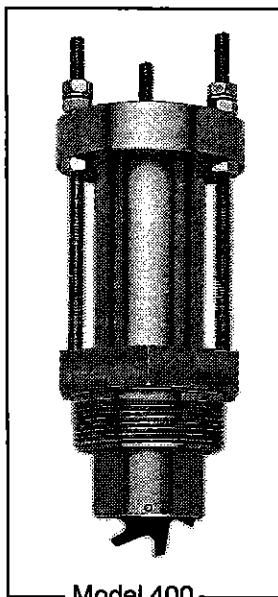


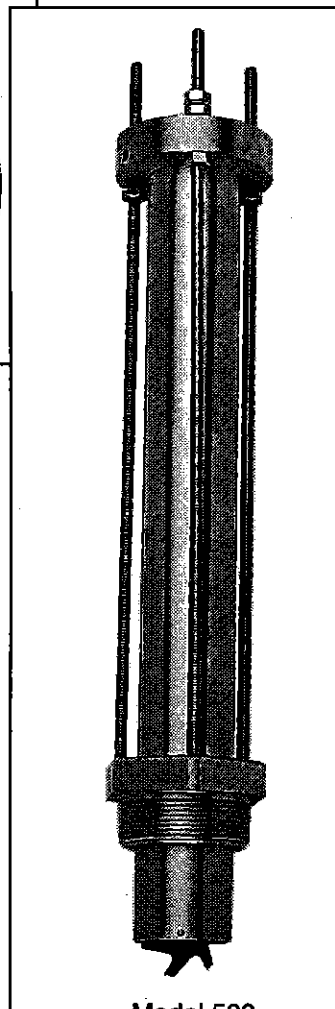
Models 400, 475, and 500 Impeller Flow Sensors



Model 400



Model 475



Model 500

INSTRUCTION MANUAL

Models 400, 475, and 500 Impeller Flow Sensors

Notice

This document is designed to promote personal and system safety and to optimize product performance. It should be read carefully before installing, using, or maintaining the sensor. If the product is used in a manner not specified by Peek Measurement, the protection provided by the product may be impaired.

If a problem occurs that is not resolved in the manual, refer to Section 1.10 for more information on additional service and support.

USA

Peek Measurement, Inc.
10335 Landsbury, Suite 300
Houston, Texas 77099-3407 USA
Telephone: (281) 879-3700
Facsimile: (281) 498-7721

Europe

Peek Measurement, Ltd.
King's Worthy
Winchester, Hampshire SO23 7QA UK
Telephone: (01962) 883200
Facsimile: (01962) 885530

Publication Number 0400-8000
© Peek Measurement Inc. 6/97
Printed in the U.S.A.



Table of Contents

Models 400, 475, and 500 Impeller Flow Sensors

1.1 SCOPE	1-1
1.1.1 PRINCIPLE OF OPERATION OF MAGNETIC SENSOR.....	1-1
1.1.2 PRINCIPLE OF OPERATION OF RF SENSOR.....	1-2
1.2 GENERAL INSTALLATION GUIDELINES.....	1-2
1.2.1 ADDITIONAL GUIDELINES FOR MAGNETIC SENSOR	1-4
1.3 INSTALLING THE MODEL 400 SENSOR.....	1-4
1.4 INSTALLING THE MODEL 475 SENSOR.....	1-7
1.5 INSTALLING THE MODEL 500 SENSOR.....	1-8
1.6 REPLACING THE SENSOR'S IMPELLER AND SHAFT ASSEMBLY ...	1-11
1.7 ORDERING INFORMATION.....	1-12
1.8 SPECIFICATIONS.....	1-15
1.9 OUTPUT FREQUENCY AND PULSE RATE TABLES	1-18
1.10 SERVICE SUPPORT AND WARRANTY	1-19
1.10.1 RESOLVING THE PROBLEM	1-19
1.10.2 LOCAL REPRESENTATIVE SUPPORT	1-19
1.10.3 CONTACTING PEEK MEASUREMENT BY PHONE.....	1-19
1.10.4 FACTORY SERVICE	1-20
1.10.5 FIELD SERVICE.....	1-20
1.10.6 WARRANTY	1-21

1.1 Scope

The Peek Measurement line of impeller flow sensors includes Models 400, 475, and 500. These sensors provide an accurate, repeatable, and economical method of measuring liquid flow in either metallic or non-metallic pipes. The sensors are available in a variety of materials to address virtually any measurement application and are available with magnetic technology (Section 1.1.1) or RF technology (Section 1.1.2).

To obtain measurement accuracy, it is important to observe the general installation guidelines (Section 1.2) and the installation procedures for the specific model of sensor (Sections 1.3 through 1.5). In addition, procedures for routine replacement of a worn impeller and shaft assembly are described (Section 1.6).

NOTE: Peek Measurement provides a full range of electronics for use with its impeller sensors, including a battery-powered rate/total display, loop- and AC-powered indicating transmitters, blind transmitters, and BTU energy meters.

1.1.1 PRINCIPLE OF OPERATION OF MAGNETIC SENSOR

The magnetic sensor (Figure 1-1) incorporates a 6-bladed impeller with a small cylindrical magnet embedded in each blade. The magnets are orientated with north and south fields to produce alternating positive and negative magnetic field intensities as the impeller rotates within the coil pick-up. This produces a sine wave output, the frequency of which is three times the RPM of the impeller.

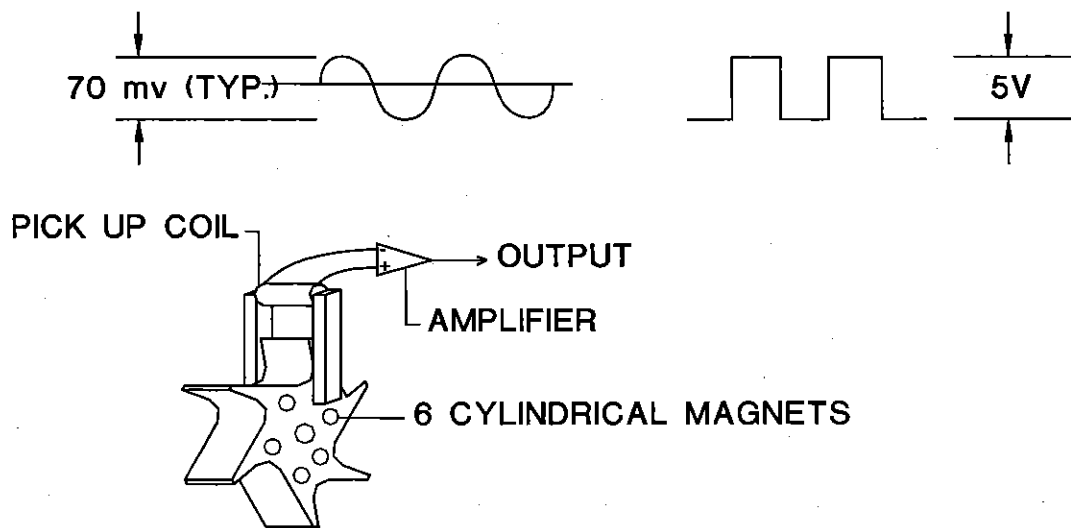


Figure 1-1 Magnetic Sensor

1.1.2 PRINCIPLE OF OPERATION OF RF SENSOR

The RF sensor (Figure 1-2) uses a similar impeller to the one in the magnetic system. Instead of magnets, a ferrite cylinder is embedded in the impeller. A non-magnetic counterweight is located opposite the ferrite cylinder to provide balance. As the impeller rotates, the ferrite cylinder passes by the sensor coil. The frequency shifts slightly and then returns to the normal frequency as the ferrite target leaves the area of the sensor coil. The small frequency changes produce a digital signal of 1 pulse per revolution. This results in an FM-based system which is very immune to motor noise and other sources of noise commonly found in industrial environments. Another benefit of RF technology is the ability to measure flows as low as 0.3 feet per second (0.09 meters per second).

