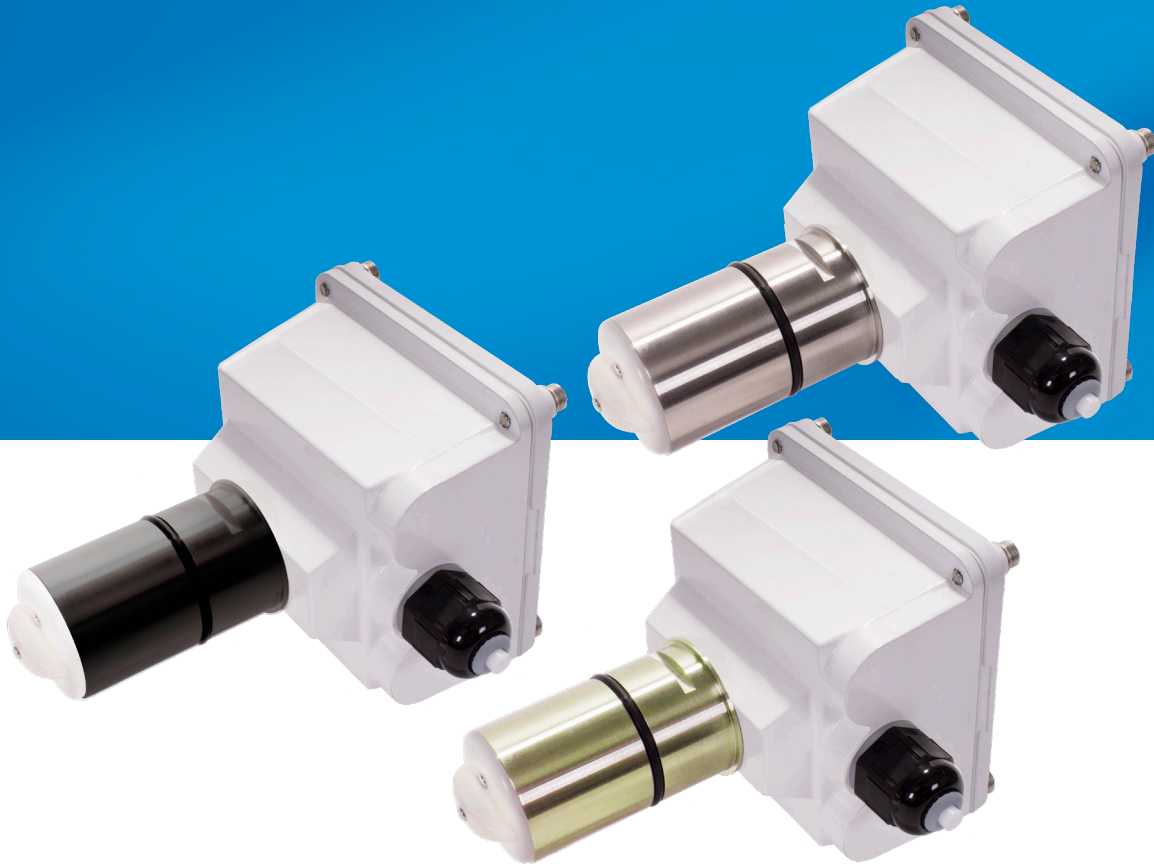


EX800-Series

Electromagnetic Flow Sensor
Instructions



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Caution: These flow sensors are not recommended for installation downstream of a boiler feedwater pump where installation fault may expose the flow sensor to boiler pressure and temperature. Maximum recommended temperature is 130°F (Plastic), 200°F (Metal).

EX800-Series insertion electromagnetic flow meters are designed for use with conductive liquids in 1 to 12" pipe. A choice of materials (stainless steel, brass, and PVC) allows the meter to adapt to a range of temperature, pressure, and corrosive environments.

The EX800 is highly suitable for difficult applications with changing viscosities. With no moving parts, these meters can be used in "dirty water" applications where debris would foul a mechanical meter. Like all magmeters, when used in chemical injection applications, these meters should be installed upstream of the chemical line (or far enough downstream to allow complete mixing of fluids before the meter).

Designed for modularity and versatility, the EX800-Series has a current-sinking pulse output that can be combined with

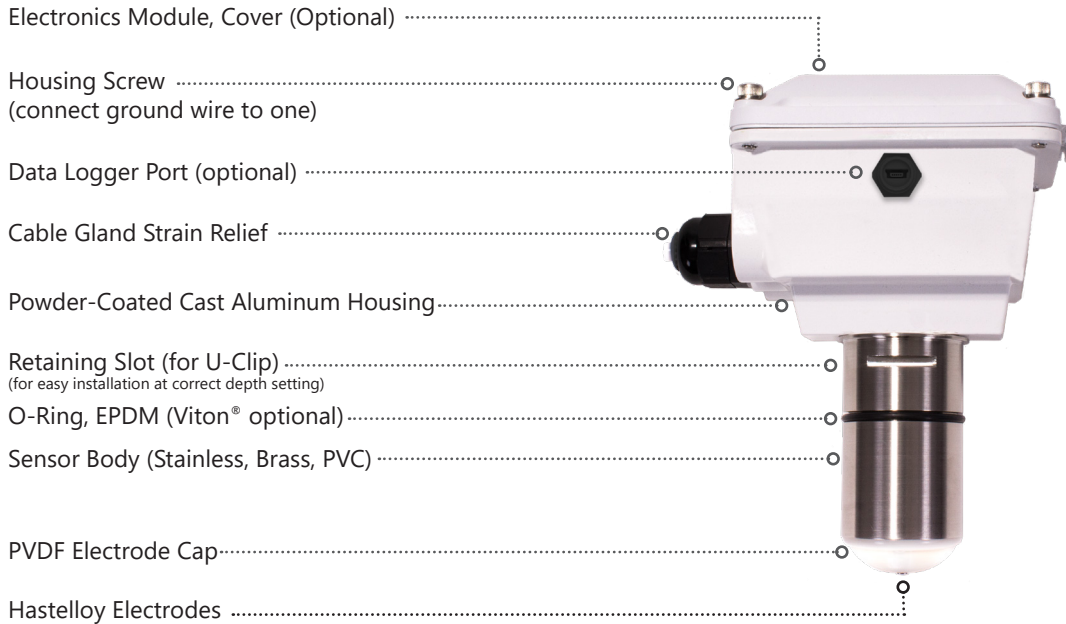
the appropriate transmitter or indicator for the application.

