

iMAG

Municipal/Industrial Magmeter Instructions

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GENERAL INFORMATION

The **iMAG-Series** is the most economical flanged electromagnetic flowmeter on the market. It is used in 3" to 12" pipe in municipal or industrial water, waste and reclaimed water, pump stations and packaged plant applications. The iMAG has no moving parts and electrodes are designed to discourage fouling. This magmeter requires no maintenance in applications where debris would impede mechanical meters. There are no parts to wear out. Minimal straight pipe requirements allow iMAG-Series meters to be used in piping configurations where there is little space between the meter and an elbow.

iMAG-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.

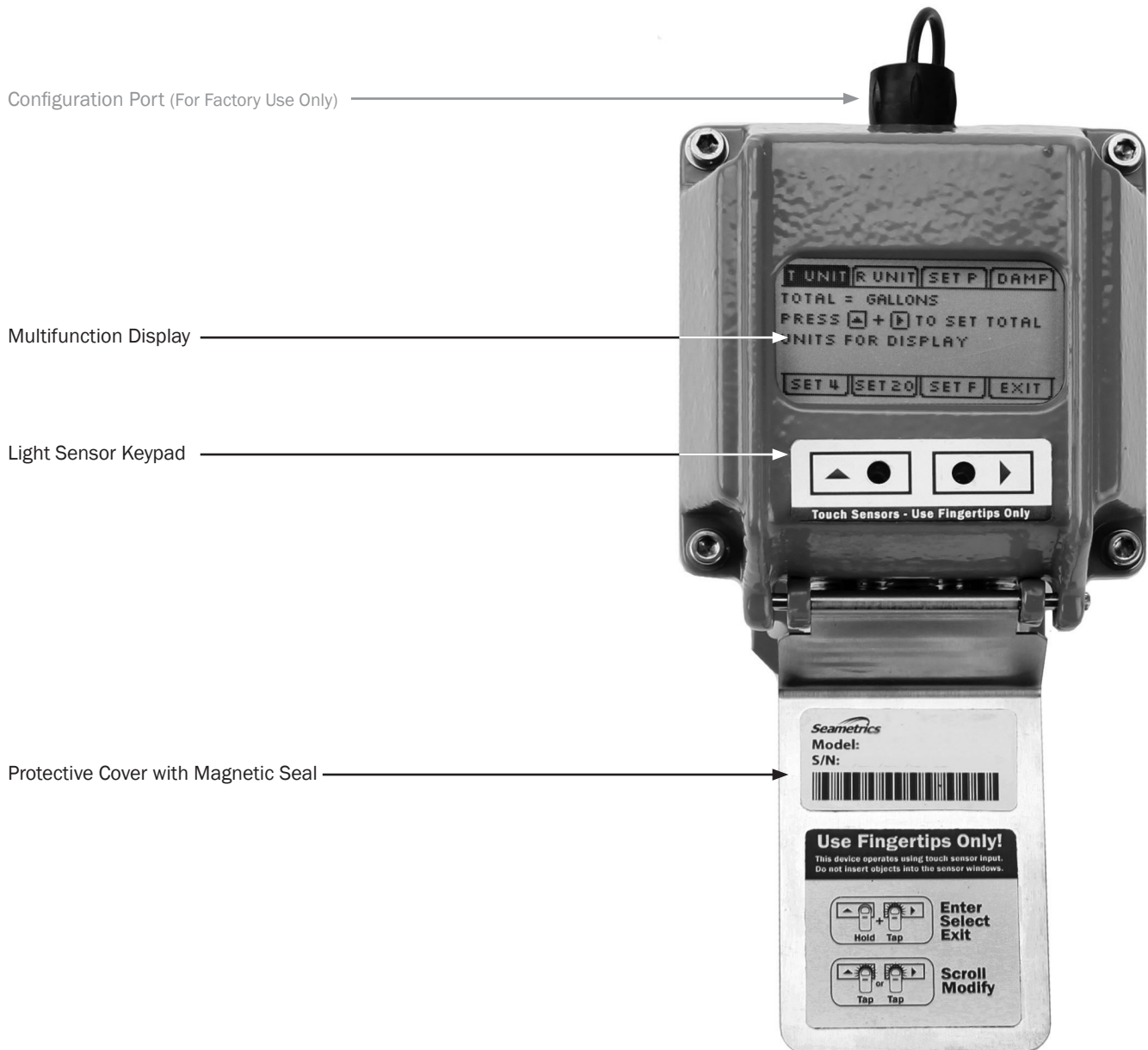
Rate and total indication are standard. Rate and total units and pulse output are settable via the front panel touch key pad by

the user. Bi-directional flow is standard. Forward, reverse and net flow can be read from the display. If forward and reverse flow data needs to be sent to another device, Modbus output is required.

The iMAG 3600 and 4600 can be externally powered with 9-36 Vdc at 30 mA average. The 4600 is also available in a battery powered version.

