Seametrics

IP800-Series

Insertion Paddlewheel Flow Sensor Instructions

PROUDLY MADE IN THE USA

ISO 9001:2008

General Information

Installation

Connections

Operation and Maintenance

Troubleshooting

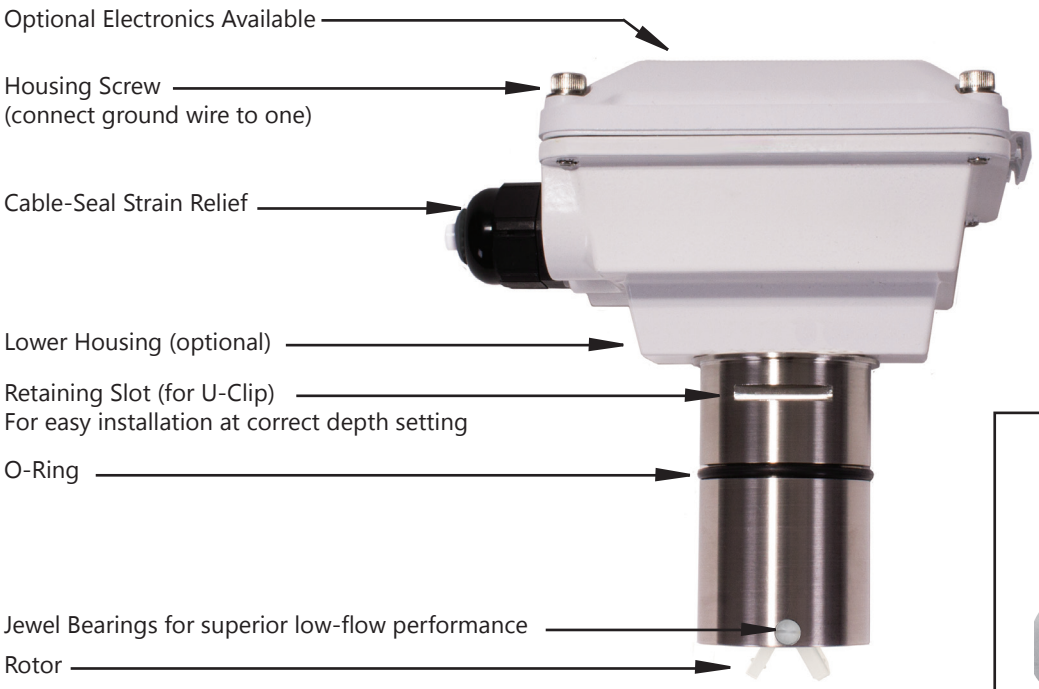
The **IP800-Series** are impeller (or "paddlewheel") insertion meters designed for use with a wide variety of liquids in pipe sizes 1/2" to 8". Sensors are available in brass, 316 stainless steel, PVC, and polypropylene. Bodies are machined from a solid rod for maximum precision. High-quality jewel bearings and nickel-bound tungsten carbide shafts are used for extreme low friction and long life. Low-flow performance is good, although other Seametrics flow meters are recommended where extremely low flows are being measured.

The rotation of the rotor is detected by a non-drag Hall-effect sensor. Output is a current-sinking pulse, which can be sent long distances (up to 2,000 feet) without a transmitter. This signal can be connected directly to PLC's, counters, and computer cards, as well as a variety of Seametrics controls and displays.

Seametrics IP meters are ideal for chemical proportioning applications. If no display is required, a simple divider such as the PD10 provides adjustable pump pacing. For rate and total display, a modular system of electronics can be installed directly on the flow sensor or mounted remotely. The FT430 (externally powered with pulse), FT440 (loop powered), and FT450 (battery powered) all provide digital rate and total displays, as well as a programmable pulse; the FT440 also provides a 4-20 mA analog output. The AO55 blind analog transmitter can be used to convert to a 4-20 mA output. IP meters are also compatible with the DL76 data logger and FT520 batch processor.

The IP800-Series require special fittings that ensure correct depth placement in the pipe. Fittings come in a variety of materials for compatibility with specific applications. Tee fittings are individually wet-calibrated at the factory and marked with the K-factor (pulses per gallon). Saddle fittings must be field-installed on the pipe and do not come wet-calibrated. K-factors for saddles are based on factory-testing.