For basic rate/total and pulse output, the FT430 is best. For analog output and display of rate and total, the FT440 can be used. Electronic modules can be wall- or meter-mounted. If the EX800 meter is used with a programmable controller, the output signal can be fed direct, with no other conditioning required.

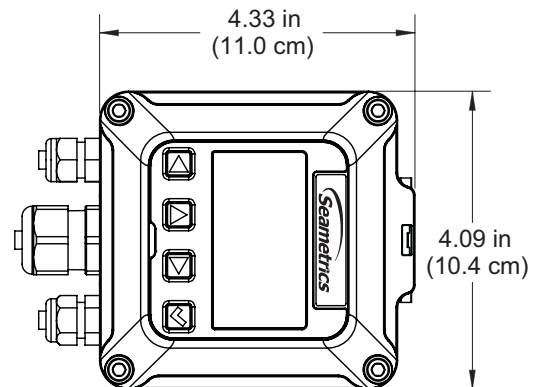
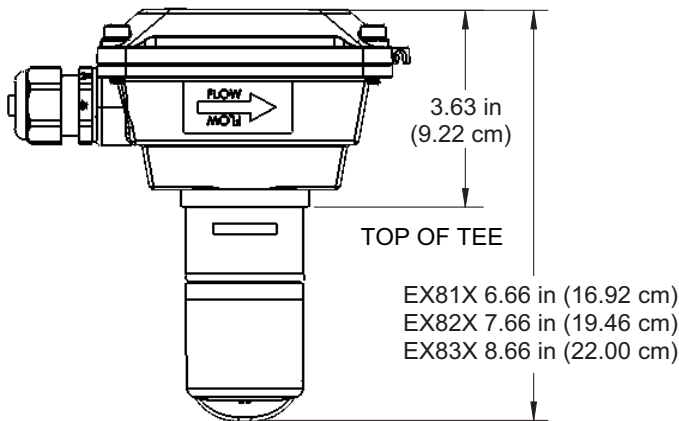
EX800-Series fixed depth insertion meters require special fittings. Factory installation in the fitting ensures correct depth placement in the pipe. The EX800-Series meter can be ordered in a full power model when a source of electricity is available, or in a low power model that can run on an external battery with solar panel.

Reverse flow output and immersibility are optional.

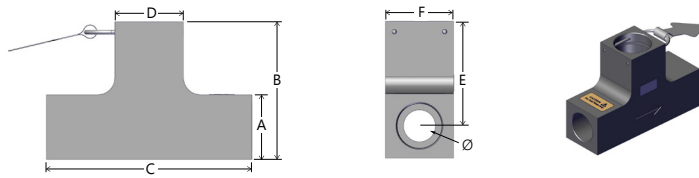
Features



Dimensions



PVC Block Tee Fitting (Figure 1)



EX800-Compatible Fittings

Material	Tee	Saddle	Weldolet	Sweat Tee
Bronze	1" - 4"	3" - 4"	3" - 12"	1" - 4"
PVC	1" - 2"	3" - 8"	x	x
Stainless Steel	1" - 2"	x	3" - 12"	x
Carbon Steel	1" - 2"	x	3" - 12"	x
Ductile Iron	x	3" - 12"	x	x

PVC Tee Fittings (Figure 2)

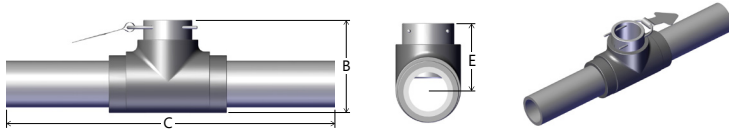


Fig.	Pipe Size	A	B	C	D	E	F	Ø
1	1"	1.88" (4.77 cm)	4.00" (10.16 cm)	6.00" (15.24 cm)	2.00" (5.08 cm)	3.06" (7.77 cm)	2.00" (5.08 cm)	1.325" (3.36 cm)
2	1 1/2"	—	4.50" (11.43 cm)	19.4" (49.28 cm) <i>(nominal)</i>	—	3.35" (8.51 cm)	—	—
2	2"	—	4.90" (12.45 cm)	19.9" (50.55 cm) <i>(nominal)</i>	—	3.45" (8.76 cm)	—	—

Specifications*

Pipe Size	1" to 12"	
Power	Full Power: 12 - 24 Vdc, 250mA	Low Power: 12 - 24 Vdc, 40mA average with 250mA peaks
Materials	Housing	Powder-coated cast aluminum
	Sensor Body	316 Stainless Steel, Brass, or PVC
	O-ring	EPDM (Viton® optional)
	Electrodes	Hastelloy
	Electrode Cap	PVDF (Kynar®)
Maximum Pressure	Brass/Stainless Steel	PVC (See Pressure vs. Temp. Chart)
	200 psi (13.8 bar)	150 psi (10 bar) @ 75° F (24° C)
Temperature	Ambient	0° to 160° F (-17° to 72° C)
	Fluid	32° to 200° F (0° to 93° C)
Minimum Conductivity	20 microSiemens/cm	
Flow Velocity	0.28 to 20 ft/sec (0.08 - 6.09 m/sec)	
Accuracy	± 1% of full scale	
Output	Square wave pulse, opto-isolated, 500 Hz @ 20 ft/sec	
Empty Pipe Detection	Software, defaults to zero flow	
Cable	Standard 18' (6m), #22 shielded twisted pair, 4-conn. Max. cable run at 24 Vdc = 1000' (300m); at 12 Vdc = 500' (150m). For other circumstances, contact the factory.	
Environmental	See meter mounted electronics specification for rating.	
Regulatory	CE Mark (applies to full power sensor only configuration and full power FT 430/440 mounted configurations). Certified to NSF/ANSI standard 61 and NSF 372 (Stainless only with EPDM O-ring. Viton pending)	

*Specifications subject to change • Please consult our website for current data (www.seametrics.com).
Kynar is a registered trademark of Arkema, Inc., Viton is a registered trademark of DuPont Corporation.