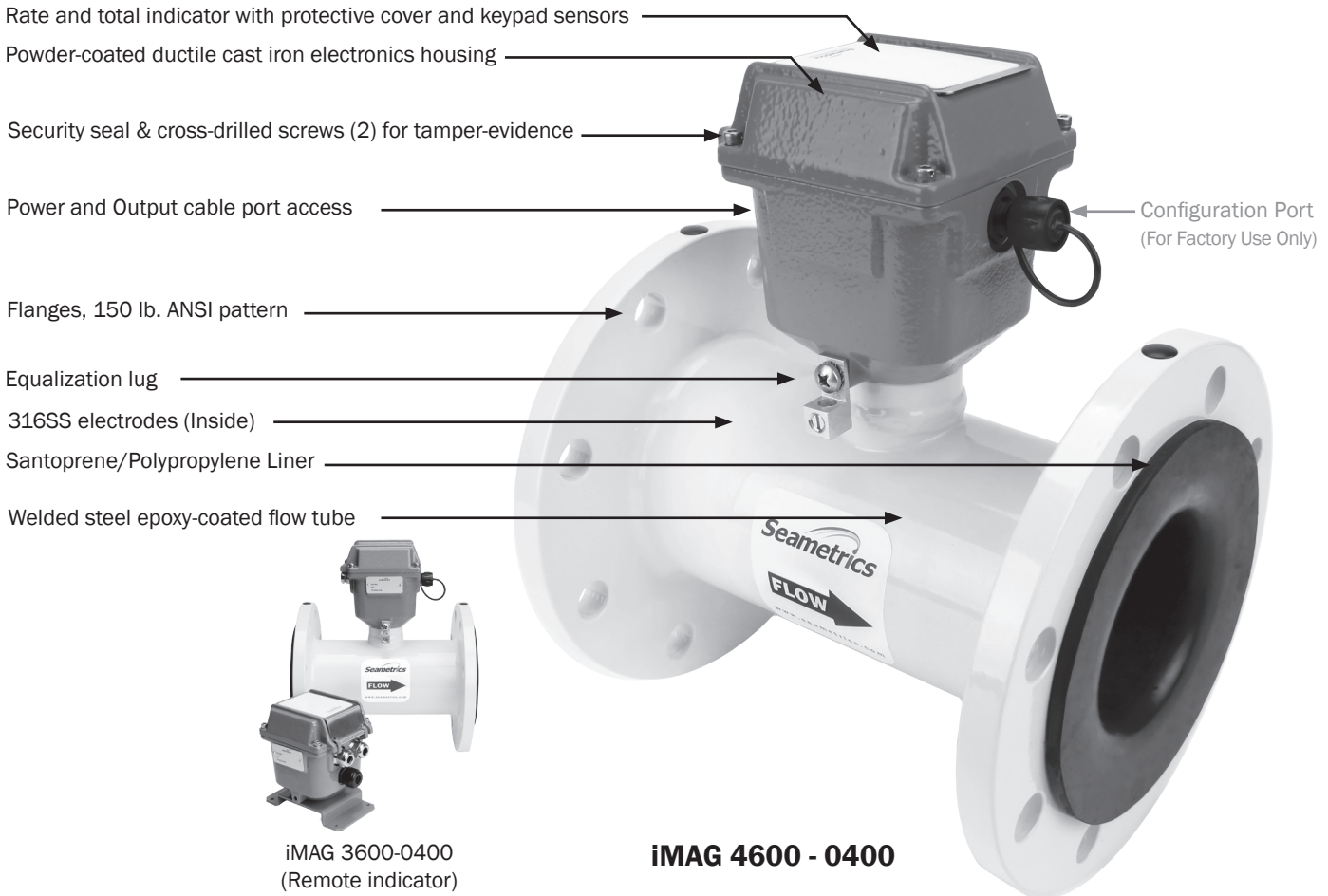
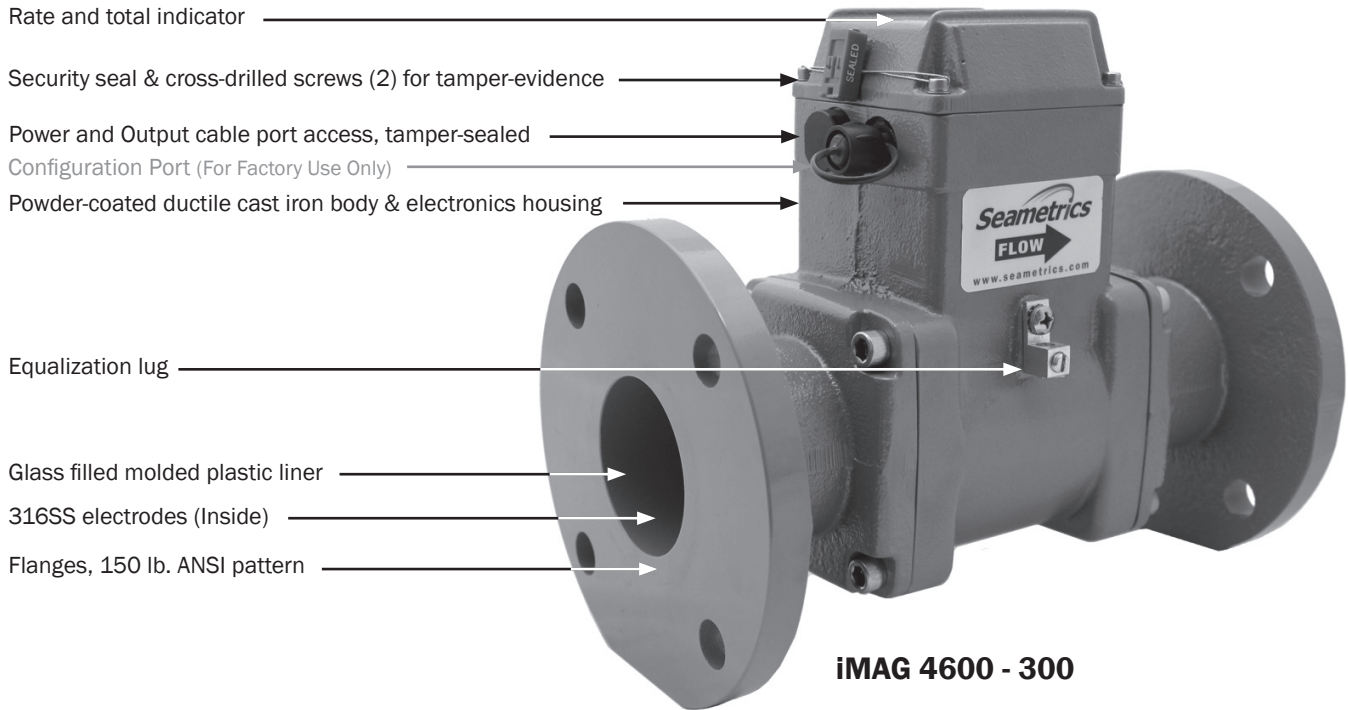
The standard 20-foot (6 meter) cable also provides outputs for use with a variety of Seametrics and other displays and controls for remote reading, data logging and telemetry applications. 4-20mA passive current loop and high frequency outputs are optional on the externally powered models. Pulse output is standard on the battery powered model. The iMAG 3600 remote display meter can be supplied with an optional internal AC power supply.

FEATURES



GENERAL INFORMATION

FEATURES Continued



SPECIFICATIONS

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 +/- 0.025% 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 | | | |
| | Body (4"-12") | Welded steel, epoxy-coated | | | |
| | Liner (3" Only) | Noryl® | | | |
| | 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 <i>Please Note: All iMAG meters are factory set for gallons per minute (GPM) rate and gallons total. If other units are required, they can be programmed in the field.</i> | Rate Volume Units | | Rate Time Units | Total Volume Units |
| | | Gallons | Second | Gallons | Cubic Meters x 1000 |
| | | Liters | Minute | Gallons x 1000 | Cubic Feet |
| Barrels (42 gallon) | | Hour | Million Gallons | Cubic Feet x 1000 | |
| Cubic Feet | Day | Liters | Million Cubic Feet | | |
| Cubic Meters | | Kilo Liters | Imperial Gallons | | |
| Million Gallons | | Mega Liters | Imperial Gallons x 1000 | | |
| Mega Liters | | Barrels (42 gallon) | Million Imperial Gallons | | |
| Imperial Gallons | | Cubic Meters | | | |
| Million Imperial Gallons | | | | | |
| | Bi-directional¹ | Forward Total, Reverse Total, Net Total | | | |
| Power | DC Power | 9-36 Vdc @ 250 mA max, 30 mA average | | | |
| | AC Power² | 85-264Vac, 50/60Hz, 0.12A | | | |
| | Battery³ | Two lithium 3.6V 'D' batteries, replaceable. See chart on page 11 for battery life expectancy. | | | |
| Pulse Frequency Output | Signal | Current sinking pulse, isolated, 36 Vdc at 10 mA max | | | |
| | Pulse Rates | 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, 10 pulses/sec max battery option | | | |
| Options | 4-20mA Current Loop | Isolated, passive, 24Vdc, error less than +/- 0.1% of pulse/frequency output | | | |
| | Digital Output | Isolated, open collector, 24 Vdc, 650 Ω maximum loop resistance | | | |
| | Serial Communications | Isolated, asynchronous serial RS485 (Reconfigurable for RS232 or 3.3V CMOS), Modbus RTU protocol | | | |
| Cable | Control Cable | Six-conductor water-blocked cable, polyurethane jacket, 20ft (6m) standard length for power, pulse frequency or optional outputs (optional lengths up to 100' available) | | | |
| | Remote Display Cable (iMAG 3600) | 33ft (10m) standard length (optional lengths up to 100' available) | | | |
| Conductivity | | >20 microSiemens/cm | | | |
| Empty Pipe Detection | | Hardware/software, conductivity-based | | | |
| Regulatory | | C € (EN 61326) pending, NSF-61 on 3" ONLY | | | |
| Environmental | | IP68 to 10ft (3m) depth | | | |