Features



High Pressure

Specfications*

Pipe Size		1/2" to 8"		
Power		**Low Power:** 6-40 Vdc/< 2 mA	**Micropowered (-04 Option):** 3.1-16 Vdc/60 µA @ 3.6 Vdc	
Sensor		**Low Power:** Digital Magnetoresistive	**Micropowered (-04 Option):** Giant Magnetoresistance (GMR)	
Materials	**Optional Housing**	Powder-coated cast aluminum		
	Sensor Body	Brass, 316 Stainless Steel, PVC, or Polypropylene		
	O-ring	EPDM (Viton® optional)		
	Rotor	PVDF (Kynar®)		
	Shaft	Kynar® /Tungsten Carbide (Kynar® /Ceramic or Kynar®/Silicon Carbide optional)		
	Bearings	Ruby jewel		
Maximum		**Brass**	**316 Stainless Steel**	**PVC or Polypropylene** (See Pressure vs. Temp. Chart)
	Pressure	200 psi (14 bar)	200 psi (14 bar)	175 psi (12 bar) @ 75˚ F (24˚ C)
	High Pressure	Not available	400 psi (28 bar)	Not available
	Temperature	200˚ F (93˚ C)	200˚ F (93˚ C)	130˚ F (55˚ C)
Flow Velocity		0.3 to 30 ft/sec (0.9 to 9.14 m/sec)		
Accuracy		± 1.5% of full scale		
Output Transistor Maximum Current Sinking		150mA (low power version only)		
Cable		#22 AWG 3-con, 18' (6m); 2,000' (610m) maximum cable run Note: 50' (15m) maximum for battery powered or micropowered versions.		
Regulatory		CE Mark		

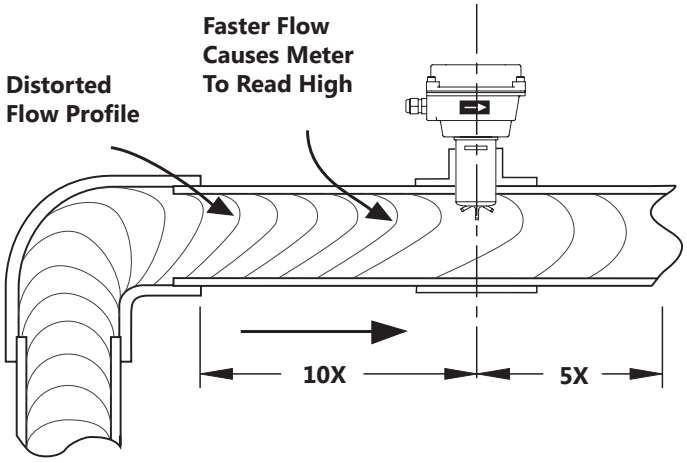
**Specifications subject to change • Please consult our website for current data (www.seametrics.com).*
Kynar is a registered trademark of Arkema, Inc., Viton is a registered trademark of DuPont Corporation.

Fitting Installation

The IP800-Series are fixed-depth meters that must be used with matched fittings appropriate to the application and pipe size. This ensures that the flow sensor is installed at the correct insertion depth to measure the average flow velocity of the stream.

Straight pipe of at least 10 diameters upstream and five diameters downstream of the meter is strongly recommended for proper accuracy. This is necessary because the shape of the velocity profile changes as the rate increases around an elbow; placing the meter too near the elbow causes a distorted reading. Additional straight run may be needed under specific adverse circumstances (see next page).

If you can't provide enough straight run to smooth out the velocity profile, some decrease in accuracy may result. This does not mean the meter's reading is meaningless, however. In some applications (e.g., control system, valve operation) a repeatable reading may be more important than a highly accurate one.



Distorted Flows

Stainless steel and brass fittings have female pipe threads, requiring the appropriate male threaded fittings. Saddle fittings require a hole to be cut in the pipe (recommended hole size is 1-3/4"). Before cutting into the pipe, observe the drawing below to choose your meter orientation.

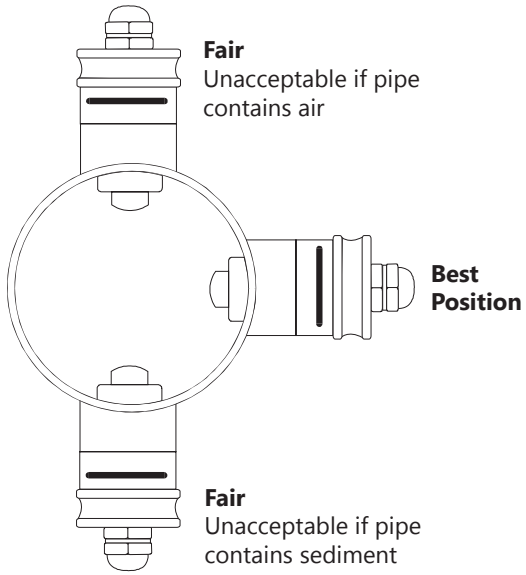
A PVC fitting is usually installed by solvent welding. PVC tees are supplied with some upstream straight pipe, less than the recommended straight pipe requirements. It is not advisable to connect directly to the end of these fittings with a flow disturbing device (valve, elbow), but rather add straight pipe to the end of these fittings to meet the straight pipe requirements for your application.

Meter Installation

After the meter fitting is installed in the pipeline, the meter can be installed in the fitting. 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 the 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).

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), top (12 o'clock), and vertical pipe installations are all acceptable if required by the piping layout.

