuit board.
9. Close the top cover and replace the four cap screws, securing tightly to reseal the housing against moisture ingress.

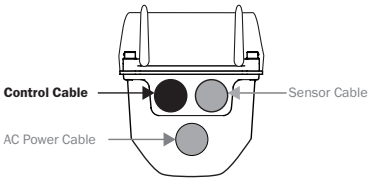


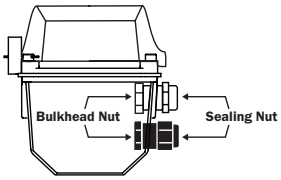
Lengthening the Sensor Cable. Replacing the entire cable with a longer cable is not recommended. To extend the distance from the sensor body to the remote display head:

1. Install a junction box with two holes for 5/8" connector bushings at the cable splicing location.
2. Install the sensor cable gland threaded bushing into one junction box hole and secure with the bulkhead nut.
3. Obtain the required additional length of 2-pair Seametrics sensor cable and two additional cable glands, installing the additional cable and glands from the junction box to the display head. Secure all cable gland sealing and bulkhead nuts to tightness required to prevent moisture ingress as described in previous instructions. Use pull test to assure sufficient tightness.
4. Splice wires in junction box using moisture-sealed wire connectors or pot to seal against moisture ingress. Replace junction box sealing cover.
5. Connect 5-position plug to the small circuit board receptacle in the display head as described in previous instructions.

WIRING TO POWER SOURCES AND EXTERNAL MONITORING AND CONTROL EQUIPMENT

The six-conductor Control Cable exiting the display head provides user connections for DC power as well as for external monitoring and control equipment needed for pump control, SCADA equiment, Programmable Logic Controllers, remote displays and other monitoring equipment. A four-character Option Identifier (OID) code found in the "*Control Cable Wiring*" table on page 11 shows available combinations of external wiring connections. In addition, it gives the corresponding electrical function for each of the wires in the cable. The OID code is also included in the model number on the meter as well as on the label attached to the control cable as shipped from the factory. The first character in the OID code identifies the power source as either external DC (D) or internal AC (A). The next two characters identify the functions of the other wiring options such as Pulse Output (P), Telemetry (T), Analog Output (L), Digital Output (D), Relay Output (R) or Serial Output (SS.) (The fourth character (X) is reserved for future applications.) Application, wiring and other electrical interface guidelines for each of these is outlined in the following paragraphs.

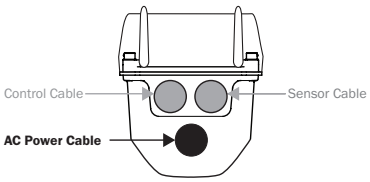


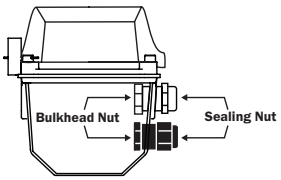


DC Power Connection. When the first OID code character is a "D", connect the RED and BLACK wires to the positive and negative terminals respectively of a clean (low-noise) source of dc power in the range of 9-32Vdc and able to supply at least 250mA. AC line-operated power supplies with outputs greater than 18Vdc must be regulated. Where possible, connections from either power supply terminal to the cable shield or any other ground should be avoided.

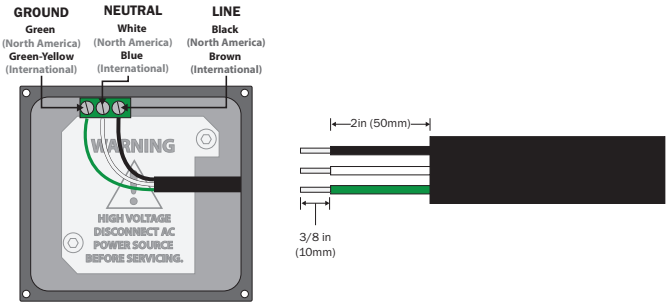
AC Power Connection. When the first OID code character is "A", the RED and BLACK wires are not used. Instead, 85-264Vac power is supplied to the flow meter via a separate meter housing cable-entry gland and user-supplied three-conductor power cord having local regulatory agency approval. If installed outdoors or less than 33 ft. (10m) from a utility power service entrance, ac power should be supplied via a properly-grounded surge suppression device. See diagrams below for wiring instructions.

1. Using a 5/32" hex driver, remove the four cap screws securing the top housing to the lower housing and swing the top open to expose the internal wiring and components.
2. Loosen the cable gland sealing nut, remove the plug and insert the unconnected cable end through the open hole.





