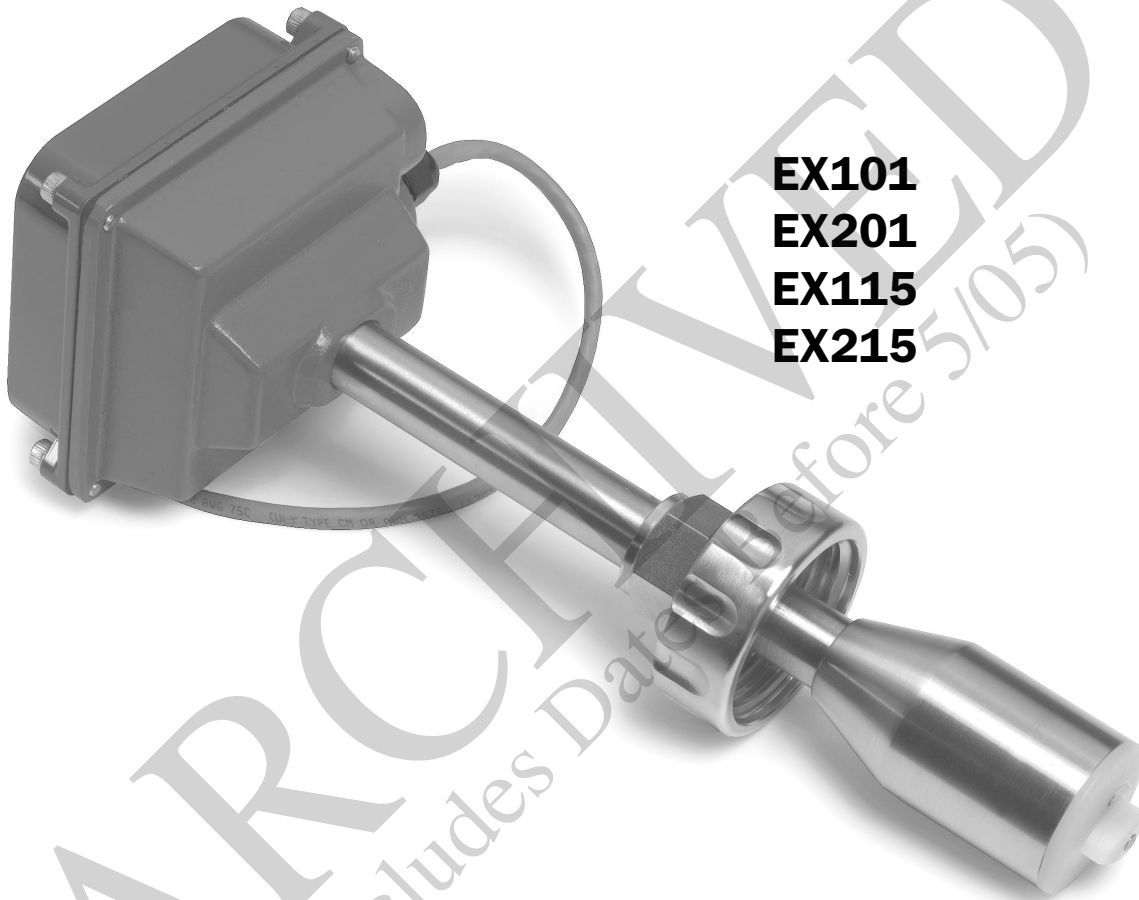


# EX100/200 Series

## INSERTION MAGNETIC FLOW METER INSTRUCTIONS



**EX101**  
**EX201**  
**EX115**  
**EX215**

EX100/200 SERIES INSERTION MAGNETIC FLOW METER INSTRUCTION

**SeaMetrics**

*The Leader in Flow Meter Value.*

## TABLE OF CONTENTS

---

### General Information

Specifications, Parts Diagram .....	<b>Page 1</b>
-------------------------------------	---------------

### Installation

Piping, Distorted Flows, Immersion, Fitting Installation, Meter Installation, Positioning the Meter .....	<b>Page 2</b>
Proper Depth Setting .....	<b>Page 3</b>
Table 1: Dimension "C", Table 2: Pipe Wall Thickness .....	<b>Page 4</b>
Straight Pipe Recommendations (examples) .....	<b>Page 5</b>
Correct and Incorrect Installations .....	<b>Page 6</b>

### Electrical Connections

General Electrical Guidelines, Power, Pulse Output, Direction Indicator, Grounding Guidelines, Grounding Diagram .....	<b>Page 7</b>
--	---------------

### Connections Diagrams

Counter or PLC, A055 4-20 mA Output, FT520 Controller .....	<b>Page 8</b>
FT420 Display and Proportional Feed, FT420 & 4-20 mA Output, FS30 Flow Switch .....	<b>Page 9</b>

### Operation & Maintenance

Zero Adjustment, Minimum Flow, Filtering, Electrode Coating, K-Factor, Location of K-Factor Diagram .....	<b>Page 10</b>
Operating Charts: Flow in Gallons Per Minute at Various Velocities - Schedule 40 Pipe .....	<b>Page 11</b>
EX Series K-Factors for Various Pipe Sizes .....	<b>Page 11</b>

### Troubleshooting

Problems, Possible Causes, Things to Try .....	<b>Page 12</b>
--	----------------

## TABLES, DIAGRAMS & CHARTS

---

Parts Diagram .....	<b>Page 1</b>
Distorted Flows Diagram, Positioning the Meter .....	<b>Page 2</b>
Proper Depth Setting .....	<b>Page 3</b>
Table 1: Dimension "C", Table 2: Pipe Wall Thickness .....	<b>Page 4</b>
Straight Pipe Recommendations (examples) .....	<b>Page 5</b>
Correct and Incorrect Installations (examples and explanations) .....	<b>Page 6</b>
Grounding Diagram .....	<b>Page 7</b>
Counter or PLC, A055 4-20 mA Output, FT520 Controller .....	<b>Page 8</b>
FT420 Display and Proportional Feed, FT420 & 4-20 mA Output, FS30 Flow Switch .....	<b>Page 9</b>
Operating Charts: Flow in Gallons Per Minute at Various Velocities - Schedule 40 Pipe .....	<b>Page 11</b>
EX Series K-Factors for Various Pipe Sizes .....	<b>Page 11</b>
Troubleshooting Problems, Possible Causes, Things to Try .....	<b>Page 12</b>

## GENERAL INFORMATION

The complete lack of moving parts of this insertion flow sensor is the source of its reliability. There is no rotor to stop turning in dirty water and there are no bearings to wear out. A rapidly reversing magnetic field is produced in the lower housing, and as the fluid moves through this field a voltage is generated. This tiny voltage is measured and translated into a frequency signal which is proportional to flow rate. This square wave signal can be sent directly to a PLC or other control, or can be converted using any of the SeaMetrics family of indicators and converters.