*Specifications subject to change. Please consult our website for the most current data (www.seametrics.com).

¹ If forward and reverse flow data needs to be sent to another device, either the -ADDX, -DDDX or Modbus output is required.

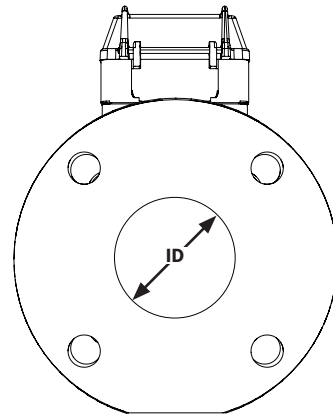
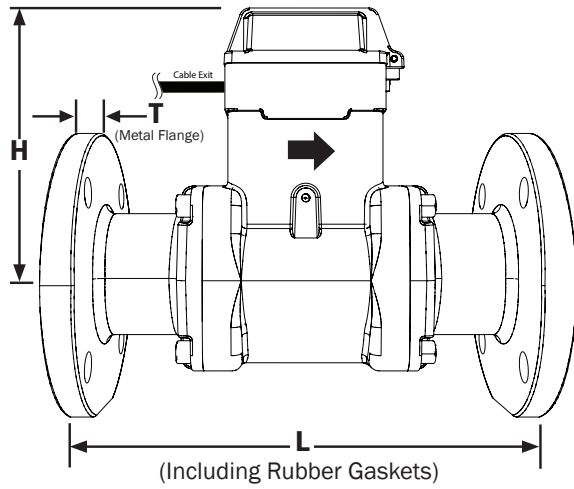
²iMAG3600 only, iMAG4600 requires external AC power supply

³iMAG4600 only

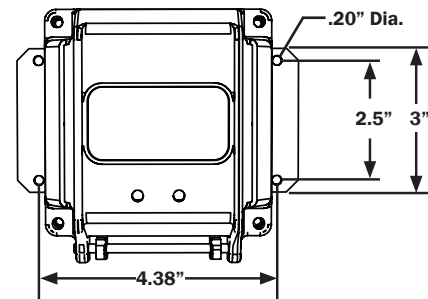
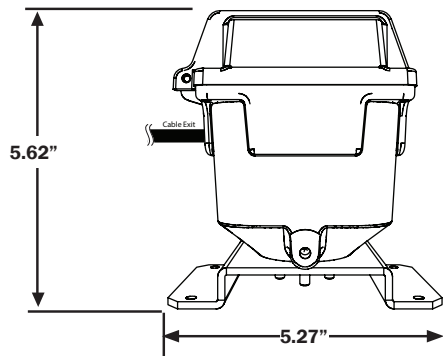
SPECIFICATIONS

DIMENSIONS

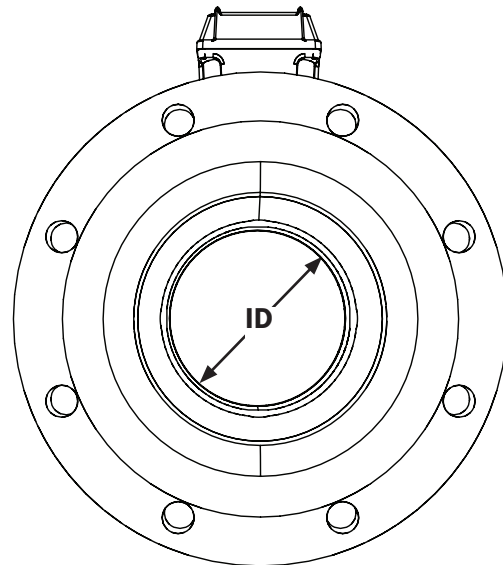
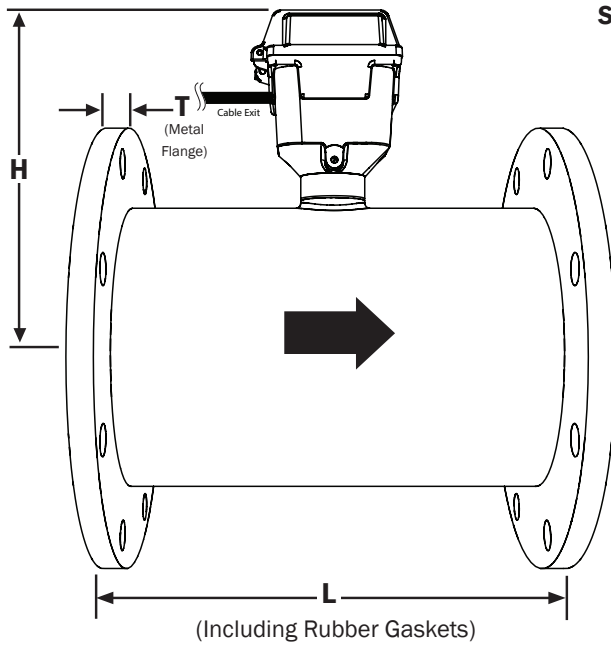
iMAG4600 - 0300 Shown