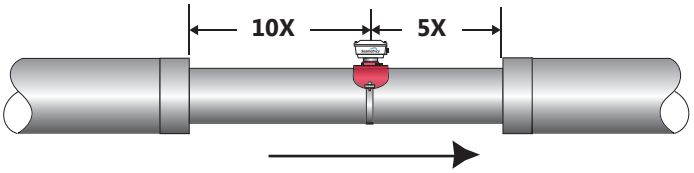


Orienting the Meter

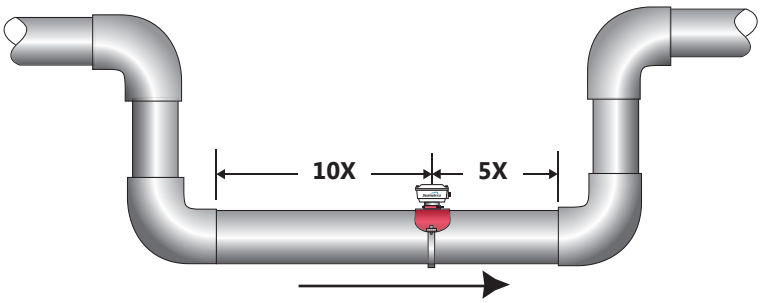
Caution: Never remove the U-clip retainer when the pipe is under pressure. Always remove pressure from the pipe before you attempt to remove the meter. Removal under pressure may result in damage or serious injury.

Straight Pipe Recommendations (X = diameter)