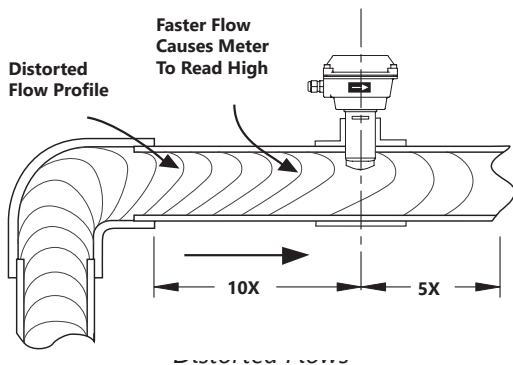
Flow Range

Nominal Pipe Size	1"	1½"	2"	3"	4"	6"	8"	10"	12"
Min GPM	.69	1.5	2.7	6.2	11	25	43	68	99
Min LPM	2.6	5.6	10.2	23.4	41	94	162	257	374
Max GPM	49	110	196	440	783	1760	3130	4900	7050
Max LPM	185	416	741	1665	2963	6662	11848	18548	26687

Fitting Installation

EX800-Series meters require special fittings that ensure that the flow sensor is installed to the correct depth. The fitting must be installed in the pipeline before the meter can be installed. For best results, install with at least ten diameters of straight pipe upstream of the meter and five diameters downstream (or more under specific adverse circumstances). See diagrams, next page.

If there is not enough straight run to smooth out the turbulence caused by valves, fittings, and changes in direction, some decrease in accuracy may result. This does not mean that the flow meter's reading is meaningless, however. In some applications (control systems, valve operation, chemical addition), a repeatable reading may be more important than a highly accurate one.



Although EX800-Series PVC meter tees are supplied with some straight pipe, additional straight pipe should be added to meet straight pipe recommendations. It is not advisable to connect a flow-disturbing device (e.g. valve or elbow) directly to the end of these fittings.

A PVC fitting is usually installed by solvent welding. The stainless steel and brass meter fittings have female pipe threads, requiring the appropriate male threaded fittings. Saddle or weld fittings (3" and above) require a hole to be cut in the pipe. Recommended hole size is 1-3/4".

Immersion

The EX800-Series sensors are not designed for underwater operation. Even occasional immersion can cause damage. If occasional immersion, such as when a vault floods, then the -40 option, (immersion) is recommended.

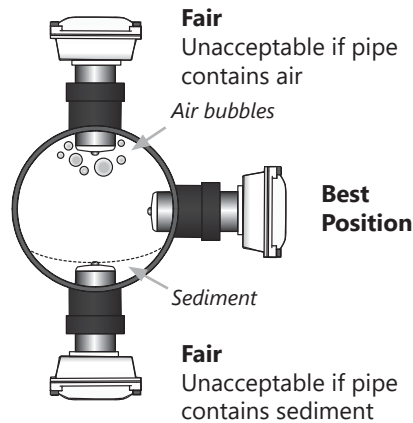
Meter Installation

After the meter fitting is installed in the pipeline, the meter can be installed in the fitting. After noting the direction of the flow arrow, press the meter into the fitting as far as it will go. Retain the meter in place by inserting the U-clip. The clip can be installed from either side. It may be necessary to rotate the probe back and forth slightly to start the clip into the slots on the probe. Slide the clip in as far as it will go.



Caution: These flow sensors are not recommended for installation downstream of a boiler feedwater pump where installation fault may expose the flow sensor to boiler pressure and temperature. Maximum recommended temperature is 130°F (54.4°C), plastic, 200°F (93.3°C), metal.

Horizontal (3 o'clock or 9 o'clock position) is the preferred installation orientation, since it improves low-flow performance and avoids problems with trapped air and sediment. (See Orienting the Meter diagram below.) Bottom (6 o'clock), and top (12 o'clock) installations are acceptable if required by the piping layout.



Orienting the Meter



Caution: Never remove the U-clip retainer when the pipe is under pressure. Always remove pressure from the pipe before you attempt to remove the meter. Removal under pressure may result in damage or serious injury.

Chemical Injection or Fertigation

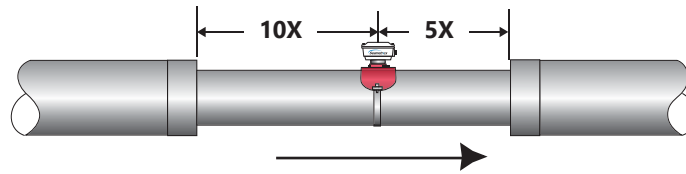
When any magmeter, by any manufacturer, is used in a chemical injection application (including fertigation), the chemical injection point must be placed downstream of the magmeter OR far enough upstream for complete mixing to occur before the fluid reaches the meter. When unmixed chemical or fertilizer 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.



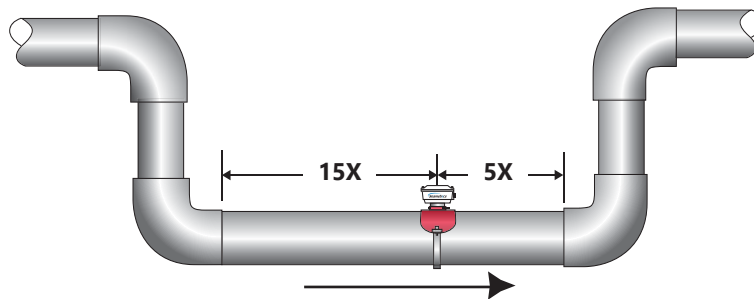
Caution: In chemical injection or fertigation applications, install chemical injection point downstream of magmeter, or far enough upstream to allow complete mixing of fluids before the meter.