iMAG3600 Remote Shown



iMAG4600 - 0400 to 1200 Shown

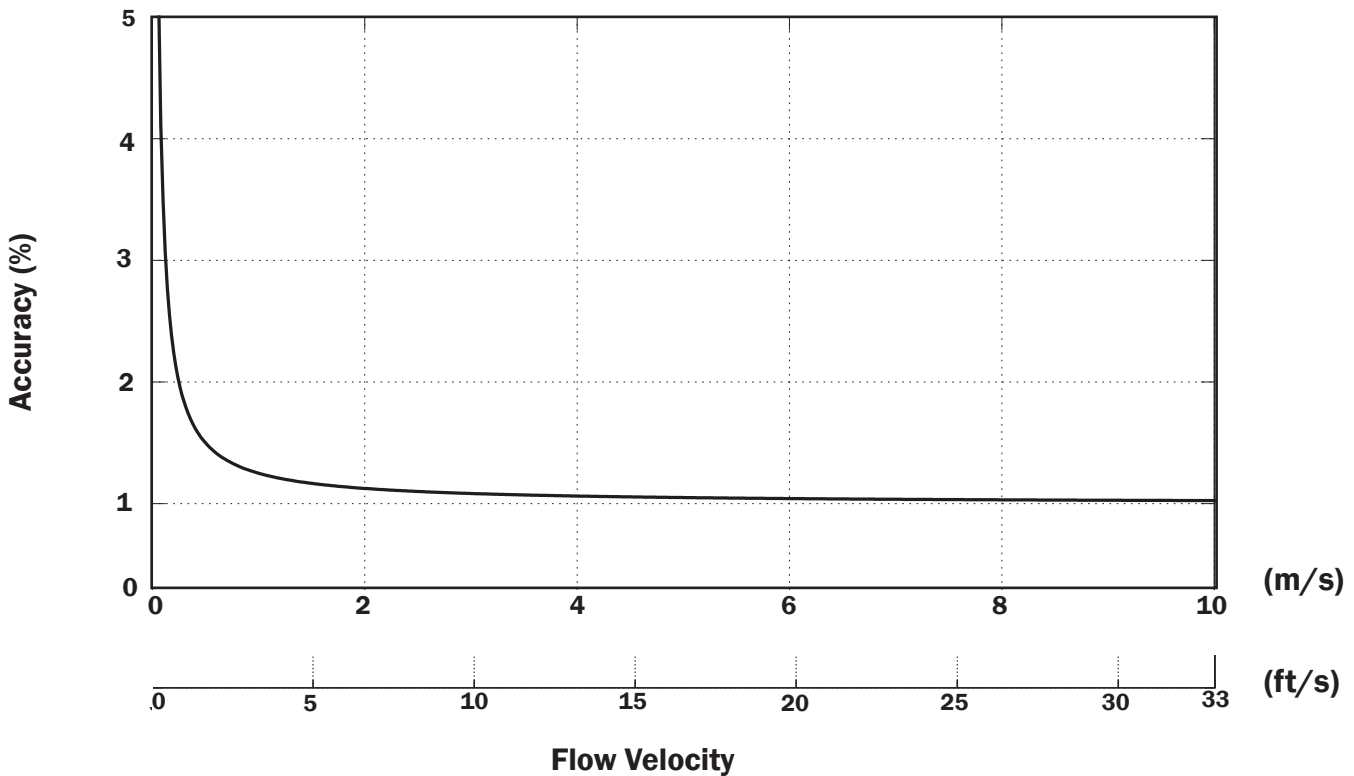


SPECIFICATIONS

iMAG Dimensions

| iMAG 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. | |

iMAG Accuracy



FLOW RANGE (3" - 12")

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

INSTALLATION



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.

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 iMAG 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 iMAG flanges have standard ANSI 150 lb. drilling pattern and mate with any other ANSI 150 lb. flange. See table on next page for flange bolt tightening torque specifications.

Calibration. The iMAG 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.

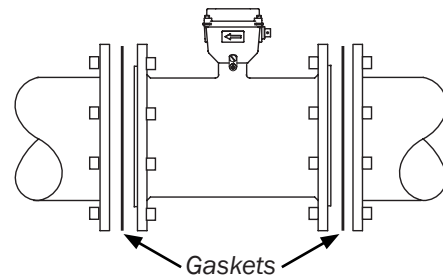
Installing Gaskets



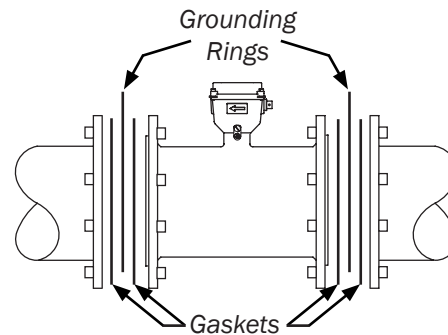
GASKETS

Gaskets are required at all junctions.
(Not applicable to 3" model.)

1. Select a suitable full-face gasket.
 - Only use flat compressible gaskets (either pliable or hard fiber will work).
 - Use a material compatible with the fluid you will be using.
 - Thickness should be 1/8" - 1/4" (3 - 6 mm), depending on the flatness of the pipe flange surface.
 - Inner diameter must be larger than opening in flow meter.
2. Be sure all mating surfaces are smooth and free of debris.
3. Install gaskets on each end of meter as shown in diagrams below. If using grounding rings, install one gasket on each side of the grounding ring.



Installation without gaskets



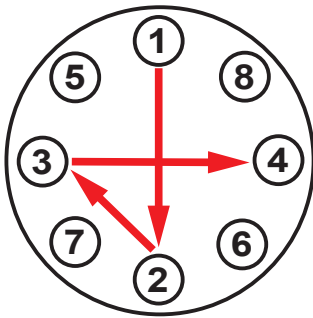
Installation with gaskets

INSTALLATION and GROUNDING

Tightening Flange Bolts

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

- 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%.
- Test for leaks.
- If needed, tighten further in 10% increments until leaking stops. **DO NOT over-tighten. Over-tightening can cause serious damage to the flow meter.**
- 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

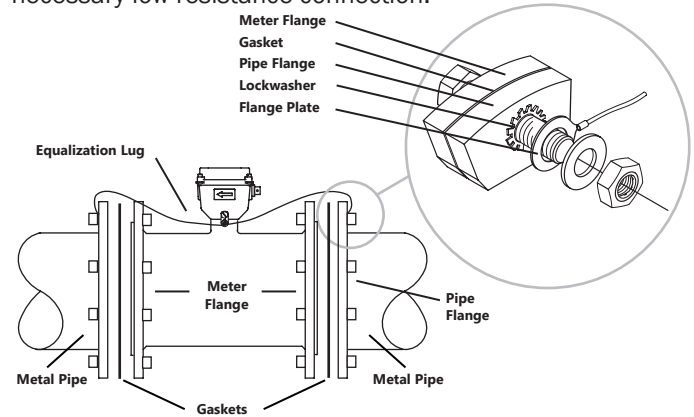
| Pipe Size | Santoprene Liner | |
|-----------|------------------|-----|
| | ft-lb | Nm |
| 3" | 25 | 34 |
| 4" | 20 | 27 |
| 6" | 42 | 57 |
| 8" | 65 | 88 |
| 10" | 73 | 99 |
| 12" | 97 | 132 |

Equalization and Grounding



WARNING: ELECTRICAL SHOCK HAZARD
When the iMAG 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.

