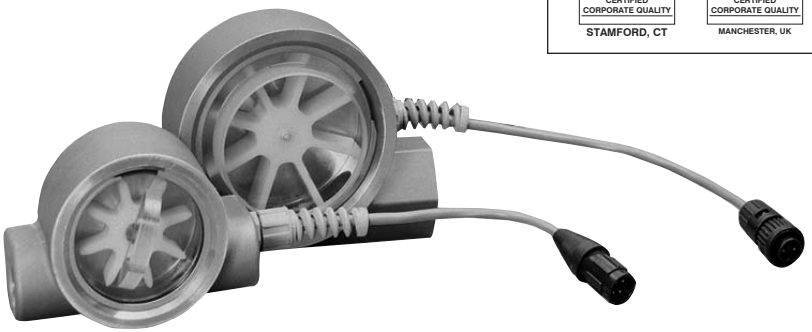
User's Guide

Flow Sensor with
Polypropylene Body



Flow Sensor with Stainless Steel Body

FPR 200
Flow Sensor

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Introduction

This manual is a service guide produced by the manufacturer. The manual provides specific procedures and/or illustrations for installation, inspection, cleaning and filtration of all Omega FPR 200 flow sensors. When properly followed, these procedures will keep your flow sensor operating dependably for many years.

It is important for operators and maintenance personnel to be safety conscience when operating or repairing equipment. Developing a thorough knowledge of the precautionary areas and following safe operating procedures, can prevent equipment damage and/or personal injury.

Before making any repair, read all of the repair procedures to learn the correct method and all precautions.

General

Omega's flow sensors integrate rugged tangential turbine technology with a precision digital to analog conversion circuit hermetically encapsulated within the body of the sensor. The flow sensor is ideal for measuring flow rates in cooling circuits, HVAC systems and batching operations.

Additional features are:

- simple in-the-field serviceability of its moving components
- the integral 4-20mA circuit design eliminates the need for separate signal conditioning modules
- units come factory calibrated to **your** system requirements
- the low impedance 4-20mA circuit can transmit a "clean" signal over low-cost wire for several thousand feet without degradation
- accurately measures flow in both directions.

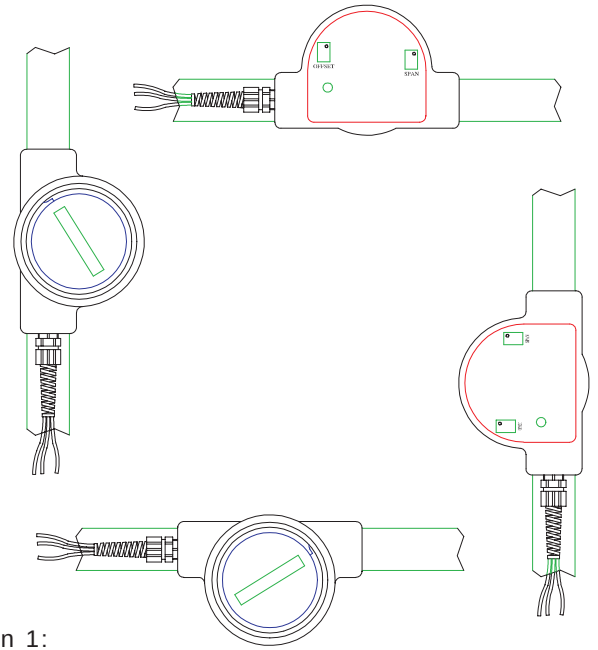


Illustration 1:
Mounting Instructions

Installation - Mechanical

1. The flow sensor has NPT (National Pipe Thread) plumbing connections. It is recommended that a paste type pipe sealant be used on these threads. [Teflon tape sealant can be used as long as it is applied in such a way that it will not enter the flow stream. Pieces of Teflon tape can wrap around the turbine and impede its rotation.]

2. The recommended mounting orientation would be any plane that will place the axis of the turbine horizontal with respect to the ground. **See Illustration 1**. The unit will operate satisfactorily with its axis at angles other than horizontal, but side loading of the bearing surfaces will lead to premature wear of the rotating parts.

3. For the best flow measurement results, place the inlet (See Note 1) of the flow sensor at least 10 straight pipe diameters downstream from any fitting, valve, elbow, reducer, etc. that causes non-stable flow conditions. Ideally, 5 straight pipe diameters should be placed at the outlet of the sensor. If the sensor must be placed closer to a source of non-stable flow than these recommended distances, some instability of the output signal may result. The average signal will be accurate.

