Series PDWS

PADDLE WHEEL FLOW SENSOR INSTRUCTIONS

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TABLES AND DIAGRAMS

GENERAL INFORMATION

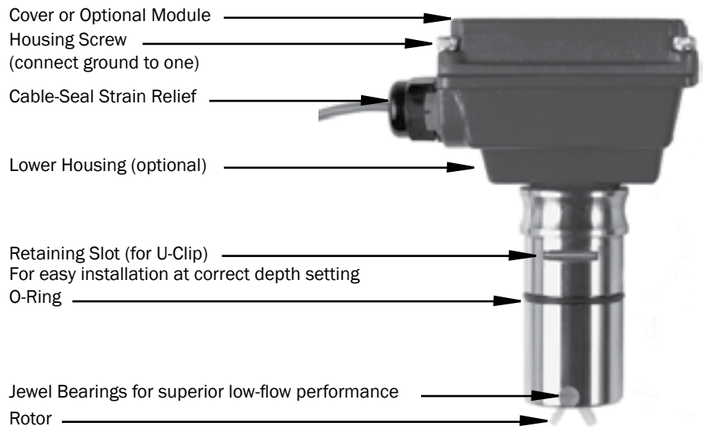
The PDWS Series are impeller (or “paddlewheel”) insertion meters designed for use with a wide variety of liquids in pipe sizes 1/2" to 8". Sensors are available in brass, 316 stainless steel, PVC, and polypropylene. Bodies are machined from a solid rod for maximum precision. High-quality jewel bearings and nickel-bound tungsten carbide shafts are used for extreme low friction and long life. Low-flow performance is good, although other Dwyer Instruments Inc. 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 (square wave), 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 Dwyer Instruments Inc. controls and displays.

PDWS meters are ideal for chemical proportioning applications. If no display is required, a simple divider such as the PWD provides adjustable pump pacing. For rate and total display, the Series RTI (loop powered) flow indicator can be mounted directly on the Series PDWS meter, or remotely on a wall or panel. The Series BAT blind analog transmitter can be used to convert to a 4 to 20 mA output.

The Series PDWS 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. Please see Series PWF for appropriate fittings.

FEATURES



Caution: Clip(s) must be installed before use.

High Pressure Model

SPECIFICATIONS*

Materials	Sensor Body	Brass, 316 Stainless Steel, PVC, or Polypropylene		
	Rotor	PVDF		
	Shaft	Nickel-bonded tungsten carbide (Ceramic optional)		
	Bearings	Ruby jewel		
	O-Ring	EPDM (Fluoroelastomer optional)		
Rotor Pickup		GMR (Giant Magnetoresistive) Sensor		
Maximum		Brass	316 SS	PVC or Polypropylene (See Pressure vs. Temp. Chart)
	Pressure	200 PSI (14 bar)	250 PSI (17 bar)	175 PSI (12 bar) @ 75˚ F
	High Pressure	Not Available	400 psi (28 bar)	Not Available
	Temperature	200˚F (93˚C)		130˚F (55˚C)
Flow Range		0.3 to 30 ft/s		
Accuracy		+/- 1.5% of full-scale		
Signal		Hall-effect current sinking pulse		
Power		6-24 Vdc, 2 mA		
Maximum Current		20 mA		
Cable		#22 AWG, 3 Cond, 18' (maximum 2000' run)		

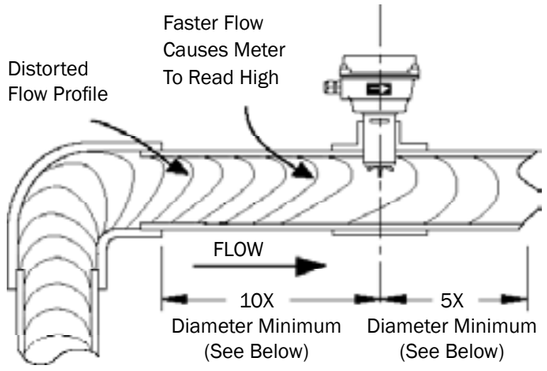
Specifications subject to change

Insertion Depth. The PDWS 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. 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).