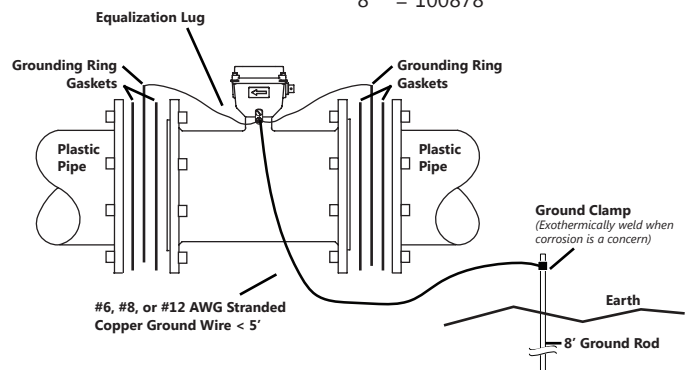
Metal Pipe Installations. To equalize the electrical potential of the fluid, the iMAG meter, and the surrounding pipe, secure the flange plates (factory-installed on the equalization wire) to both pipe flanges at one of the bolt holes, as shown below. Be sure the lock washer fits between the pipe flange 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 Installations. When the iMAG is installed in a plastic piping system, grounding rings are recommended (except 3" pipe size), especially in the presence of electrical interference sources such as VFD pump drives. As shown in the diagram below, the equalization wires should then be 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.

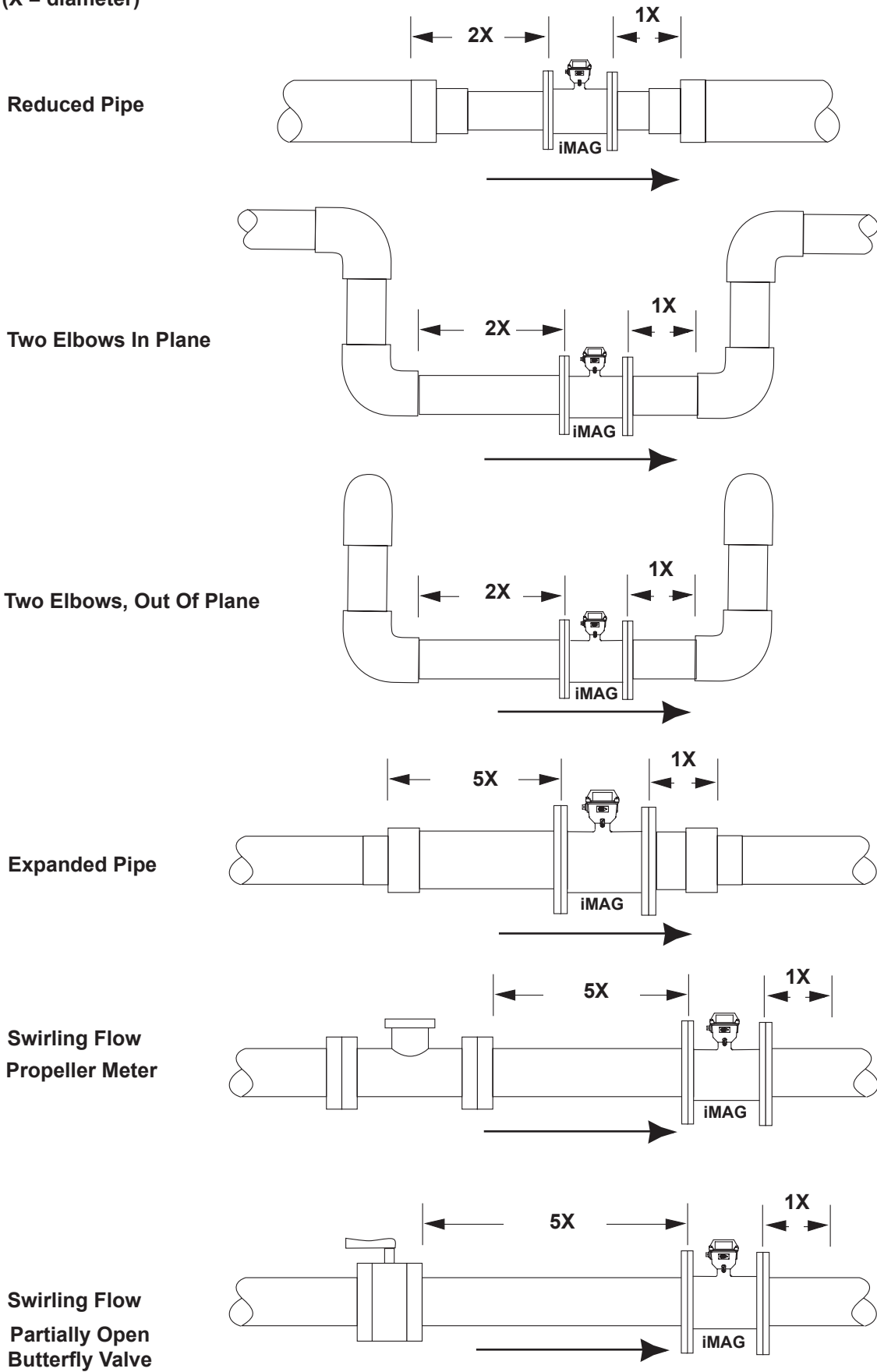
Grounding Ring Part Numbers:

4" = 100876 10" = 100879
6" = 100877 12" = 103288
8" = 100878



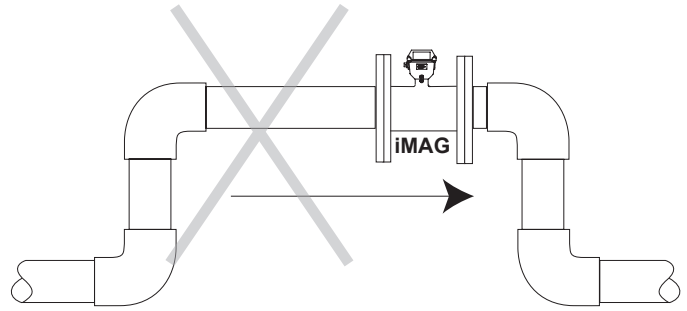
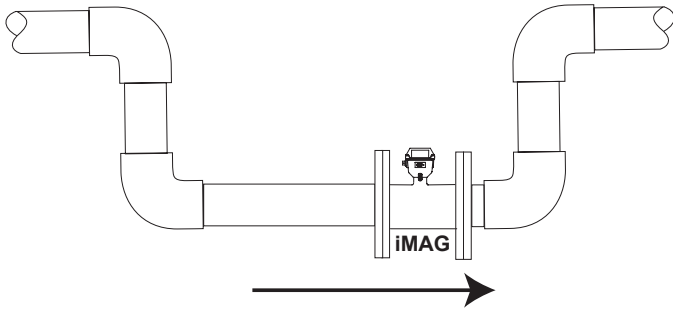
STRAIGHT PIPE RECOMMENDATIONS

