



**Impeller**  
Data Industrial®

## Flow Sensor

Series 4000



**Badger Meter**

SEN-UM-01714-EN-01 (April 2018)

# User Manual

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## INTRODUCTION

The Series 4000 Flow Sensor has an in line, flow-through design using a tangential six bladed impeller. The Sensor is available in 1/2 in. (12.70 mm), 3/4 in. (19.05 mm) and 1 in. (25.40 mm) pipe sizes, and a wide range of pressure and temperature specifications.

The sensors have a molded housing, rotating impeller and externally mounted electronics housing using a proprietary, nonmagnetic sensing technology. The closed, six-bladed impeller design provides higher and more constant torque than four-bladed designs, and is less prone to fouling by water borne debris. The shape of the impeller and the absence of magnetic drag provides improved operation and repeatability even at low flow rates. The housing design allows the impeller, bearings, shaft or O-rings to be cleaned or replaced without removing the sensor from the piping system.

Two signal output options are available. One option is a square wave frequency proportional to flow rate. Power for the circuit is provided by an external source through a three-wire shielded cable. An internal preamplifier allows the signal to travel a maximum of 2000 ft (609 m) without amplification, and 20 ft (6 m) of three-conductor cable is included. The second output option is a 4...20 mA current analog signal. Power is provided by the two-wire loop so the distance from the receiver is a function of power supply voltage and wire resistance. A maximum 30 in. (762 mm) connector cable is included.

Sensors of similar type are interchangeable, so there is no need for recalibration after servicing or replacement.

### Theory of Operation

The Sensor operates by converting kinetic energy (in the flow stream) into rotation (of an impeller). Almost all flow sensors work on the principle of converting flow energy to output signals. The only arguable exceptions are ultrasonic and electromagnetic sensors. The interaction of the flow stream and the impeller depend, to a currently unquantified extent, on fluid properties (density, viscosity, and pressure) and on physical properties of the impeller. The Badger Meter impeller design features the following:

- A low mass polar moment of inertia
- No magnetic drag
- Very low eddy current drag
- Low bearing friction

The impeller housing forms the periphery of a rotating fluid stream, the only source of drag tending to retard the impeller. The efficiency of this design is the key to the repeatability of sensor output at very low flow rates, and is the reason that the pressure drop across the installed sensor is so low.

## MECHANICAL INSTALLATION

### Vibration

There is a direct relationship between sensor housing vibration levels and impeller wear. Sensors mounted in a low vibration region (close to pipe supports) consistently give longer bearing life than those mounted in a high vibration region. The difference in bearing life persists, independent of impeller and shaft materials, or methods of construction. The wear is most obvious at high flow rates, when high levels of pipe vibration are most pronounced.

When mounting a Sensor, minimize housing vibration using either of the following methods:

- Mount the sensor as close as possible to a stable, low vibration, anchored inlet or outlet pipe. Provide 10 diameters upstream and 5 diameters downstream of straight pipe.
- Provide pipe supports, on both sides of the sensor, that are firmly anchored to a stable platform. This is particularly important if the sensor is mounted in the approximate center of a pipe section two feet long between supports.

You must minimize sensor vibration, or sensor accuracy will be affected and impeller life reduced.

## Accuracy

The accuracy of flow measurement depends on proper location of the sensor in the piping system. Irregular flow velocity profiles caused by valves, fittings and pipe bends can produce inaccurate overall flow rate indications even though local velocity measurement might be accurate. A sensor located in the pipe where it can be affected by air bubbles, floating debris, or sediment might not achieve full accuracy, and could be damaged. Follow these directions for maximum system accuracy:

- Install the sensor in a pipe with 10 pipe diameters of straight pipe upstream and 5 pipe diameters of straight pipe downstream of the sensor for no flow disturbance. Allow no pipe bends, valves, other fittings, pipe enlargements and reductions in this length of pipe.
- For horizontal flow applications, install the sensor with the curved portion of the housing down. Sensors installed with the curved portion in the up position trap air, causing inaccurate flow measurement, especially at low flows. Sensors installed with the curved portion pointing sideways not only trap air, but increase impeller friction, which might also affect measurements at low flow rates. Install the sensor to facilitate servicing.
- The preferred vertical location is with liquids flowing up. If vertical flow downward is the only option, the pipe must be completely filled with fluid. Any circumferential orientation is correct, but the sensor location should facilitate servicing. A vertical location might result in reduction of accuracy.
- Mount sensors with a minimum of 3 in. (75 mm) clearance in all directions around the gray electronics assembly to prevent electro-mechanical interference. This space requirement applies to multiple sensor sensors installed in close proximity as well as to other EMI generators, such as electric motors or controls for motors, heaters or lighting.

## Installation for PVC Sensors

Any compatible size and type of fitting or adapter can be connected to the pipe nipples by thermal or solvent welding. Make sure the fittings and method you choose to install the PVC unit comply with American Society for Testing and Materials (ASTM) standards. Install the sensor so the arrow in the stainless steel cover is pointing the same direction as the flow of the fluid. Do not connect directly to reducing or enlarging fittings. Install an additional 10 diameter upstream and five diameter downstream allowance if this is unavoidable.

## Installation of PVDF Sensors

PVDF sensors are supplied with combination end connections. A Heat Weld Female Slip connection can accept most metric sized PVDF pipes. The external thread is used with George Fisher type Unions. Badger Meter® offers PVDF, 316SS FNPT, and CPVC Slip Socket Union Ends.

In PVDF sensors with the enhanced flow feature, the flow enhancement jet must be inserted before installing the sensor into the system. With the stainless steel cover facing you, insert the jet into the left socket (upstream end) and then perform the method chosen for installation. Install the sensor with the arrow on the stainless steel cover pointing in the same direction as the flow of the liquid. Follow the same ten and five diameter upstream and downstream allowance and orientation recommendations, as described in "*Installation for PVC Sensors*".

## ELECTRICAL INSTALLATION

Sensor part	Cable supplied
Digital Transmitter	20 ft (6 m) of 20 AWG three-conductor cable with drain wire and shield
Analog Unit	30 in. (762 mm) of AWG two-conductor cable with drain wire and shield

Make electrical wiring connections according to accepted trade practices.