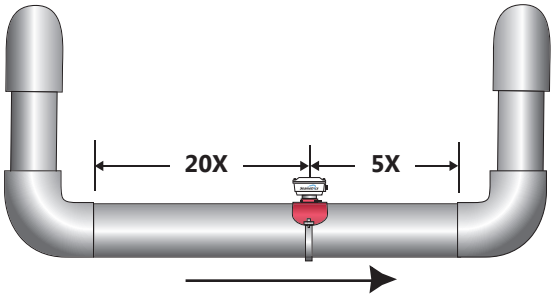
Reduced Pipe



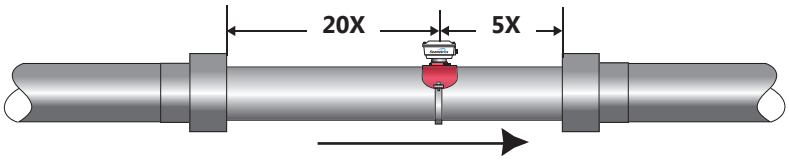
Two Elbows In Plane



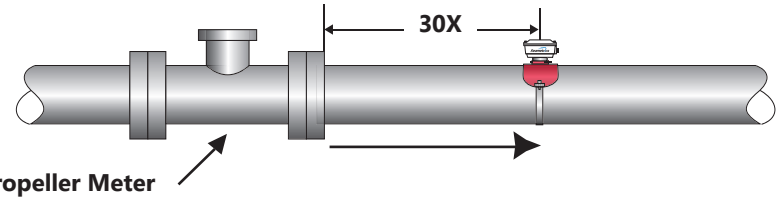
Two Elbows, Out Of Plane



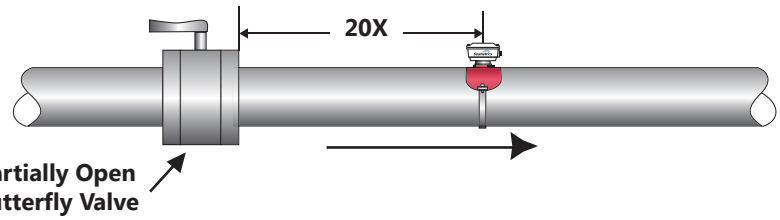
Expanded Pipe



Spiral Flow

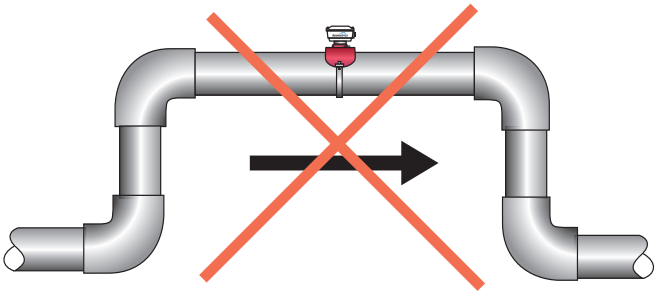


Swirling Flow



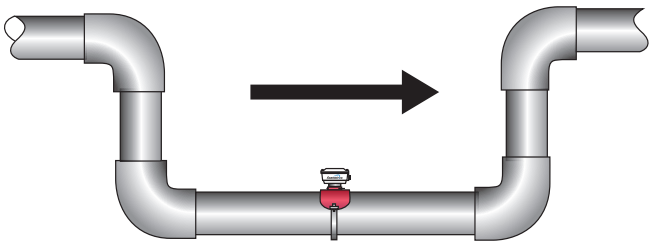
Full Pipe Recommendations

Possible Problem



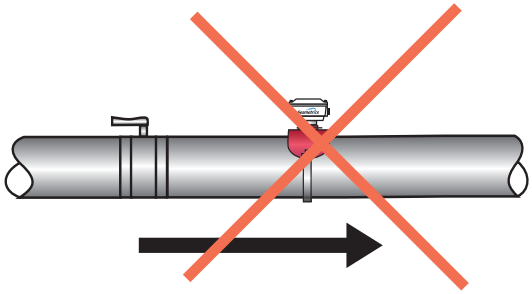
Allows air pockets to form at sensor

Better Installation



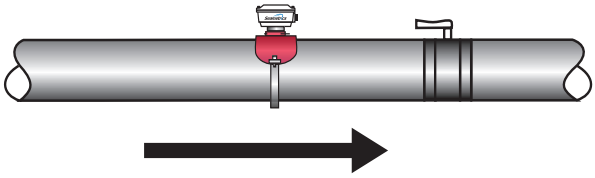
Ensures full pipe

Possible Problem



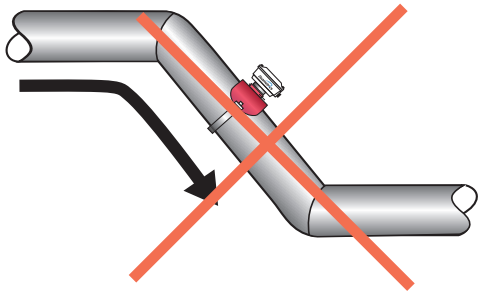
Post-valve cavitation can create air pocket