3. Strip cable jacket and conductors (see below) and install 3-conductor power cable and wire to Line (L), Neutral (N) and Ground (G) positions on power supply terminal block as shown below



4. Tighten terminal block screws securely using 1/8" (3mm) screwdriver. Tighten the cable gland sealing nut securely. A loose nut could cause moisture ingress and compromise the meter head's IP67 rating, voiding the warranty.
5. Close the top cover and replace the four cap screws, securing tightly to reseal the housing against moisture ingress.

Pulse Output Connection. When the second OID code character is "P", refer to the "*Digital Output Application*" diagrams on page 12 for recommended pulse output connections to external equipment. 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. Pulse output rate in volume units/pulse is user-settable via the SET P tab on the meter's setup menus.

Analog Output (4-20mA) Connection. When the second or third OID code character is "L", refer to the "*Analog Output Application*" diagram on page 12 for 4-20mA current loop output connections to external analog input devices. Since the meter's analog output is isolated and passive loop power must be supplied externally as shown. (In addition, an external resistor R_L will be needed to convert the loop current to voltage for voltage-only input devices.) The meter's loop

transmitter minimum voltage drop is 6V which, with wiring resistance and loop power supply voltage, will determine the maximum resistance for R_L. The flow rates corresponding to 4 and 20mA are user-settable via the SET 4 and SET20 tabs on the meter's setup menus.

Digital Output Connection. When the second or third OID code character is "D", refer to "*Digital Output Application*" diagrams on page 12 for recommended connections to external equipment. These outputs are essentially the same as the Pulse Output described above except they are capable of output frequencies up to 10kHz. Frequency output scaling is user-settable via the FOUT tab on the meter's setup menus.

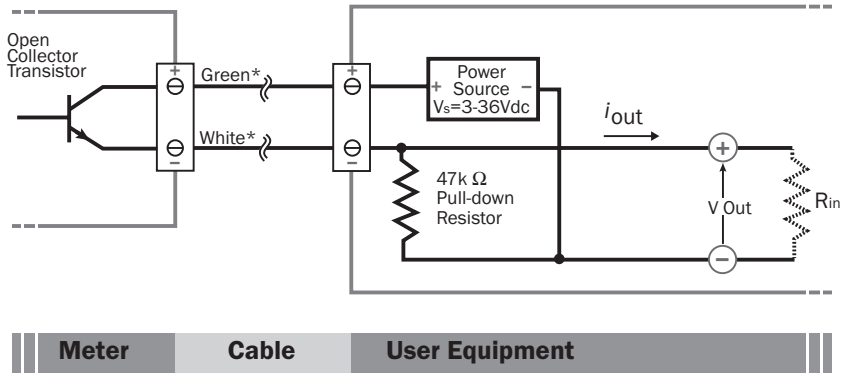
Serial Communication Connection. When the second and third OID code characters are "SS", refer to *"Control Cable Wiring"* table below for recommended connections to external equipment. These connections provide a half-duplex, isolated, RS485 serial communications port using the Modbus messaging protocol. The port is reconfigurable by internal jumper settings to full-duplex RS232 or 3.3V CMOS. The TXD connection is the transmitted data output from the meter and RXD is the received data input to the meter. Optionally, the RTS input can be used to open the port. Contact Seametrics customer service for supported Modbus message protocol and electrical interface specifications.

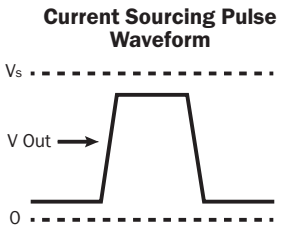
Cable Shield. In general, the cable shield and its bare drain wire should be left unconnected at the user equipement end of the cable to minimize "ground loop" problems.