Straight Pipe Recommendations (X = diameter)

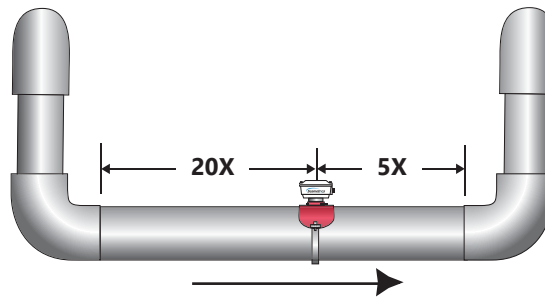
Reduced Pipe



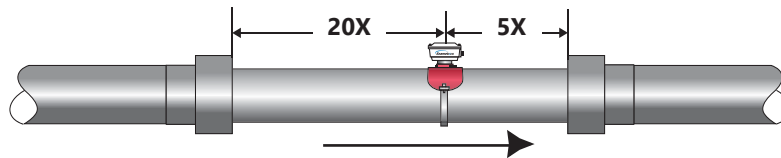
Two Elbows In Plane



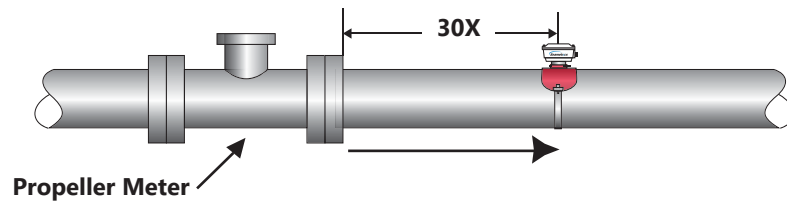
Two Elbows, Out Of Plane



Expanded Pipe

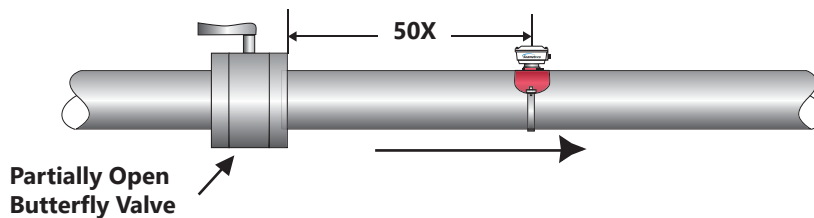


Spiral Flow



Propeller Meter

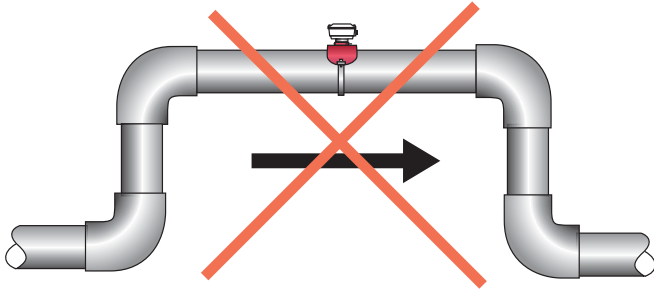
Swirling Flow



Partially Open Butterfly Valve

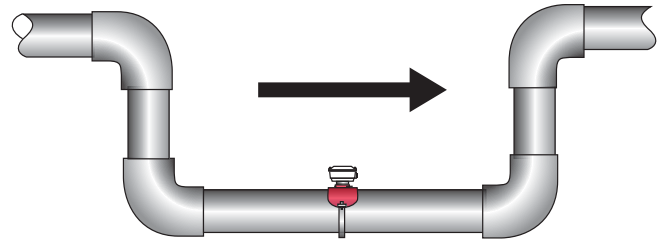
Full Pipe Recommendations

Possible Problem



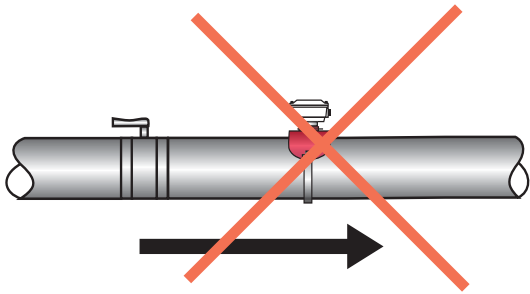
Allows air pockets to form at sensor

Better Installation



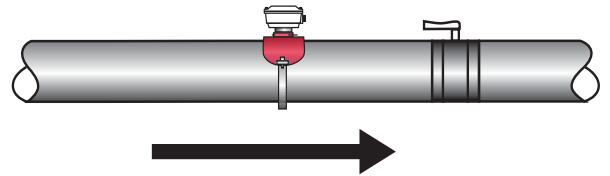
Ensures full pipe

Possible Problem



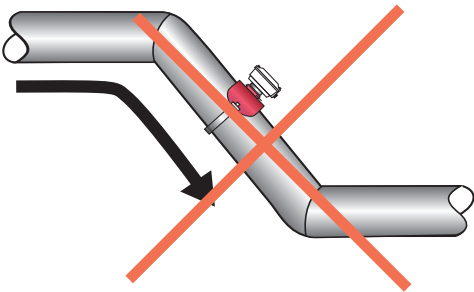
Post-valve cavitation can create air pocket

Better Installation



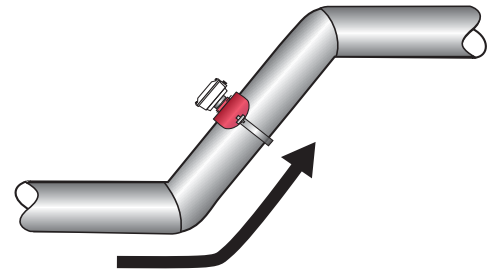
Keeps pipe full at sensor

Possible Problem



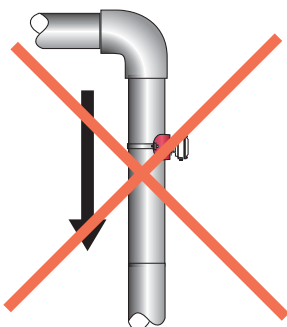
Air can be trapped

Better Installation



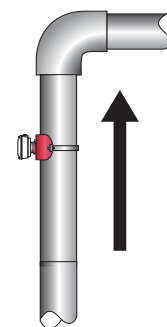
Allows air to bleed off

Possible Problem



Air can be trapped

Better Installation



Allows air to bleed off

General Electrical Guidelines

- Whenever possible avoid running control cables in the same conduit with or bundled with AC power.
- Using shielded cable, be sure to connect shield to ground at power supply end of the cable.
- Avoid routing flow sensor cables in close proximity to a variable frequency drive.
- Recommended power and output wiring is shielded twisted pair 18-22 AWG control cable.
- Recommended voltage is 12-24 Vdc. Note that unregulated power supplies can vary from nameplate voltage by a considerable amount, especially with AC line voltage fluctuation. Therefore 24V power supplies must be regulated.