You can attach an electrical junction box directly to the sensor electronic module, or mount it in the vicinity of the sensor. Locate it conveniently to facilitate replacement of the electronic module assembly. Do not subject the wiring connections to water or conductive liquids, as these might impair operations or damage the sensor circuitry.

When connecting to the electronic device, observe the wire colors and polarity to allow proper performance and to prevent damage to the sensor or electronic device.

### Electrical Wiring for a Digital Unit

Below are the general wiring instructions for the digital output unit. If you are connecting to a Badger Meter flow monitor, consult the user manual.

1. Connect the red sensor wire to the positive (+) wire or terminal.
2. Connect the black sensor wire to the negative (-) wire or terminal.
3. Connect the white sensor wire to the signal (S) wire or terminal.
4. Connect the bare sensor wire to sensor shield.

### Electrical Wiring for an Analog Unit

Turn off the 4...20 mA power and finish all wiring before turning on the loop power.

1. Wire the red wire (+ analog loop) of the flow sensor to the positive (+) output of a DC power supply.
2. Wire the black wire (- analog loop) of the flow sensor to the positive (+) input of your analog device.
3. Wire the negative (-) input of your analog device to the negative (-) of the DC power supply.

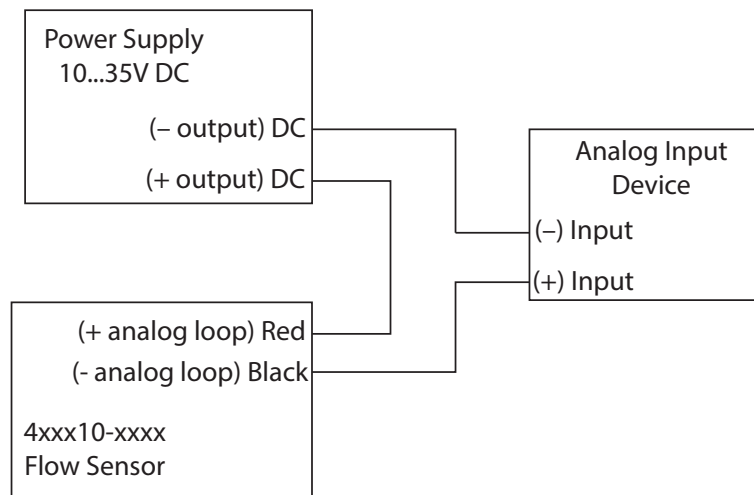


Figure 1: Wiring for analog 4000

**NOTE:** Some legacy units may have additional orange and brown wires. Do not connect these wires. Connecting to these wires will damage the unit and void the warranty. They are for factory calibration only.

### Calibration

If you are replacing an existing sensor and have already calibrated your flow monitor, no calibration changes are necessary. For installation of a new flow monitor, please refer to the calibration instructions in the flow monitor manual.

## MAINTENANCE

### Impeller Assembly and Shaft Replacement

The following tools are required for the replacement of the impeller and shaft:

- 5/32 in. Allen wrench
- Flat blade screwdriver
- Torque driver in in-lb with 5/32 in. male hex adapter

**NOTE:** Units are factory calibrated at 12 in-lb.

1. Depressurize the pipe on which the sensor is being serviced.

#### **⚠ WARNING**

**DO NOT REMOVE SOCKET HEAD CAP SCREWS WHILE SYSTEM IS UNDER PRESSURE.**

2. Using the Allen wrench, loosen and remove the four #10 socket head cap screws along with the stainless steel cover. It is not necessary to remove the electronics to service the impeller and shaft.
3. Use the flat-blade screwdriver to pry the impeller cover/shaft assembly from the sensor housing by using the provided slots alternately.
4. Inspect the impeller and impeller cover/shaft assembly for signs of wear.
5. Replace the O-rings before reassembly. Do not use lubricants on the O-rings.
6. Insert the impeller into the cavity of the sensor housing, making sure the six blades are pointing into the flow direction. The unit does not operate if the impeller is positioned incorrectly. For example, if flow direction is to the right, position the impeller with blades pointing to the left. See *Figure 2*.
7. Orient the keyway of the impeller cover/shaft assembly to the small slot between the two large slots and align the shaft to the shaft hold of the impeller.
8. Hand press the impeller cover/shaft assembly into the sensor housing cavity.
9. Fasten the stainless steel cover to the sensor housing using the #10 socket head cap screws.
10. Torque the #10 hardware to 12 in-lb.
11. Pressurize the system.

#### **⚠ WARNING**

**ALL FOUR SCREWS MUST BE IN PLACE AND TORQUED CORRECTLY BEFORE PRESSURIZING SYSTEM!**

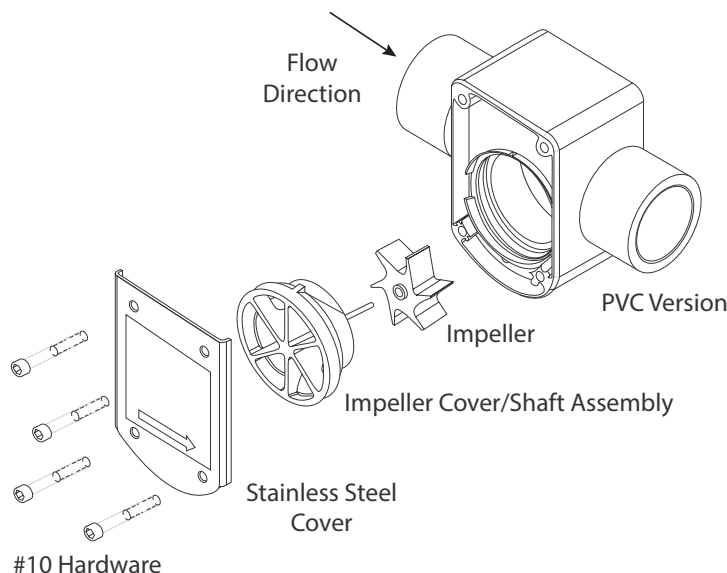


Figure 2: Assembly and shaft replacement

## Electronic Assembly Replacement

A #1 Phillips screwdriver is required for servicing electronics. It is not necessary to depressurize or drain the system to service the electronics.