Control Cable Wiring

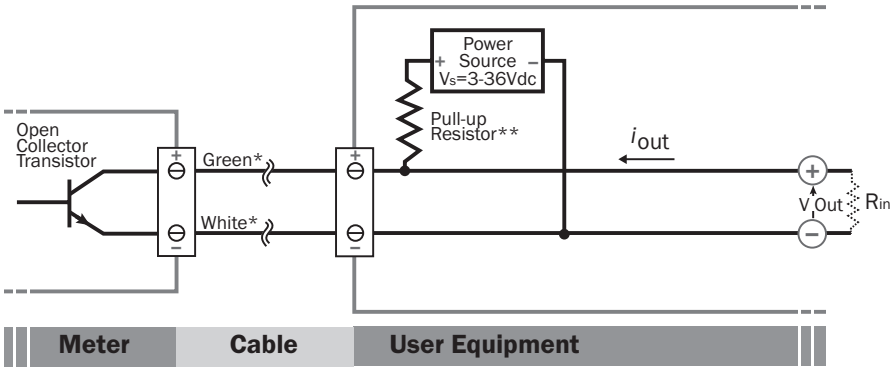
Power Source	Options Installed	OID Codes	Cable Conductor Usage					
			Red	Black	Green	White	Orange	Blue
DC	4-20mA Output	DPLX	DC PWR +	DC PWR -	Pulse +	Pulse -	4-20mA Out +	4-20mA Out -
DC	Two Digital Outputs	DDDX	DC PWR +	DC PWR -	Out 1 +	Out 1 -	Out 2 +	Out 2 -
DC	4-20mA Output 1 Digital Output	DDLX	DC PWR +	DC PWR -	Out 1 +	Out 1 -	4-20mA Out +	4-20mA Out -
DC	One Pulse Output	DPXX	DC PWR +	DC PWR -	Pulse +	Pulse -	Do Not Connect	Do Not Connect
AC	4-20mA Output	APLX	Do Not Connect	Do Not Connect	Pulse +	Pulse -	4-20mA Out +	4-20mA Out -
AC	Two Digital Outputs	ADDX	Do Not Connect	Do Not Connect	Out 1 +	Out 1 -	Out 2 +	Out 2 -
AC	4-20mA Output 1 Digital Output	ADLX	Do Not Connect	Do Not Connect	Out 1 +	Out 1 -	4-20mA Out +	4-20mA Out -
AC	One Pulse Output	APXX	Do Not Connect	Do Not Connect	Pulse +	Pulse -	Do Not Connect	Do Not Connect

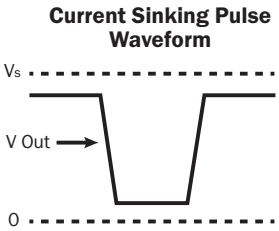
Digital Output Application - Sourcing Mode (Recommended for R_{in} < 30kΩ)



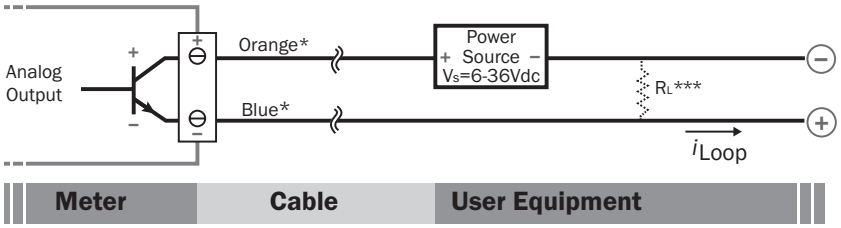


Digital Output Application - Sinking Mode (Recommended for R_{in} > 30kΩ)





Analog (4-20mA Current Loop) Output Application



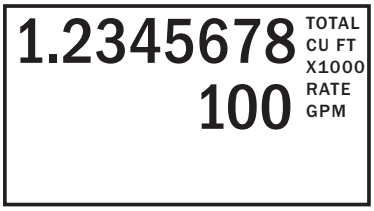
***** Wire colors shown are typical but because there are exceptions, always refer to the color codes shown on the cable label or "*Control Cable Wiring*" table on page 11.

** Minimum resistor value is (100 x 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.

CHANGING FLOWMETER SETTINGS

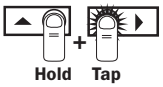
The HOME Screen. The HOME Screen shown below is the normal screen which displays TOTAL flow volume and flow RATE along with status conditions such as Empty Pipe. Two buttons below the LCD display are used to access menu screens for viewing and changing meter setup parameters.



Button Sensors. The two buttons are light sensors which can detect when a finger is covering them. Only three button touch actions are needed to control navigation through the menus, settings changes and back to the home screen. They are:

HORIZONTAL SCROLLING: Tap right-hand button to scroll horizontally through menu tabs or move horizontally within a tab dialog when applicable.

SELECT: Tap left-hand button to change a highlighted item within a tab dialog.

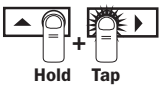


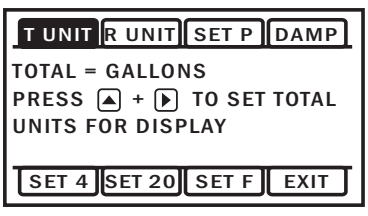
ENTER/EXIT: Hold left button while tapping right button once to enter or exit a tab dialog or to navigate between the HOME and other menu screens.