See the Connections diagrams on the following pages for the appropriate terminals.

Power

A 12 - 24 Vdc power supply capable of at least 250 mA current output is needed.

Output

Forward Flow Output: This open-collector isolated output does not supply power. This pulse is generated in the forward flow direction on the standard unit. (Reverse flow output is available as an option). Note: This output is limited to 6 mA at 30 Vdc maximum.

Reverse Flow Output: Reverse flow output is available as an option. This open-collector isolated output does not supply power. It functions like a polarity-sensitive switch closure. Note: This output is limited to 6 mA at 30 Vdc maximum. Grounding Guidelines:

Grounding Guidelines



Caution: The EX800 has a strong start and run current. When using solar panels and VRSLA batteries as a power source, use caution to insure the EX-series sensor has the -50 Low-power Option and that all Seametrics products on the power circuit receive sufficient voltage and current under all conditions. Failure to do so will lead to unreliable operation and possible damage to the unit/s. Please reference the technical bulletin, 'Solar and Battery-Power Guidelines' available on our website: seametrics.com

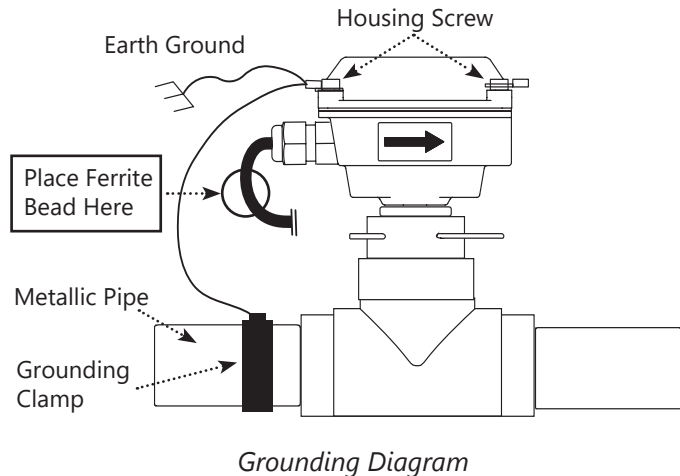
For best results, use a good quality earth ground, such as metallic water piping or a driven ground rod, to ensure a good connection to earth ground and good noise suppression.

For Metallic Pipe: For optimum connection, clamp wire to the piping a short distance to one side of the flow sensor using an electrical grounding clamp. Connect the wire to the earth ground and to one of the housing screws.

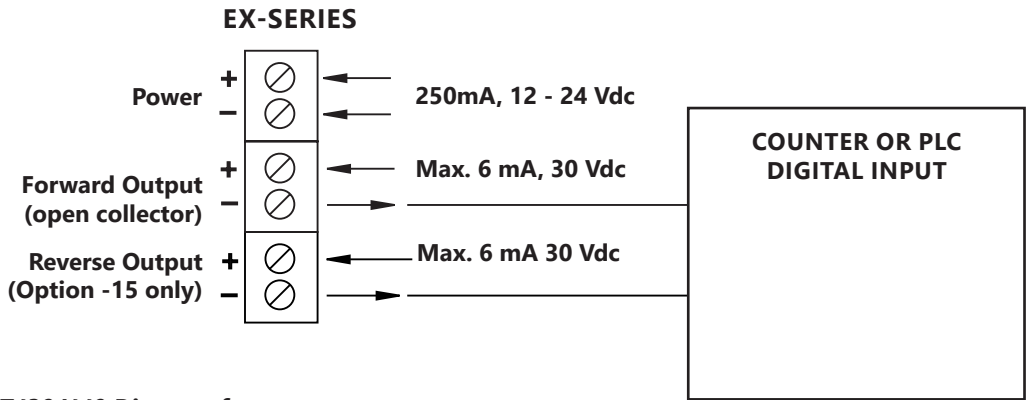
For Non-Metallic Pipe: Connect one of the housing screws by wire to a good earth ground, such as metallic water piping or a rod driven into the ground.

EX meters are usually unaffected by moderate levels of electrical noise. In some applications performance may be improved by taking the following steps:

- Use shielded twisted pair cable (Belden 8723 or equivalent above ground or Alpha 35482 or equivalent burial).
- Clamp a ferrite bead (Steward 28A2029-OAO or equivalent) on meter signal/power wire within 3/4" of the meter strain relief cable gland (tape or tie wrap in place if necessary). See diagram below.
- IMPORTANT - Connect the cable shield ground wire to ground, ONLY at power supply end of cable.