Better Installation



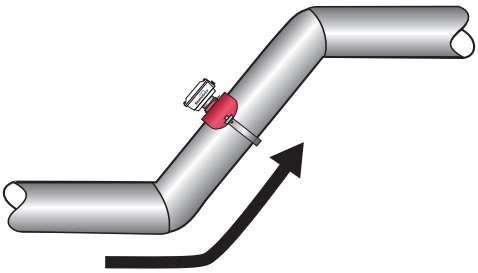
Keeps pipe full at sensor

Possible Problem



Air can be trapped

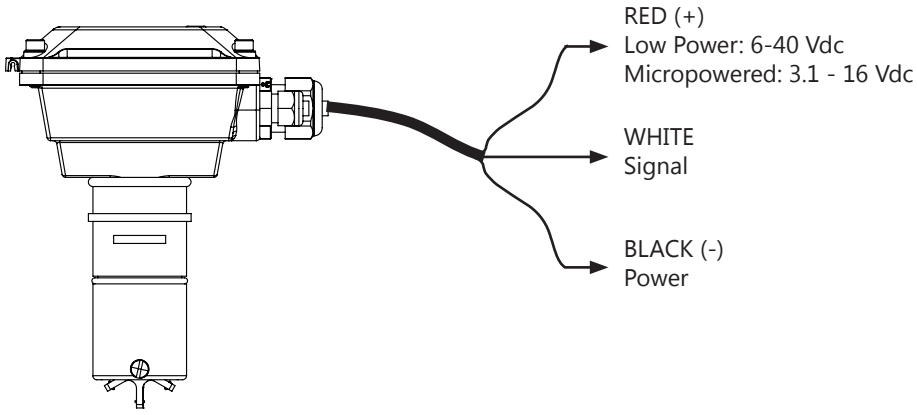
Better Installation



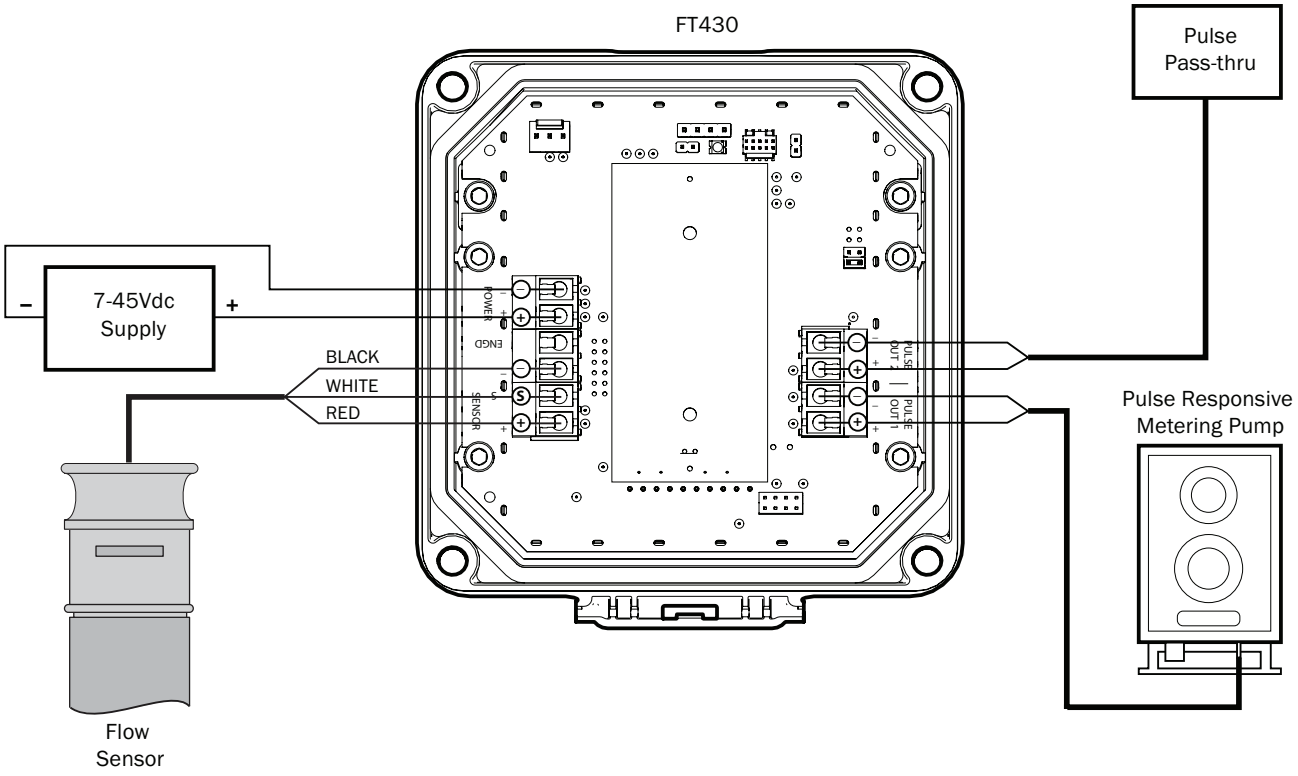
Allows air to bleed off

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).

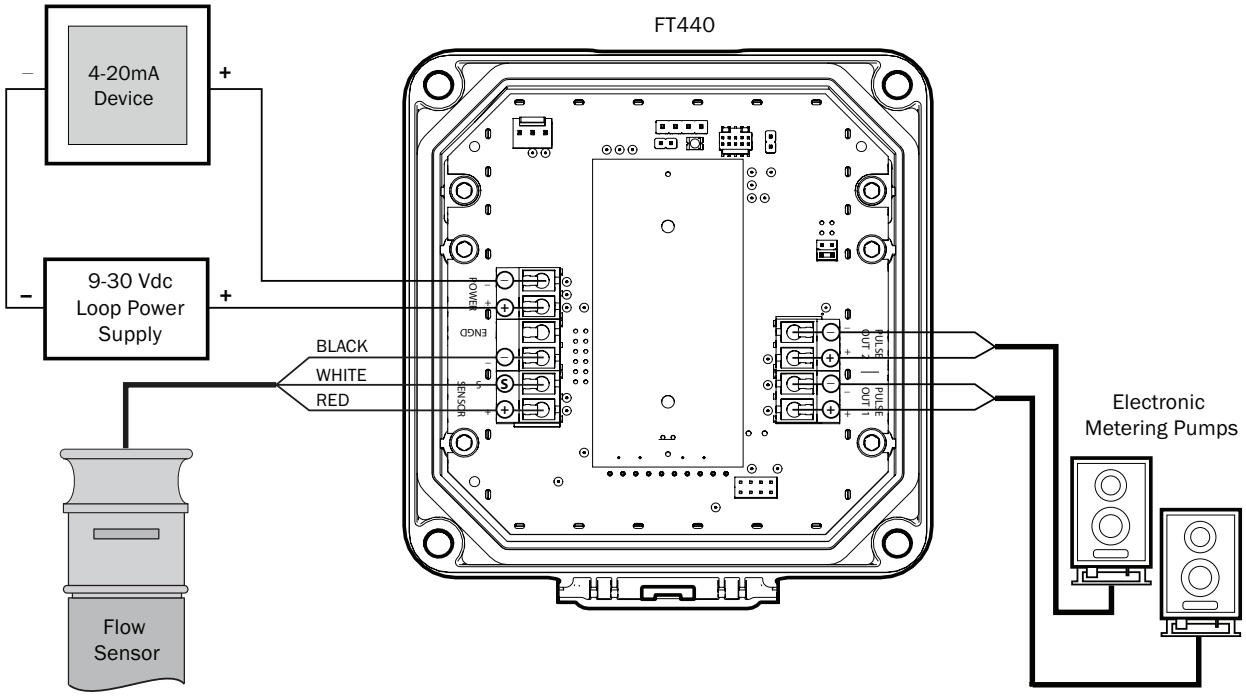
Sensors are supplied with 18 ft. (6m) of cable. For sensors with no additional electronics, see diagram for color coding of connections. For sensors with on-board electronics, see the manual accompanying the electronic module.