4. It is recommended that the sensor be placed in such a position that the round access cover can be removed for cleaning and turbine servicing. It is also recommended that a union be placed near the sensor to allow easy removal.

   Note1: The flow sensor is a bi-directional measuring device. References to “inlet” and “outlet” refer to uni-directional systems.

Installation - Electronic (4-20mA Only)

The flow sensor circuit is a two-wire loop-powered design that transmits a 4-20mA signal that is proportional to flow rate. The noise-immune current transmission from the sensor can be routed with low cost two conductor twisted-pair cable. The circuit operates on 12-35 VDC and requires a source capable of supplying at least 20mA of current. The circuit has built in polarity protection and over-current limiting to protect both the transmitter and what the transmitter is connected to.

1. Connect the red wire (pin 1 for units with the electronic disconnect option) from the transmitter sensor to the positive 12-35 VDC power supply output.

2. Connect the black wire (pin 2 for units with the electronic disconnect option) from the transmitter to the positive side of the loop load (resistor, chart recorder, data acquisition board, meter, etc.). This connection may be labeled "4-20mA Input" or "4-20mA (+)" on some devices.

3. If applicable, connect the negative side of the loop load to negative side of the power supply.

4. Apply power to the system.

5. If everything is operating correctly, the green LED on the sensor will dimly illuminate and 4mA will be flowing in the loop. If there is fluid flowing through the sensor, the current will be higher than 4mA and the LED will be quite bright.

   If the LED does not illuminate:

   - check wiring terminations for good connections
   - check wiring polarity
   - verify correct supply voltage
   - ensure that the load impedance is within allowable limits

- Apply the DC supply voltage directly across the sensor wires. If the LED does illuminate, the load is either: too great of impedance or an open circuit. If the LED does not illuminate, the sensor's lead wires or circuit are defective.

6. The installation should be complete.

Installation - Electronic (0-5VDC Output Only)

1. Connect the red wire (pin 1 for units with the electronic disconnect option) from the sensor to the positive terminal of the 12-35 VDC power supply.

2. Connect the black wire from the transmitter (pin 2 for units with the electronic disconnect option) to the negative terminal of the 12-35 VDC power supply.

3. Connect the green wire from the transmitter (pin 3 for units with electronic disconnect) to the (+) 0-5 VDC input of the data acquisition device. This connection may be labeled "Voltage Input" or "Analog Input" on some devices.

4. If applicable, connect the negative side of the power supply to the negative side of the pulse input.

5. Apply power to the system.

6. If everything is operating correctly, the green LED will illuminate brightly and the data acquisition device should show an increase in flow rate as fluid starts flowing through the sensor.

   If data acquisition device does not show an increase in flow rate:

   - check wiring terminations for good connections
   - verify that the LED is illuminated
   - verify that the DC supply voltage is between 12 and 35 VDC

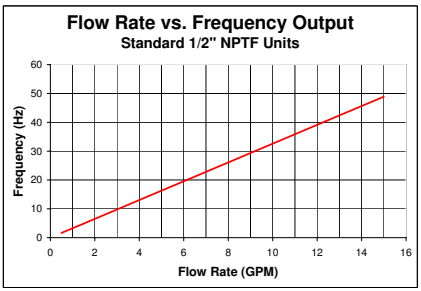
Installation - Electronic (Pulse Output Only)

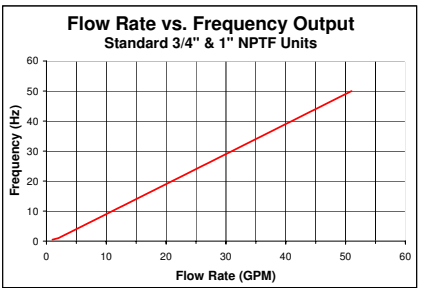
The flow sensor pulse output circuit is a three-wire DC-powered design that transmits a frequency proportional to flow rate. The circuit operates on 5-24 VDC and will consume a maximum of 25 mA from the power supply.

1. Connect the red wire (pin 1 for units with the electronic disconnect option) from the sensor to the positive terminal of the 5-24VDC power supply.
2. Connect the black wire from the transmitter (pin 2 for units with the electronic disconnect option) to the negative terminal of the 5-24 VDC power supply.
3. Connect the green wire from the transmitter (pin 3 for units with electronic disconnect) to the (+) pulse input of the data acquisition device. This connection may be labeled "Pulse In" or "DC Input" on some devices.
4. If applicable, connect the negative side of the power supply to the negative side of the pulse input.
5. Apply power to the system.
6. If everything is operating correctly, the data acquisition device should begin "counting" pulses when fluid starts flowing through the sensor.