Main Menu. All menu screens consist of two rows of tabs surrounding a dialog box that lets you view and change setup parameters. For the MAIN MENU, the tabs have the following functions:

TAB	FUNCTION
T UNIT	View or change TOTAL volume units
R UNIT	View or change flow RATE units
SET P	View or change pulse output scaling
DAMP	View or change filter settings
SET 4	View or change flow rate corresponding to 4mA
SET 20	View or change flow rate corresponding to 20mA
F OUT	View or change high frequency output scaling
EXIT	Return to HOME SCREEN or Enter SUBMENU

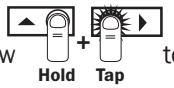
To enter the MAIN MENU perform the hold and tap sequence:



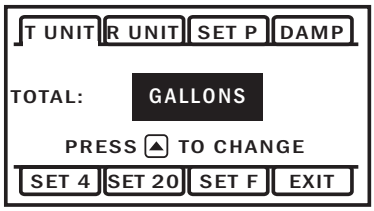


Once in the main menu you can move from tab to tab by tapping the button:

In the dialog box for the currently highlighted tab you will see that tab parameter's current value. In the previous screen illustration, the first line indicates that the current unit for the TOTAL is GALLONS. The next two lines in the dialog box 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 dialog box that will tell you how to change the setting.



You select the new setting by scrolling through a list of selections as in the screen illustration below by tapping to find a different TOTAL unit.

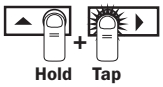


Similiarly, for the SET tabs, the dialog box instructions will tell you how to change a numerical value using both the and buttons.

To accept any changes you've made just hold and tap again, and the changes will be saved and you will be returned to the MAIN MENU screen where you can move to another tab.

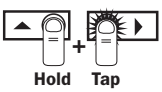
When you are finished making changes, move to the EXIT tab using:

To return to the HOME screen, hold and tap:



Submenu. 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 four times.

You will be redirected to a SUBMENU screen which provides access to more information about the meter, such Serial Numbers and firmware revisions. Navigation in this SUBMENU is the same as for the MAIN MENU. Whenever you wish, go to the EXIT tab in the SUBMENU and use the hold and tap sequence to return to the MAIN MENU.



PROBLEM	PROBABLE CAUSES	Try...
Blank Display	Faulty wiring from power source to meter or faulty AC power supply	Check for miswiring. Measure voltage with DMM where red and black wires connect to terminal block TB2 inside meter display head. Verify correct polarity and confirm that voltage is steady and between 9Vdc and 32Vdc
Flow rate reads zero continuously regardless of flow	Flow is below cutoff	Increase flow above cutoff
Flow rate shows 'REVERSE FLOW' continuously when flow is greater than cutoff	Meter is installed backwards	Reinstall correctly
Flow rate reading fluctuates excessively when flow is unchanging	Excessively turbulent or unsteady flow due to partially closed valves or other flow obstructions	Eliminate or minimize causes of flow disturbances or increase meter damping
	Pipe not full.	Provide back pressure or other means to ensure pipe is filled
	Pulsing flow due to combining multiple upstream flow sources	Move connection point further upstream
	Insufficient mixing of upstream chemicals	Move chemical injection downstream from meter
	Low fluid conductivity < 20 µS/cm	Replace with different type of meter
	Noisy electrical environment	Improve grounding at meter and nearby potential ly noisy electrical equipment. Increase distance between meter and electrical noise sources.
	Defective or noisy ac switching power supply	Replace power supply
Flow Rate appears correct but pulse/ frequency output is low, erratic or absent	Wiring incorrect	Compare wiring with appropriate wiring recommendations
	External device input impedance too low	Use sourcing rather than sinking interface connection
	Cable too long	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	Isolate, remove or reduce noise sources. Move meter control cable away from noise sources.
	Wrong type of cable	Use only twisted pair cable and ensure both signal wires are on same twisted pair
	Grounding problem	Improve or try different grounding method.
Flow rate reads "COMM FAIL" instead of rate (FMG2100 only)	Cable between flow sensor body and display head is disconnected, miswired or damaged	Inspect cable for damage. Check cable connection inside display head for correct wiring to five-position connector, ensure that connector is properly inserted, inspect for broken connections.

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.

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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.

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