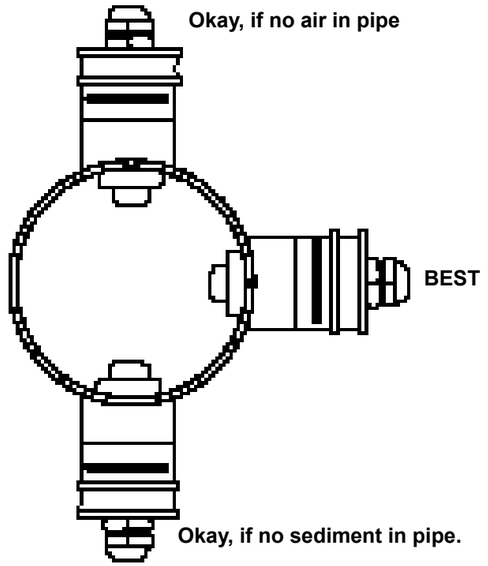
If you can't provide enough straight run to smooth out the velocity profile, some decrease in accuracy may result. This does not mean the meter's reading is meaningless, however. In some applications (e.g., control system, valve operation) a repeatable reading may be more important than a highly accurate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

DISTORTED FLOWS



Fitting Installation. 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.

POSITIONING THE METER



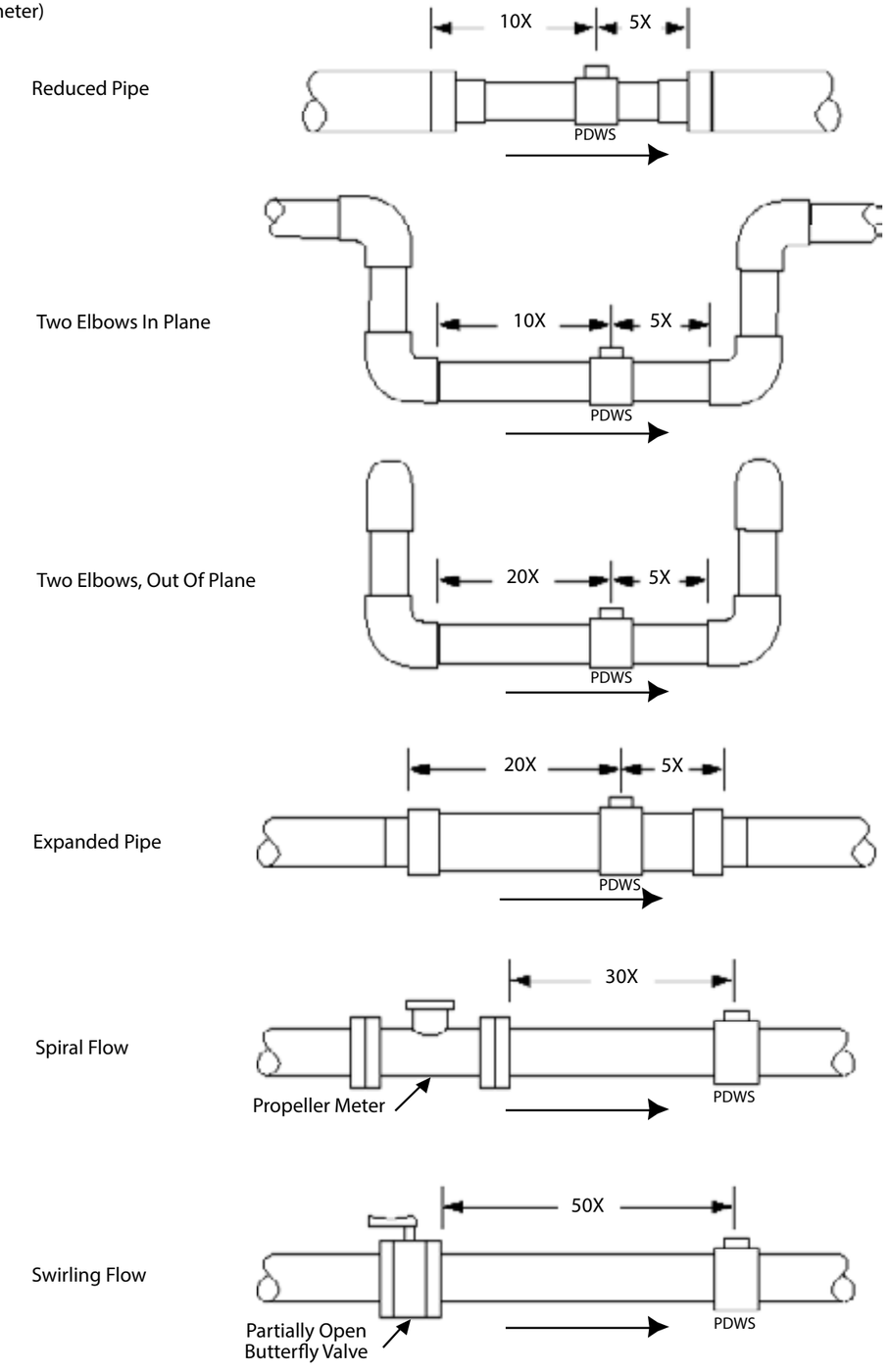
PVC Fittings. A PVC fitting is usually installed by solvent welding. PVC tees are supplied with some upstream straight pipe, less than the recommended straight pipe requirements. It is not advisable to connect directly to the end of these fittings with a flow disturbing device (valve, elbow), but rather 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-pin. The pin can be installed from either side. It may be necessary to rotate the probe back and forth slightly to start the pin into the slots on the probe. Slide the pin in as far as it will go.