   If the data acquisition device is not “counting”:

   - check wiring terminations for good connections
   - verify correct supply voltage and current





7. The installation should be complete. The relationship between the frequency output and flow rate is shown in the graphs above.

Installation - Electronic (Relay Output Only)

1. Connect the red wire from the sensor to the positive terminal of the 12-35 VDC power supply.

2. Connect the black wire from the transmitter to the negative terminal of the 12-35 VDC power supply.

3. *(Versions with stainless steel sensor body only)* Be sure to properly ground the flow sensor by using the ground screw shown in **Illustration 2** to connect the sensor body Earth ground. This step may be unnecessary if the piping system that the flow sensor is plumbed into is already connected to Earth ground.

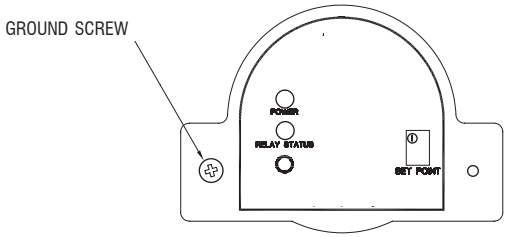


Illustration 2

4. Wire the appropriate relay contacts to the load that is to be switched per Table 1 below.

5. If the unit is operating correctly, the green power indication LED and the red relay status LED should illuminate after the DC supply voltage is turned on. As fluid flow is increased above the factory-adjusted set point, the red relay status LED should turn off.

   If the LEDs do not illuminate when power is applied:

   - check wiring terminations for good connections
   - verify that the DC supply voltage is between 12 and 35 VDC

Table 1.: Wiring Connections

Wire Color	Connection
Red	+12-35 VDC
Black	DC Ground
Green	Relay Common
White	Relay Normally Closed Contact
Brown	Relay Normally Open Contact

Set Point Adjustment (Relay Output Only)

1) Adjust the flow rate through the line in which the flow sensor is installed to the rate that corresponds to the desired relay trip point.

2) If the red LED on the back side of the sensor is not illuminated, use a small flat bladed screwdriver to slowly turn the adjustment screw on the set point potentiometer counter-clockwise until the red LED illuminates.

3) If the red LED is already illuminated, turn the adjustment screw on the potentiometer clockwise until red LED turns off. Next, slowly rotate the adjustment screw counter-clockwise until the red LED illuminates.

4) Once the set point has been adjusted, the relay will operate as shown in the Truth Table illustrated in **Table 2** below.

Table 2.: Truth Table - Relay Operation

Condition	Relay NC Contact	Relay NO Contact	Red LED	Green LED
Flow rate< set point	Open	Closed	Illuminated	Illuminated
Flow rate > set point	Closed	Open	Not Illuminated	Illuminated
Loss of power to sensor	Open	Closed	Not Illuminated	Not Illuminated

Service and Maintenance

The sensor is designed to provide years of low maintenance service in industrial environments. As with all mechanical rotating devices, the bearing surfaces will wear with use. The life of the parts will depend on factors such as cleanliness of the fluid, media, mounting orientation, temperature, fluid velocity and frequency of operation. The flow sensor was designed with simple field-replacement of the rotating parts in mind. To inspect or replace the rotating components:

1. Relieve pressure in the piping system.
2. Remove the retainer ring that secures the turbine access cover.
3. Remove the access cover with a pliers, taking care not to damage the o-ring seal.
4. Pull out the turbine assembly and the shaft.
5. Inspect the shaft for things that may have wrapped around it.
6. Inspect the turbine bearing surface for wear and elongation. Replace as necessary.
7. Clean any rust off of the magnets that may have accumulated.
8. Reassemble the unit by placing the turbine into the body cavity with the two magnet pockets facing inward. Place the shaft into the turbine hole and guide it into the retaining hole in the body cavity. Lubricate the o-ring seal with some glycerin or other lubricant and press it into the pocket of the body. Replace the retaining ring securely before applying pressure to the system.

Circuit recalibration (4-20mA version):

1. Place a milliamp meter into the current loop.
2. Turn off the flow going though the sensor. Adjust the **OFFSET** control for a reading of 4mA on the milliamp meter.
3. Adjust the flow rate though the meter to full flow rate. Adjust the **SPAN** control for a reading of 20mA on the milliamp meter. The two controls are not interactive, so further adjustment should not be necessary.