(X = diameter)

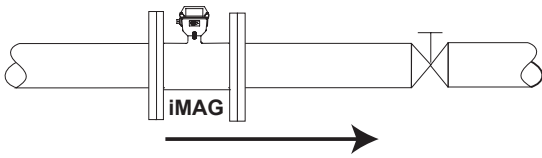


FULL PIPE RECOMMENDATIONS

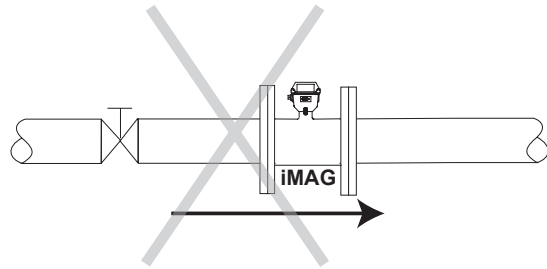
Recommended:
Keep pipe full at meter for accuracy



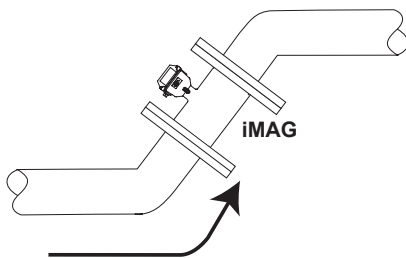
Not Ideal:
Allows air pockets to form at meter



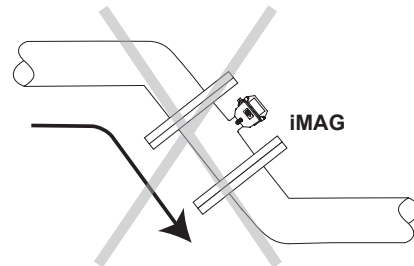
Recommended:
Keeps pipe full at meter for accuracy



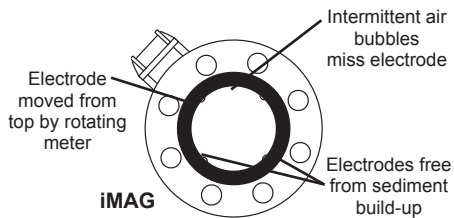
Not Ideal:
Post-valve cavitation can create air pocket



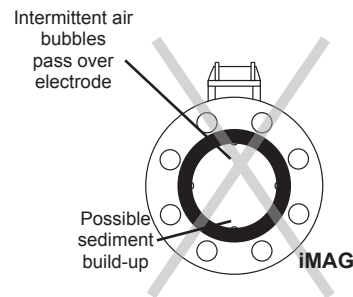
Recommended:
Allows air to bleed off



Not Ideal:
Air can be trapped



Recommended:
Improved accuracy results from unimpeded electrodes

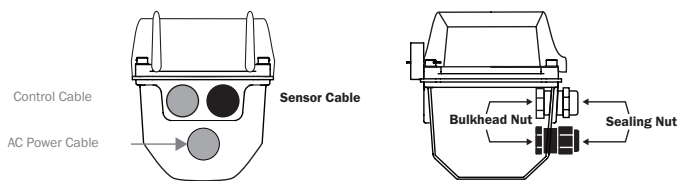


Not Ideal:
Air bubbles and sediment on the electrodes can affect accuracy

REMOTE SENSOR CABLE INSTALLATION (iMAG3600 ONLY)

The standard 33 foot (10m) cable connecting the iMAG3600 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-position plug and cable gland threaded bushing into the open hole. (see drawing.) Do not loosen the cable jacket sealing nut.



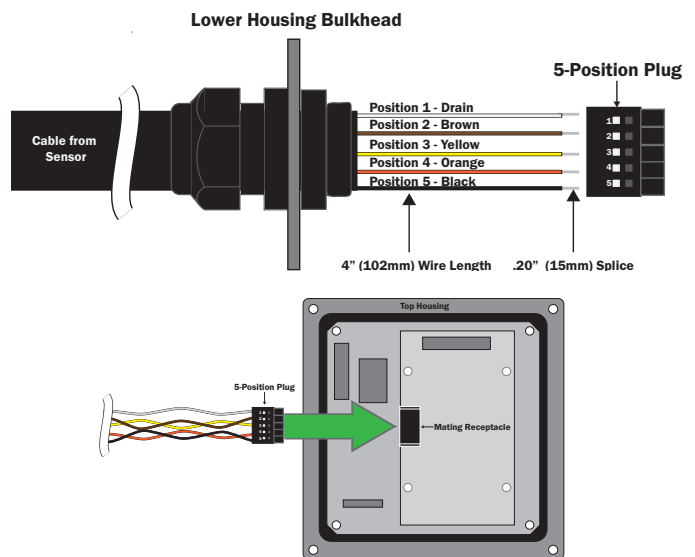
4. Install the bulkhead nut back onto the cable gland threads inside the housing and tighten securely. A loose nut could cause moisture ingress and compromise the meter head's IP68 rating, voiding the warranty.
5. Insert the five-position plug into the mating receptacle on the small circuit board attached 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.
7. Do not remove gel packs.

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.

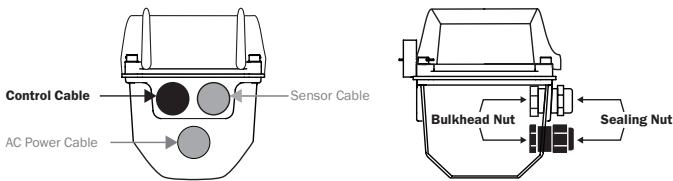


Lengthening the Sensor Cable. Replacing the entire cable with a longer cable is not recommended. To extend the distance from the sensor body to the remote display head:

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.
6. **Warning! Extending the length of the sensor cable beyond 100 feet (30 meters) may cause the meter to malfunction.**

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 equipment, 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), Analog Output (L), Digital Output (D) 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.

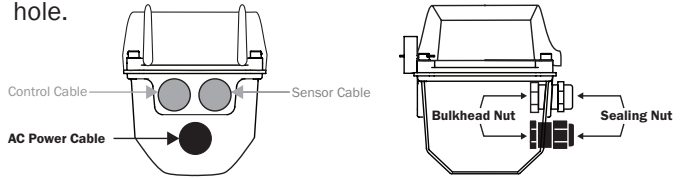


DC Power Connection. When the first OID code character is a “D”, connect the RED and BLACK wires to the positive and negative terminals respectively of a clean (low-noise) source of dc power in the range of 9-32Vdc and able to supply at least 250mA. AC line-operated power supplies with outputs greater 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.