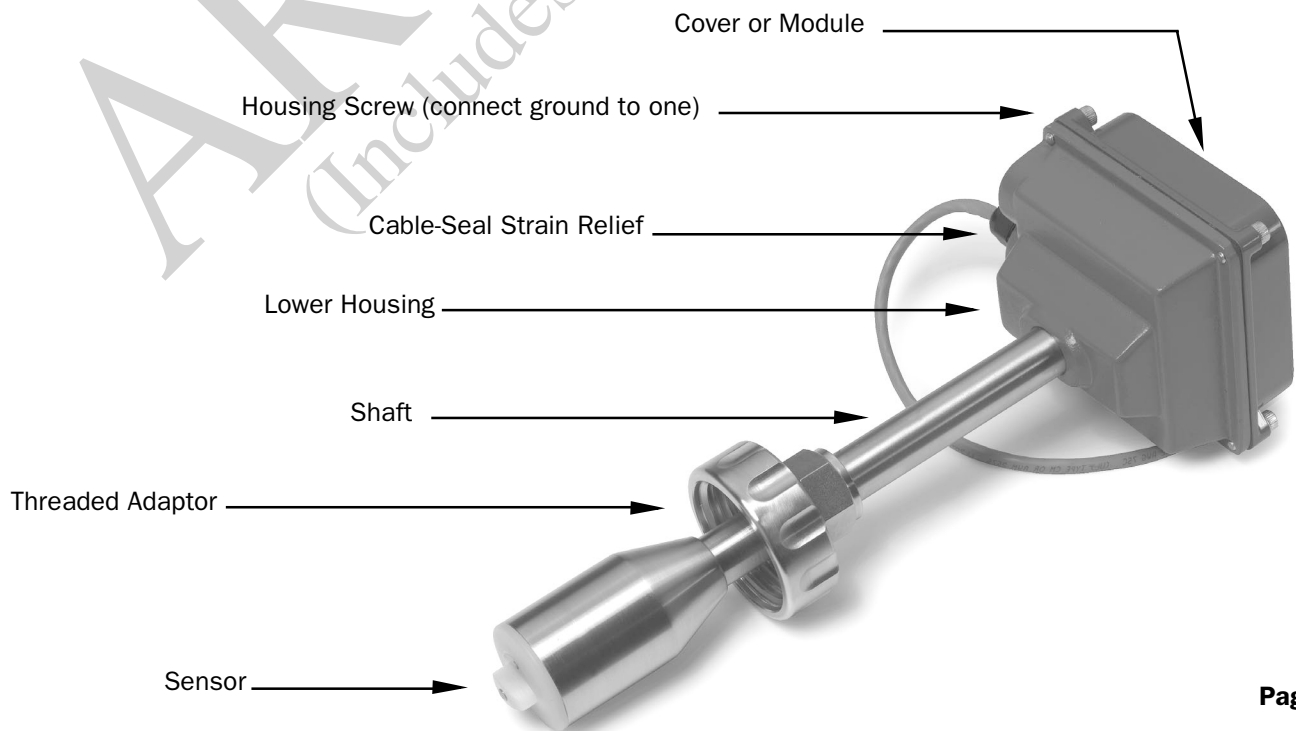
A modular system of electronics can be attached directly to the flow sensor, or remotely mounted. SeaMetrics currently offers four systems: The FT420 provides full indication of rate and total, plus 4-20 mA output. The A055 provides blind 4-20 mA output, the PD10 divides the pulse frequency, and the FS30 can be used for a precise setpoint flow switch.

The installation fitting of the EX sensor is standard male NPT, and can be directly threaded into ordinary saddles or threaded weld fittings. The EX115 and 215 include an isolation valve, allowing hot-tap installation, or installation and removal under pressure. The standard isolation valve is bronze, but a 316 stainless steel valve is available as an option if needed.

## SPECIFICATIONS

<b>POWER</b>	12 - 24 Vdc, 250 mA
<b>FLOW RANGE</b>	0.2 – 20 ft/sec
<b>INSTALLATION</b>	
<b>FITTING SIZE</b>	EX101, 201: 1.5" MNPT EX115, 215: 2" MNPT
<b>TEMPERATURE</b>	Ambient: 0 – 180 F Fluid: 32 – 212 F
<b>PRESSURE</b>	200 psi
<b>MINIMUM CONDUCTIVITY</b>	20 microsiemens/cm
<b>CALIBRATION ACCURACY</b>	1% of full scale
<b>OUTPUT</b>	Square wave pulse, Opto isolated, 500 Hz @ 20 ft/sec
<b>BI-DIRECTIONAL</b>	Direction output, Opto isolated
<b>EMPTY PIPE DETECTION</b>	Software, defaults to zero flow