1. Disconnect the sensor wiring from the display or transmitter.
2. Using a Phillips screwdriver, remove the two #4 Phillips head screws and accompanying hardware.

### **CAUTION**

**LETTING THE ELECTRONIC ASSEMBLY DROP FROM THE SENSOR COULD DAMAGE THE DETECTING COIL.**

3. Unplug the coil from the electronics

**NOTE:** On analog units, the coil is permanently attached to electronics.

4. Plug the coil into the replacement electronics.
5. Reattach the electronics to the sensor with the two #4 Phillips screws. See "Replacement Part Numbers" on page 20 for replacement part numbers.

### **IMPORTANT**

Make sure the wires from the coil are tucked in before tightening the screws.

## Detecting Coil Replacement

A #1 Phillips screwdriver is required for replacing the detecting coil. Depressurizing or draining the system is not necessary for detecting coil replacement.

1. Remove the electronic assembly like in step 1 in "Electronic Assembly Replacement".
2. Unplug the coil from the electronics.
3. Using a Phillips screwdriver, remove the two #6 Phillips head screws, and the coil retaining plate.
4. Secure new coil to sensor housing with the #6 hardware.
5. Plug the replacement coil into the electronic assembly.
6. Fasten the electronics to the sensor with the #4 hardware. The coil wire orientation is not critical to operation. See "Replacement Part Numbers" on page 20 for replacement part numbers.

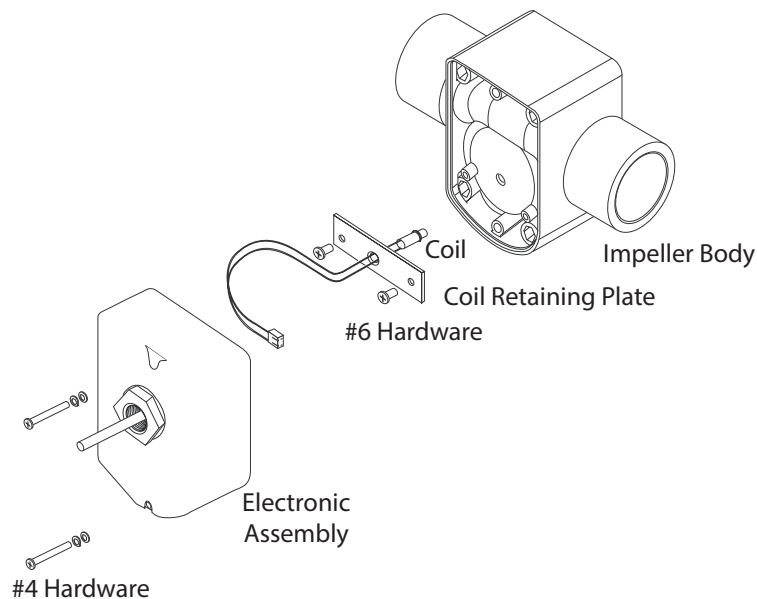


Figure 3: Coil and electronic assembly replacement



## SPECIFICATIONS

### Wetted Materials

- Sensor Housing and Enhancing Jet (If Applicable)
- **PVC** - Virgin polyvinyl chloride, type 1, grade 1
- **PVDF** - Virgin polyvinylidene fluoride

### Digital Meter Specifications

Sensor Model #	Housing Material	Nominal Pipe Size (in.)	Pipe OD in. (mm)	Pipe ID in. (mm)	Slope K	Offset	Min Flow Rate (GPM)	Max Flow Rate (GPM)	Min Pulse Rate (Hz)	Max Pulse Rate (Hz)
400200	PVC	1/2 #80	0.08 (2.13)	0.55 (13.97)	0.413	0.3496	0.75	15.00	1.46	35.97
401200	PVC	3/4 #80	1.05 (26.67)	0.82 (20.83)	0.5735	0.2638	1.75	35.00	2.78	60.76
402000	PVC	1 #80	1.32 (33.40)	0.96 (24.38)	0.6134	0.1826	2.25	45.00	3.48	73.17
410200	PVC	1/2 #80 Enhanced Low Flow	0.08 (2.13)	0.55 (13.97)	0.1421	0.8474	0.18	6.00	0.48	41.37
411200	PVC	3/4 #80 Enhanced Low Flow	1.05 (26.67)	0.82 (20.83)	0.3287	0.2159	0.40	13.00	1.00	39.33
400300 400400 400500	PVDF	1/2	0.79 (20.00)	0.64 (16.26)	0.5987	0.0008	1.00	20.00	1.66	33.40
401300 401400 401500	PVDF	3/4	0.98 (24.99)	0.84 (21.34)	0.613	0.02664	1.75	35.00	2.82	57.06
402300 402400 402500	PVDF	1	1.26 (32.00)	1.07 (27.18)	0.6266	0.0314	3.00	50.00	4.75	79.76
410300 410400 410500	PVDF	1/2 Enhanced Low Flow	0.79 (20.00)	0.64 (16.26)	0.1445	0.4841	0.25	8.00	1.24	54.87
411300 411400 411500	PVDF	3/4 Enhanced Low Flow	0.984 (25)	0.84 (21.34)	0.3195	0.4679	0.40	14.00	0.78	44.28

The calibration constants in columns Slope K and Offset relate frequency (Hz) to flow rate (GPM) in the equations:

$$\text{FREQ} = \frac{\text{GPM}}{K} - \text{Offset}$$

$$\text{GPM} = K (\text{FREQ} + \text{Offset})$$

## Analog Meter Specifications

Analog versions of the sensor are precalibrated at the factory using the flow ranges below.