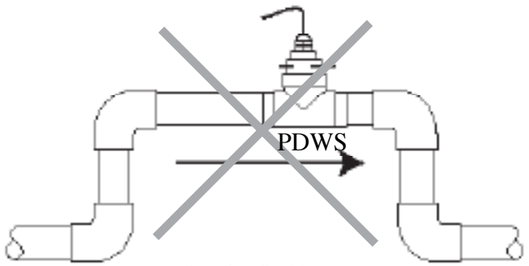
Caution: Never remove the u-clip retainer when the pipe is under pressure. Always remove pressure from the pipe before you attempt to remove the meter. Removal under pressure may result in damage or serious injury.

STRAIGHT PIPE RECOMMENDATIONS

(X = diameter)

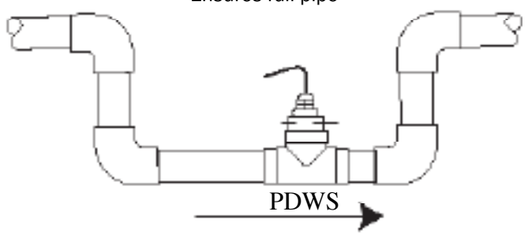


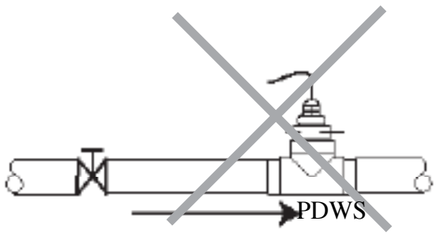
FULL PIPE RECOMMENDATIONS



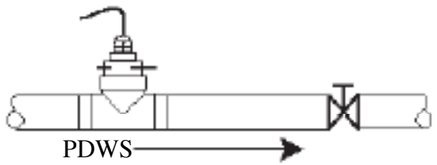
Possible Problem:
Allows air pockets to form at sensor

Better Installation:
Ensures full pipe

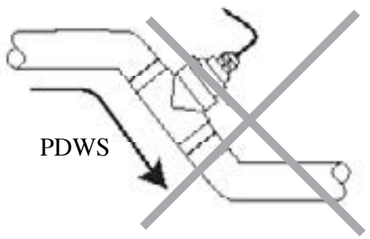




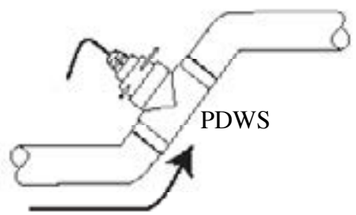
Possible Problem:
Post-valve cavitation can create air pocket



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 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).