Circuit recalibration (0-5VDC version):

1. Place a voltmeter across the black & green wires of the sensor pigtail.
2. Turn off the flow going though the sensor. Verify a reading of less than 50 mVDC on the voltmeter.
3. Adjust the flow rate though the meter to full-scale flow rate. Adjust the **SPAN** control for a reading of 20mA on the milliamp meter. The two controls are not interactive, so further adjustment should not be necessary.

Mechanical Specifications

FLOW SENSOR WITH STAINLESS STEEL BODY

Maximum pressure:	200 PSI clear cover, 500 PSI SS cover
Maximum temperature:	225°F
Measuring range*	
1/2" NPT Ported:	0.5 - 15 GPM
3/4" & 1" NPT Ported:	1.5 - 50 GPM
Wetted materials:	316SS, acetal copolymer, Buna, PEEK and polycarbonate
Non-wetted materials:	Epoxy, Lexan® and PVC

FLOW SENSOR WITH POLYPROPYLENE BODY

Maximum pressure:	150 PSI
Maximum temperature:	150°F
Measuring range*	
1/2" NPT Ported::	0.5 - 15 GPM
Wetted materials:	316SS, acetal copolymer, Buna, PEEK, polycarbonate and polypropylene
Non-wetted materials:	Epoxy, Lexan® and PVC

***Important:** *Chose a maximum flow rate. For 1/2": 5 - 15 maximum GPM. For 3/4" and 1": 15 - 50 maximum GPM. Minimum flow rate will be 10% of maximum flow rate. Example: If your maximum flow rate is 8 GPM, the minimum flow rate would be .8 (8 x .1 = .8). Thus, the correct flow range would be .8 - 8.0 GPM.*

Electronic Specifications

ALL VERSIONS WITH 4-20 MA CIRCUIT

Power requirements:	12-35VDC, 20mA
Load driving capacity:	Max. Load (Ω) = 50(Power Supply Voltage - 12)
Trans. Distance:	limited only by wire resistance & supply voltage
LED:	provides power indication
Flow rate accuracy:	±2% of full scale
Repeatability:	±0.5% of scale
Resolution:	infinite
Response time:	2 seconds to 90%
Over-current protection:	self limiting at 30mA
Fail safe indication:	4 mA

ALL VERSIONS WITH 0-5 VDC CIRCUIT

Power requirements:	12-35VDC, 20 mA
Maximum Current:	30 mA DC
Max. Trans. Distance:	<200 feet recommended
Min. Load Resistance:	1000 Ω
Flow rate accuracy:	2% of full scale
Repeatability:	0.5% of scale
Resolution:	infinite
Response time:	2 seconds to 90%

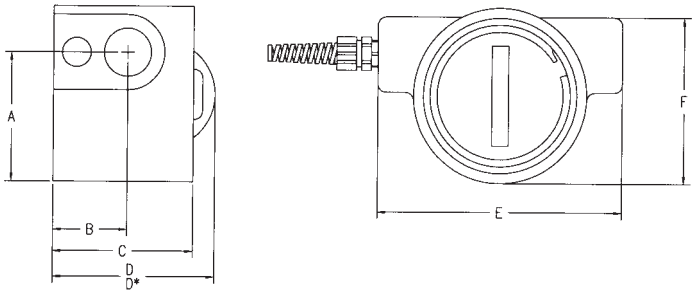
ALL VERSIONS WITH PULSE OUTPUT CIRCUIT

Power requirements:	5-24VDC, 20 mA
Maximum Current:	25 mA DC
Max. Trans. Distance:	<200 feet recommended
Flow rate accuracy:	2% of full scale
Linearity:	0.5% of scale
Resolution:	Infinite
Response time:	< 100 mS

ALL VERSIONS WITH RELAY OUTPUT CIRCUIT

Power Requirements	12-35 VDC
Max. Trans. Distance	< 200 feet recommended
Switch Contact	Form C, 5A max @120 or 240 VAC
Hysteresis	5% of reading max.

Dimension Drawings



DIM	1/2" NPTF Ports	3/4" & 1" NPTF Ports
A	1.94" (49 mm)	3.06" (78 mm)
B	1.13" (29 mm)	1.33" (34 mm)
C	2.00" (51 mm)	2.46" (62 mm)
D	2.45" (62 mm)	2.78" (71 mm)
D[1]	2.60" (66 mm)	2.88" (73 mm)
E	3.70" (94 mm)	5.25" (133 mm)
F	2.63" (67 mm)	3.80" (97 mm)
F[2]	3.38" (86 mm)	n/a

[1]Dimension with optional clear cover installed

[2]Polypropylene version only

NOTES:

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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