Sensor Model #	Housing Material	Nominal Pipe Size (in.)	Pipe OD in. (mm)	Pipe ID in. (mm)	Min Flow Rate 4 mA	Max Flow Rate 20 mA
400210	PVC	1/2 #80	0.08 (2.13)	0.55 (13.97)	0	20
401210	PVC	3/4 #80	1.05 (26.67)	0.82 (20.83)	0	30
402010	PVC	1 #80	1.32 (33.40)	0.82 (20.83)	0	30
410210	PVC	1/2 #80	0.08 (2.13)	0.55 (13.97)	0	8
411210	PVC	3/4 #80	1.05 (26.67)	0.82 (20.83)	0	12
400310 400410 400510	PVDF	1/2 in.	0.79 (20.00)	0.64 (16.26)	0	20
401310 401410 401510	PVDF	3/4 in.	0.98 (24.99)	0.84 (21.34)	0	30
402310 402410 402510	PVDF	1 in.	1.26 (32.00)	1.07 (27.18)	0	40
410310 410410 410510	PVDF	1/2 in.	0.79 (20.00)	0.64 (16.26)	0	8
411310 411410 411510	PVDF	3/4 in.	0.98 (24.99)	0.84 (21.34)	0	12

## Technical Specifications

<b>O-Rings</b>	Viton®	Neoprene®
	EPDM	Chemraz®
	Kalrez®	Teflon® Encapsulated Viton
	Silicon, food grade	—
<b>Impeller Shafts</b>	Zirconia Ceramic	Monel,® Grade K500
	Hastelloy,® C-276	316 stainless steel
	Tungsten Carbide, GE carboloy 883 colbalt binder	Tantalum, commercial grade
	Titanium alloy 86Ti-6AL-6V-25A	—
<b>Process Connections</b>	PVC (virgin polyvinyl chloride, type 1, grade 1) schedule 80 tail pieces	PVDF union nuts with 316 stainless steel FNPT union ends
	PVDF (virgin polyvinylidene fluoride) sockets	PVDF flanges
	PVDF union thread (for joining existing piping systems with GF unions)	PVDF union nuts with CPVC socket union ends
	PVDF union nuts with socket union ends	—
<b>Impeller and Bearing</b>	Tefzel®	
<b>Nominal Pipe Size</b>	1/2 in. (12.70 mm), 3/4 in. (19.05 mm), 1 in. (25.40 mm)	
<b>End Connections</b>	PVC PVDF	Plain end pipe Socket weld/union
<b>Max Temp Rating</b>	PVC PVDF	140° F (60° C) 220° F (104° C)
<b>Max Pressure Rating</b>	PVC PVDF	350 psi @ 73° F (23° C) 275 psi @ 65° F (18° C)
<b>Pressure, Temperature Ratings</b>	Depends on hardware configurations. See <i>Figure 4 on page 12</i> .	
<b>Cable</b>	Digital output	3-wire
	Analog output	2-wire
<b>Digital Output Unit</b>	Pulse	Square wave (approximately) output at 1 pulse/revolution
	Voltage	0.4V maximum (output low) 45V minimum (output high) into high impedance load
	Sink current	2 mA maximum
	Output signal is 5V CMOS and LSTTL compatible. The output can be forced to any logic level up to 20V by an external pullup resistor	
<b>Analog Output Unit</b>	Signal	Loop powered 4...20 mA current analog output with offset compensation for ripple less then 0.25% of full scale
	Sink current	2 mA maximum
	Output signal is 5V CMOS and LSTTL compatible. The output can be forced to any logic level up to 20V by an external pull-up resistor.	
<b>Operating Flow Range</b>	0...20 ft/sec for standard range units 0...10 ft/sec for enhanced flow range units	
<b>Recommended Design Flow Range</b>	1...20 ft/sec for standard range units to maintain calibration accuracy 0.25...8 ft/sec for enhanced flow range units to maintain calibration accuracy	
<b>Accuracy</b>	Better than ±1.0% of full scale over recommended design flow range with water at 50...80° F (10...26.67° C) and 20...40 psig	
<b>Repeatability</b>	±0.5% of full scale over recommended design flow range	
<b>Linearity</b>	±0.7% of full scale over recommended design flow range ±1.0% frequency to current conversion	

<b>Transducer Power</b>	Digital Output Unit	Normally provided by flow monitor or transmitter. Any alternate supply must be of a resistance-limited type meeting the following constraints: Supply voltage: 9...20V DC Supply current: 2 mA maximum
	Analog Output Unit	10...35V DC maximum. The combination of loop supply voltage and total loop series resistance must make sure that the device voltage remains within these limits over the 4...20 mA output span
<b>Accessories</b>	Model A301-20 programming kit with 20 ft cable USB to COM adapter	