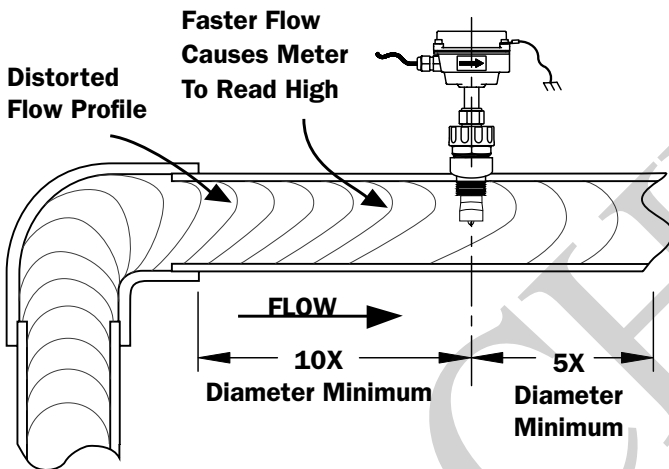
## EX100/200 SERIES PARTS DIAGRAM



## INSTALLATION

**Piping.** For best results, the EX sensor should be installed with at least ten diameters of straight pipe upstream and five downstream. Certain extreme situations such as partially-opened valves are particularly difficult and may require more straight diameters upstream. The 101 and 201 sensors are supplied with a 1-1/2" male pipe thread fitting. The 115 and 215 sensors have a 2" NPT thread, for compatibility with the 2" isolation valve. Any fitting which provides the matching NPT female thread may be used. The installation procedure compensates for differences in height of the fitting.

### DISTORTED FLOWS



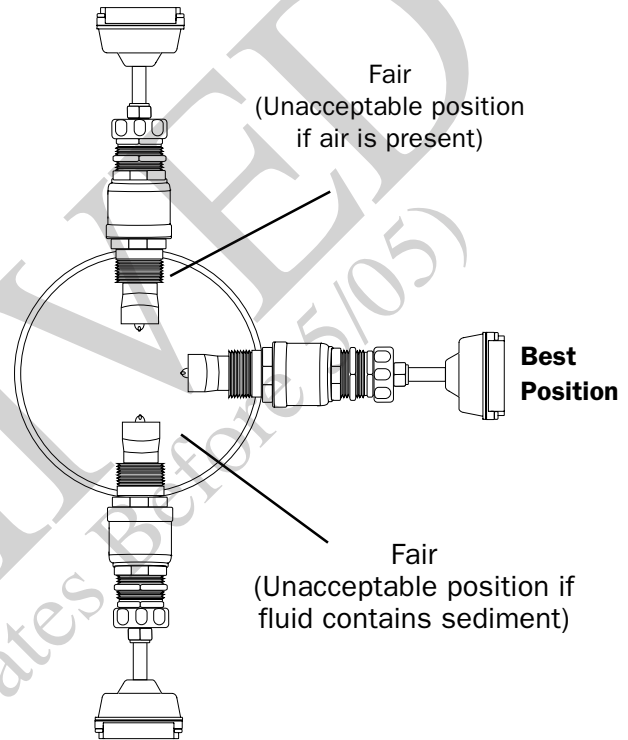
Horizontal is the preferred installation orientation, since it improves low-flow performance and avoids problems with trapped air. Bottom, top, and vertical pipe installations are all acceptable if required by the piping layout.

**Immersion.** The 100/200 Series standard sensors are not designed for continuous underwater operation. If this is a possibility, as in a flooded vault, a unit modified for immersion should be specified.

**Fitting Installation.** First cut a minimum 1-3/4" hole in the pipe. If possible, measure the wall thickness and write it down for use in depth setting, below. Then install the threaded fitting (saddle, weldolet, etc.) on the pipe.

**Meter Installation.** Remove the threaded adapter from the sensor. Using a thread sealant, install the adapter in the pipe fitting. *Do not overtighten.* Slide the meter through the adapter fitting. Engage the locking collar threads and turn until the collar stops, about 1-1/2 to 2 turns.

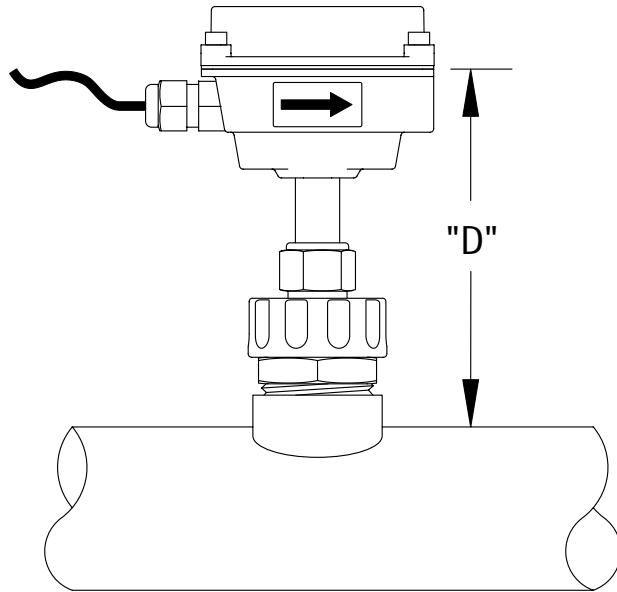
### POSITIONING THE METER



**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).

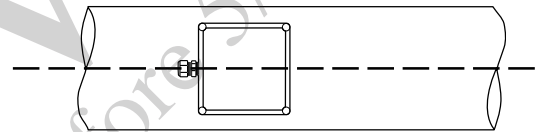
## INSTALLATION

### PROPER DEPTH SETTING



**Depth Setting.** It is important for accuracy that the sensor be inserted the correct depth into the pipe. Follow these steps:

1. In Table 1, find the model of sensor which you have. Take Dimension C from this table for the pipe size.
2. Subtract wall thickness of your pipe to find Dimension D. Use Table 2 if you do not know the thickness.
3. Measuring from the outside of the pipe to the joint in the housing, as shown in the diagram, adjust the sensor to Dimension D and tighten enough to hold it there.
4. Line the conduit housing with the centerline of the pipe, as shown.



**Caution!** Never attempt to remove a flow sensor when there is pressure in the pipe. Loosen the locking collar slowly to release any trapped pressure. If fluid sprays out when removing the sensor, stop turning and depressurize the pipe. Failure to do so could result in the sensor being thrown from the pipe, resulting in damage or serious injury.