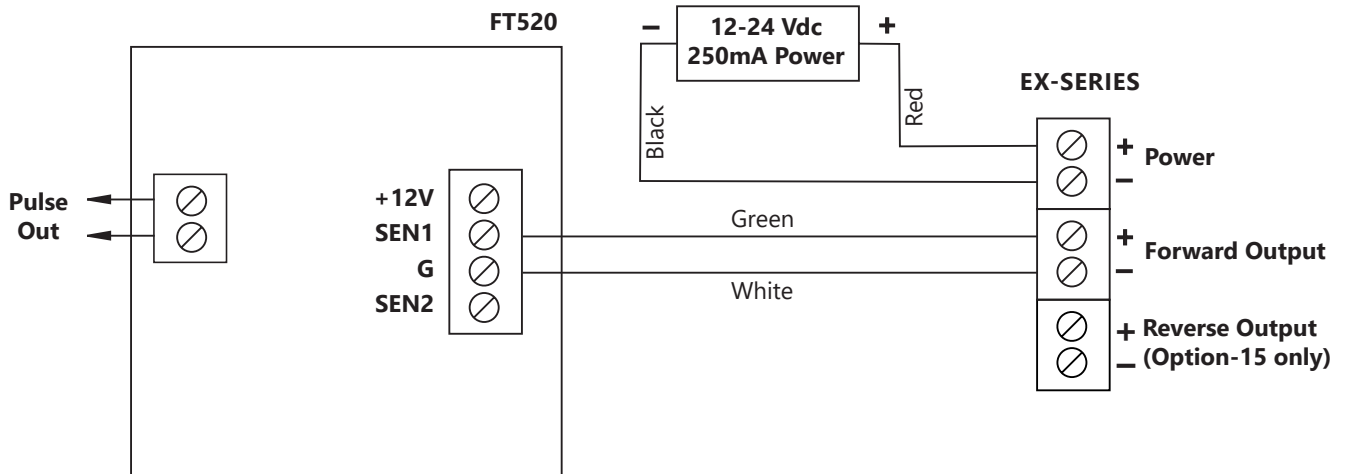


Counter or PLC



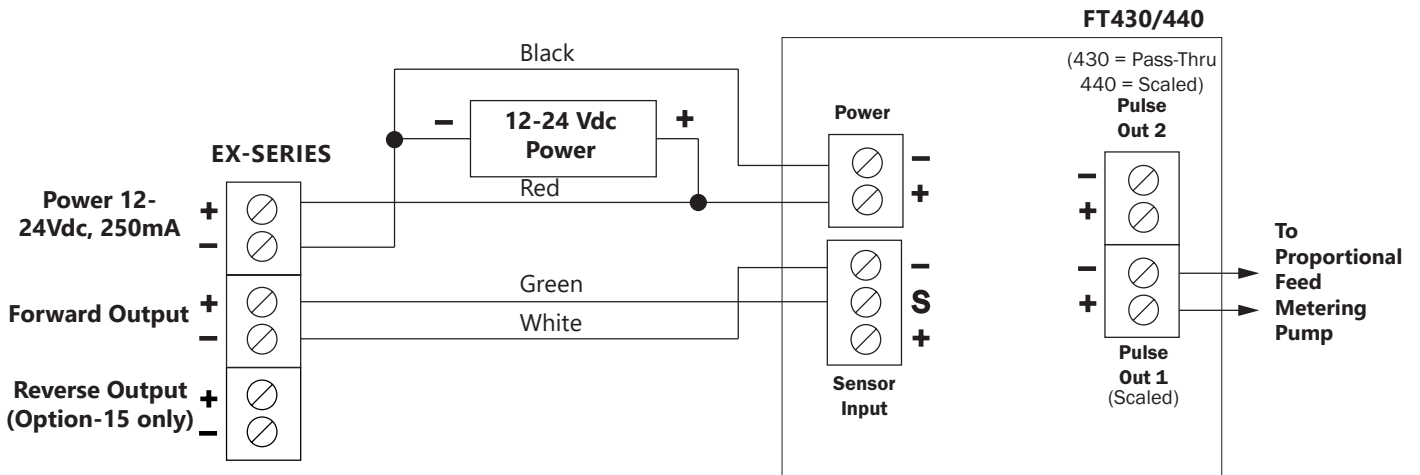
See Dual FT430/440 Diagram for an example of bidirectional connections.

FT520 Controller



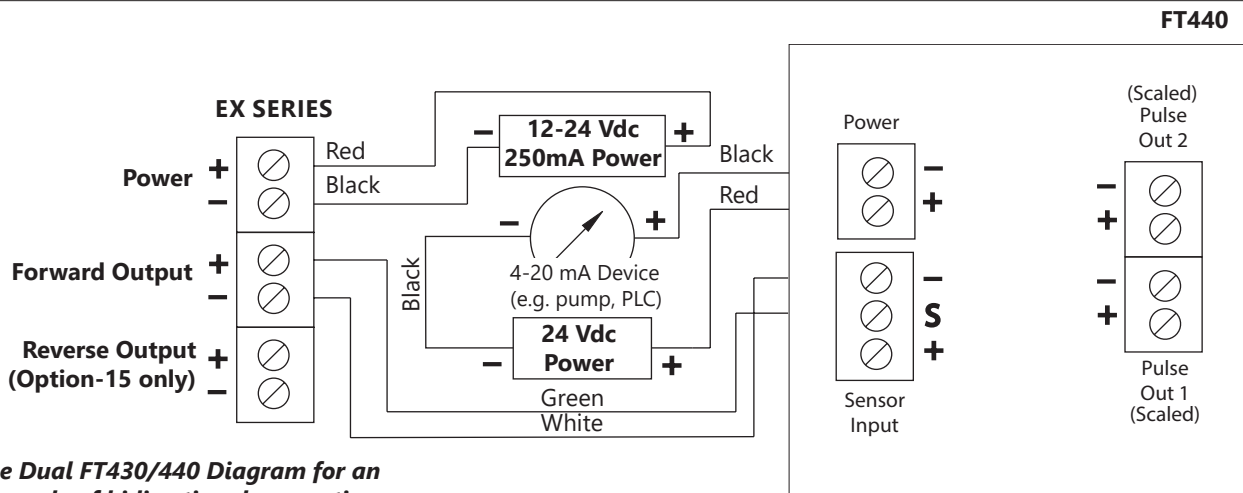
See Dual FT430/440 Diagram for an example of bidirectional connections.