**Pressure, Temperature Diagram**

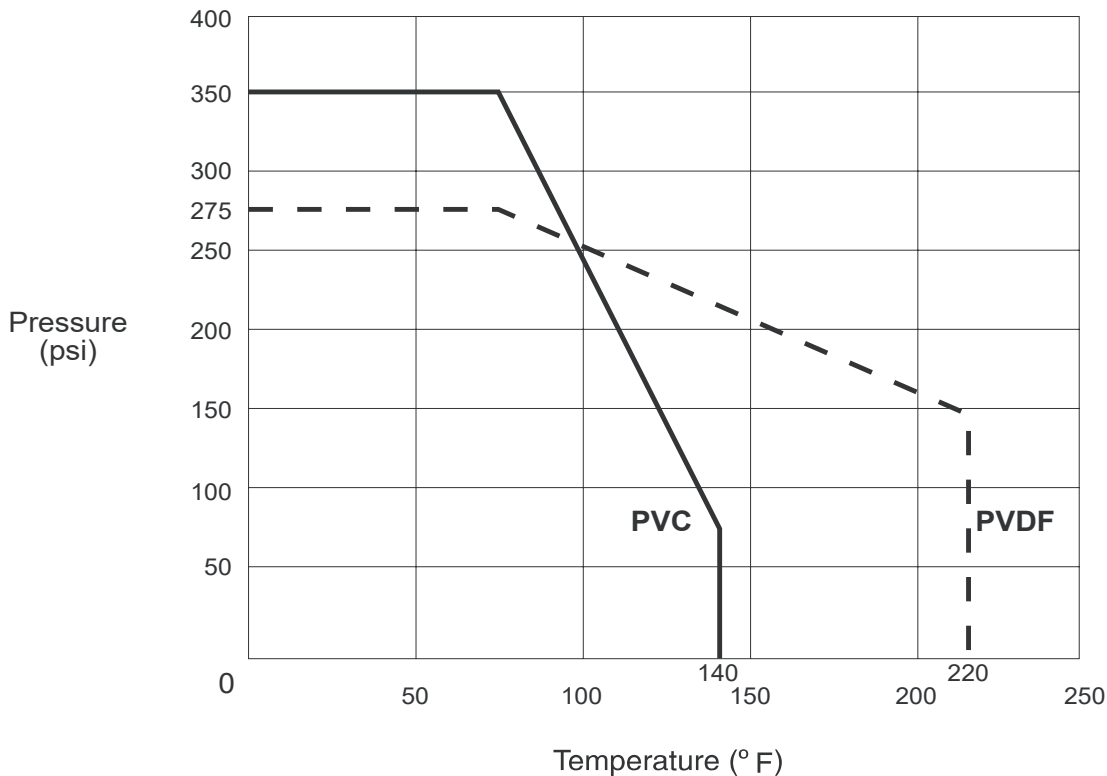
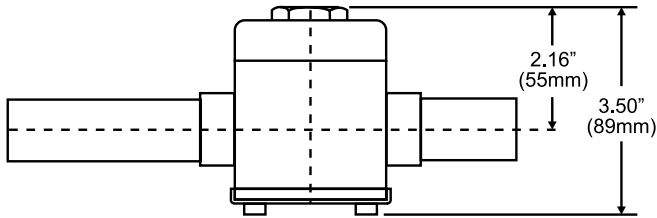


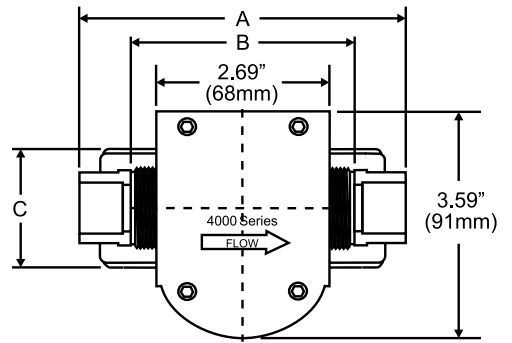
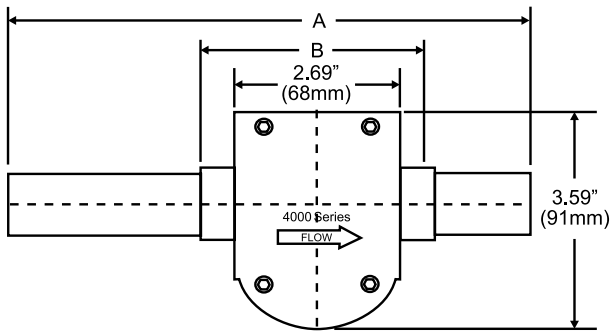
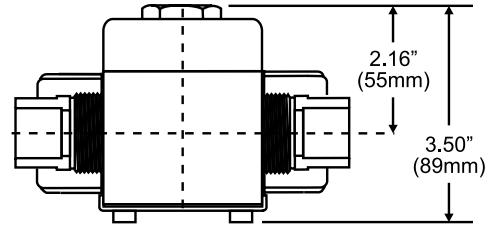
Figure 4: Sensor pressure temperature diagram

# DIMENSIONS

PVC



PVDF



PVC			PVDF			
Model	A	B	Model	A	B	C
1/2 in.	8.77 in. ± 0.25 in. (222 mm ± 6.35 mm)	4.33 in. (104 mm)	1/2 in.	5.03 in. (128 mm)	3.54 in. (90 mm)	1.85 in. (47 mm)
3/4 in.	10.57 in. ± 0.25 in. (268 mm ± 6.35 mm)	4.69 in. (119 mm)	3/4 in.	5.55 in. (141 mm)	3.92 in. (100 mm)	2.24 in. (57 mm)
1 in.	13.03 in. ± 0.25 in. (331 mm ± 6.35 mm)	5.40 in. (137 mm)	1 in.	6.10 in. (155 mm)	4.32 in. (110 mm)	2.52 in. (64 mm)

# TROUBLESHOOTING

## General

When troubleshooting a sensor, first establish that the problem lies with the sensor and not with the electronic device connected to it. A simple way to determine this is to substitute a known working sensor for the suspect unit. If the electronics react as they should, the problem is sensor related. Another option is to provide a similar, square wave pulse simulation by hooking up a frequency generator to the interface electronics and simulating, as close as possible, the actual sensor signal.

If you suspect a sensor problem, address these mechanical considerations:

- Make sure there is flow in the pipe line appropriate to the operations range (0.25...20 feet/second) of the sensor.
- Make sure that the wiring between the sensor and the electronics is correct. If a junction box has been added, make sure that all wiring connections are correct.
- Check the impeller assembly to make sure it is not mounted in the reverse direction of flow.
- Make sure that the impeller can spin freely on the shaft and that no foreign matter or debris has lodged in the sensor housing.

## Check Using a Digital Circuit

A sensor is a powered device, required voltage at 8... 20V DC, applied between the red (+) and black (-) sensor leads. The sensor normally draws about 1mA for this supply.

### **⚠ WARNING**

**DO NOT EXCEED 20V DC; SENSOR DAMAGE MIGHT RESULT.**

### Checking the Sensor

1. Make sure that the black, red and shield wires remain connected to the proper terminals. Disconnect the white sensor wire.
2. Install a voltmeter, positive (+) to the white sensor wire and negative (-) to the black sensor wire. If flow exists, a square wave signal switches between 0.0V DC (low) and 4.0V DC (high).