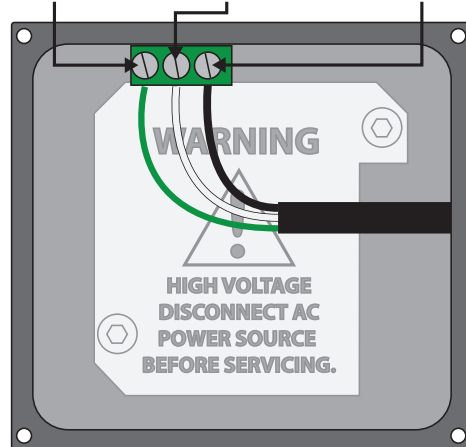
1. Using a 5/32” hex driver, remove the four cap screws securing the top housing to the lower housing and swing the top open to expose the internal wiring and components.

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

| GROUND | NEUTRAL | LINE |
|-----------------|-----------------|-----------------|
| Green | White | Black |
| (North America) | (North America) | (North America) |
| Green-Yellow | Blue | Brown |
| (International) | (International) | (International) |



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 IP68 rating, voiding the warranty.

5. Close the top cover and replace the four cap screws, securing tightly to reseal the housing against moisture ingress.

Battery Power. The iMAG 4600 meter can come configured with two replaceable 3.6V lithium ‘D’ batteries. In this configuration, the only option/output is the scaled pulse output which comes standard. The scaled output for the battery powered option has a maximum frequency of 10Hz, with a fixed pulse width of 10ms. Be sure to set your P value such that the meter will function properly over the flow range in your application. See the tech bulletin on this topic for more details. The sample rate of the meter is user selectable through the SAMP tab in the meter’s sub-menu. Sample periods of 0.2, 0.33, 1, 3, 5, 15, 30, and 60 seconds can be selected. Larger sample periods will yield longer battery life but slower response time. Care must be taken to select a sample period that is suitable for your application. See the table on the next page for the expected battery life as a function of sample period.

Battery Life/Sample Period



| Sensor sample period(s) (Seconds) | Expected battery life* |
|--------------------------------------|------------------------|
| 1/5 (0.2) | 1 year |
| 1/3 (0.33) | 1.5 years |
| 1 | 2.5 years |
| 3 | 4 years |
| 5 | 5 years |
| 15 | 5.5 years |
| 30 | 6 years |
| 60 | 6.5 years |

*Based on 75% battery capacity at room temperature with no option cards installed. NOTE: If a large percentage of the meter’s life will be spent below 0.5 meters/second and above cutoff, battery life will be reduced.

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” or “H”, 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 6Vdc (8Vdc with HART) 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.

(Optional) Setup and Connection to a HART Network. The HART protocol, rev.7.5, allows for a Polling address of 0-63. The default value in the iMAG is 0. To change the Polling address, use iMAG menu HPOLL to set the Polling address.

To get to this menu, move to the EXIT tab and tap the  4 times. This will bring up another menu page containing the tab HPOLL. Use the  to select the Polling address.

A minimum of 250 ohms of loop resistance must be present in order for the HART modem to correctly and reliably demodulate FSK voltage. With this in mind, the maximum loop resistance* for the iMAG HART interface cannot be exceeded in order to assure correct operation.

Use of HART Communicator. The iMAG HART interface is HART compatible. All the commands have been implemented in accordance with the HART Protocol Specification published by HART Foundation. A HART Communicator can be used with the iMAG, even in the absence of DD files, by taking advantage of the Generic Online Menu capability of a Communicator. This means that a generic menu is automatically available when DD files are not present.

The following information from the iMAG HART can be displayed on the Communicator using the generic menu:

| | |
|------------------------|----------------------------------------------------|
| PV | Flowrate in units selected for iMAG |
| PV Loop Current | Loop current in mA |
| PV LRV | Lower range value of PV in units selected for iMAG |
| PV URV | Upper range of PV in units selected for iMAG |

*4-20 mA loop has maximum loop resistance of 650ohms and requires a 24Vdc power supply.

INPUTS/OUTPUTS and OPERATION

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 electrically similar to 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. Selections are: 500Hz and 1, 2, 5 and 10 KHz at maximum flow rate.

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. See Seametric’s Modbus Interface Description, LT-103393 (available at www.seametrics.com) 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 equipment end of the cable to minimize “ground loop” problems.

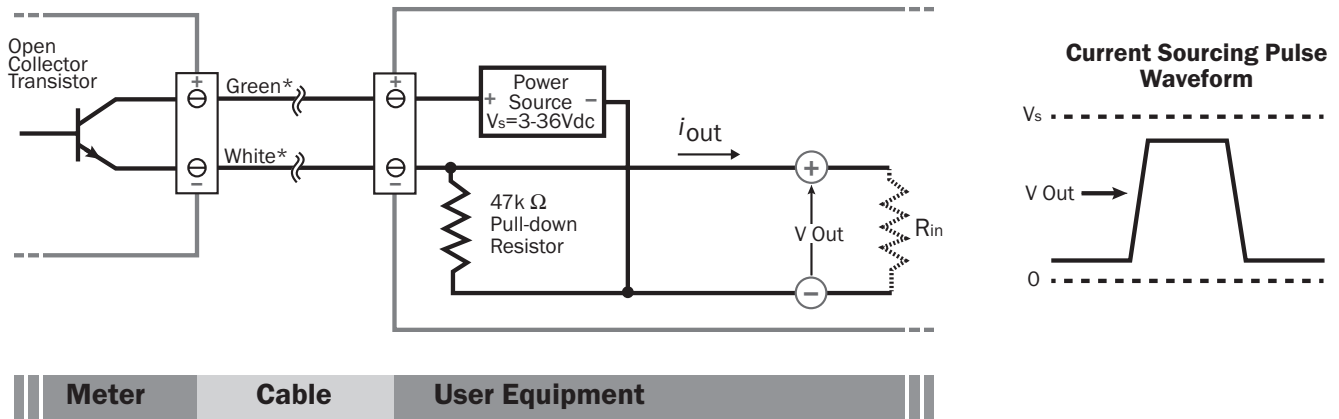
Control Cable Wiring

| Power Source | Options Installed | OID Codes | Cable Conductor Usage | | | | | |
|--------------|--------------------------------|-----------|-----------------------|----------------|---------|---------------|----------------|----------------|
| | | | Red | Black | Green | White | Orange | Blue |
| AC | One Pulse, HART | APHX | Do Not Connect | Do Not Connect | Pulse + | Pulse - | 4-20mA Out + | 4-20mA Out - |
| DC | One Pulse, HART | DPHX | DC PWR + | DC PWR - | Pulse + | Pulse - | 4-20mA Out + | 4-20mA Out - |
| DC | One Pulse, 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 | RS-485 Serial Comm | DSSX | DC PWR + | DC PWR - | RTS | Signal Ground | B | A |
| DC | One Pulse Output | DPXX | DC PWR + | DC PWR - | Pulse + | Pulse - | Do Not Connect | Do Not Connect |
| AC | One Pulse, 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 | RS-485 Serial Comm | ASSX | Do Not Connect | Do Not Connect | RTS | Signal Ground | B | A |
| AC | One Pulse Output | APXX | Do Not Connect | Do Not Connect | Pulse + | Pulse - | Do Not Connect | Do Not Connect |
| Battery | One Pulse Output | BPXX | Do Not Connect | Do Not Connect | Pulse + | Pulse - | Do Not Connect | Do Not Connect |