5. Check Dimension D one more time.
6. Tighten the compression nut fully.

**INSTALLATION**

**TABLE 1: DIMENSION "C"**

	NOMINAL PIPE SIZE												
	2"	2.5"	3"	4"	5"	6"	8"	10"	12"	16"	24"	30"	36"
<b>MX101</b>	10.20	10.12	10.03	9.86	9.69	9.52	9.18	8.84	8.50	7.82	-	-	-
<b>MX201</b>	15.20	15.12	15.03	14.86	14.69	14.52	14.18	13.84	13.50	12.82	11.46	10.44	10.42
<b>MX115</b>	17.24	17.14	17.04	16.84	16.74	16.54	16.14	15.84	15.54	14.84	-	-	-
<b>MX215</b>	-	-	-	20.89	20.69	20.49	20.19	19.89	19.49	18.79	17.49	16.49	15.39

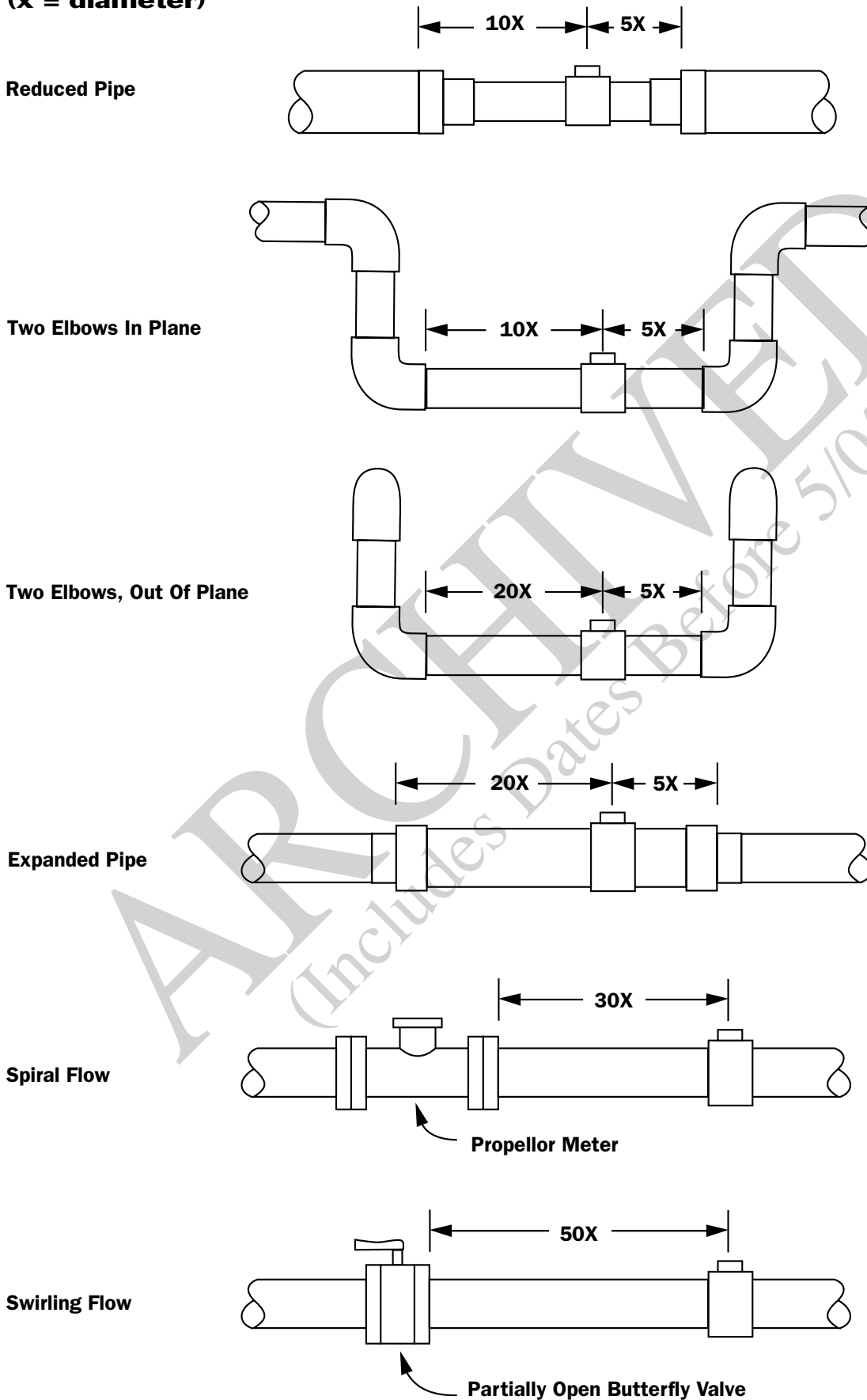
**TABLE 2: PIPE WALL THICKNESS**

	PIPE SIZES												
	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"	16"	24"	30"	36"
<b>IPS Steel Schedule(10S)</b>	0.109	0.120	0.120	0.120	0.134	0.134	0.148	0.165	0.180	-	-	-	-
<b>IPS Schedule (40)</b>	0.154	0.203	0.216	0.237	0.258	0.280	0.322	0.365	0.406	0.500	0.687	-	0.750
<b>IPS Schedule (80)</b>	0.218	0.276	0.300	0.337	0.375	0.432	0.500	0.593	0.687	0.843	1.218	-	-
<b>Copper Tubing (Type K)</b>	0.083	0.095	0.109	0.134	0.160	0.192	0.271	-	-	-	-	-	-
<b>Copper Tubing (Type L)</b>	0.070	0.080	0.090	0.100	0.125	0.140	0.200	-	-	-	-	-	-
<b>Copper Pipe</b>	0.157	0.188	0.219	0.250	0.250	0.250	0.313	-	-	-	-	-	-
<b>Class 52 Duct. Iron</b>	-	-	0.280	0.290	-	0.310	0.330	0.350	0.370	0.400	-	-	-