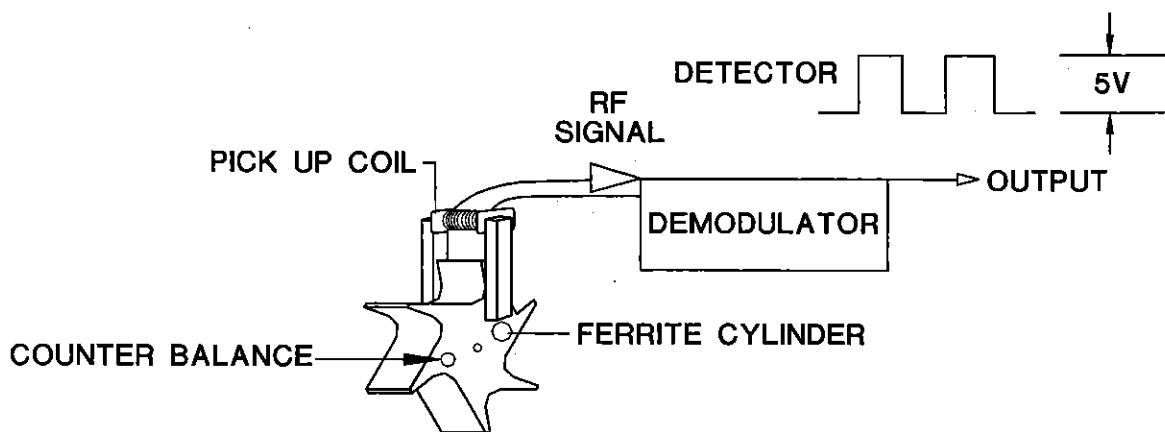


Figure 1-2 RF Sensor

1.2 General Installation Guidelines

Observe the following guidelines when installing a sensor:

- Select a section of pipe that is always full of fluid such as a vertical pipe with upflow or a full horizontal section. Avoid sites with vertical downward flows. Do not install where gas or air gaps may occur in-line.
- Locate the sensor on a straight piping run to provide a smooth and fully developed flow profile (Reynolds number of 4000 or greater). Ensure that any flow disturbance device (such as elbows, tees, etc.) are located a minimum of 10 pipe diameters upstream and 5 diameters downstream of the sensor. (Figure 1-3). (Greater distances may be required when piping arrangements include valves, pipe reducers, elbows, or any other devices that alter the smooth flow profile directly ahead of or after the sensor.)

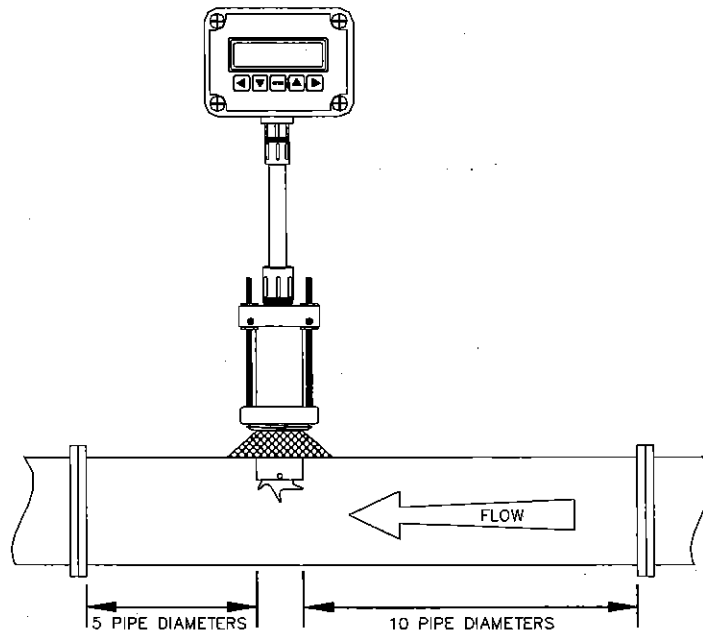


Figure 1-3 Minimum Distance from Flow Disturbance Devices (Model 400 sensor shown with Model 211OR1F monitor)

- If installing in a horizontal pipe, mount the sensor at the top of the pipe in the 12 o'clock position, allowing no air gaps or sediment. If the sensor cannot be mounted at the top of the pipe, it can be mounted at an angle between the 10 o'clock and 2 o'clock positions (Figure 1-4). If installing in a vertical pipe, ensure that the flow is in the upward direction.

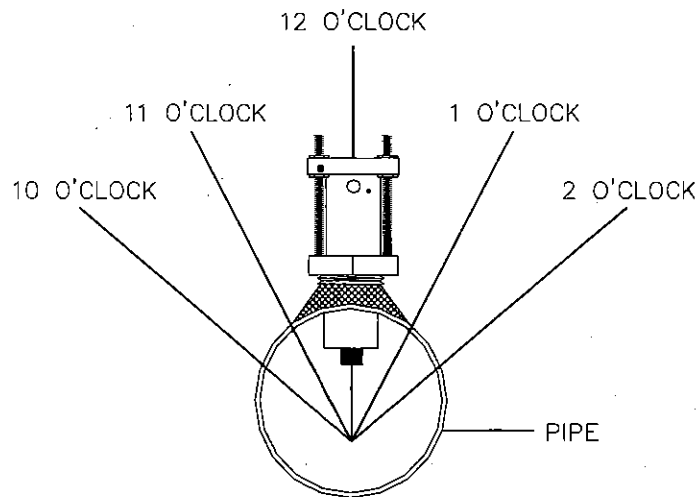


Figure 1-4 Allowable Installation Angle (Model 400 sensor shown)

Wiring

Both the magnetic and RF type sensors have a cable with two insulated wires. The insulated wires are interchangeable. The magnetic type sensors have a third wire which is bare. The sensor wiring should be connected in accordance with the instruction manual for the flowmeter.

The following general wiring guidelines apply:

- If the sensor cable is run in conduit, seal off the conduit from exposure to moisture.
- For the magnetic type sensor, use twisted, two-wire, shielded cable with a minimum gauge of 24 AWG. Cable can be run directly from the sensor to the flow transmitter with a maximum length of 1000 feet (304.8 meters).

NOTE: Contact the representative or dealer regarding requirements for sensor cable runs on a magnetic system which exceed 1000 feet (304.8 meters).

- For the RF type sensor, use only the special two-wire, low capacitance, non-shielded cable installed at the factory. This cable has a maximum length of 3 feet (.91 meters) between the sensor and the flowmeter (or between the sensor and the RF signal amplifier if a PLC is used). Run the RF sensor cable through PVC conduit to keep the cable from close proximity to metal objects. Do not use metal conduit with the RF sensor cable.

IMPORTANT: The RF-based system cannot function if additional cable length or a different type of cable is used.