SERIES RTI/BAT

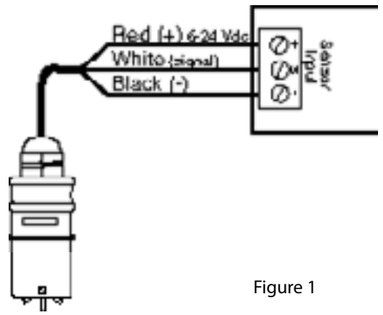


Figure 1

PLC's and Controls

Input Designed for Current Sinking (NPN) Devices

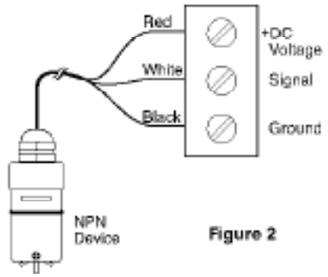


Figure 2

Input Designed for Current Sourcing (PNP) Devices

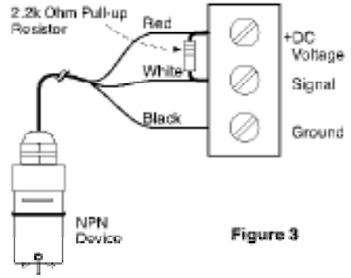


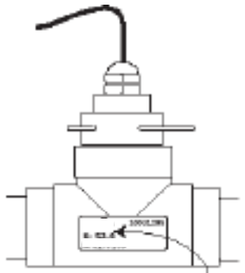
Figure 3

Minimum Flow. As with any other flow sensor, there is a rate below which the Series PDWS 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 (GPM)

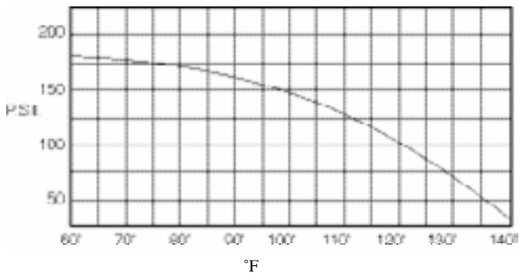
	1/2"	3/4"	1"	1-1/2"	2"	3"	4"	6"	8"
Min	0.28	0.5	0.8	1.9	3.1	6.9	12	27	46.8
Max	28	50	80	190	314	691	1190	2700	4680

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 PDWS Series meter is ordered with a tee fitting, it is factory-calibrated in the Series PWF fitting and the K-factor is indicated on the side (see below).



Find Your K-Factor Here

PRESSURE VS. TEMPERATURE (PVC/Polypropylene)



If a saddle or weld-type fitting has been ordered, see the table below to determine the proper K-factor.

PDWS SERIES K-FACTORS FOR SADDLE & WELDOLET FITTINGS

	3"	4"	6"	8"
PVC/ Steel Sch. 40	28.92	16.790	7.412	4.275
PVC/ Steel Sch. 80	32.368	18.591	8.215	4.684
Stainless Steel (10S)	25.614	14.996	6.747	3.926
Stainless Steel (10S)	28.920	16.790	7.412	4.275
Copper Tubing (Type L)	31.386	17.847	7.981	4.563
Copper Tubing (Type K)	32.212	18.294	8.272	4.736
Brass Pipe	29.033	17.009	7.268	4.254
Duct. Iron (Class 52)	23.548	15.282	6.913	3.485

Field Calibration. It is possible to field-calibrate a Series PDWS 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 (PDWS meters are calibrated for water use) or which lack adequate straight pipe ahead of the meter.

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.

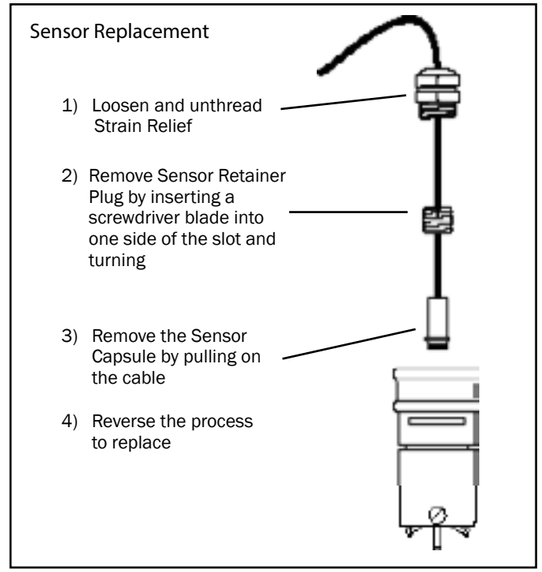
Rotor Replacement. It is unusual for a rotor to require replacement due to damage sustained in normal service. More commonly, the meter is dropped while it is out of the pipe. Another reason for rotor replacement is shaft wear after long service. Rotors are easily field-replaced.