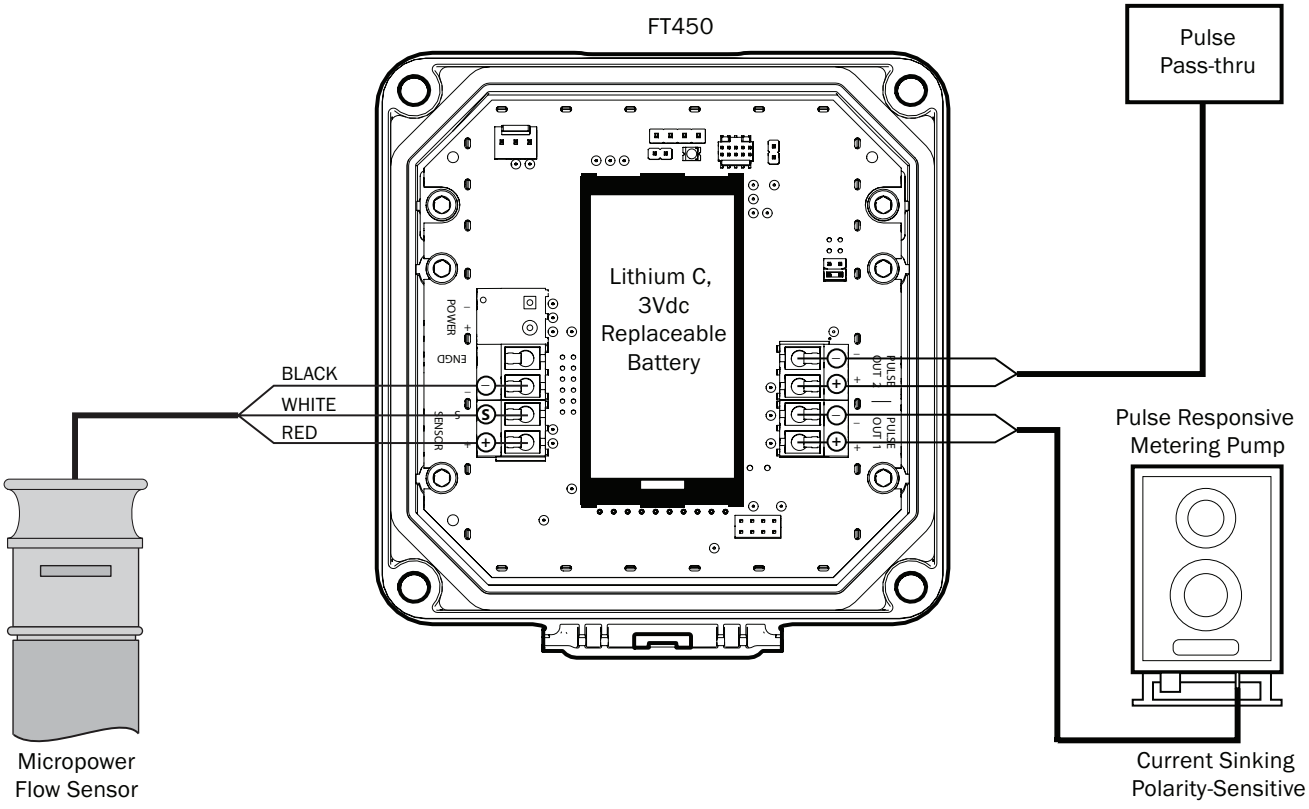
FT430



FT440

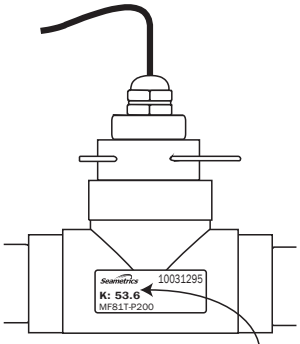

FT440
4-20mA Device
–
+
9-30 Vdc Loop Power Supply
–
+
BLACK
WHITE
RED
Flow Sensor
Electronic Metering Pumps

FT450


FT450
Pulse Pass-thru
Lithium C, 3Vdc Replaceable Battery
BLACK
WHITE
RED
Micropower Flow Sensor
Pulse Responsive Metering Pump
Current Sinking Polarity-Sensitive

Calibration ("K-factor")

The K-factor represents the number of pulses per gallon the meter produces during a flow test. This number must be entered into your electronic control to make it read properly. If the IP800-Series meter is ordered with a **tee fitting**, it is factory-calibrated in the fitting and the K-factor is indicated on the side (see below).