# INSTALLATION

## STRAIGHT PIPE RECOMMENDATIONS

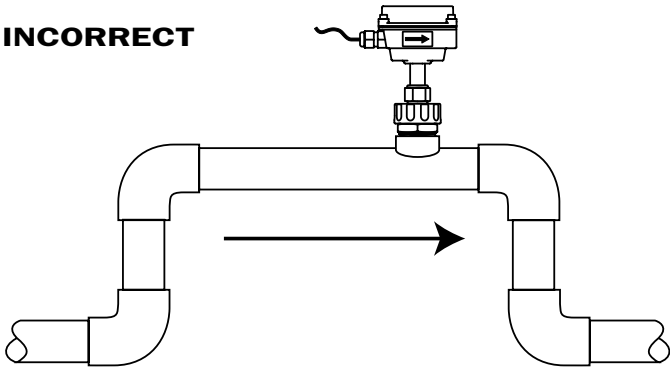
(x = diameter)



# INSTALLATION

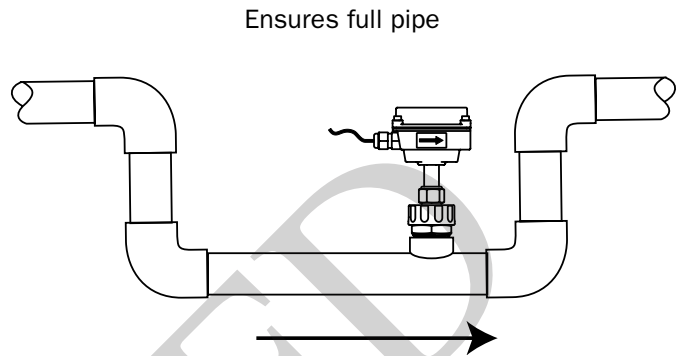
## CORRECT AND INCORRECT INSTALLATIONS

**INCORRECT**

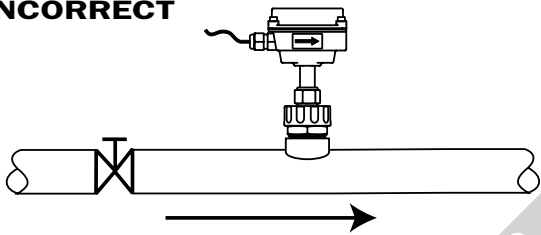


Allows air pockets to form at sensor

**CORRECT**

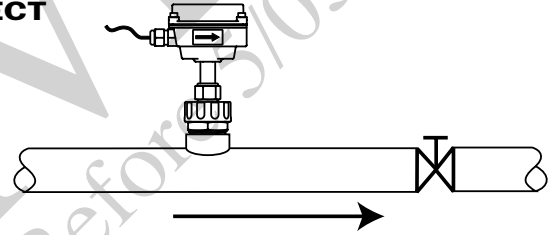


**INCORRECT**



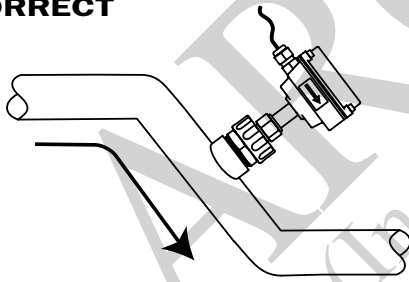
Post-valve cavitation can create air pocket

**CORRECT**



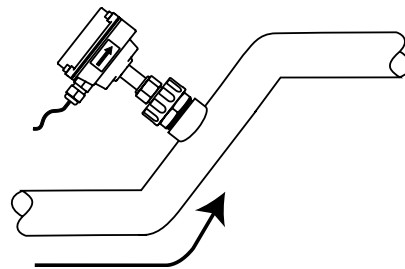
Keeps pipe full at sensor

**INCORRECT**



Air can be trapped

**CORRECT**



Allows air to bleed off



**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).



## ELECTRICAL CONNECTIONS

### General Electrical Guidelines:

- Whenever possible avoid running control cables in the same conduit with AC power. Use shielded control cable where this type of installation is necessary.
- If using shielded cable, be sure that one end is grounded
- Avoid routing flow sensor cables in close proximity to a variable frequency drive.
- Recommended power and output wiring is 18-22 AWG control cable, shielded if the run length is more than 18 feet (6 meters).
- Recommended voltage is 12-24 VDC. Note that unregulated power supplies can vary from nameplate voltage by a considerable amount. When in doubt, use a regulated power supply.

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

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

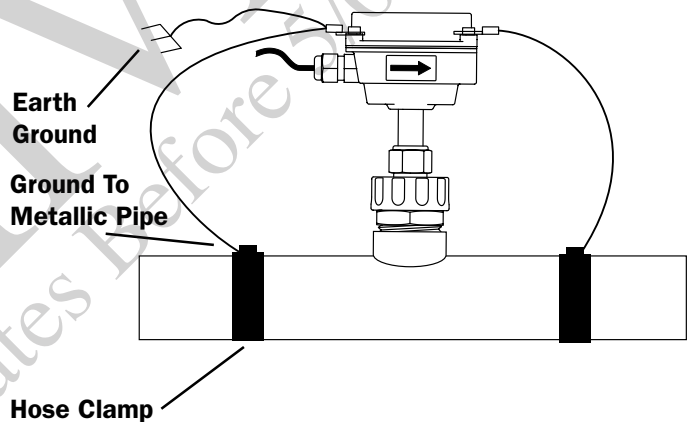
**Pulse Output:** This open-collector isolated output does not supply power. It functions like a polarity-sensitive switch closure. It reaches a maximum of 500 Hz at the maximum flow rate of 20 feet/second. This pulse is generated in both forward and reverse flow directions (see "Direction" below). **Note:** This output is limited to 5 mA at 30 Vdc maximum.