FT430/440 Display and Proportional Feed



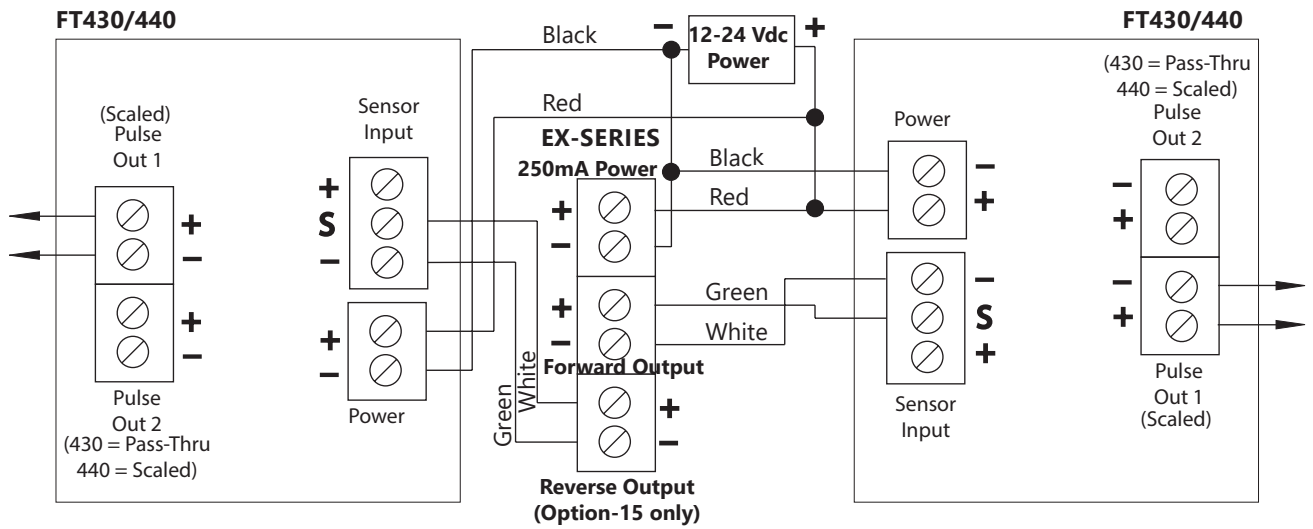
See Dual FT430/440 Diagram for an example of bidirectional connections.

FT440 DISPLAY AND 4-20 mA Output



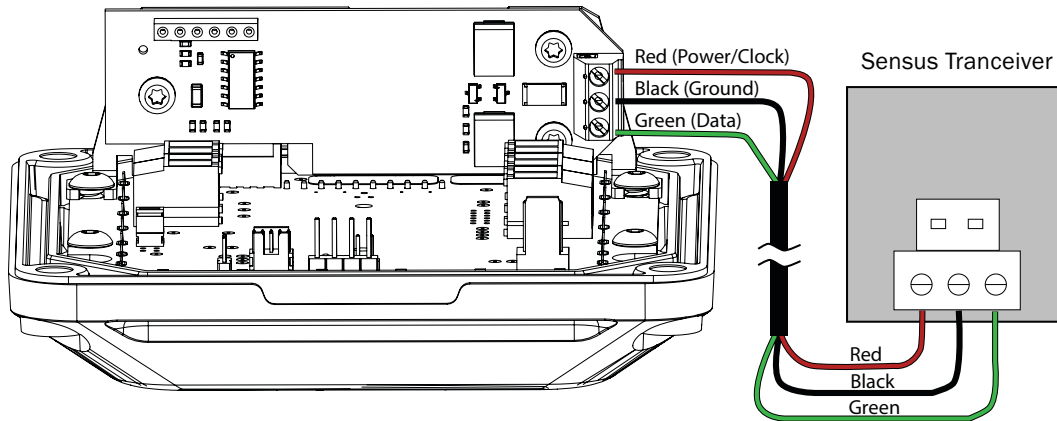
See Dual FT430/440 Diagram for an example of bidirectional connections.

Dual FT430/440 Displays (Example of Bidirectional Connection)



FT4XX Sensus Tranceiver Connections

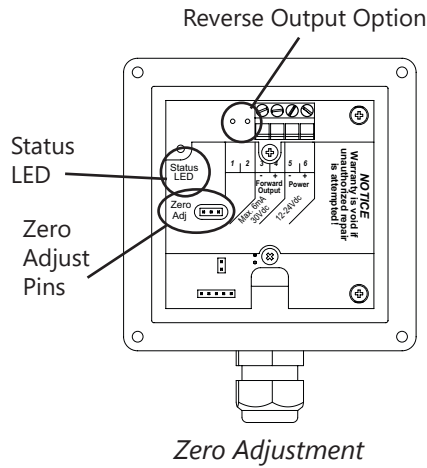
FT4XX Equipped with Sensus Board (Side View)



NOTE: A Sensus 2m (6 ft) output cable is prewired to the Seametrics product at the factory. Longer cables are optional.

Zero Adjustment

When the EX800-Series meter is powered up and there is no flow, there should be no output pulses (or, if connected to the FT430/440, flow rate should read "0"). If there are pulses, it may be necessary to adjust the flow meter under no-flow conditions after it has been installed. **This should only be done if the indicated flow is low, near the lower cutoff.**



To perform the adjustment, after determining that there is a full pipe with no flow, short between the two pins marked "Zero Adjust". A red LED light will come on for approximately 50 seconds and then go out. The zero adjustment is completed.

Minimum Flow

As with any other flow sensor, there is a rate below which the EX800-Series sensor cannot read. Check the table below for the minimum flow rate detectable by the sensor for a given pipe size.

Flow Rate (GPM)									
Feet Per Second	Nominal Pipe Size								
	1"	1.5"	2"	3"	4"	6"	8"	10"	12"
Min 0.28	0.7	1.5	2.7	6	11	25	44	69	99
Max 20.0	49	110	196	440	783	1760	3130	4900	7050

Presence of Flow Indication. To assist in troubleshooting, the "Status LED" has two blinking modes in normal operation. When there is no flow detectable by the meter (below minimum threshold) the LED blinks every 8.0 seconds. When there is detectable flow, the same indicator blinks every 3.0 seconds (Pulses are being output when indicator is blinking every 3 seconds).

Filtering

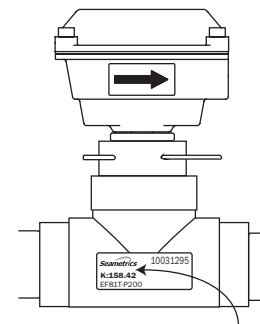
The software of the EX800-Series filters out electrical noise and averages sudden variations in the flow to smooth the output. It takes a matter of seconds for the flow sensor to get up to full output when it is powered up or when flow begins.