**NOTE:** The pulse might be too fast for the voltmeter to recognize as a square wave, but it might appear as an unstable reading somewhere between 2.0...4.9V DC. If flow is stopped, the output holds in either a high (4.0V DC) state or low (0.0V DC) state, depending on the position of the impeller reflector or other factors. To simulate impeller rotation, pass a metal object (like a large screwdriver or pliers) past the back of the sensor. The output signal should then switch states.

3. If the sensor produces pulses in the above tests, reconnect the white sensor wire to the signal input terminal of the transmitter.
4. With the voltmeter still connected, note the actual voltage levels between the output switching (such as 0.0V DC low or 4.0V DC high). If reconnecting the sensor to the transmitter either stops or significantly alters the voltage levels of the pulses, or if the transmitter does not respond to the pulses, consult the factory or your local representative.
5. If the sensor switches states when a metal object is passed near the back of the sensor, but no pulse occurs when flow exists, verify that the flow meets our minimum flow requirements for the sensor. Check the condition of the impeller and the shaft for mechanical wear or damage. If replacement is necessary, order a repair kit.

### Checking the Electronic Module

A nonworking sensor could be the result of a sensing coil failure or a component failure in the electronic module (gray cover).

1. Use an Ohmmeter to determine the coil resistance
  - a. Remove the gray electronics cover containing the encapsulated circuitry.
  - b. Unplug the coil from the electronics in the cover.
  - c. Connect the probes of the Ohmmeter to the wire terminals of the coil plug-in connector. The coil resistance should measure 5...10 Ohms. A very low or very high resistance reading might indicate a failed coil. In this case, replace the coil.

2. If the coil appears to be within specification, check the electronic assembly.
  - a. Replace the gray cover assembly with one from another working device.
  - b. If the sensor begins working, the electronic assembly is not functioning. Replace it.

### **Checking the Impeller**

If the sensor was working and a rebuild kit was installed due to a failure of the impeller or shaft and the sensor did not return to working order, check to verify that the impeller was installed in the proper direction. If the impeller was installed backwards to the flow direction, no signal pulse is generated, even if the impeller spins freely.

If you experience any other difficulties with the sensor, please consult the factory or your local representative. Please have a description of the problem, model, serial number and application information available when you call.

### **Check Using an Analog Circuit**

1. Connect power supply and ammeter in a series loop.
2. With no flow in the pipe, check to see if the output is reading 4 mA. If the output is greater or less than 4 mA, the analog electronics assembly must be recalibrated at the factory.
3. With flow in the pipe, the output should be something higher than 4 mA but not greater than 20 mA. If you cannot get flow through the system, you can simulate flow in two ways. Either method excites the analog output to change and read greater than 4 mA.
  - ◇ Blow into one side of the unit to make the impeller spin
  - ◇ Pass a metal object (nut driver or wrench) across the back of the electronics housing
4. If the analog output does not change, replace the electronics assembly.
5. If the analog changes when you pass a metal object across the rear of the electronics assembly but does not at any other time, inspect the impeller assembly, according to the directions in "*Checking the Impeller*" on page 15.

# PROGRAMMING

## Connecting Via DIC COM Port

To program the transmitter, follow these steps:

1. Load the interface software into the computer.
2. Power the flow meter.
3. Connect the computer to the flow meter with the Data Industrial Series A-301 communications cable to the socket labeled "D.I.C. COM port", taking care to properly align the tab on the plug and socket to maintain polarity. Connect the DB9 connector of the Data Industrial Series A301 communications cable to a PC COM port that has the 340 software installed. If a DB9 COM port is not available, a USB to COM Port Adapter may be purchased locally or from Badger Meter.
4. Open the program and from the *Device* tab and select **4000** as shown in *Figure 5*.