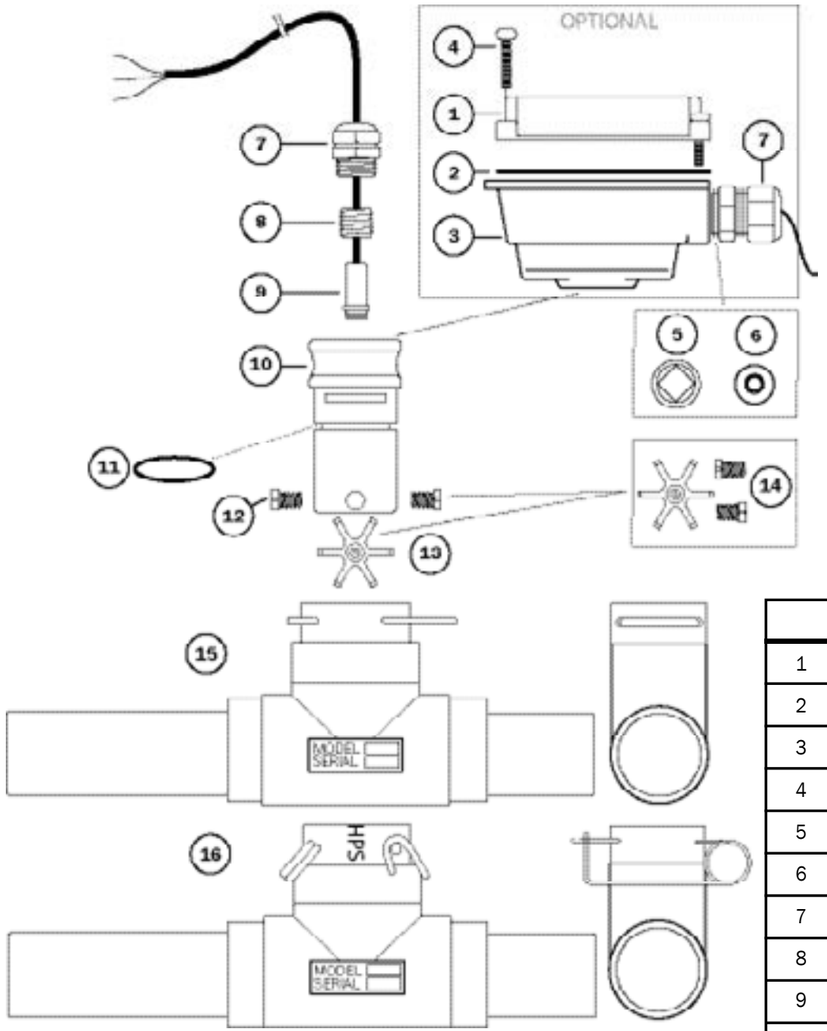
To install a rotor, follow these steps:

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.





SERIES PDWS PARTS LISTING	
1	Upper Housing
2	Gasket
3	Lower Housing
4	Housing Screw Assembly
5	Plug, Steel
6	Plug, Plastic
7	Strain Relief
8	Sensor Retainer
9	Sensor, Low Power
10	Body
11	O-Ring, EPDM
12	Bearing Screws (2)
13	Rotor (Nickel/Carbide Shaft) Rotor (Ceramic Shaft)
14	Rotor Repair Kit (Kynar/Carbide) Rotor Repair Kit (Kynar/Ceramic)
15	Standard Fitting
16	High Pressure Fitting

Problem	Probable Cause	Try...
No signal after installation	Insufficient flow	Consult Flow Range 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 to 24 VDC power supply 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; 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-Factor entered	Check fitting for K-Factor, check indicator to see if it is entered properly ("Set K" on RTI)
	Magnetic sensor failing to pick up each blade	Remove flow sensor from pipe. If indicator is an RTI, set K to 1.00, turn rotor slowly by hand, indicator should count each blade; replace sensor
	Wrong time units on flow indicator	If using an RTI, check left side of display (sec, min, hr, day); change to desired unit

WARRANTY/RETURN

Refer to "Terms and Conditions of Sale" in our catalog or on our website. Contact customer service to receive a Returns Goods Authorization number before shipping your product back for repair. Be sure to include a brief description of the problem plus any relevant applciation notes.

Dwyer Instruments, Inc. • 102 Indiana Highway 212 • Michigan City, IN 46360 • USA
(P) 219.879.8868 • (F) 219.872.9057 • 1.800.872.9141 • www.dwyer-inst.com

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