1.2.1 ADDITIONAL GUIDELINES FOR MAGNETIC SENSOR

The following additional guidelines apply to a magnetic sensor:

- Select a site which avoids heavy interference from items such as large power transformers, turbines, high power lines, and microwave transmitters.
- Avoid running the sensor cable alongside power transmission cables and near neon lights.
- Do not coil any excess sensor cable. Cut and splice it as required.

1.3 Installing the Model 400 Sensor

The Model 400 sensor may be installed in a pipe with a diameter of 2 to 30 inches (51 to 762 millimeters). To install the sensor, follow the general installation guidelines (Section 1.2) and complete the following steps (Figures 1-5 and 1-6):

1. Install a 2-inch (51-millimeter) weld-on threaded FNPT fitting or service saddle according to the manufacturer's instructions. (This requires cutting a 2-inch [51-millimeter] hole at the top of the pipe.)
2. Measure the pipe wall thickness with a metal measuring tape and record this reading as "Wt".
3. Wrap the threads of the sensor with pipe thread tape.

4. Screw the sensor into the pipe and tighten it.
5. Measure the vertical height from the top of the pipe to the top of the hex adapter. Record this reading as "Vh".
6. Determine the proper insertion depth and record it as "D". The insertion depth is determined by referring to Table 1-1:

Table 1-1 Model 400 Sensor Insertion Depth	
Pipe ID	Insertion Depth
2 in (51 mm)	1/2 in (13 mm)
3 in (76 mm)	1 in (25 mm)
4 in (102 mm)	1 1/2 in (38 mm)
5 in (127 mm) and larger	Approximate depth is determined by dividing the actual pipe ID by 8. ¹
¹ For example, a 6-inch (152-mm) Schedule 40 pipe has an actual ID of 6.065 in (154 mm). To calculate this example in inches: $\frac{6.065}{8} = 0.758$ in (approx. 3/4 in) To calculate this example in millimeters: $\frac{154}{8} = 19$ mm	

7. Calculate the remaining length "L" using the following formula (to provide the answer in inches):

$$L = 6.375 - (Wt + Vh + D)$$

Length "L" is achieved on the sensor by moving the positioning collar. The collar is held in place by the insertion adjustment nuts on the three all-threads.

8. Turn the nuts on the all-threads and move the collar as required until the distance between the top of the hex adapter and the top of the collar equals "L".
9. With "L" set, tighten the lock nuts on the all-threads.

NOTE: When "L" is properly adjusted, the sensor's insertion depth is automatically set.

10. Loosen the two set screws in the positioning collar using a hex wrench.
11. Insert a rod through the 5/8-inch (16-millimeter) alignment holes in the sleeve of the sensor.
12. Rotate the rod so that the alignment holes are parallel with the pipe and the 1/16 inch (1.6 millimeter) upstream indicator hole is located at the upstream end of the pipe. The flow should be directed into the impeller cup (Figure 1-10).

IMPORTANT: The upstream indicator hole must be located at the upstream end of the pipe to avoid erroneous readings. In addition, the alignment holes must be exactly parallel with the pipe. If they are not, the impeller is positioned at an angle to the flow, causing possible erratic readings and accelerated wear on the impeller bearings.

13. With the alignment holes in proper position, tighten the two set screws.
14. Use plumbers putty to seal off the alignment holes and the upstream indicator hole from exposure to moisture.

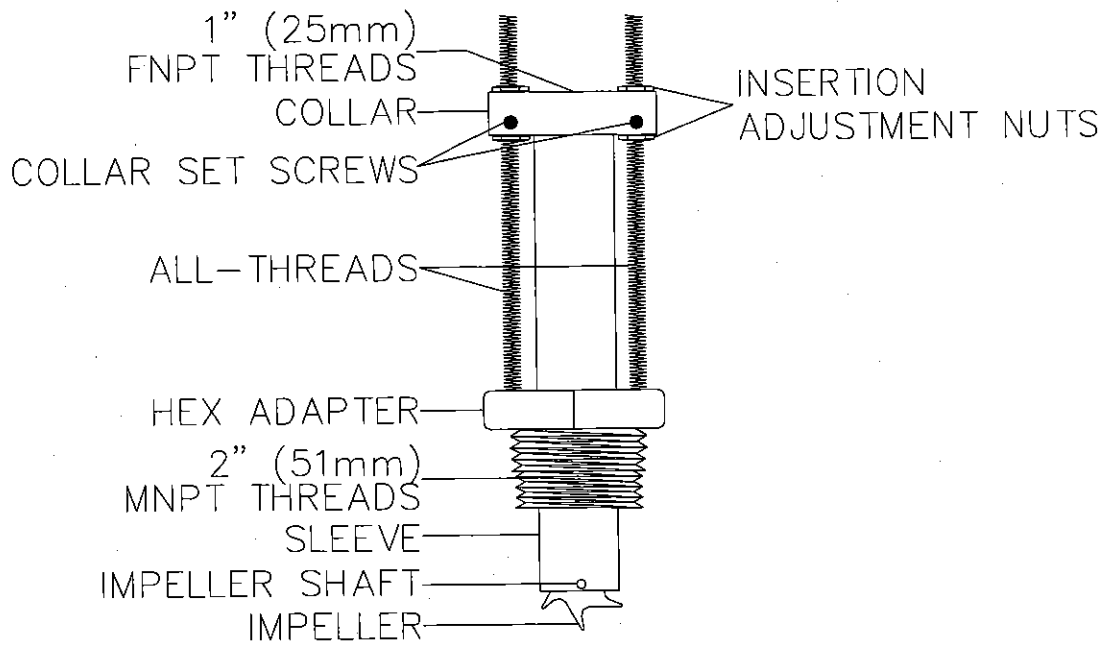


Figure 1-5 Model 400 Sensor (side view prior to installation)

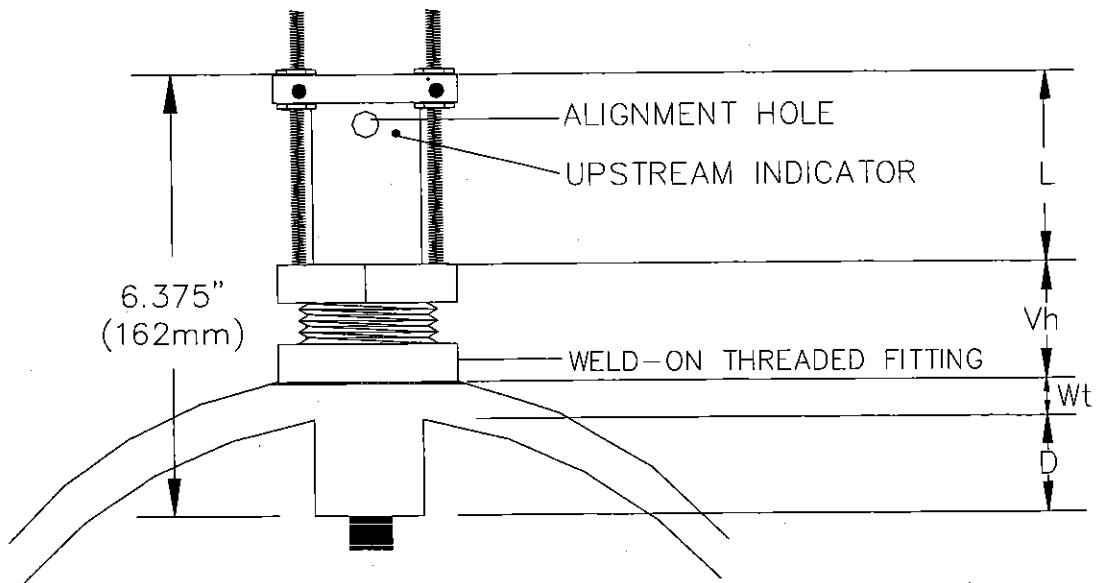


Figure 1-6 Model 400 Sensor Installed (end view)