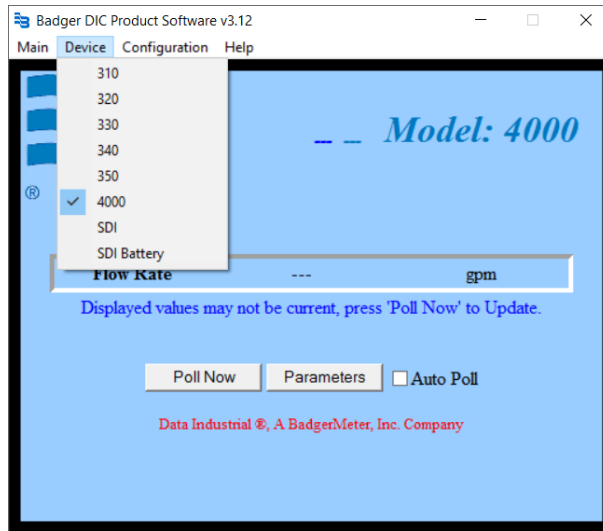


Figure 5: Select 340

5. Under the *Configuration* tab, select **Set Comm Port**.

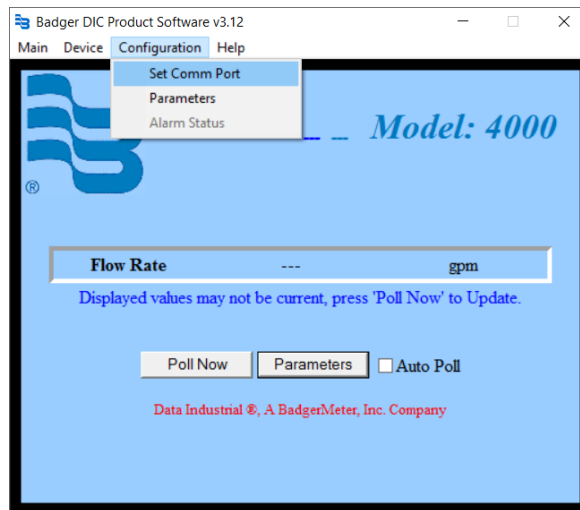


Figure 6: Select Set Comm Port



6. Select the Comm Port from the drop-down menu.

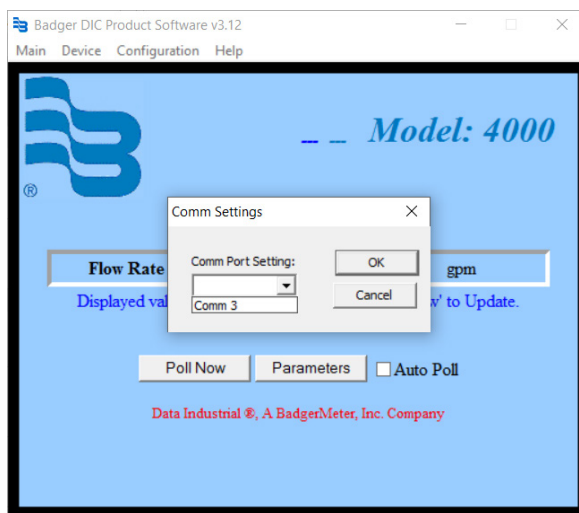


Figure 7: Select the Comm Port

If the COM and Device type have been properly selected, the dashes (“---”) are replaced with values.

**NOTE:** If this does not happen, communication has not been established and you cannot continue to the next step. If it does not connect automatically, click on **Poll Now**.

- a. If communication still does not occur and you are using a DB9-to-COM 1 or COM2, try using a USB-to-COM adapter. This usually creates a new COM port that was not previously listed. Use the Windows Device Manager to determine the actual COM ports that are available.

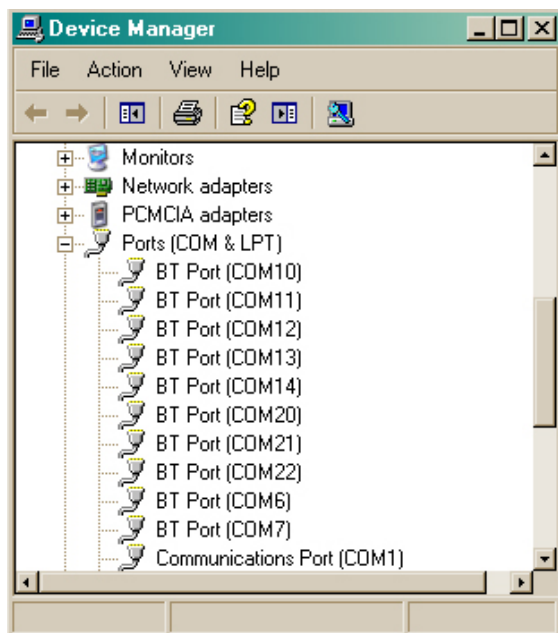


Figure 8: Device manager

- b. Select this new port created by the adapter and the screen should change to display the information. The dashes (“---”) are replaced with values, confirming normal communications.

7. When communication has been confirmed, click **Parameters**. The *Parameters* screen displays.

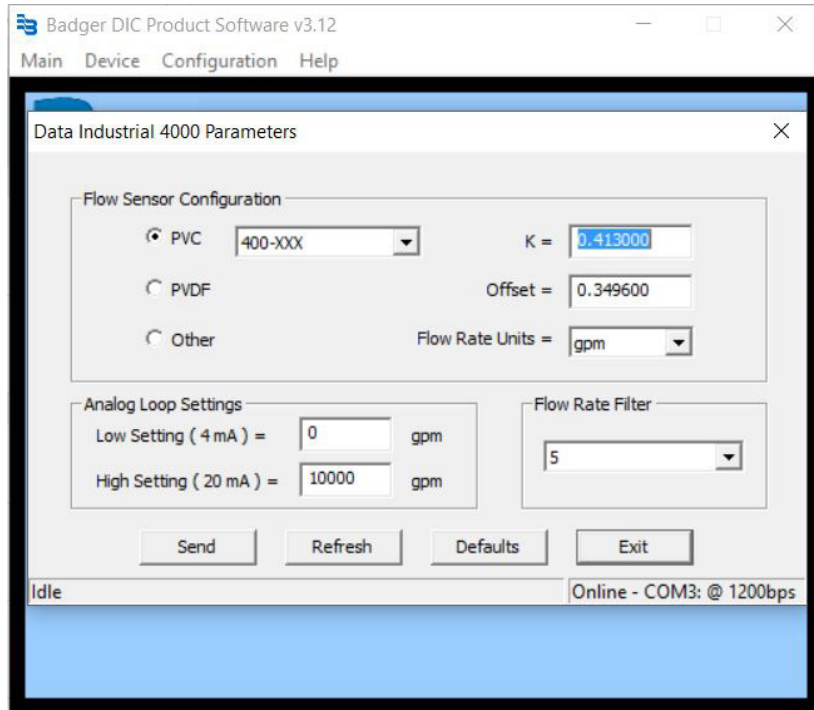


Figure 9: Parameters screen

8. From this screen, set up the following:

- ◇ Flow sensor piping material, scaling and units
- ◇ Analog loop low to high settings
- ◇ Flow rate filter number

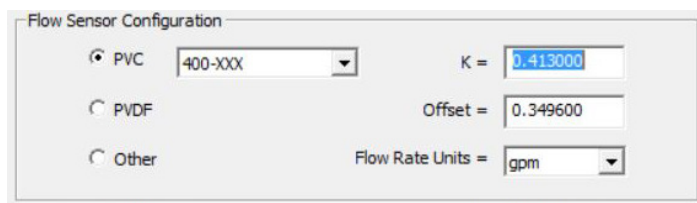
9. Press **Send** before leaving this page to save any changes.

**Refresh** rereads the unit and refreshes the screen. **Defaults** restores all factory settings. **Exit** returns to the main screen.



Figure 10: Parameter screen buttons

## Flow Sensor Configuration Section

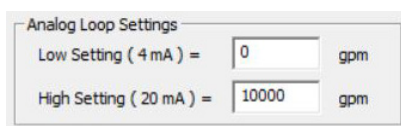


The image shows a 'Flow Sensor Configuration' dialog box. It contains three radio buttons for material selection: 'PVC' (selected), 'PVDF', and 'Other'. Next to the 'PVC' radio button is a dropdown menu showing '400-XXX'. To the right, there are three input fields: 'K =' with the value '0.413000', 'Offset =' with the value '0.349600', and 'Flow Rate Units =' with a dropdown menu showing 'gpm'.