**Direction Indicator:** This output is switched by a solid state relay, which is not polarity sensitive. It is "off" (open) when flow is in the forward direction and "on" (closed) when flow is in the reverse direction. **Note:** this output is limited to 100 mA at 150 Vdc maximum.

### Grounding Guidelines:

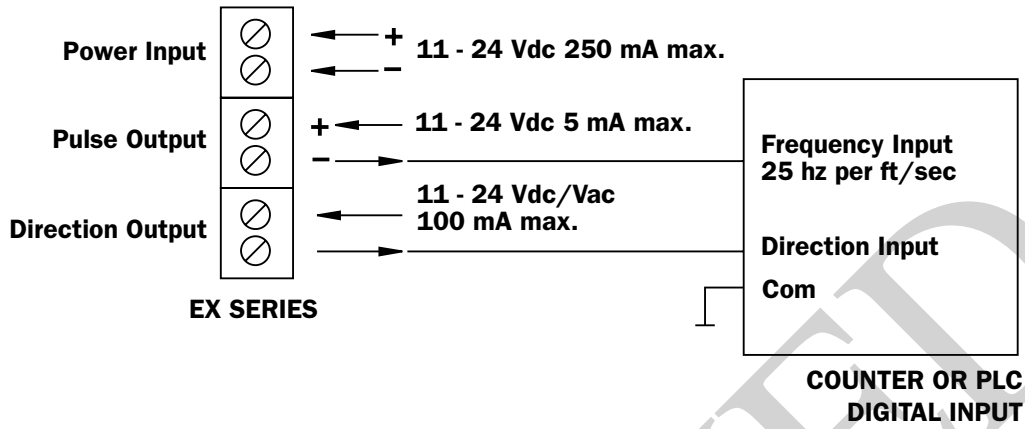
- For best results, use a good quality earth ground, such as metallic water piping, or a stake driven into the ground.
- If the flow sensor is installed in metallic piping, for optimum grounding clamp wires to the piping a short distance to either side of the flow sensor using hose-type clamps. Connect these wires to the earth ground and to one of the housing screws.