1.4 Installing the Model 475 Sensor

The Model 475 sensor has FNPT threads for installation on one of the following pipe sizes:

- 1/2-inch (13-millimeter)
- 3/4-inch (19-millimeter)
- 1-inch (25-millimeter)
- 1 1/4-inch (32-millimeter)
- 1 1/2-inch (38-millimeter)

In addition, all Model 475 sensors have a 1-inch (25-millimeter) conduit connection which is either a slip fit type (for PVC and PVDF models) or has FNPT-threads (for anodized aluminum and stainless steel models). To install the sensor, follow the general installation guidelines (Section 1.2) and complete the following steps (Figure 1-7):

1. Determine the direction of flow and orient the sensor accordingly. Note that the direction of flow is marked on a label on the outside of the sensor.
2. Wrap the pipe ends with pipe thread tape.
3. Screw the pipe ends into the sensor and tighten them.
4. Connect the sensor cable to the flow monitor or transmitter. (Refer to the instruction manual provided for the flow monitor/transmitter.)

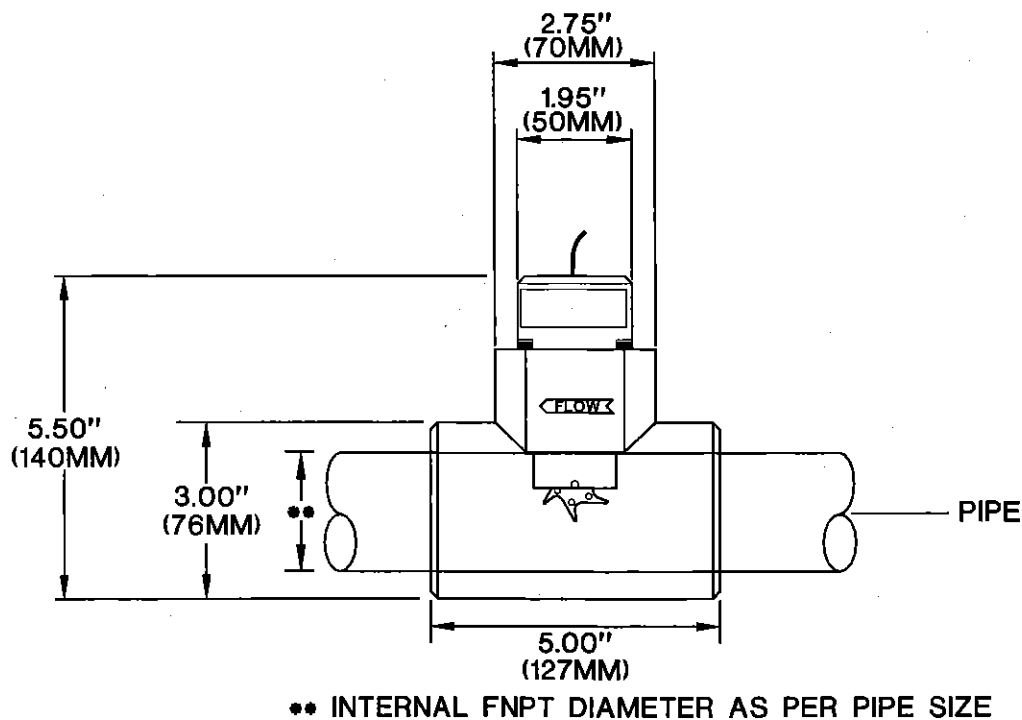


Figure 1-7 Model 475 Sensor Installed (side view)

1.5 Installing the Model 500 Sensor

The Model 500 sensor may be installed in a pipe with a diameter of 2 to 96 inches (51 to 2438 millimeters). To install the sensor, follow the general installation guidelines (Section 1.2) and complete the following steps (Figures 1-8 and 1-9):

1. Install a 2-inch (51-millimeter) weld-on FNPT threaded fitting or service saddle according to the manufacturer's instructions.
2. Install a 2-inch (51-millimeter) pipe nipple with a maximum length of 3 1/2 inches (89 millimeters) into the weld-on threaded fitting or service saddle.
3. Install a 2-inch (51-millimeter) full port isolation valve (gate valve recommended) with 2-inch (51-millimeter) FNPT threaded ends onto the other end of the nipple.
4. Measure from the top of the pipe to the uppermost surface of the gate valve and record this reading as "Vp".



To prevent possible personal injury and damage to equipment, carefully follow the drilling/tapping saw manufacturer's instructions when working with pressurized systems. In addition, the installation/extraction tool (Figure 1-9) must be used if working with pressures of 50 PSI or greater. (Once the sensor has been installed in or removed from the pipe, the tool may be removed.)

5. Install a drilling/tapping saw on the isolation valve.
6. Open the valve and cut a 2-inch (51-millimeter) hole.
7. Extract the hole saw just enough to clear the valve, then close the valve.
8. Remove the saw, carefully releasing trapped pressure as the saw is removed.
9. Measure the wall thickness of the piece of pipe which was cut out by the saw and record this reading as "Wt".
10. Wrap the threads of the sensor with pipe thread tape.
11. Screw the sensor into the valve and tighten it.



To prevent damage to the sensor, avoid hitting the impeller against the valve or closing the valve on the impeller.

12. Measure the distance from the top of the valve to the top of the hex adapter of the sensor and record this reading as "Vh".
13. Determine the proper insertion depth and record it as "D". The insertion depth is determined by referring to Table 1-2:

**Table 1-2
Model 500 Sensor Insertion Depth**

Pipe ID	Insertion Depth
2 in (51 mm)	1/2 in (13 mm)
3 in (76 mm)	1 in (25 mm)
4 in (102 mm)	1 1/2 in (38 mm)
5 in (127 mm) and larger	Approximate depth is determined by dividing the actual pipe ID by 8. ¹
¹ For example, a 6-inch (152-mm) Schedule 40 pipe has an actual ID of 6.065 in (154 mm). To calculate this example in inches: $\frac{6.065}{8} = 0.758$ in (approx. 3/4 in)	
To calculate this example in millimeters: $\frac{154}{8} = 19$ mm	

14. Install the installation/extraction tool at the bottom of the hex adapter and tighten the screw head drive to the top of the sensor positioning collar.
15. Calculate the remaining length "L" (the distance between the top of the hex adapter and the top of the collar) using one of the following formulas:
 - In inches: $L = 15.375 - (V_p + V_h + W_t + D)$
 - In millimeters: $L = 391 - (V_p + V_h + W_t + D)$

Length "L" should equal approximately 5 1/2 inches (140 millimeters) for pipes 4-inch (102-millimeter) diameter and larger. "L" is achieved on the sensor by moving the positioning collar. The collar is held in place by the insertion adjustment nuts on the three all-threads.
16. Open the valve and insert the sensor to achieve length "L" by turning the crank on the installation/extraction tool and moving the insertion adjustment nuts on the all-threads as required.
17. Remove the installation/extraction tool.
18. With "L" set, tighten the lock nuts on the all-threads.