Electrode Coating

Grease or other adhering, non-conductive materials can stop flow detection if the electrodes become heavily coated. To clean the electrodes, remove the sensor from the pipe and gently scrub the electrodes (three silver bumps) on the reading face of the flow sensor. A mild soap (dish washing liquid for example) can be used to aid the cleaning process.

Calibration ("K-Factor")

The K-factor represents the actual number of pulses per gallon the meter produces during a flow test. This number can be entered into your electronic control to make it read properly. If the EX800-Series meter is ordered with a **tee fitting**, it is factory-calibrated in the fitting and the K-factor is indicated on the side of the fitting (see diagram).



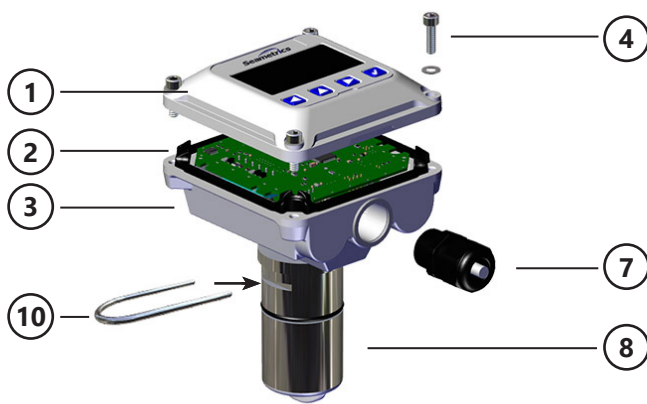
If the EX800-Series meter is ordered with a **saddle or weldolet** fitting, find your K-factor in the chart below.

K-Factors: Saddles & Weldolets						
	3"	4"	6"	8"	10"	12"
Schedule 40	64.061	37.297	16.498	9.552	6.073	4.285
Schedule 80	71.660	41.278	18.276	10.460	6.663	4.717
Stainless Steel (10S)	56.770	33.329	15.024	8.774	5.618	3.980
Stainless Steel (40S)	64.061	37.297	16.498	9.552	6.073	4.241
Copper Tubing (L)	69.497	39.632	17.757	10.193	6.579	4.565
Copper Tubing (K)	71.317	40.620	18.403	10.576	6.825	4.768
Brass Pipe	64.311	37.781	19.166	9.505	6.073	4.241
Duct. Iron (Class 52)	52.212	33.961	15.393	8.648	5.639	3.935

NOTE: K-factors are in pulses/gallon. For pulses/liter, divide by 3.785

Be aware that K-factors derived using the K-factor calculator will be expressed as pulses/'unit chosen' but will usually need to be entered as pulses/gallon when used with other equipment.

EX800 Parts List



EX800 Series Parts		
1	Upper housing/ electronics	Contact service representative for your specific model
2	Housing gasket/seal	102025
3	Lower housing	Not field replaceable
4	Housing screw/washer kit (4 each)	100414
7	Strain relief kit, large (includes 1)	101850
8	Sensor assembly	Not field replaceable
10	U-clip, retainer	100154-01

Problem	Probable Cause	Things to Try...
No pulse output	Pipe not full Below minimum flow cutoff Unit not grounded Excessive electrical noise No power Power reversed Flow reversed Output connections reversed Fluid conductivity <20 microSiemens/cm	Check plumbing Check the presence of flow LED (see page 12) Connect to earth ground (see page 8) Check for proper electrical wiring Check for power across power input terminals Reverse connections Note flow direction arrow, reverse direction of meter Change output connections Select another flow meter
Output pulses incorrect	Missing or incorrect ground wire Excessive electrical noise Fluid conductivity <20 microSiemens/cm Empty pipe Not enough straight pipe	Check for proper ground Check for proper electrical wiring Select another flow meter Check for full pipe or install meter in the vertical position Check for ten diameters upstream AND five diameters downstream
Jumpy reading	Rapidly changing conductivity (in chemical injection or fertigation applications)	Install chemical injection line downstream of magmeter (or far enough upstream to allow complete mixing of fluids before meter)

The limited warranty set forth below is given by Seametrics, with respect to Seametrics brand products purchased in the United States of America.

Seametrics warrants that products manufactured by Seametrics, when delivered to you in new condition in their original containers and properly installed, shall be free from defects in material and workmanship. **Seametrics products are warranted against defects for a minimum period of two (2) years from date of installation, unless otherwise specified, with proof of install date. If no proof of install date can be provided, warranty period will be two (2) years from date of shipment from Seametrics, as defined on Seametrics' invoice.** Seametrics' obligation under this warranty shall be limited to replacing or repairing the part or parts, or, at Seametrics' option, the products, which prove defective in material or workmanship. The following are the terms of Seametrics' limited warranty:

- a. Buyer must give Seametrics prompt notice of any defect or failure and satisfactory proof thereof.
- b. Any defective part or parts must be returned to Seametrics' factory or to an authorized service center for inspection.
- c. Buyer will prepay all freight charges to return any products to Seametrics' factory, or another repair facility, as designated by Seametrics.
- d. Defective products, or parts thereof, which are returned to Seametrics and proved to be defective upon inspection, will be repaired to factory specifications.
- e. Seametrics will deliver repaired products or replacements for defective products to the buyer (ground freight prepaid) to the destination provided in the original order.
- f. Products returned to Seametrics for which Seametrics provides replacement under this warranty shall become the property of Seametrics.
- g. This limited warranty covers all defects encountered in normal use of Seametrics products, and does not apply to the following cases:
 - i. Loss of or damage to Seametrics product due to abuse, mishandling, or improper packaging by buyer
 - ii. Failure to follow operating, maintenance, or environmental instructions prescribed in Seametrics' instruction manual
 - iii. Products not used for their intended purpose
 - iv. Alterations to the product, purposeful or accidental
 - v. Electrical current fluctuations
 - vi. Corrosion due to aggressive materials not approved for your specific product
 - vii. Mishandling, or misapplication of Seametrics products
 - viii. Products or parts that are typically consumed during normal operation
 - ix. Use of parts or supplies (other than those sold by Seametrics) which cause damage to the products, or cause abnormally frequent service calls or service problems
- h. A new warranty period will be established for repaired products, or products replaced during the original warranty period.
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