### GROUNDING DIAGRAM

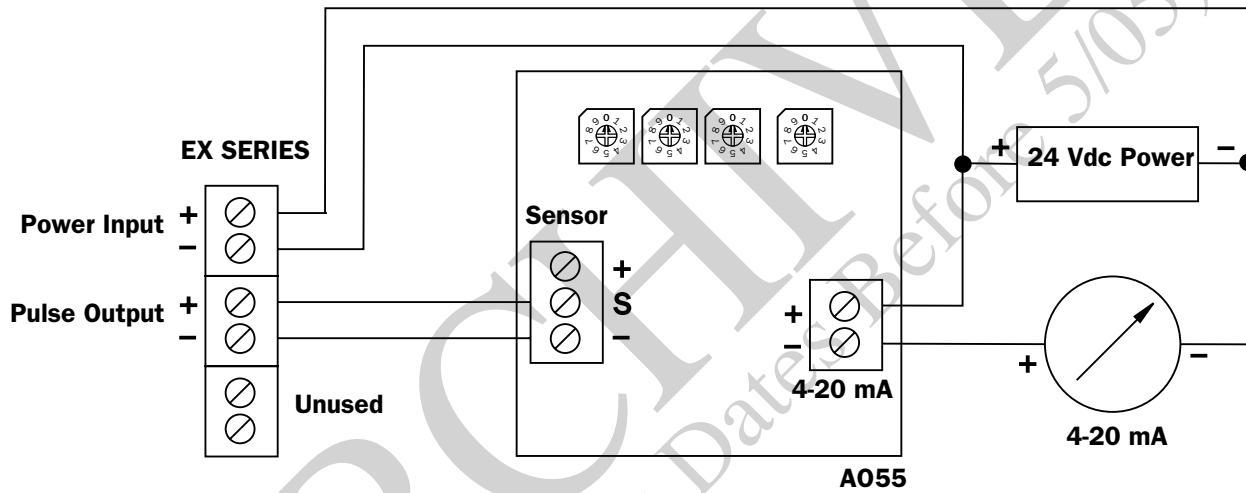


# CONNECTIONS DIAGRAMS

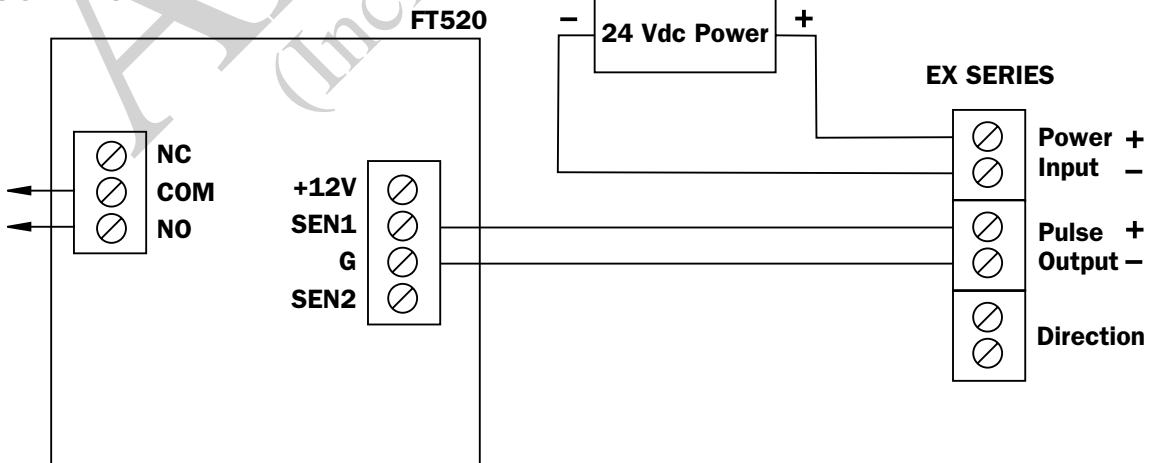
## COUNTER OR PLC



## A055 4-20 mA OUTPUT

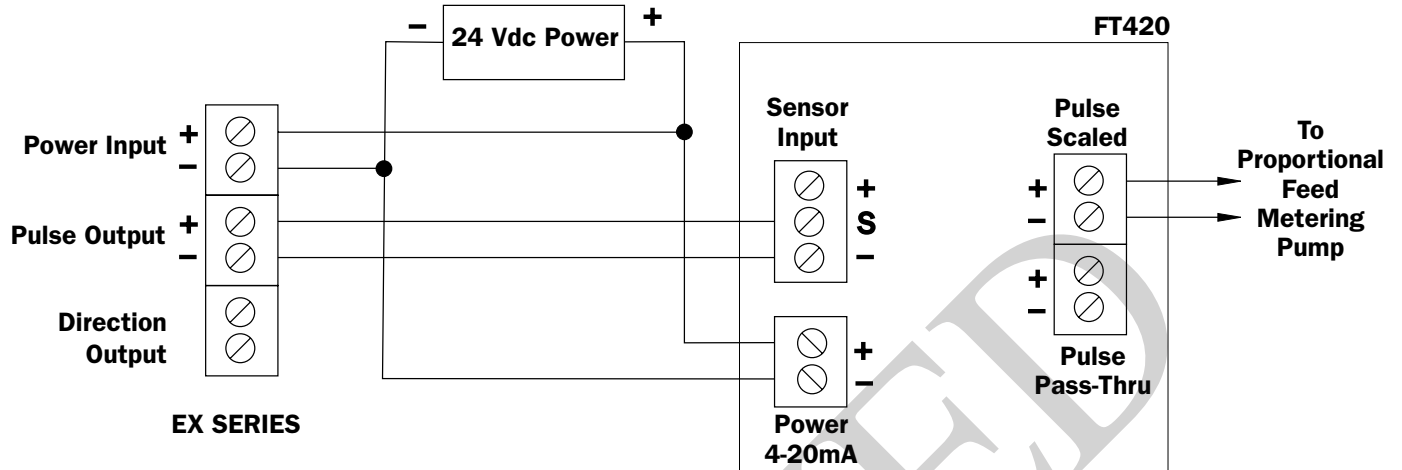


## FT520 CONTROLLER

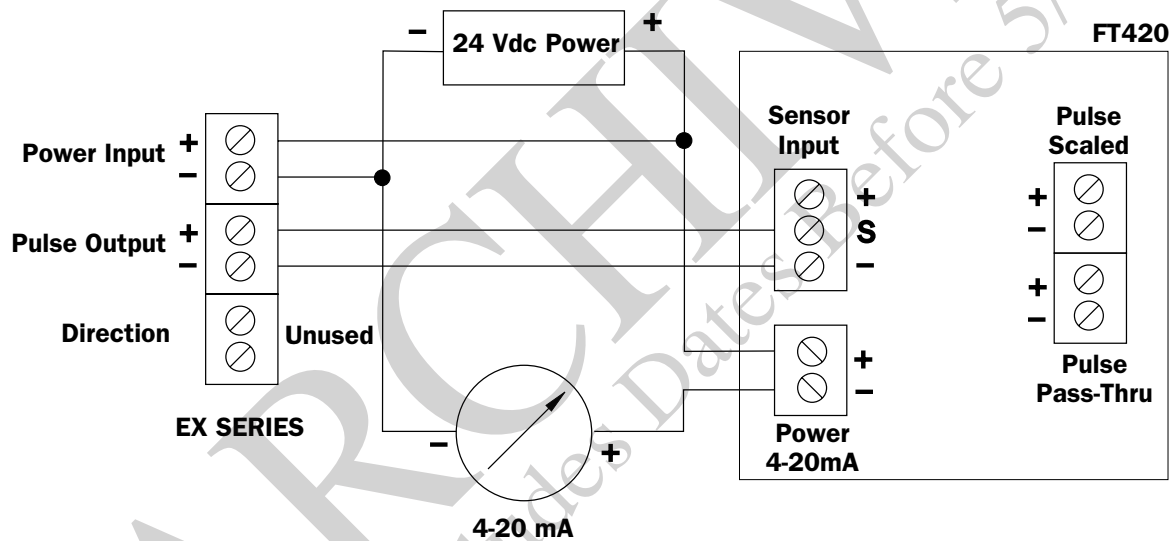


# CONNECTIONS DIAGRAMS

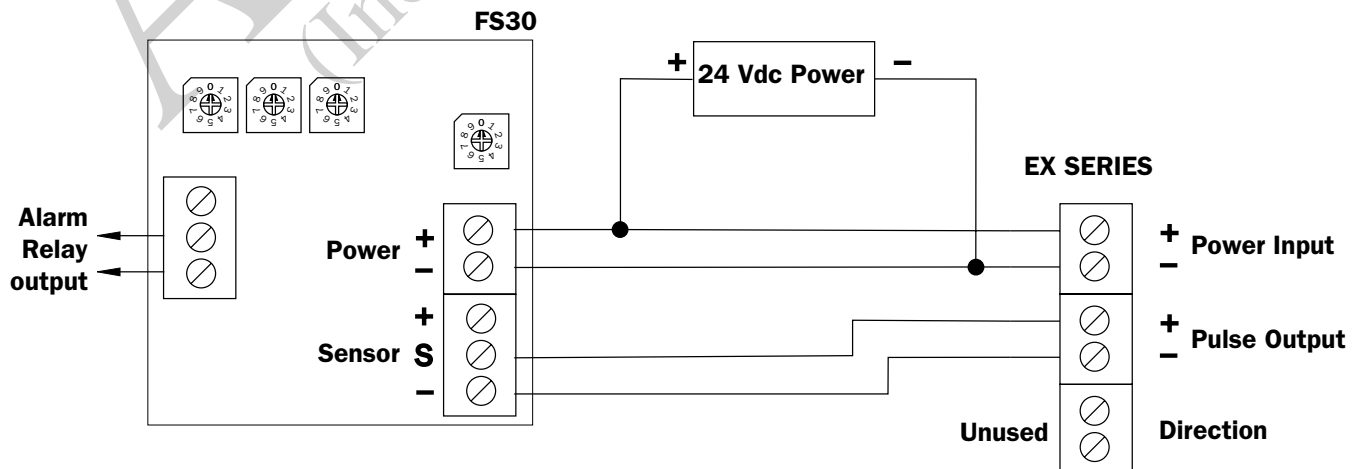
## FT420 DISPLAY AND PROPORTIONAL FEED



## FT420 DISPLAY AND 4-20 mA OUTPUT



## FS30 FLOW SWITCH



## OPERATION & MAINTENANCE

---

When the EX100 Series Meter is powered up and there is no flow, there should be no output pulses (or, if connected to the FT420, flow rate should read "0"). If there are pulses...