NOTE: When "L" is properly adjusted, the sensor's insertion depth is automatically set.
19. Loosen the two set screws in the positioning collar using a hex wrench.
20. Insert a rod through the 5/8-inch (16-millimeter) alignment holes in the sleeve of the sensor.
21. Rotate the rod so that the alignment holes are parallel with the pipe and the 1/16-inch (1.6-millimeter) upstream indicator hole is located at the upstream end of the pipe. The flow should be directed into the impeller cup (Figure 1-10).

IMPORTANT: The upstream indicator hole must be located at the upstream end of the pipe to avoid erroneous readings. In addition, the alignment holes must be exactly parallel with the pipe. If they are not, the impeller is positioned at an angle to the flow, causing possible erratic readings and accelerated wear on the impeller bearings.

22. With the alignment holes in proper position, tighten the two set screws.
23. Use plumbers putty to seal off the alignment holes and the upstream indicator hole from exposure to moisture.
24. Connect the sensor cable to the flow monitor or transmitter. (Refer to the instruction manual provided for the flow monitor/transmitter.)

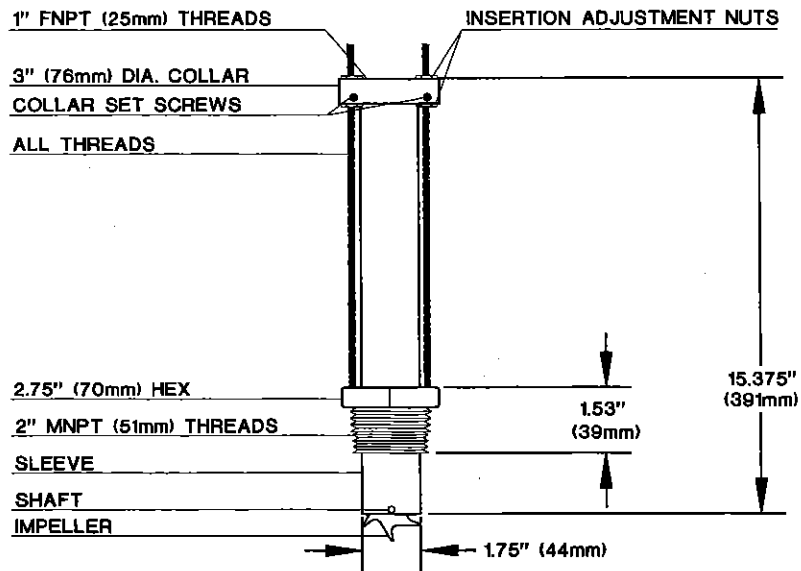


Figure 1-8 Model 500 Sensor (side view prior to installation)

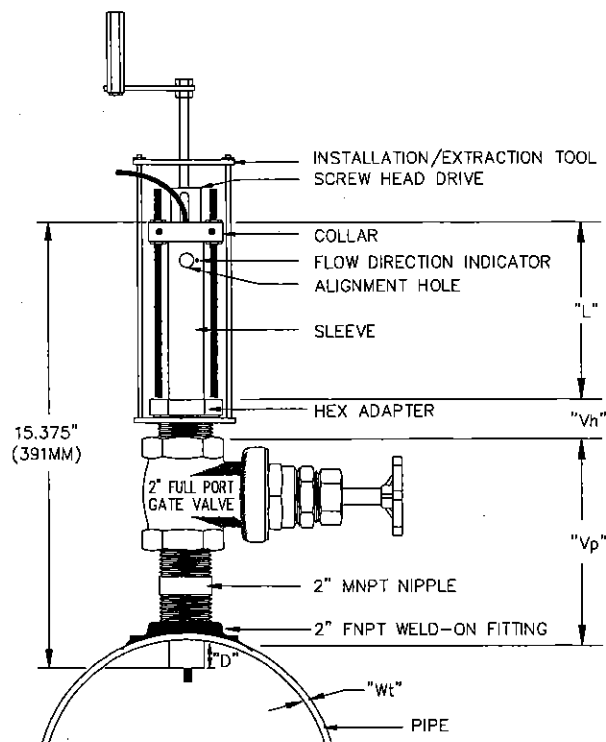


Figure 1-9 Model 500 Sensor Installed (end view)

1.6 Replacing the Sensor's Impeller and Shaft Assembly

If the flowmeter is not operating properly, it may display an erratic reading or a reading of zero flow under good flow conditions. If the sensor was properly aligned when it was installed, the problem may be related to the condition of the impeller and shaft assembly.

There may be foreign matter in the line that gets trapped in the impeller such as sand or moss. If the foreign matter is removed, oftentimes the flowmeter is ready to resume proper operation. If, however, the impeller or shaft is worn due to age or improper alignment, the worn part must be replaced.

The following tools are required for replacing the impeller and shaft assembly:

- Small hammer
- Small punch: 0.093 (3/32)-inch (2.4-millimeter) or smaller
- Pair of pliers

IMPORTANT: If replacing the old impeller shaft with a new shaft constructed of a different material, consult the factory for installation requirements.

To replace the impeller and shaft assembly:

1. Remove the sensor from the pipe and place it on a work bench.
2. Place the tip of the punch in the center of the impeller shaft.
3. Tap gently with the hammer until the shaft protrudes approximately 1/4 to 1/2 inches (6 to 13 millimeters) on the other side.
4. Grasp the exposed shaft with the pliers and remove the shaft and impeller.
5. Position the new impeller in the impeller housing such that the fluid would strike into the "cups" of the impeller (Figure 1-10) whenever the sensor body is correctly oriented to the flow.

IMPORTANT: The sensor body is correctly oriented to the flow when the following occurs:

- For Model 475 sensor - the flow indicator arrow on the side of the sensor is indicating the correct flow direction.
- For Model 400 and 500 sensors - the 1/16-inch (1.6-millimeter) upstream indicator hole located in the sleeve of the sensor (Figures 1-6 and 1-9) is pointing in the upstream direction.

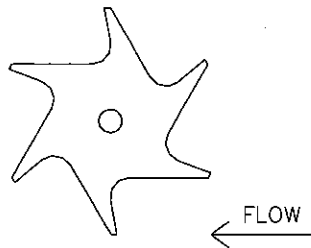


Figure 1-10 Impeller Orientation

6. Insert the new impeller shaft into the shaft hole by tapping gently with the hammer until it just enters the impeller housing.
7. Carefully align the shaft through the bearings in the impeller, then tap the shaft into place until the edges are flush.