Figure 11: Pulse or sine

1. Select the material that the flow sensor is installed in.
2. Find the k and offset values in the chart for either "Digital Meter Specifications" on page 9 or "Analog Meter Specifications" on page 10.
3. Select the flow rate units of measure from the drop-down box.

## Analog Loop Settings



The image shows an 'Analog Loop Settings' dialog box. It has two rows of settings. The first row is 'Low Setting ( 4 mA ) =' with an input field containing '0' and a dropdown menu showing 'gpm'. The second row is 'High Setting ( 20 mA ) =' with an input field containing '10000' and a dropdown menu showing 'gpm'.

Figure 12: Analog loop settings box

Enter flow rates for the low and high outputs.

## Flow Rate Filter



The image shows a 'Flow Rate Filter' dialog box. It contains a single dropdown menu with the value '5' selected.

Figure 13: Flow rate filter box

Choose the flow rate filter from the drop-down box.

## REPLACEMENT PART NUMBERS

<b>Name</b>	<b>Included Parts</b>	<b>Part No.</b>
Impeller	Impeller	08010
Coil Kit (For Digital Output Unit Only)	(1) coil	711333
	(1) retaining plate	
	(2) #6 screws	
O-ring Kit (PVDF Units Only for Use With Unions)	O-Ring Kit, EPDM O-Rings, 1/2 in. for 20 mm Union	4003OKE
	O-Ring Kit, EPDM O-Rings, 3/4 in. for 25 mm Union	4013OKE
	O-Ring Kit, EPDM O-Rings, 1 in. for 32 mm Union	4023OKE
	O-Ring Kit, Viton O-Rings, 1/2 in. for 20 mm Union	4003OKV
	O-Ring Kit, Viton O-Rings, 3/4 in. for 25 mm Union	4013OKV
	O-Ring Kit, Viton O-Rings, 1 in. for 32 mm Union	4023OKV
Union Kit 1/2 in. (20 mm) PVDF	(2) PVDF Union Ends, 20 mm	711380
	(2) PVDF Union Nuts, 20 mm	
	(2) Viton O-Rings	
Union Kit 3/4 in. (25 mm) PVDF	(2) PVDF Union Ends, 25 mm	711381
	(2) PVDF Union Nuts, 25 mm	
	(2) Viton O-Rings	
Union Kit 1 in. (32 mm) PVDF	(2) PVDF Union Ends, 32 mm	711382
	(2) PVDF Union Nuts, 32 mm	
	(2) Viton O-Rings	

**Part Number Matrix**

	Example	4	0	0	7	10	-	0	0	2	2
<b>Series</b>											
4000		4									
<b>Style</b>											
Standard Flow			0								
Enhanced Flow (available with 1/2 in. and 3/4 in. only)			1								
<b>Size</b>											
1/2 in.				0							
3/4 in.				1							
1 in.				2							
<b>Material</b>											
PVC furnished with schedule 80 tail pieces					2						
PVDF socket					3						
PVDF union threaded					4						
PVDF with unions and socket ends					5						
PVDF with 316 stainless steel FNPT union end					7						
PVDF with CPVC socket union end					9						
<b>Electronics</b>											
Pulse output						00					
Pulse output with EFI foil shield						01					
Pulse output with CE housing						05					
4...20 mA analog output						10					
4...20 mA analog output with EFI foil shield						11					
4...20 mA with CE housing						15					
<b>O-Ring (set of 3 rings)</b>											
Viton®								0			
EPDM								1			
<b>Shaft</b>											
Zirconia Ceramic									0		
Hastelloy® C									1		
Tungsten Carbide									2		
316 Stainless Steel									6		
Tantalum									7		
<b>Impeller</b>											
Tefzel®										2	
<b>Bearing</b>											
UHMWPE											1
Tefzel											2
Teflon®											3

Figure 14: Part number matrix

## Electronics Repair Kit Part Number Matrix

Example: 4000EK  -   10	
<b>Electronics</b>	
Pulse Output	00
Pulse output with EFI foil shield	01
CE Pulse output	05
4-20 mA analog output	10
4-20 mA analog output with foil shield	11
CE 4-20 mA analog output	15

Figure 15: Electronics repair kit matrix

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## Control. Manage. Optimize.

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**[www.badgermeter.com](http://www.badgermeter.com)**

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The Americas | Badger Meter | 4545 West Brown Deer Rd | PO Box 245036 | Milwaukee, WI 53224-9536 | 800-876-3837 | 414-355-0400  
México | Badger Meter de las Americas, S.A. de C.V. | Pedro Luis Ogazón N°32 | Esq. Angelina N°24 | Colonia Guadalupe Inn | CP 01050 | México, DF | México | +52-55-5662-0882  
Europe, Eastern Europe Branch Office (for Poland, Latvia, Lithuania, Estonia, Ukraine, Belarus) | Badger Meter Europe | ul. Korfantego 6 | 44-193 Knurów | Poland | +48-32-236-8787  
Europe, Middle East and Africa | Badger Meter Europa GmbH | Nurtinger Str 76 | 72639 Neuffen | Germany | +49-7025-9208-0  
Europe, Middle East Branch Office | Badger Meter Europe | PO Box 341442 | Dubai Silicon Oasis, Head Quarter Building, Wing C, Office #C209 | Dubai / UAE | +971-4-371 2503  
Slovakia | Badger Meter Slovakia s.r.o. | Racianska 109/B | 831 02 Bratislava, Slovakia | +421-2-44 63 83 01  
Asia Pacific | Badger Meter | 80 Marine Parade Rd | 21-06 Parkway Parade | Singapore 449269 | +65-63464836  
China | Badger Meter | 7-1202 | 99 Hangzhong Road | Minhang District | Shanghai | China 201101 | +86-21-5763 5412  
Switzerland | Badger Meter Swiss AG | Mittelholzerstrasse 8 | 3006 Bern | Switzerland | +41-31-932 01 11