**Zero Adjustment.** In some cases it may be necessary to adjust the flow meter under no-flow conditions after it has been installed.

To perform the adjustment, after determining that there is no flow, short between the two pins marked "Zero Adj." 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 EX100 Series sensor cannot read. Check the table on page 11 for the minimum flow rate detectable by the sensor (0.2) for a given pipe size.

**Filtering.** The software of the EX100 Series sensor filters out electrical noise and also 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. If the unit responds very slowly, it is probably due to excessive electrical noise. If this is the case, check for adequate grounding to improve the response.

**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 dark grey bumps) on the reading face of the flow sensor. A mild soap (dishwashing liquid for example) can be used to aid the cleaning process.

**Calibration ("K-Factor").** In order to properly process pulses from the flow sensor, a number must be entered into the control to which the sensor is connected. This number, called the K-factor, is the number of pulses the sensor puts out per unit of fluid passing through the pipe. It is normally provided for SeaMetrics sensors in pulses per gallon, and is given on the chart "K-factors for Various Pipe Sizes." These numbers are based on extensive testing, which has shown close agreement between different EX sensors in the same installation. Typically, most K-factor error can be attributed to installation variables, such as depth setting and fitting configuration.

## OPERATING CHARTS

<b>FLOW IN GALLONS PER MINUTE AT VARIOUS VELOCITIES: SCHED. 40 PIPE</b>														
<b>Feet Per Second (0.2)</b>	<b>NOMINAL PIPE SIZE</b>													
	<b>2"</b>	<b>2.5"</b>	<b>3"</b>	<b>4"</b>	<b>5"</b>	<b>6"</b>	<b>8"</b>	<b>10"</b>	<b>12"</b>	<b>16"</b>	<b>24"</b>	<b>36"</b>	<b>38"</b>	<b>48"</b>
	2.6	3.8	5.8	9.9	15.6	22.5	39	66.4	88	138	314	729	884	1409
<b>(1.0)</b>	10.5	14.9	23	39.7	62.4	90	156	246	349	551	1250	2910	3530	5640
<b>(5.0)</b>	52.3	74.6	115	198	312	450	780	1230	1740	2750	6270	14570	17670	28200
<b>(10.0)</b>	105	149	230	397	624	900	1560	2460	3490	5510	12530	29140	35350	56400
<b>(20.0)</b>	209	298	461	794	1250	1800	3120	4920	6980	11020	25060	58270	70700	112800

<b>EX SERIES K-FACTORS FOR VARIOUS PIPE SIZES</b>																	
	<b>NOMINAL PIPE SIZE</b>																
	<b>2"</b>	<b>3"</b>	<b>4"</b>	<b>6"</b>	<b>8"</b>	<b>10"</b>	<b>12"</b>	<b>14"</b>	<b>16"</b>	<b>18"</b>	<b>20"</b>	<b>22"</b>	<b>24"</b>	<b>30"</b>	<b>36"</b>	<b>42"</b>	<b>48"</b>
<b>PVC/Steel Sch. 40</b>	143.4	65.01	37.80	16.66	9.62	6.10	4.30	3.56	2.72	2.152	1.731	-	1.197	-	0.515	-	-
<b>PVC/Steel Sch. 80</b>	163.0	72.86	41.86	18.46	10.54	6.70	4.74	3.92	2.99	2.357	1.904	1.571	1.318	0.722	0.497	-	-
<b>Stainless Steel (10S)</b>	131.7	57.66	33.76	16.20	8.83	5.64	3.99	3.30	2.51	1.973	1.601	1.318	1.110	0.710	-	-	-
<b>Stainless Steel (40S)</b>	143.4	65.01	37.80	16.66	9.62	6.10	4.19	3.49	2.63	2.059	1.654	1.357	1.134	0.716	0.493	0.360	0.263
<b>Copper Tubing (Type L)</b>	155.5	70.65	40.18	17.94	10.27	6.61	4.58	-	-	-	-	-	-	-	-	-	-
<b>Copper Tubing (Type K)</b>	159.7	72.51	41.19	18.59	10.66	6.86	4.79	-	-	-	-	-	-	-	-	-	-
<b>Copper Pipe</b>	144.3	65.35	38.80	16.33	9.58	6.13	-	-	-	-	-	-	-	-	-	-	-
<b>Duct. Iron (Class 52)</b>	-	-	34.41	15.54	8.71	5.65	3.95	2.91	2.22	1.756	1.422	-	0.987	0.635	0.442	-	-

## TROUBLESHOOTING

Problem	Probable Cause	Try...
No pulse output	Unit not grounded Flow reversed Output connections reversed	Connect to earth ground Note flow direction arrow, reverse direction to meter Change output connections
Output pulses incorrect	Missing or incorrect ground wire Incorrect depth setting Fluid conductivity <20 microsiemens/cm Empty pipe Not enough straight pipe	Check for proper ground Check depth setting from Dimension "C" table (page 6) Select another flow meter Install meter in the vertical position Check chart on page 5

ARCHIVED  
(Includes Dates Before 5/03)



19026 72ND AVE SOUTH, KENT, WA 98032 USA  
(P) 253.872.0284 (F) 253.872.0285  
WWW.SEAMETRICS.COM 1.800.975.8153