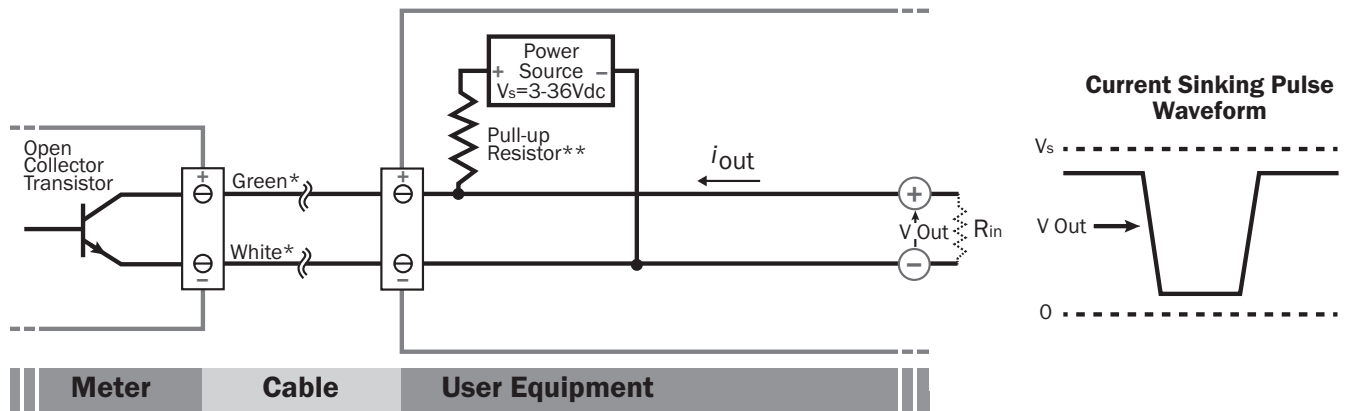
K-factors for High Speed Digital Output (High Frequency)

| Size | FOUT (Hz) | | | | |
|------|-----------|----------|----------|----------|----------|
| | 500 | 1K | 2K | 5K | 10K |
| 3" | 41.55125 | 83.10249 | 166.205 | 415.5125 | 831.0249 |
| 4" | 23.3463 | 46.69261 | 93.38521 | 233.463 | 466.9261 |
| 6" | 10.37703 | 20.75406 | 41.50813 | 103.7703 | 207.5406 |
| 8" | 5.836576 | 11.67315 | 23.3463 | 58.36576 | 116.7315 |
| 10" | 3.735525 | 7.47105 | 14.9421 | 37.35525 | 74.7105 |
| 12" | 2.594034 | 5.188067 | 10.37613 | 25.94034 | 51.88067 |

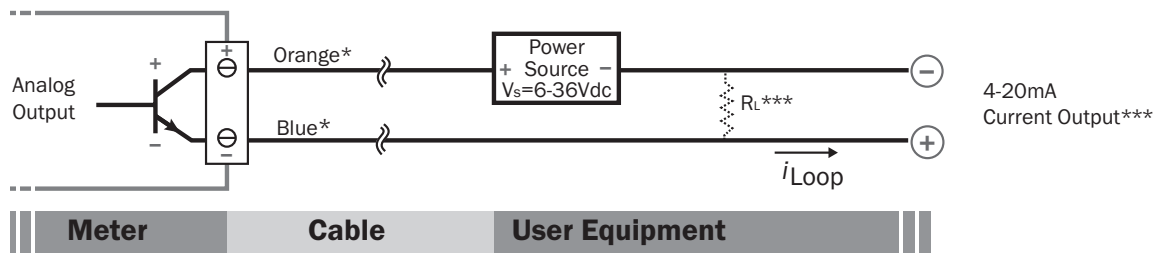
Pulse or Digital Output Application - Sourcing Mode (Recommended for $R_{in} < 30k\Omega$)



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



Analog (4-20mA Current Loop) Output Application



* 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 $(100 \times V_s)$ 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.

CHANGING FLOWMETER SETTINGS

The HOME Screen. The HOME Screen shown below is the normal screen which displays TOTAL FORWARD 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.



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.

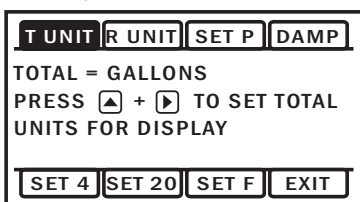
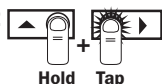
SELECT: Tap left-hand button to change a highlighted item within a tab dialog.

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 |
| SET F | View or change high frequency output scaling (See chart on page 12) |
| EXIT | Return to HOME SCREEN or Enter SUBMENU |

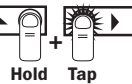
To enter the MAIN MENU perform the hold and tap sequence:



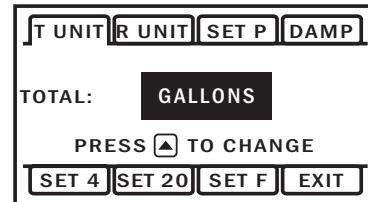
Once in the main menu you can move from tab to tab by tapping the button:



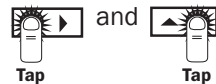
In the dialog box for the currently highlighted tab you will see that tab parameter's current value. In the previous screen illustration, the first line indicates that the current unit for the TOTAL is GALLONS. The next two lines in the dialog box tell you what to do next. If you would like to change the TOTAL units, just perform the hold and tap sequence



You select the new setting by scrolling through a list of selections as in the screen illustration below by tapping



Similarly, for the SET tabs, the dialog box instructions will tell you how to change a numerical value using both the

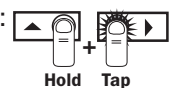


To accept any changes you've made just hold and tap again, and the changes will be saved and you will be returned to the MAIN MENU screen where you can move to another tab.

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



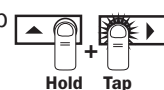
To return to the HOME screen, hold and tap:



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



You will be redirected to a SUBMENU screen which provides access to more information about the meter, such as serial numbers, firmware revisions, Modbus, HART, battery options and the bi-directional flow options display which toggles between FWD, REV and NET TOTAL. 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.



Please Note: All iMAG meters are factory set for gallons per minute (GPM) rate and gallons total. If other units are required, they can be programmed in the field.

TROUBLESHOOTING

| 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 [-] negative flow and FWD total remains at [0] zero, 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 $\mu\text{S}/\text{cm}$ | Replace with different type of meter |
| | Noisy electrical environment | Improve grounding at meter and nearby potentially 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 | 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. |



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