1.7 Ordering Information

The standard configuration and options for the Model 400, 475, and 500 sensors are designated by the model code numbers listed in Tables 1-3 through 1-5. For example, the model code 400MBHR describes a Model 400 sensor with the following options:

- Magnetic sensor technology
- Brass body material
- Hastelloy C-nitride coated shaft and Rulon bearings

Table 1-3 Model 400 Sensor Standard Configuration and Options	
Description	Model Code Number
Product Flow sensor for pipe sizes 2 to 30 in (51 to 762 mm)	400
Sensor Technology RF sensor with mounted fittings - 1 ft. cable (for direct mounted display, transmitter, or amplifier). Flow range: 0.3 ft/s to 30 ft/s (0.09 m/s to 9 m/s)	R
Magnetic sensor - 20 ft cable Flow range: 1 ft/s to 30 ft/s (0.3 m/s to 9 m/s)	M
Body Material PVC ¹ PVDF ² Brass Stainless steel	P K B S
Shaft and Bearing Material Hastelloy C- nitride coated shaft and Rulon bearings Ceramic shaft and ceramic bearings ³ Hastelloy C-nitride coated shaft and ceramic bearings	HR CC HC
Options Extended temperature range: -40 to +350°F (-40 to 165°C) [available on brass and stainless steel models] Mounted fittings on magnetic sensor (for direct mounted display, transmitter, or amplifier) 500 PSI pressure test (available on brass and stainless steel models) 2500 PSI pressure test (available on stainless steel models) Extended cable length (available in 5 ft [1.5 m] increments, with a maximum of 800 ft [243 m]) ⁴	T1 F P1 P2 xxxA
¹ PVC maximum rating: 180°F @ 85 PSI (82°C @ 586 kPa) / 85°F @ 180 PSI (37°C @ 1241 kPa). ² PVDF maximum rating: 220°F @ 180 PSI (104°C @ 1241 kPa) / 175°F @ 225 PSI (79°C @ 1551 kPa). ³ Ceramic maximum pressure rating: 250 PSI. ⁴ Specify cable length.	

**Table 1-4
Model 475 Sensor Standard Configuration and Options**

Description	Model Code Number
Product Tee type flow sensor	475
Sensor Technology RF sensor with mounted fittings - 1 ft. cable (for direct mounted display, transmitter, or amplifier). Flow range: 0.3 ft/s to 30 ft/s (0.09 m/s to 9 m/s) Magnetic sensor - 20 ft cable Flow range: 1 ft/s to 30 ft/s (0.3 m/s to 9 m/s)	R M
Body Material Anodized aluminum PVC ¹ PVDF ² Brass Stainless steel	A P K B S
Nominal Line Size (Schedule 40) 1/2-in (13-mm) 3/4-in (19-mm) 1-in (25-mm) 1 1/4-in (32-mm) 1 1/2-in (38-mm)	1/2 3/4 1 1 1/4 1 1/2
End Connection FNPT	F
Shaft and Bearing Material Hastelloy C- nitride coated shaft and Rulon bearings Ceramic shaft and ceramic bearings ³ Hastelloy C-nitride coated shaft and ceramic bearings	HR CC HC
Options Extended temperature range: -40 to +350°F (-40 to 165°C) [available on brass and stainless steel models] Mounted fittings on magnetic sensor (for direct mounted display, transmitter, or amplifier) 500 PSI pressure test (available on anodized aluminum, brass and stainless steel models) 2500 PSI pressure test (available on stainless steel models) Extended cable length (available in 5 ft [1.5 m] increments, with a maximum of 800 ft [243 m]) ⁴	T1 F P1 P2 xxxA
¹ PVC maximum rating: 180°F @ 85 PSI (82°C @ 586 kPa) / 85°F @ 180 PSI (37°C @ 1241 kPa). ² PVDF maximum rating: 220°F @ 180 PSI (104°C @ 1241 kPa) / 175°F @ 225 PSI (79°C @ 1551 kPa). ³ Ceramic maximum pressure rating: 250 PSI. ⁴ Specify cable length.	

**Table 1-5
Model 500 Sensor Standard Configuration and Options**

Description	Model Code Number
Product Hot tap flow sensor for pipe sizes 2 to 96 in (51 to 2438 mm) ¹	500
Sensor Technology RF sensor with mounted fittings - 1 ft. cable (for direct mounted display, transmitter, or amplifier). Flow range: 0.3 ft/s to 30 ft/s (0.09 m/s to 9 m/s) Magnetic sensor - 20 ft cable Flow range: 1 ft/s to 30 ft/s (0.3 m/s to 9 m/s)	R M
Body Material PVC ² PVDF ³ Brass Stainless steel	P K B S
Shaft and Bearing Material Hastelloy C- nitride coated shaft and Rulon bearings Ceramic shaft and ceramic bearings ⁴ Hastelloy C-nitride coated shaft and ceramic bearings	HR CC HC
Options Extended temperature range: -40 to +350°F (-40 to 165°C) [available on brass and stainless steel models] Mounted fittings on magnetic sensor (for direct mounted display, transmitter, or amplifier) 500 PSI pressure test (available on brass and stainless steel models) 2500 PSI pressure test (available on stainless steel models) Extended cable length (available in 5 ft [1.5 m] increments, with a maximum of 800 ft [243 m]) ⁵	T1 F P1 P2 xxxA
¹ Extended length sensors available. Consult factory. ² PVC maximum rating: 180°F @ 85 PSI (82°C @ 586 kPa) / 85°F @ 180 PSI (37°C @ 1241 kPa). ³ PVDF maximum rating: 220°F @ 180 PSI (104°C @ 1241 kPa) / 175°F @ 225 PSI (79°C @ 1551 kPa). ⁴ Ceramic maximum pressure rating: 250 PSI. ⁵ Specify cable length.	

1.8 Specifications

Technical specifications are provided for the Model 400, 475, and 500 sensors in Tables 1-6 through 1-8.

Table 1-6 Model 400 Sensor Specifications	
Performance specifications	
Accuracy	±0.8% rate Model 400R ±1.5% rate Model 400M
Repeatability	±0.5% of full range
Linearity	±0.5% of full range
Velocity range	0.3 to 30 ft/s (0.09 to 9.14 m/s) Model 400R 1 to 30 ft/s (0.3 to 9.14 m/s) Model 400M
Pipe dimensions	2 to 30 in (51 to 762 mm)
Physical specifications	
Rating	NEMA 4X (IP65), NEMA 12
Body material options	PVC, PVDF, brass, or stainless steel
Impeller and impeller housing material options	PVDF (standard) or Ryton (extended temperature)
Bearing material options	Rulon or ceramic
Shaft material options	Titanium nitride coated Hastelloy C or ceramic ³
O-ring material	Viton
Pressure rating	
PVC	180 PSI (1241 kPa) ¹
PVDF	225 PSI (552 kPa) ²
Brass	250 PSI (1723 kPa) Optional pressure: 500 PSI (3447 kPa)
Stainless steel	250 PSI (1723 kPa) Optional pressure: 500 PSI (3447 kPa) or 2500 PSI (17,237 kPa)
Operating temperature	
Standard	-20° to +165°F (-29 to +74°C) ^{1, 2}
Optional extended temperature	-40 to +350°F (-40 to +165°C) ⁴
Sensor mounting	Through a 2-in (51-mm) FNPT service saddle or weld-on threaded fitting
Conduit connection	1-in (25-mm) FNPT
Sensor cable	
Model 400R	Flat ribbon cable, 1 foot long. For direct mounted Peek Measurement transmitters or monitors.
Model 400M	20 AWG, 2-conductor, shielded cable, standard length 20 ft (6 m)
Electrical specifications	
Model 400R	Output signal: 0 to 52 Hz to direct mounted Peek Measurement flow transmitters or monitors. (Peek Measurement flow transmitters or monitors provide power for the sensor.)
Model 400M	Output signal: 40 to 600 mV AC @ 5 to 167 Hz (no external power required)
¹ PVC maximum rating: 180°F @ 85 PSI (82°C @ 586 kPa) / 85°F @ 180 PSI (37°C @ 1241 kPa). ² PVDF maximum rating: 220°F @ 180 PSI (104°C @ 1241 kPa) / 175°F @ 225 PSI (79°C @ 1551 kPa). ³ Ceramic maximum pressure rating: 250 PSI. ⁴ Extended temperature option: available on brass and stainless steel models.	