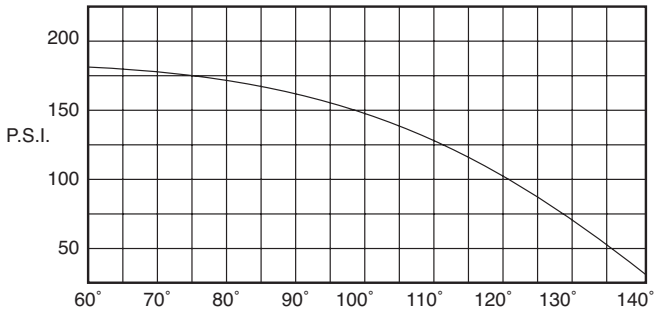
Find Your K-Factor Here

If a **saddle** or **weld-type** fitting has been ordered, use the K-factor calculator at the bottom of the **seametrics.com** home page to determine the K-factor. In PVC, however, it is possible to order a saddle pre-installed on a standard length of pipe, and the fitting can be wet-calibrated in this case.

Field Calibration

It is possible to field-calibrate an IP800-Series flow sensor to determine an accurate K-factor in the actual installation. The reason for doing this would be to compensate for an unusual condition, for instance, applications with higher viscosity fluid (IP meters are calibrated for water use) or which lack adequate straight pipe ahead of the meter. Field Calibration procedures are described in a Technical Bulletin on our website (www.seametrics.com).

Pressure vs. Temperature (PVC/Polypro)



Minimum Flow

As with any other flow sensor, there is a rate below which the IP800-Series sensor cannot read. Check the flow rate table below for the minimum flow rate detectable by the sensor for a given pipe size.

Flow Range

Nominal Pipe Size	½"	¾"	1"	1½"	2"	3"	4"	6"	8"
Min GPM	0.28	0.5	0.8	1.9	3.1	6.9	12	27	46.8
Min LPM	1.06	1.89	3.03	7.2	11.7	26.1	45	102	177
Max GPM	28	50	80	190	314	691	1190	2700	4680
Max LPM	106	189	302	719	1188	2615	4504	10221	17716

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

Rotor Replacement

It is unusual for a rotor to require replacement due to damage sustained in normal service. More commonly, the meter is dropped while it is out of the pipe. Another reason for rotor replacement is shaft wear after long service. Rotors are easily field-replaced.

To install a rotor, follow these steps:

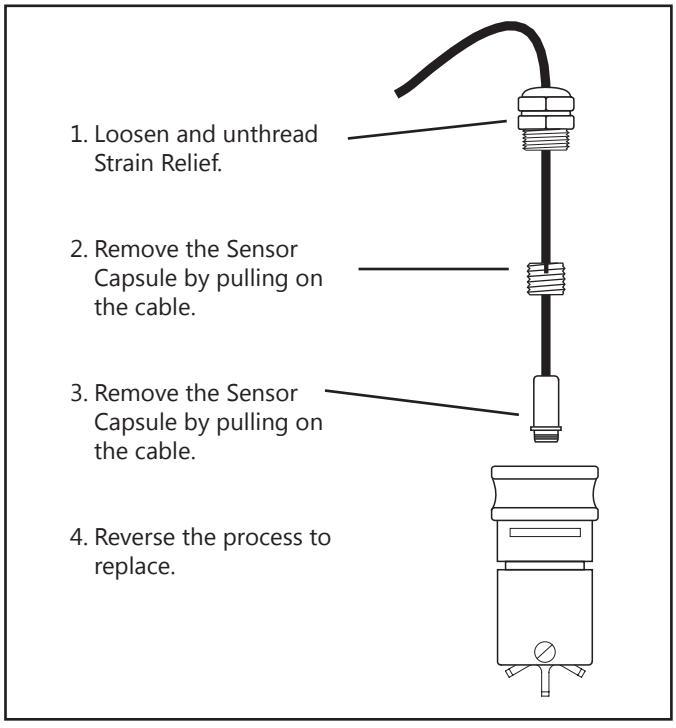
1. Unscrew the threaded bearing housings to expose the shaft ends. If bearings are being replaced, back them completely out.
2. Remove the rotor. Put the new rotor in its place.
3. Thread in one bearing housing part way, then the other. Take care to start the end of the shaft into the bearing hole before tightening further.
4. Screw in bearing housings until they bottom. **Note: Do not use excessive force.**
5. Check for free spin. Blowing lightly on the rotor should result in it spinning rapidly and coasting to a smooth stop.