**Table 1-7
Model 475 Sensor Specifications**

Performance specifications	
Accuracy	±0.8% rate Model 475R ±1.5% rate Model 475M
Repeatability	±0.5% of full range
Linearity	±0.5% of full range
Velocity range	0.3 to 30 ft/s (0.09 to 9.14 m/s) Model 475R 1 to 30 ft/s (0.3 to 9.14 m/s) Model 475M
Pipe dimensions	FNPT, schedule 40 internal diameters: 1/2-, 3/4-, 1-, 1 1/4-, and 1 1/2-in (13-, 19-, 25-, 32-, and 38-mm)
Physical specifications	
Rating	NEMA 4X (IP65), NEMA 12
Body material options	Anodized aluminum, PVC, PVDF, brass, or stainless steel
Impeller and impeller housing material options	PVDF (standard) or Ryton (extended temperature)
Bearing material options	Rulon or ceramic
Shaft material options	Titanium nitride coated Hastelloy C or ceramic ³
O-ring material	Viton
Gasket material	Neoprene
Pressure rating	
Anodized aluminum	225 PSI (552 kPa) Optional pressure: 500 PSI (3447 kPa)
PVC	180 PSI (1241 kPa) ¹
PVDF	225 PSI (552 kPa) ²
Brass	250 PSI (1723 kPa) Optional pressure: 500 PSI (3447 kPa)
Stainless steel	250 PSI (1723 kPa) Optional pressure: 500 PSI (3447 kPa) or 2500 PSI (17,237 kPa)
Operating temperature	
Standard	-20° to +165°F (-29 to +74°C) ^{1, 2}
Optional extended temperature	-40 to +350°F (-40 to +165°C) ⁴
Sensor mounting	FNPT connections, size as specified
Conduit connection	1-in (25 mm) FNPT on anodized aluminum, brass, and stainless steel models 1-in (25 mm) slip fit on PVC and PVDF models
Sensor cable	
Model 475R	Flat ribbon cable, 1 foot long. For direct-mounted Peek Measurement transmitters or monitors.
Model 475M	20 AWG, 2-conductor, shielded cable, standard length 20 ft (6 m)
Electrical specifications	
Model 475R	Output signal: 0 to 52 Hz to direct-mounted Peek Measurement flow transmitters or monitors. (Peek Measurement flow transmitters or monitors provide power for the sensor.)
Model 475M	Output signal: 40 to 600 mV AC @ 5 to 167 Hz (no external power required)
¹ PVC maximum rating: 180°F @ 85 PSI (82°C @ 586 kPa) / 85°F @ 180 PSI (37°C @ 1241 kPa). ² PVDF maximum rating: 220°F @ 180 PSI (104°C @ 1241 kPa) / 175°F @ 225 PSI (79°C @ 1551 kPa). ³ Ceramic maximum pressure rating: 250 PSI. ⁴ Extended temperature option: available on anodized aluminum, brass, and stainless steel models.	

**Table 1-8
Model 500 Sensor Specifications**

Performance specifications	
Accuracy	±0.8% rate Model 500R ±1.5% rate Model 500M
Repeatability	±0.5% of full range
Linearity	±0.5% of full range
Velocity range	0.3 to 30 ft/s (0.09 to 9.14 m/s) Model 500R 1 to 30 ft/s (0.3 to 9.14 m/s) Model 500M
Pipe dimensions	2 to 96 in (51 to 2438 mm) ¹
Physical specifications	
Rating	NEMA 4X (IP65), NEMA 12
Body material options	PVC, PVDF, brass, or stainless steel
Impeller and impeller housing material options	PVDF (standard) or Ryton (extended temperature)
Bearing material options	Rulon or ceramic
Shaft material options	Titanium nitride coated Hastelloy C or ceramic ²
O-ring material	Viton
Pressure rating	
PVC	180 PSI (1241 kPa) ³
PVDF	225 PSI (552 kPa) ⁴
Brass	250 PSI (1723 kPa) Optional pressure: 500 PSI (3447 kPa)
Stainless steel	250 PSI (1723 kPa) Optional pressure: 500 PSI (3447 kPa) or 2500 PSI (17,237 kPa)
Installation/extraction tool	Optional on operational pressures less than 50 PSI Required on operational pressures greater than 50 PSI. (Refer to optional/spare parts list.)
Operating temperature	
Standard	-20° to +165°F (-29 to +74°C) ^{3, 4}
Optional extended temperature	-40 to +350°F (-40 to +165°C) ⁵
Sensor mounting	Through a 2-in (51 mm) FNPT service saddle or weld-on threaded fitting
Conduit connection	1-in (25 mm) FNPT
Sensor cable	
Model 500R	Flat ribbon cable, 1 foot long (for direct-mounted Peek Measurement transmitters or monitors)
Model 500M	20 AWG, 2-conductor, shielded cable, standard length 20 ft (6 m)
Electrical specifications	
Model 500R	Output signal: 0 to 52 Hz to direct-mounted Peek Measurement flow transmitters or monitors. (Peek Measurement flow transmitters or monitors provide power for the sensor.)
Model 500M	Output signal: 40 to 600 mV AC @ 5 to 167 Hz (no external power required)
¹ Extended length sensors available. Consult factory. ² Ceramic maximum pressure rating: 250 PSI. ³ PVC maximum rating: 180°F @ 85 PSI (82°C @ 586 kPa) / 85°F @ 180 PSI (37°C @ 1241 kPa). ⁴ PVDF maximum rating: 220°F @ 180 PSI (104°C @ 1241 kPa) / 175°F @ 225 PSI (79°C @ 1551 kPa). ⁵ Extended temperature option: available on brass and stainless steel models.	

1.9 Output Frequency and Pulse Rate Tables

Tables 1-9 and 1-10 provide the output frequency and pulse rate (in gallons per minute and liters per minute) for the Model 400, Model 475, and Model 500 magnetic sensors. These tables do not apply to the RF sensors. The Model 475 sensor is used for pipe sizes less than 2 inches; the pipe IDs listed for these smaller pipe sizes are based on a "bore factor" derived from the bore size and characteristics of the sensor (shown in gray).

Table 1-9 Pulse Rate and Output Frequency							
Nominal Pipe Size: 1 Inches (millimeters)		Pipe ID or Bore Factor: inches (millimeters)		Pulses: Pulses per Gallon (PPG) and Pulses per Liter (PPL)		Output Frequency (F): F=(K-Factor x GPM) and F=(K Factor x LPM)	
Inches	Millimeters	Inches	Millimeters	PPG	PPL	K Factor for GPM	K Factor for LPM
0.5	12.7	0.723	18.2	260.4300	21.0251	4.3405	0.3504
0.75	19.1	0.899	22.8	168.4411	13.5986	2.8074	0.2266
1	25.4	1.208	30.7	93.2897	7.5315	1.5548	0.1255
1.25	31.8	1.619	41.0	51.9366	4.1930	0.8656	0.0699
1.5	38.1	1.859	47.2	39.3921	3.1802	0.6565	0.0530
2	50.8	1.939	49.3	36.2086	2.9232	0.6035	0.0487
		2.067	52.5	31.86299	2.5724	0.5310	0.0429
2.5	63.5	2.469	62.7	22.3319	1.8029	0.3722	0.0300
		2.900	73.7	16.18719	1.3068	0.2698	0.0218
3	76.2	3.068	77.9	14.4630	1.1676	0.2410	0.0195
		4.026	102.3	8.3989	0.6781	0.1400	0.0113
5	127	5.047	128.2	5.3444	0.4315	0.0891	0.0072
6	152.4	6.065	154.1	3.7009	0.2988	0.0617	0.0050
8	203.2	7.981	202.7	2.1372	0.1725	0.0356	0.0029
10	254	10.020	254.5	1.3559	0.1095	0.0226	0.0018
		9.750	247.7	1.4321	0.1156	0.0239	0.0019
		9.500	241.3	1.5084	0.1218	0.0251	0.0020
12	304.8	12.000	304.8	0.9454	0.0763	0.0158	0.0013
		11.938	303.2	0.9552	0.0771	0.0159	0.0013
		11.750	298.5	0.9860	0.0796	0.0164	0.0013
		11.500	292.1	1.0294	0.0831	0.0172	0.0014
14	355.6	13.250	336.6	0.7754	0.0626	0.0129	0.0010
		13.124	333.3	0.7904	0.0638	0.0132	0.0011
16	406.4	15.250	387.4	0.5854	0.0473	0.0098	0.0008
		15.000	381	0.6050	0.0488	0.0101	0.0008
18	457.2	16.876	428.7	0.4780	0.0386	0.0080	0.0006
		17.180	436.4	0.4612	0.0372	0.0077	0.0006

¹ Contact the factory for any unlisted pipe sizes which are smaller than 6 inches (152.4 millimeters). For pipe IDs of 6 inches (152.4 millimeters) or larger, the K factor can be determined as follows:

English:	Metric:
FPS x (pipe ID) ² x 2.448 = GPM	MPS x (pipe ID) ² x 0.047 = LPM
(7.64 ÷ GPM) X 0.727 = K Factor	(7.64 ÷ LPM) x 0.727 = K Factor
K Factor x GPM = Output Frequency	K Factor x LPM = Output Frequency
K Factor x 60 = PPG	K Factor x 60 = PPL

1.10 Service Support and Warranty

This section covers the procedures for obtaining service support and provides warranty information for the impeller sensor. Due to the complex nature of electronic equipment, it is not feasible to attempt internal repairs or service in the field other than the replacement of the impeller and shaft assembly (Section 1.6). All parts used in the repair or maintenance of the sensor are supplied by Peek Measurement.

1.10.1 RESOLVING THE PROBLEM

If the unit does not perform satisfactorily, complete the following steps in order until the problem is resolved:

1. Verify that:
 - The site for the sensor was suitable (Section 1.2)
 - The sensor was properly installed (Section 1.3 through 1.5)
 - The sensor was properly wired to the flowmeter (Section 1.2 and the appropriate flowmeter instruction manual)
2. Contact the installation contractor or representative through which the sensor was purchased (Section 1.10.2).
3. Contact Peek Measurement to attempt to resolve the problem over the phone (Section 1.10.3).
4. Return the unit to Peek Measurement for repair (Section 1.10.4) or arrange for Peek Measurement field service (Section 1.10.5).

1.10.2 LOCAL REPRESENTATIVE SUPPORT

The local Peek Measurement representative is the first contact for support. The representative has access to current product information and is well-equipped to answer questions and provide application assistance.

1.10.3 CONTACTING PEEK MEASUREMENT BY PHONE

Before contacting Peek Measurement by phone, make a note of the instrument's model and serial number. Have the operating parameters of the application available (type of fluid, pipe size, pipe material, fluid velocity, temperature, etc.). If the problem cannot be remedied over the phone, the service engineer may request that the instrument be returned to the factory for repair. The address and telephone numbers of the service centers are listed in Section 1.10.4.

1.10.4 FACTORY SERVICE

If Peek Measurement determines that the problem cannot be resolved over the phone, the entire unit should be returned to Peek Measurement' service department or arrangements made for Peek Measurement field service (Section 1.10.5).

The Peek Measurement Service Department should be contacted before returning an instrument for repair. The service department issues an RMA number which must be placed on the outside of the shipping box in order for the receiving dock to accept the shipment.

A letter should be included with the instrument fully explaining the symptoms of the failure as well as details regarding the application in which the unit was being operated (type of fluid, pipe size, pipe material, fluid velocity, temperature, etc.). This letter is required for all units including those returned for warranty repairs. Service cannot be adequately performed until this written information is received.

To ship an instrument to Peek Measurement:

1. Ensure that the instrument is well packed (in its original shipping box, if available).
2. Include the letter of explanation.
3. Write the RMA number on the outside of the shipping box.
4. Send the unit freight-paid to one of the following service centers:

North American Service Center (USA)

Peek Measurement, Inc.
10335 Landsbury, Suite 300
Houston, Texas 77099-3407 USA
Telephone: (281) 879-3700
Facsimile: (281) 498-7721

European Service Centre (UK)

Peek Measurement, Ltd.
King's Worthy
Winchester, Hampshire SO23 7QA UK
Telephone: (01962) 883200
Facsimile: (01962) 885530

Peek Measurement pays the return freight if the unit is under warranty. All repairs are made in accordance with the Peek Measurement limited warranty (Section 1.10.6).

1.10.5 FIELD SERVICE

Field service is available and is recommended in some instances. All field service calls are to be scheduled in advance and paid for by the customer. Contact Peek Measurement for rates.

1.10.6 WARRANTY

Peek Measurement products are warranted to be free from defects in material and workmanship at the time of shipment and for two years thereafter. Any claimed defects in Peek Measurement products must be reported within the warranty period. Peek Measurement shall have the right to inspect such products at buyer's plant or to require buyer to return such products to Peek Measurement plant.

In the event Peek Measurement request return of its products, Buyer shall ship with transportation charges paid by the Buyer to Peek Measurement plant. Shipment of repaired or replacement goods from Peek Measurement plant shall be F.O.B. Peek Measurement plant. A shop charge may apply for alignment and calibration services. Peek Measurement shall be liable only to replace or repair, at its option, free of charge, products which are found by Peek Measurement to be defective in material or workmanship, and which are reported to Peek Measurement within the warranty period as provided above. This right to replacement shall be Buyer's exclusive remedy against Peek Measurement.

Peek Measurement shall not be liable for labor charges or other losses or damages of any kind or description, including but not limited to, incidental, special or consequential damages caused by defective products. This warranty shall be void if recommendations provided by Peek Measurement or its Sales Representatives are not followed concerning methods of operation, usage and storage or exposure to corrosive conditions.

Materials and/or products furnished to Peek Measurement by other suppliers shall carry no warranty except such suppliers' warranties as to materials and workmanship. Peek Measurement disclaims all warranties, expressed or implied, with respect to such products.

EXCEPT AS OTHERWISE AGREED TO IN WRITING BY PEEK MEASUREMENT, THE WARRANTIES GIVEN ABOVE ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND PEEK MEASUREMENT HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR PURPOSE.



10335 Landsbury, Suite 300 ■ Houston, Texas 77099-3407 USA

Telephone: (281) 879-3700 ■ Facsimile: (281) 498-7721

King's Worthy ■ Winchester, Hampshire SO23 7QA UK

Telephone: (01962) 883200 ■ Facsimile: (01962) 885530