Signal Troubleshooting

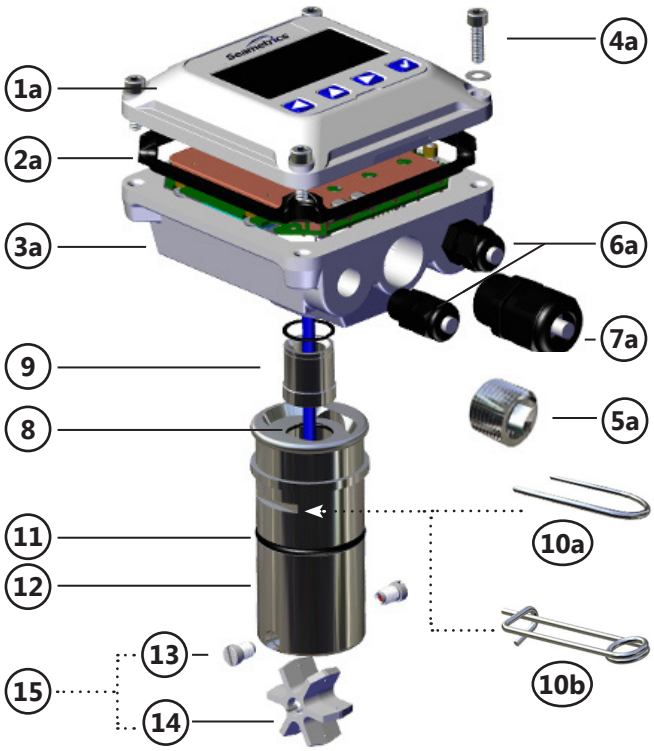
The flow sensor has only one moving part, the rotor. If this is turning properly and there is no signal, the magnetic sensor is not operating properly. To check the signal, apply 12 Vdc power to the red (+) and black (-) leads. Set a multimeter to voltage reading. Put the positive multimeter lead on the red wire and the negative lead on the white wire. Slowly turn the rotor. Voltage reading should swing between -12 Volts and 0 Volts as the rotor turns. If it does not, the solid-state magnetic sensor is not working properly. Checking for continuity is not a useful test of these sensors.

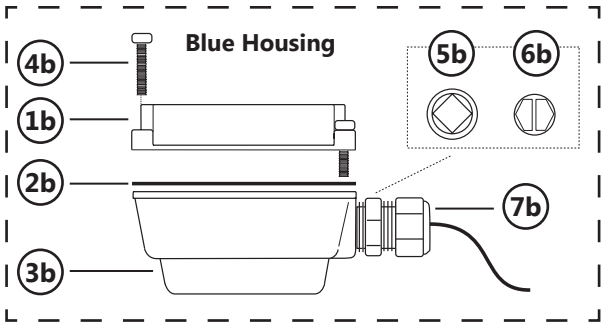
Sensor Replacement

It is very unusual for a sensor to require replacement in normal use. The primary cause of sensor failure is overvoltage (inadvertent connection of high voltage, for example) or incorrect polarity on hookup. The sensor is replaced by removing the strain relief, then threading out the sensor retainer plug. Remove the entire sensor capsule by pulling on the cable. The new sensor capsule can then be installed. Replace the retainer plug, and then replace and tighten the strain relief.



IP800-Series Parts List





IP800 Series Parts

		White Housing 1a thru 7a	Blue Housing 1b thru 7b
1	Upper housing/ electronics	Contact service representative for your specific model	Contact service representative for your specific model
2	Housing gasket/seal	102025	100411
3	Lower housing	Not field replaceable	Not field replaceable
4	Housing screw/washer kit (4 each)	100414	100414
5	Plug, steel (battery units)	100360	100360
6	Strain relief kit, small (includes 2)	100364	100364
7	Strain relief kit, large (includes 1) (externally powered units)	101850	101850
8	Sensor pickup	100508 (Micropower, gray cable, FT450) 100419 (Standard, blue cable, FT430/440)	
9	Sensor retaining screw	100298	
10a	U-clip, retainer	100154	
10b	High pressure retaining clip (requires 2)	101776	
11	O-ring	100264 (EPDM)	
12	Body	See distributor	
13	Bearings (includes 2)	103315	
14	Rotor with shaft	100035 (Kynar®/tungsten carbide) 100036 (Kynar®/ceramic) 100435 (Kynar®/silicone carbide)	
15	Rotor repair kit (#13 & #14 above)	100317 (Kynar®/tungsten carbide) 100043 (Kynar®/ceramic) 100556 (Kynar®/silicone carbide)	

Problem	Probable Cause	Things to Try...
No signal after installation	Insufficient flow	Consult Flow Rate Chart Reduce pipe size or use different sensor
	Bad connections to control electronics	Check connections at control: Red (+), Black (-), White (signal)
	Incompatible control	Use 6-40 Vdc power supply - for low power Use 3.1-16 Vdc power supply - for micropowered Add pull up resistor, if using current-sourcing device
	Damaged or missing rotor	Remove flow sensor from fitting and check for free spinning; replace rotor
	Failed magnetic sensor	See Signal Troubleshooting (page 11); replace magnetic sensor
Inaccurate metering	Not enough straight pipe between meter and severe flow disturbance	Move meter away from flow disturbance or field calibrate
	Wrong K-Factory entered	Check fitting for K-Factor, check indicator to see if it is entered properly ("Set K" on FT430, FT440, FT450, or FT520)
	Magnetic sensor failing to pick up each blade	Remove flow sensor from pipe. If indicator is FT430, FT440, FT450, or FT520, set K to 1.00, turn rotor slowly by hand, indicator should cound each blade; replace sensor
	Wrong time units on flow indicator	If using FT430, FT440, or FT520, check left side of display (sec, min, hr, day); change to desired unit